

APPENDIX 'A'

SITE PHOTOS



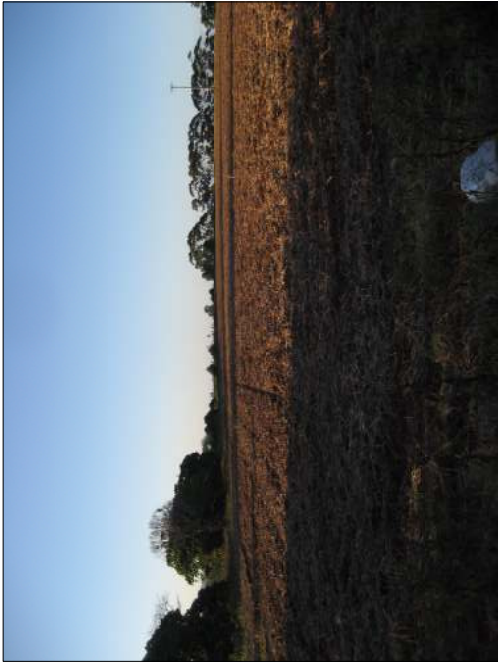


Plate 1 - Slightly elevated flat terrain at location of proposed hospital (Area 1).



Plate 2 - Looking southwards at slightly elevated flat terrain also at location of proposed hospital (Area 1).

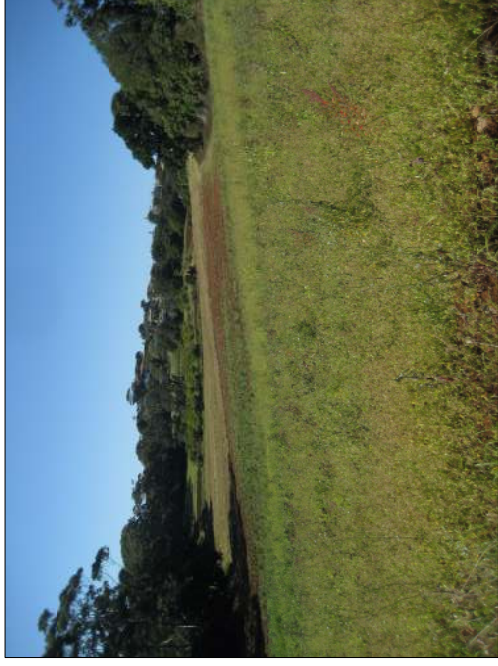


Plate 3 - Mild sloping terrain downslope of proposed car parking area to the north east. Detention basin is proposed in this terrain in the distance.



Plate 4 - Mild sloping terrain downslope to the north of the proposed hospital.



Plate 5 - Mild sloping terrain downslope to the west of the proposed hospital.



Plate 6 - Mild sloping terrain in the far western portion of the site at the location of the proposed south western car parking area (Area 4)

APPENDIX 'B'

BOREHOLE LOGS





Morrison Geotechnic Pty Ltd

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Engineering Log - Borehole

Borehole No.: **BH1**

Page: 1 of 4



Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555510.00 Drilling Rig: Hydrapower Scout
Northing: 6873397.00 Driller: Redlands Drilling
RL: 23.20 Logged By: L. Bexley
Total Depth: 1.60 Date: 01/08/2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | | | |
|--------------------------|-------|------|----------------|----------------------|---|---------------------|--|------------|----------|----------------------------------|-----------------|------------|-----------|--------------------------|---|-----|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | | | |
| 100mm Auger with T.C Bit | | 23.0 | 0.4 | Residual Slopewash |  | CH | Silty CLAY: Stiff, high plasticity, red brown, moist. | | M | St | | 0.1 0.3 | U50 PP | PP: 400kPa 150-200kPa | | | |
| | | | | | | CH | Silty CLAY: As above but very stiff and cobbles. | | M | VSt | | | | | | | |
| | | | | | | CI | Silty CLAY: Very stiff, medium plasticity, red brown with some orange brown mottling, moist. | | M | VSt | | | | | | | |
| | | | | Bedrock |  | BAS | BASALT: Very low strength, extremely weathered, orange brown mottled dark grey. | XW | | VLS | | | | | 1 | SPT | 8,17,25, N=42 |
| | | | | | | BAS | BASALT: As above but medium strength and distinctly weathered. | DW | | MS | | | | | | | |
| Washbore | | 22.0 | 1.2 | | | | | | | | | | | | | | |
| | | | 1.4 | | | | | | | | | | | | | | |
| | | | 1.6 | | | | | | | | | | | | | | |
| | | | 2.0 | | | | 1.60m: COMMENCE NMLC CORING | | | | | | | | | | |
| | | | 21.0 | | | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | | | | |
| | | | 20.0 | | | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | | | | |
| | | | 19.0 | | | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | | | | |
| | | | 18.0 | | | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Cored Borehole

Borehole No.: **BH1**

Page: 2 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555510.00 Drilling Rig: Hydrapower Scout
Northing: 6873397.00 Driller: Redlands Drilling
RL: 23.20 Logged By: L. Bexley
Total Depth: 17.40 Date: 01/08/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | |
|----------------------|-------|------|----------------|----------------------|-------------|--|---|--|--------------------|---------------------------|-------|--|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | Defect Spacing (mm) | Defect Description |
| | | | | | | | | ELS VLS LS MS HS VHS EHS | | IS ₍₅₀₎ MPa | RQD % | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness |
| NMLC Coring | | | 23.0 | | | | | | | | | | |
| | | | 0.5 | | | | | | | | | | |
| | | | 22.5 | | | | | | | | | | |
| | | | 1.0 | | | | | | | | | | |
| | | | 22.0 | | | | | | | | | | |
| | | | 1.5 | | | | Commence NMLC Coring at 1.60m | | | | | | |
| | | | 21.5 | Bedrock | ▽ ▲ | BAS | BASALT: Very high strength, slightly weathered to fresh, dark grey, moderately fractured. | SW-Fr | | 7.84 | | | ↘J10° Pl/Ro,St,O ↘S25° 30mm cly & VLS ↘J15° Pl/Ro,St,O |
| | | | 2.0 | | ▽ ▲ | | | | | | | | ↘J5° Pl/Sm,St,O ↘J70° Un/Ro,Vr,O |
| | | | 21.0 | | ▽ ▲ | BAS | BASALT: As above but medium strength, distinctly weathered, dark grey mottled orange brown. | DW | | | | | ↘J10° Un/Ro,St,O ↘J30° Pl/Sm,St,O |
| | | | 2.2 | | ▽ ▲ | | | | | | | | ↘S35° 15mm VLS |
| | | 2.5 | | ▽ ▲ | | | | | | | | ↘J40° Pl/Sm,St,O ↘J10° Pl/Sm,Cn,O | |
| | | 20.5 | | ▽ ▲ | BAS | BASALT: As above but medium strength to high strength. | DW | | | | | ↘J15° Un/Sm,St,O ↘600mm HFZ ↘VN10° Plagioclase | |
| | | 20.0 | | ▽ ▲ | | | | | | | | | |
| | | 3.0 | | ▽ ▲ | | | | | | | | | |
| | | 20.5 | | ▽ ▲ | | | | | | | | | |
| | | 3.5 | | ▽ ▲ | BAS | BASALT: As above but medium strength. | DW | | 0.98 | | | | ↘S5° 10mm ↘J5° Un/Ro,St,O ↘J45° Un/Sm,St,C |
| | | 19.5 | | ▽ ▲ | | | | | | | | | |
| | | 4.0 | | ▽ ▲ | | | | | | | | | |
| | | 19.0 | | ▽ ▲ | | | | | | | | | |
| | | 4.5 | | ▽ ▲ | | | | | | | | | |
| | | 18.5 | | ▽ ▲ | | | | | | | | | |
| | | 5.0 | | ▽ ▲ | | | | | | | | | |
| | | 18.0 | | ▽ ▲ | BAS | BASALT: As above but high strength and distinctly weathered to slightly weathered. | DW-SW | | 6.01 | | | | ↘J45° Stp/Ro,St,O ↘S10° 10mm ↘J5° Un/Ro,St,O ↘J15° Pl/Ro,St,O |
| | | 5.5 | | ▽ ▲ | | | | | | | | | |
| | | 17.5 | | ▽ ▲ | | | | | | | | | |
| | | 6.0 | | ▽ ▲ | | | | | | | | | ↘J20° Pl/Sm,Cn,C ↘VN5° Plagioclase ↘J5° Un/Pl,Vr,C |

| | | | | | |
|-----------------------------|-------------------------|---------------------|-----------------|----------------------|-----------------------------------|
| Comments: | | | | Authorised by: | |
| | | | | Date: | |
| Water | Weathering | Consistency | Density | Rock Strength | Defects |
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | |
| | | H Hard | | VHS Very high | |
| | | Moisture | | EHS Extremely high | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH1**

Page: 3 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555510.00 Drilling Rig: Hydrapower Scout
Northings: 6873397.00 Driller: Redlands Drilling
RL: 23.20 Logged By: L. Bexley
Total Depth: 17.40 Date: 01/08/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|--|------------|--|-------------------|--|------------------------|----------------------------------|---|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| | | | | | | | | | ELS VLS LS MS HS VHS EHS | | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness | |
| NMLC Coring | | | 17.0 | | | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | 10.8 | 38% | | J10° Un/Ro,Cn,O J25° Pl/Sm,Cn,O |
| | | | 6.56.4 | | | BAS | BASALT: As above but high strength, distinctly weathered to slightly weathered, with some medium strength and very high strength zones | DW-SW | | | | | | | S10° 10mm VLS J90° Pl/Sm,Vr,O |
| | | | 7.0 | | | | | | | | | | | | J5° Pl/Sm,Vr,O |
| | | | 7.1 | | | BAS | BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered | SW | | | | 9.4 | | | J15° Pl/Sm,St,O J50° Pl/Sm,Vr,O J35° Pl/Sm,Vr,O J15° Un/Ro,Ct,O |
| | | | 7.2 | | | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | | | | J10° Pl/Sm,Cn,O S20° 30mm VLS |
| | | | 7.57.4 | | | BAS | BASALT: As above but low strength and extremely weathered. | XW | | | | | | | -2650mm HFZ |
| | | | 15.5 | | | | | | | | | | | | |
| | | | 8.0 | | | | | | | | | | 7% | | |
| | | | 15.0 | | | | | | | | | | | | |
| | | | 8.5 | | | | | | | | | | | | |
| | | | 14.5 | | | | | | | | | | | | |
| | | | 9.0 | | | | | | | | | | | | |
| | | | 14.0 | | | | | | | | | | | | |
| | | | 9.5 | | | | | | | | | | | | |
| | | | 13.5 | | | | | | | | | | | | |
| | | | 10.0 | | | | | | | | | | | | |
| | | | 10.05 | | | | | | | | | 0.63 | | | |
| | | | 13.0 | | | Cl | Silty CLAY: Very stiff, medium plasticity, dark grey mottled orange brown, extremely weathered basalt layers throughout, moist. | | | | | | 0% | | |
| | | | 10.5 | | | | | | | | | | | | |
| | | | 12.5 | | | | | | | | | | | | |
| | | | 11.0 | | | | | | | | | | | | |
| | | | 12.0 | | | | | | | | | | | | |
| | | | 11.5 | | | | | | | | | | | | |
| | | | 11.6 | | | | | | | | | | | | |
| | | | 12.0 | | | | CORE LOSS | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|--|--|--|---|--|-----------------------------------|
| Water level on date shown Water inflow Water outflow | RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh | VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet | VL Very loose L Loose MD Medium dense D Dense VD Very dense | ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high | Refer to Defect Description Sheet |



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Engineering Log - Cored Borehole

Borehole No.: **BH1**

Page: 4 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555510.00 Drilling Rig: Hydrapower Scout
 Northing: 6873397.00 Driller: Redlands Drilling
 RL: 23.20 Logged By: L. Bexley
 Total Depth: 17.40 Date: 01/08/2018

| Drilling Information | | | | Material Description | | | | | | | Rock Mass Defects | | | | | | | | | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|---|------------|--------------------|-----|-------------------|------------------------|-------|---------------------|--------------------|--|----|-----|-----|------|------|---|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description | | | | | | | |
| | | | | | | | | | ELS | VLS | LS | MS | HS | VHS | EHS | | 30 | 100 | 300 | 1000 | 3000 | type, inclination, planarity, roughness, coating, thickness |
| NMLC Coring | | | 11.0 | | | CI | CORE LOSS | | | | | | | | | | 0% | | | | | |
| | | | 12.1 | | | | Silty CLAY: Very stiff, medium plasticity, dark grey mottled orange brown, extremely weathered basalt layers throughout, moist. | | | | | | | | | | | | | | | |
| | | | 12.5 | | | | | | | | | | | | | | | | | | | |
| | | | 10.5 | | | | | | | | | | | | | | | | | | | |
| | | | 13.0 | | | | | | | | | | | | | | | | | | | |
| | | | 13.5 | | | | | | | | | | | | | | | | | | | |
| | | | 13.8 | | | | | | | | | | | | | | | | | | | |
| | | | 14.0 | | | BAS | BASALT: Very low strength, extremely weathered, dark grey. | XW | | | | | | | | | | | | | | |
| | | | 14.2 | | | BAS | BASALT: As above but very high strength and slightly weathered, hardly any fractures. | SW | | | | | | | | | | | | | | |
| | | | 14.5 | | | | | | | | | | | | | | | | | | | J5° Pl/Ro,Cn,O J5° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O J40° Un/Ro,Cn,O J5° Pl/Ro,Cn,O J5° Pl/Ro,Cn,O J5° Pl/Sm,Cn,O |
| | | | 8.5 | | | | | | | | | | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | | | | | | | | | | J15° Pl/Sm,Cn,O |
| | | | 8.0 | | | | | | | | | | | | | | | | | | | |
| | | | 15.5 | | | | | | | | | | | | | | | | | | | J5° Pl/Ro,Cn,O |
| | | | 7.5 | | | | | | | | | | | | | | | | | | | |
| | | | 16.0 | | | | | | | | | | | | | | | | | | | |
| | | | 7.0 | | | | | | | | | | | | | | | | | | | |
| | | | 16.5 | | | | | | | | | | | | | | | | | | | J5° Pl/Ro,Cn,O |
| | | | 6.5 | | | | | | | | | | | | | | | | | | | |
| | | | 17.0 | | | | | | | | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | | | | | | | | | |
| | | | 17.4 | | | | | | | | | | | | | | | | | | | |
| | | | 5.5 | | | | 17.40m: BOREHOLE TERMINATED | | | | | | | | | | | | | | | |
| | | | 18.0 | | | | | | | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|--|--|--|---|--|-----------------------------------|
| Water level on date shown Water inflow Water outflow | RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh | VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet | VL Very loose L Loose MD Medium dense D Dense VD Very dense | ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high | Refer to Defect Description Sheet |

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH1
BOREHOLE DEPTH: 1.6m TO 17.4m





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Engineering Log - Borehole

Borehole No.: **BH2**

Page: 1 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555532.40

Drilling Rig: Hydrapower Scout

Northing: 6873454.10


Driller: Redlands Drilling

RL: 24.10

Logged By: L. Bexley

Total Depth: 3.10

Date: 01/08/2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|--------------------------|-------|----|----------------|----------------------|--|---------------------|--|------------|----------|----------------------------------|-----------------|---|-------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Auger with T.C Bit | | | 24.0 | Slopewash |  | CH | Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist. | | M | St | | 0.15 } < | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555532.40

Drilling Rig: Hydrapower Scout

Northing: 6873454.10

Driller: Redlands Drilling

RL: 24.10

Logged By: L. Bexley

Total Depth: 9.80




Date: 01/08/2018

| Drilling Information | | | | Material Description | | | | | | | Rock Mass Defects | | | | | | | | | | | |
|----------------------|-------|----|----------------|-------------------------------|-------------|-------------|-------------|---|--------------------|-----|-------------------|----|----|---------------------------|-------|---------------------|---|----|-----|-----|------|------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | | | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description | | | | | |
| | | | | | | | | | ETS | VLS | LS | MS | HS | | | VHS | EHS | 30 | 100 | 300 | 1000 | 3000 |
| | | | | Commence NMLC Coring at 3.10m | | | | | | | | | | | | | | | | | | |
| NMLC Coring | | | | Bedrock | | | BAS | BASALT: Very high strength, slightly weathered to fresh, dark grey, slightly fractured. | SW-Fr | | | | | | 9.14 | 81% | S5° 60mm cly & VLS S15° 70mm cly & VLS J5° Pl/Ro,Vn,O J20° Stp/Ro,St,O J5° Pl/Sm,Cn,C S5° 25mm VLS J5° Pl/Sm,Cn,O | | | | | |
| | | | | | | | | | | | | | | | 10.2 | | J5° Un/Ro,Cn,O S10° 30mm VLS | | | | | |
| | | | | | | | | | | | | | | | 12.5 | 64% | J20° Un/Ro,Vr,O J5° Pl/Sm,Cn,O S15° 40mm VLS J40° Pl/Sm,Ct,O J5° Pl/Sm,Ct,O 10mm cly & VLS S30° 60mm VLS & cly | | | | | |

Comments:

Authorised by:

Date:

| Water | | Weathering | | Consistency | | Density | | Rock Strength | | Defects | |
|--|----|-------------------------|-----------------|-------------|-------|-----------------|-----|------------------|--------------------------------------|---------|--|
|  Water level on date shown | RS | Residual soil | VS | Very soft | VL | Very loose | ELS | Extremely low | Refer to Defect Description Sheet | | |
| | XW | Extremely weathered | F | Firm | MD | Medium dense | VLS | Very low | | | |
|  Water inflow | DW | Distinctly weathered | St | Stiff | | | LS | Low | | | |
| | | | VSt | Very stiff | D | Dense | MS | Medium | | | |
|  Water outflow | | | H | Hard | VD | Verv dense | HS | High | | | |
| | SW | Slightly weathered | Moisture | | | | | VHS | | | |
| | FR | Fresh | D Dry | M Moist | W Wet | | | EHS | Extremely high | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH2**

Page: 3 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555532.40 Drilling Rig: Hydropower Scout
Northing: 6873454.10 Driller: Redlands Drilling
RL: 24.10 Logged By: L. Bexley
Total Depth: 9.80 Date: 01/08/2018

| Drilling Information | | | | Material Description | | | | | | | Rock Mass Defects | | | | |
|----------------------|-------|------|----------------|----------------------|---|-------------|--|--|--------------------|--|-------------------|------------------------|-------|----------------------------------|---|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| | | | | | | | | ELS VLS LS MS HS VHS EHS | | | | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness |
| NMLC Coring | | 18.0 | | Bedrock | | BAS | BASALT: Very high strength, slightly weathered to fresh, dark grey, slightly fractured. | SW-Fr | | | | 11.6 | 64% | | -S15° 15mm VLS |
| | | 17.5 | 6.5 | | | | | | | | | | | | -J15° Pl/Sm, Vr, O -S20° 40mm VLS -J30° Pl/Sm, Cn, O |
| | | | 6.7 | | | BAS | BASALT: As above but medium strength, distinctly weathered, highly fractured. | DW | | | | | | | -S25° 15mm |
| | | 17.0 | 7.0 | | | BAS | BASALT: As above but very high strength and slightly weathered to fresh. | SW-Fr | | | | | | | -J20° Pl/Sm, St, O -60mm HFZ -90mm HFZ |
| | | | 7.25 | | | BAS | BASALT: As above but medium strength, distinctly weathered, orange brown, highly fractured. | DW | | | | | | | -J45° Pl/Sm, St, O -190mm HFZ |
| | | 16.5 | 7.5 | | | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | | | | -70mm BZ |
| | | | 7.65 | | | BAS | BASALT: As above but very high strength and slightly weathered. | DW | | | | | | | -J15° Pl/Sm, Cn, O -J30° Pl/Ro, St, O -150mm BZ |
| | | 16.0 | 8.0 | | | BAS | BASALT: As above but medium strength, distinctly weathered, orange brown and grey. | SW-Fr | | | | | | | -50mm BZ |
| | | | 8.5 | | | | BASALT: As above but very high strength and slightly weathered to fresh. | | | | | | | | -60mm BZ -S5° cly & VLS |
| | | | 15.5 | | | 8.7 | BAS | BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered. | XW-DW | | | | | | |
| | | 15.0 | 9.0 | BAS | BASALT: As above but very high strength and slightly weathered to fresh. | SW-Fr | | | | | 10.9 | 32% | | -S5° 35mm VLS | |
| | | 14.5 | 9.35 | BAS | BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered. | XW-DW | | | | | | | | -270mm HFZ -200mm CZ | |
| | | 14.0 | 10.0 | | | | 9.80m: BOREHOLE TERMINATED | | | | | | | | |
| | | | 10.5 | | | | | | | | | | | | |
| | | 13.5 | 11.0 | | | | | | | | | | | | |
| | | 13.0 | 11.5 | | | | | | | | | | | | |
| | | 12.5 | 12.0 | | | | | | | | | | | | |

| | | | | | | | | | | | |
|-----------------------------|-------------------------|---------------------|-----------------|----------------------|-----------------------------------|----------------------|--|--|--|--|--|
| Comments: | | | | | | Authorised by: | | | | | |
| | | | | | | Date: | | | | | |
| Water | Weathering | Consistency | Density | Rock Strength | Defects | | | | | | |
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet | | | | | | |
| ▶ Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | | | | | | | |
| ◀ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | | | | | | | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | | | | | | | |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | | | | | | | |
| | | H Hard | | VHS Very high | | | | | | | |
| | | Moisture | | EHS Extremely high | | | | | | | |
| | | D Dry M Moist W Wet | | | | | | | | | |

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH2
BOREHOLE DEPTH: 3.1m TO 9.8m





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Engineering Log - Borehole

Borehole No.: **BH3**

Page: 1 of 2

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555581.40

Drilling Rig: Hydrapower Scout

Northing: 6873502.40

Driller: Redlands Drilling

RL: 25.30

Logged By: L. Bexley

Total Depth: 7.95

Date: 31/07/2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | |
|---------------------------|-------|-----|---|----------------------|-------------|---------------------|--|--|----------|----------------------------------|-----------------|------------|-------|---------------|-------------------------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | |
| 100mm Auger with T.C Bit | | | 25.0 | Slopewash | | CH | Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist. | | M | St | | 0.2 – | PP | 150kPa | |
| | | | | | | CH | Silty CLAY: As above but with some cobbles. | | M | St | | | | | |
| | | | 0.6 | Residual | | CH | Silty CLAY: As above but very stiff. | | M | VSt | | | 1 | SPT | 4,8,7, N=15: PP=300-350kPa |
| | | | 1.0 | | | | | | | | | | | | |
| | | | 1.5 | | | CH | Silty CLAY: Stiff, high plasticity, red brown trace of grey mottling, trace of extremely weathered basalt gravel, moist. | | M | St | | | 1.5 | D | |
| | | | 2.0 | | | | | | | | | | | | |
| | | | 2.3 | Bedrock | | | | | | | | | 2.5 | SPT | 3,3,7, N=10: PP=150-200kPa |
| | | | 3.0 | | | CH | Silty CLAY: As above but very stiff. | | M | VSt | | | | | |
| | | | 2.9 | | | | | | | | | | | | |
| | | | 2.2 | | | | | | | | | | | | |
| | | | 3.6 | | | BAS | BASALT: Very low strength, extremely weathered, orange brown mottled dark grey. | XW | | VLS | | | 4 | SPT | 18,19,30/130mm, N*=54 |
| | | | 4.0 | | | | | | | | | | | | |
| 21.0 | 4.5 | BAS | BASALT: As above but low strength. | | | XW | | LS | | | | | | | |
| Washbore with Rock Roller | | | 4.7 | | | BAS | BASALT: As above but medium strength, distinctly weathered, dark grey mottled orange brown. | DW | | MS | | | | | |
| | | | 5.0 | | | 4.9 | BAS | BASALT: As above but low strength and extremely weathered. | XW | | LS | | 5.5 | SPT | 30/100mm, N*=90 |
| | | | | | | | | | | | | | | | |
| | | | 20.0 | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | LS Low | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | D Dense | MS Medium | S Vane shear value kPa |
| | | H Hard | VD Very dense | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Borehole

Borehole No.: **BH3**

Page: 2 of 2

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555581.40

Drilling Rig: Hydrapower Scout

Northing: 6873502.40

Driller: Redlands Drilling

RL: 25.30

Logged By: L. Bexley

Total Depth: 7.95

Date: 31/07/2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|---------------------------|-------|------|----------------|-----------------------------------|-------------|---------------------|---|------------|----------|----------------------------------|-----------------|------------|-----------------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| Washbore with Rock Roller | | | 6 | | | BAS | BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered. | XW-DW | | LS-MS | | | | |
| | | 19.0 | 6.8 | | | BAS | BASALT: As above but medium strength and distinctly weathered. | DW | | MS | | 7 } - SPT | 30/140mm, N*=64 | |
| | | | 7 | | | BAS | BASALT: As above but low strength and extremely weathered. | XW | | LS | | | | |
| | | 18.0 | 7.3 | | | BAS | BASALT: As above but medium strength and distinctly weathered. | DW | | MS | | | | |
| | | | 7.8 | | | BAS | BASALT: As above but high strength and slightly weathered. | SW | | HS | | | | |
| | | | 8.0 | 7.95m: BOREHOLE TERMINATED | | | | | | | | | | |
| | | | 17.0 | | | | | | | | | | | |
| | | | 9.0 | | | | | | | | | | | |
| | | | 16.0 | | | | | | | | | | | |
| | | | 10.0 | | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | | |
| | | | 11.0 | | | | | | | | | | | |
| | | | 14.0 | | | | | | | | | | | |
| | | | 12.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Borehole

Borehole No.: **BH4**

Page: 1 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555582.40 Drilling Rig: Hydrapower Scout
Northings: 6873458.60 Driller: Redlands Drilling
RL: 26.70 Logged By: L. Bexley
Total Depth: 0.90 Date: 31/07/2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|-----------------------------|-------|------|----------------|----------------------|-------------|---------------------|--|------------|----------|----------------------------------|-----------------|------------|-----------|----------------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Auger with T.C Bit | | | | Slope wash | | CH | Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist. | | M | St | | 0.1 | PP U50 | 150kPa PP: 290kPa |
| | | 26.0 | 0.5 | Bedrock Residual | | CH | Silty CLAY: As above but very stiff and with some cobbles. | | M | VSt | | 0.5 | | |
| | | | 0.8 | | | BAS | BASALT: Medium strength, distinctly weathered, dark grey stained orange brown. | DW | | MS | | 0.6 | PP D | 300kPa |
| | | | 1.0 | | | | | | | | | | | |
| 0.90m: COMMENCE NMLC CORING | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 25.0 | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 24.0 | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 23.0 | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 22.0 | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 21.0 | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Cored Borehole

Borehole No.: **BH4**

Page: 2 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555582.40 Drilling Rig: Hydrapower Scout
Northing: 6873458.60 Driller: Redlands Drilling
RL: 26.70 Logged By: L. Bexley
Total Depth: 10.10 Date: 31/07/2018

| Drilling Information | | | | Material Description | | | | | Rock Mass Defects | | | | |
|----------------------|-------|------|----------------|----------------------|-------------|-------------|---|--|--------------------|------------------------|--|--|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | Defect Spacing (mm) | Defect Description | |
| | | | | | | | | ELS VLS LS MS HS VHS EHS | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness | |
| NMLC Coring | | | 26.5 | | | | Commence NMLC Coring at 0.90m | | | | | | |
| | | | 0.5 | | | | | | | | | | |
| | | | 26.0 | | | | | | | | | | |
| | | | 25.5 | Bedrock | V A | BAS | BASALT: Very high strength, slightly weathered, dark grey stained orange brown, moderately to highly fractured. | SW | | 8.22 | | J10° Un/Ro, Vr, O 10mm cly J10° Pl/Sm, Vr, O S10° 10mm cly S5° 15mm cly J5° Pl/Sm, Cn, O S40° 30mm cly S15° 30mm cly J20° Pl/Sm, Ct, O J15° Pl/Sm, Vr, O 10mm cly J15° Stp/Sm, St, O 100mm HFZ | |
| | | | 25.0 | | | | | | | | 17% | -260mm HFZ | |
| | | | 24.5 | | | | BASALT: As above but medium strength and distinctly weathered. | DW | | | | -100mm BZ -400mm HFZ | |
| | | | 24.0 | | | | | | | | | -120mm BZ | |
| | | | 23.5 | | | | BASALT: As above but very high strength and slightly weathered. | SW | | 8.14 | | J50° Un/Sm, St, O J15° Pl/Sm, Cn, O J20° Pl/Sm, Cn, O -110mm HFZ J30° Stp/Sm, Vr, O J40° Pl/Sm, Cn, O 30mm HFZ J5° Pl/Sm, St, O -180mm BZ | |
| | | | 23.0 | | | | | | | | 23% | 30mm CZ 30mm CZ S15° with VLS & cly | |
| | | | 22.5 | | | | | | | | | J5° Pl/Sm, Ct, O S15° with 25mm VLS S15° with 25mm VLS J5° Pl/Sm, Cn, O J5° Pl/Sm, Cn, O S20° with VLS S5° with VLS | |
| | | 22.0 | | | | | | | | | S10° 20mm J5° Pl/Sm, St, O J5° Pl/Sm, St, O J15° Un/Ro, St, O | | |
| | | 21.5 | | | | | | | | | 65% | S15° with 30mm VLS & cly J40° Pl/Sm, St, O J15° Pl/Sm, Vr, O 20mm BZ | |
| | | 21.0 | | | | | | | | | | -50mm | |
| | | | 6.0 | | | | | | | | | J10° Pl/Ro, Cn, O | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|-----------------------------|-------------------------|---------------------|-----------------|--------------------|-----------------------------------|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | |
| | | H Hard | | VHS Very high | |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH4**

Page: 3 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555582.40

Drilling Rig: Hydrapower Scout

Northing: 6873458.60

Driller: Redlands Drilling

RL: 26.70

Logged By: L. Bexley

Total Depth: 10.10

Date: 31/07/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|---|------------|--------------------|------------------------|-------|---------------------|---|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| NMLC Coring | | | 20.5 | | | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | | J10° Pl/Ro,Cn,O 40mm BZ J30° Pl/Sm,St,O J5° Un/Ro,Cn,O S5° with 15mm VLS S15° 25mm VLS S20° 50mm VLS J5° Pl/Ro,Cn,O J10° Pl/Sm,Vr,O VLS & cly J5° Pl/Sm,Vr,O with VLS & cly J5° Pl/Sm,Vr,O J5° Pl/Sm,Vr,O S15° with VLS J5° Pl/Ro,Cn,O 50mm BZ S10° 30mm S15° 20mm J20° Pl/Sm,Cn,O J35° Pl/Sm,Cn,O S25° 25mm VLS J15° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O S10° 50mm VLS J5° Pl/Sm,Cn,O J10° Pl/Sm,Vr,O 10mm VLS S5° 30mm VLS J5° Pl/Sm,St,O S15° 20mm VLS J15° Un/Ro,St,O J70° Un/Ro,St,O |
| | | | 6.5 | | | | | | 11.8 | | 65% | | |
| | | | 7.0 | | | | | | 12.0 | | | | |
| | | | 7.5 | | | | | | 11.7 | | 73% | | |
| | | | 8.0 | | | | | | 14.0 | | | | |
| | | | 8.5 | | | | | | 10.2 | | 72% | | |
| | | | 9.0 | | | | | | | | | | |
| | | | 9.5 | | | | | | | | | | |
| | | | 10.0 | | | | | | | | | | |
| | | | 10.1 | | | | | | | | | | |
| | | | 10.5 | | | | 10.10m: BOREHOLE TERMINATED | | | | | | |
| | | | 11.0 | | | | | | | | | | |
| | | | 11.5 | | | | | | | | | | |
| | | | 12.0 | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|--|--|--|---|--|-----------------------------------|
| Water level on date shown Water inflow Water outflow | RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh | VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet | VL Very loose L Loose MD Medium dense D Dense VD Very dense | ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high | Refer to Defect Description Sheet |

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH4
BOREHOLE DEPTH: 3.1m TO 10.1m





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Engineering Log - Borehole

Borehole No.: **BH5**

Page: 1 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555622.80 Drilling Rig: Hydrapower Scout
Northings: 6873483.70 Driller: Redlands Drilling
RL: 26.80 Logged By: L. Bexley
Total Depth: 1.30 Date: 30/07/2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|-----------------------------|-------|----|----------------|----------------------|-------------|---------------------|--|------------|----------|----------------------------------|-----------------|------------|-------|--------------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Auger with T.C Bit | | | 26.0 | 0.7 | | CH | Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist. | | M | St | | | | |
| | | | | | | CH | Silty CLAY: Very stiff, high plasticity, red brown, some cobbles, moist. | | M | VSt | | | | |
| | | | | | | CI | Silty CLAY: As above but hard and medium plasticity. | | M | H | | | | |
| | | | | | | BAS | BASALT: Low strength, extremely weathered, orange brown mottled dark grey. | XW | | LS | | | | |
| Was | | | 1.0 | 0.9 | | | | | | | | 1 } | SPT | 15,24/150mm, N*=48 |
| 1.30m: COMMENCE NMLC CORING | | | | | | | | | | | | | | |
| | | | 25.0 | 2.0 | | | | | | | | | | |
| | | | 24.0 | 3.0 | | | | | | | | | | |
| | | | 23.0 | 4.0 | | | | | | | | | | |
| | | | 22.0 | 5.0 | | | | | | | | | | |
| | | | 21.0 | 6.0 | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Cored Borehole

Borehole No.: **BH5**

Page: 2 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555622.80
Northing: 6873483.70
RL: 26.80
Total Depth: 6.95

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 30/07/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | | |
|----------------------|-------|------|----------------|----------------------|-------------|---|--|--|--------------------|------------------------|-------|----------------------------------|--|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description | |
| | | | | | | | | ELS VLS LS MS HS VHS EHS | | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness | |
| NMLC Coring | | | 26.5 | | | | | | | | | | | |
| | | | 0.5 | | | | | | | | | | | |
| | | | 26.0 | | | | | | | | | | | |
| | | | 1.0 | | | | | | | | | | | |
| | | | 25.5 | | | | Commence NMLC Coring at 1.30m | | | | | | | |
| | | | 1.5 | Bedrock | V Δ | BAS | BASALT: Very high strength, slightly weathered, dark grey with some orange brown staining. | SW | | 8.11 | | 48% | J15° Pl/Sm,Cn,O | |
| | | | 25.0 | 1.7 | V Δ | BAS | BASALT: As above but medium strength, distinctly weathered, highly fractured. | DW | | | | | J40° Pl/Sm,St,O 40mm CZ with cly & VLS J60° Pl/Sm,Vr,C 130mm BZ | |
| | | | 2.0 | 1.95 | V Δ | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | | J40° Pl/Sm,Vr,O J45° Pl/Sm,Vr,O 140mm HFZ | |
| | | | 24.5 | 2.3 | V Δ | BAS | BASALT: As above but medium strength and distinctly weathered. | DW | | | | | 250mm BZ | |
| | | | 2.5 | 2.52 | V Δ | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | | J10° Pl/Ro,Vr,O with VLS & cly 200mm HFZ | |
| | | | 24.0 | 3.0 | V Δ | | | | | | | | J45° Stp/Ro,Vr,O J5° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O 50mm BZ | |
| | | | 23.5 | 3.5 | V Δ | BAS | BASALT: As above but very low strength and extremely weathered. | XW | | | | | J5° Pl/Ro,Vr,O 160mm CZ with VLS | |
| | | | 3.57 | | V Δ | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | | 100mm BZ | |
| | | | 23.0 | 4.0 | V Δ | | | | | | | | 40mm CZ with VLS 50mm BZ | |
| | | | 22.5 | 4.5 | V Δ | | | | | | | | S10° 20mm J45° Pl/Sm,Cn,O J10° Pl/Sm,Vr,O J20° Pl/Sm,Vr,O S45° 30mm J50° Stp/Ro,Cn,O S10° 20mm | |
| | | 22.0 | 5.0 | V Δ | | | | | | | | | | |
| | | 4.95 | | V Δ | BAS | BASALT: As above but medium strength and distinctly weathered. | DW | | 5.3 | | | | 200mm HFZ | |
| | | 21.5 | 5.25 | V Δ | | | | | | | | | 80mm CZ | |
| | | 5.5 | | V Δ | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | | | J5° Pl/Sm,Cn,O J35° Pl/Ro,Ct,O 170mm HFZ | |
| | | 21.0 | 6.0 | V Δ | | | | | | | | | J5° Pl/Sm,Ct,O J25° Pl/Sm,Ct,O J40° Un/Ro,Cn,O S10° with VLS J15° Pl/Sm,Cn,O | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|-----------------------------|-------------------------|---------------------|-----------------|--------------------|-----------------------------------|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | |
| | | H Hard | | VHS Very high | |
| | | Moisture | | EHS Extremely high | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH5**

Page: 3 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555622.80 Drilling Rig: Hydrapower Scout
Northings: 6873483.70 Driller: Redlands Drilling
RL: 26.80 Logged By: L. Bexley
Total Depth: 6.95 Date: 30/07/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | |
|----------------------|-------|----|---|--------------------------------------|-------------|-------------|---|------------|--------------------|------------------------|-------|---------------------|---|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| NMLC Coring | | | 20.5 6.5 20.0 7.0 6.95 | V A V A V A V A | | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | 9.46 | 65% | | J40° Pl/Sm,Cn,C J10° Pl/Sm,Cn,C J10° Pl/Sm,Cn,C J5° Pl/Ro,St,O S20° -10mm BZ |
| | | | 19.5 7.5 19.0 8.0 18.5 8.5 18.0 9.0 17.5 9.5 17.0 10.0 16.5 10.5 16.0 11.0 15.5 11.5 15.0 12.0 | | | | 6.95m: BOREHOLE TERMINATED | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|---------------------------|-------------------------|---------------------|-----------------|--------------------|-----------------------------------|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet |
| Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | |
| | | H Hard | | VHS Very high | |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH5
BOREHOLE DEPTH: 1.3m TO 6.9m





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Engineering Log - Borehole

Borehole No.: **BH6**

Page: 1 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555579.90

Drilling Rig: Hydrapower Scout

Northing: 6873410.10



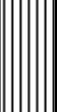
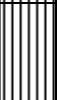






Driller: Redlands Drilling

RL: 27.00

Logged By: L. Bexley

Total Depth: 8.00

Date: 30/07/2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|---------------------------|-------|------|----------------|---|---|---------------------|--|------------|----------|----------------------------------|-----------------|------------|-------|------------------------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Auger with T.C Bit | | 27.0 | 0.2 | Slopewash |  | CH | Silty CLAY: Stiff, high plasticity, red brown, moist. | | M | St | | | | |
| | | | | |  | CH | Silty CLAY: As above but with some cobbles. | | M | St | | 0.5 – | PP | 150kPa |
| | | 26.0 | 1.0 | Residual |  | CH | Silty CLAY: Stiff, high plasticity, red brown, some fine to coarse sized gravel, moist. | | M | St | | 1 | } SPT | 2,2,2, N=4: PP=150-200kPa |
| | | 25.0 | 1.8 | |  | CI | Silty CLAY: As above but hard, medium plasticity, red brown mottled grey and some extremely weathered basalt lenses. | | M | H | | 2.5 | | |
| Washbore with Rock Roller | | | 2.7 | Bedrock |  | BAS | BASALT: Very low strength, extremely weathered, orange brown mottled dark grey. | XW | | VLS | | | } SPT | 7,21,15, N=36 |
| | | 24.0 | 3.0 | |  | | | | | | | | | |
| | | 23.0 | 4.0 | |  | | | | | | | 4 | } SPT | 23,30/120mm, N*=75 |
| | | 22.0 | 5.0 | |  | | | | | | | | | |
| | 21.0 | 6.0 | |  | | | | | | | | 5.5 | } SPT | 22,22,26, N=48 |
| | | | |  | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Borehole

Borehole No.: **BH6**

Page: 2 of 4





Job Number: GE18/144

Easting: 555579.90 **Drilling Rig:** Hydrapower Scout
Northing: 6873410.10 **Driller:** Redlands Drilling
RL: 27.00 **Logged By:** L. Bexley
Total Depth: 8.00 **Date:** 30/07/2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|---------------------------|-------|------|----------------|---|---|---------------------|--|------------|----------|----------------------------------|-----------------|------------|-------|-----------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| Washbore with Rock Roller | | 24.0 | | Bedrock |  | BAS | BASALT: Very low strength, extremely weathered, orange brown mottled dark grey | XW | | VLS | | 7 | SPT | 30/75mm, N*=120 |
| | | 20.0 | 7.0 | |  | BAS | BASALT: As above but low strength and dark grey mottled orange brown | XW | | LS | | | | |
| | | | 7.2 | |  | BAS | BASALT: As above but medium strength and distinctly weathered | DW | | MS | | | | |
| | | 19.0 | 8.0 |  | | | | | | | | | | |
| | | | | | | | 8.00m: COMMENCE NMLC CORING | | | | | | | |
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Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Cored Borehole

Borehole No.: **BH6**

Page: 3 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555579.90 Drilling Rig: Hydrapower Scout
Northings: 6873410.10 Driller: Redlands Drilling
RL: 27.00 Logged By: L. Bexley
Total Depth: 14.50 Date: 30/07/2018

| Drilling Information | | | | Material Description | | | | | | | Rock Mass Defects | | | | |
|----------------------|-------|------|----------------|----------------------|-------------|-------------|---|------------|--|------------------------|-------------------|----------------------------------|--|--|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description | | |
| | | 21.0 | | | | | | | ELS VLS LS MS HS VHS EHS | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness | | |
| NMLC Coring | | 20.5 | 6.5 | | | | | | | | | | | | |
| | | 20.0 | 7.0 | | | | | | | | | | | | |
| | | 19.5 | 7.5 | | | | | | | | | | | | |
| | | 19.0 | 8.0 | | | | Commence NMLC Coring at 8.00m | | | | | | | | |
| | | 8.1 | | Bedrock | | BAS BAS | BASALT: High strength, slightly weathered, dark grey with some orange brown staining, highly fractured. | SW SW | | | | | HFZ 100mm J35° St/Ro, St, O J15° Stp/Ro, St, O J50° Un/Sm, Vr, O J25° Pl/Sm, Cn, O HFZ 120mm S40° J5° Un/Ro, Cn, O BZ 110mm CZ 100mm J50° Pl/Sm, Vr, O CZ 70mm S30° HFZ 100mm S5° J5° Pl/Sm, Cn, O S10° 50mm J5° Pl/Sm, Cn, O J25° Pl/Sm, St, O J15° Stp/Ro, Vr, O CZ with VLS 230mm J10° Pl/Sm, Ct, O Cly 15mm J10° Pl/Sm, Ct, O Cly 20mm | | |
| | | 18.5 | 8.5 | | | | BASALT: As above but very high strength. | | | | | | | | |
| | | 18.0 | 9.0 | | | | | | | | | | | | |
| | | 17.5 | 9.5 | | | | | | | | | | | | |
| | | 17.0 | 10.0 | | | BAS | BASALT: As above but very low strength and extremely weathered. | XW | | | | | | | |
| | | 10.3 | | | | BAS BAS | BASALT: As above but high strength and slightly weathered. | SW XW | | | | | | | |
| | | 16.5 | 10.5 | | | | BASALT: As above but very low strength, extremely weathered, with some clay lenses. | | | | | | | | |
| | | 16.0 | 11.0 | | | | | | | | | | | | |
| | | 15.5 | 11.3 | | | BAS | BASALT: As above but low strength and no clay lenses. | XW | | | | | | | |
| | | 11.7 | | | | BAS | BASALT: As above but very low strength, with some highly fractured zones and crushed zones. | XW | | | | | | | |
| | | 15.0 | 12.0 | | | | | | | | | 18% | | | |

| | | | | | | | | | | | |
|-----------------------------|-------------------------|---------------------|-----------------|----------------------|-----------------------------------|----------------------|--|--|--|--|--|
| Comments: | | | | | | Authorised by: | | | | | |
| | | | | | | Date: | | | | | |
| Water | Weathering | Consistency | Density | Rock Strength | Defects | | | | | | |
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet | | | | | | |
| ▶ Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | | | | | | | |
| ◀ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | | | | | | | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | | | | | | | |
| | FR Fresh | H Hard | VD Very dense | HS High | | | | | | | |
| | | Moisture | | VHS Very high | | | | | | | |
| | | D Dry M Moist W Wet | | EHS Extremely high | | | | | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH6**

Page: 4 of 4


Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555579.90 Drilling Rig: Hydrapower Scout
Northing: 6873410.10 Driller: Redlands Drilling
RL: 27.00 Logged By: L. Bexley
Total Depth: 14.50 Date: 30/07/2018

| Drilling Information | | | | Material Description | | | | | | | Rock Mass Defects | | | | |
|-----------------------------|---|--------|----------------|----------------------|-------------|-------------|---|--|--------------------|--|-------------------|------------------------|----------------------------------|---|---|
| Drill Method | Water | RL (m) | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| | | | | | | | | ELS VLS LS MS HS VHS EHS | | | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness | |
| NMLC Coring |  | 14.50 | 12.3 | V | Δ | BAS | BASALT: As above but very low strength, with some highly fractured zones and crushed zones. | XW | | | | | | | |
| | | 14.5 | 12.5 | V | Δ | BAS | BASALT: As above but low strength. | XW | | | | 0.29 | 18% | | J70° Un/Ro, St, O J10° Stp/Ro, St, C J40° Stp/Ro, St, O |
| | | 14.0 | 13.0 | V | Δ | | | | | | | | | | CZ 50mm with Cly & VLS CZ 70mm with Cly & VLS CZ throughout ranging between 10mm & 30mm |
| | | 13.5 | 13.5 | V | Δ | | | | | | | | | | |
| | | 13.0 | 14.0 | V | Δ | BAS | BASALT: As above but low strength to medium strength and extremely to distinctly weathered. | XW-DW | | | | 0.27 | 18% | | J5° Pl/Sm, Cn, O CZ 30mm with Cly & VLS J5° Pl/Sm, Cn, O |
| | | 14.25 | 14.25 | V | Δ | | BASALT: As above but high strength and slightly weathered. | SW | | | | | | | J15° Pl/Sm, Cn, O |
| | | 14.33 | 14.33 | V | Δ | BAS | BASALT: As above but very low strength and extremely weathered. | SW | | | | | | | HFZ 100mm |
| | | 14.32 | 14.32 | V | Δ | BAS | BASALT: As above but very low strength and extremely weathered. | XW | | | | 0.39 | | | J30° Pl/Sm, Cn, O |
| | | 14.5 | 14.5 | V | Δ | BAS | BASALT: High strength and slightly weathered. | SW | | | | | | | CZ 90mm |
| 14.50m: BOREHOLE TERMINATED | | | | | | | | | | | | | | | |
| | | 12.0 | 15.0 | | | | | | | | | | | | |
| | | 11.5 | 15.5 | | | | | | | | | | | | |
| | | 11.0 | 16.0 | | | | | | | | | | | | |
| | | 10.5 | 16.5 | | | | | | | | | | | | |
| | | 10.0 | 17.0 | | | | | | | | | | | | |
| | | 9.5 | 17.5 | | | | | | | | | | | | |
| | | 9.0 | 18.0 | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|-----------------------------|-------------------------|---------------------|-----------------|--------------------|-----------------------------------|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | |
| | | H Hard | | VHS Very high | |
| | | Moisture | | EHS Extremely high | |
| | | D Dry M Moist W Wet | | | |

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH6
BOREHOLE DEPTH: 8.0m TO 14.5m





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Engineering Log - Borehole

Borehole No.: **BH7**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555540.70 Drilling Rig: Hydrapower Scout
 Northing: 6873361.10 Driller: Redlands Drilling
 RL: 25.40 Logged By: L. Bexley
 Total Depth: 2.00 Date: 02/08/2018

| Drilling Information | | | | Material Description | | | | Test Samples | | | |
|------------------------------------|-------|------|----------------|----------------------|-------------|---------------------|---|--------------|----------|----------------------------------|---|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results |
| T.C. Rig Wa shore with Rock | | 25.0 | 0.7 | Slopewash | | CH | Silty CLAY: Stiff, high plasticity, red brown, moist. | | M | St | 0.1 } 0.3 } - BP - 150kPa 1 } - SPT - 6,10,12, N=22 |
| | | | 1.0 | Residual | | CH | Silty CLAY: Very stiff, high plasticity, red brown, fine to medium sized gravel, some cobbles, moist. | | M | VSt | |
| | | | 1.05 | | | CL | Silty CLAY: As above but hard, low plasticity and grey mottled orange brown. | | M | H | |
| | | | 1.5 | Bedrock | | BAS | BASALT: Very low strength, extremely weathered, orange brown mottled grey. | XW | | VLS | |
| | | | 2.0 | | | BAS | BASALT: As above but medium strength and distinctly weathered. | DW | | MS | |
| 2.00m: COMMENCE NMLC CORING | | | | | | | | | | | |
| | | | 23.0 | | | | | | | | |
| | | | 3.0 | | | | | | | | |
| | | | 22.0 | | | | | | | | |
| | | | 4.0 | | | | | | | | |
| | | | 21.0 | | | | | | | | |
| | | | 5.0 | | | | | | | | |
| | | | 20.0 | | | | | | | | |
| | | | 6.0 | | | | | | | | |

| | | | | | | | |
|-----------------------------|-------------------------|---------------------|-----------------|----------------------|---|----------------------|--|
| Comments: | | | | | | Authorised by: | |
| | | | | | | Date: | |
| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results | | |
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. | | |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. | | |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. | | |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. | | |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa | | |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. | | |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes | | |
| | | D Dry M Moist W Wet | | EHS Extremely high | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH7**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555540.70
Northing: 6873361.10
RL: 25.40
Total Depth: 19.05

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 02/08/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|--|--|--------------------|-------------------|--|------------------------|-------|---------------------|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description type, inclination, planarity, roughness, coating, thickness |
| | | | | | | | | ELS VLS LS MS HS VHS EHS | | | | | | | |
| NMLC Coring | | | 25.0 | | | | | | | | | | | | |
| | | | 24.5 | | | | | | | | | | | | |
| | | | 24.0 | | | | | | | | | | | | |
| | | | 23.5 | | | | Commence NMLC Coring at 2.00m | | | | | | | | |
| | | | 23.0 | Bedrock | | BAS | BASALT: Very high strength, slightly weathered to fresh, dark grey, moderately fractured. | SW-Fr | | | | 6.51 | | | J5° Pl/Sm,Cn,O J10° Pl/Sm,St,O S15° 30mm S30° 30mm S45° 20mm VLS S20° 15mm J15° Pl/Sm,St,O CZ 100mm cly & VLS BZ 150mm |
| | | | 22.5 | | | BAS BAS | BASALT: As above but very low strength and extremely weathered. | XW | | | | | | | HFZ 450mm |
| | | | 22.0 | | | | BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered. | XW-DW | | | | | | | BZ 70mm |
| | | | 21.5 | | | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | 2.56 | | | J25° Stp/Ro,Cn,O J25° Un/Ro,Cn,O J5° Pl/Sm,Cn,O J5° Pl/Sm,Vr,O S5° 60mm |
| | | | 21.0 | | | BAS | BASALT: As above but low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, highly fractured, with some very high strength and slightly weathered zones. | XW-DW | | | | | | | J30° Pl/Ro,Cn,O J30° Pl/Sm,Vr,O J15° Pl/Sm,St,O J15° Pl/Sm,St,O J20° Pl/Sm,St,O BZ 340mm |
| | | | 20.5 | | | | | | | | | | | | |
| | | | 20.0 | | | | | | | | | | | | |
| | | | 19.5 | | | | | | | | | | | | |

| | | | | | | | | | | | |
|-----------------------------|-------------------------|---------------------|-----------------|----------------------|-----------------------------------|----------------------|--|--|--|--|--|
| Comments: | | | | | | Authorised by: | | | | | |
| | | | | | | Date: | | | | | |
| Water | Weathering | Consistency | Density | Rock Strength | Defects | | | | | | |
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet | | | | | | |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | | | | | | | |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | | | | | | | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | | | | | | | |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | | | | | | | |
| | | H Hard | | VHS Very high | | | | | | | |
| | | Moisture | | EHS Extremely high | | | | | | | |
| | | D Dry M Moist W Wet | | | | | | | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH7**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555540.70 Drilling Rig: Hydropower Scout
Northing: 6873361.10 Driller: Redlands Drilling
RL: 25.40 Logged By: L. Bexley
Total Depth: 19.05 Date: 02/08/2018

| Drilling Information | | | | Material Description | | | | | Rock Mass Defects | | | | |
|----------------------|-------|----|---|----------------------|-------------|--------------------------|--|--|--------------------|---|-------|----------------------------------|---|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| | | | | | | | | ELS VLS LS MS HS VHS EHS | | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness |
| NMLC Coring | | | 19.0 6.5 6.7 18.5 7.0 18.0 7.5 17.5 8.0 17.0 8.5 16.5 9.0 9.8 16.0 9.5 15.5 10.0 15.0 10.5 14.5 10.8 14.0 11.5 13.5 12.0 | | | BAS BAS BAS BAS | BASALT: As above but low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, highly fractured, with some very high strength and slightly weathered zones. BASALT: As above but medium strength and distinctly weathered. BASALT: As above but medium strength to high strength, distinctly weathered to slightly weathered, with some very high strength and extremely weathered zones. BASALT: As above but low strength and extremely weathered. | XW-DW DW DW-SW XW | | 6.36 < | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|--|--|--|---|--|-----------------------------------|
| Water level on date shown Water inflow Water outflow | RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh | VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet | VL Very loose L Loose MD Medium dense D Dense VD Very dense | ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high | Refer to Defect Description Sheet |



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Engineering Log - Cored Borehole

Borehole No.: **BH7**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555540.70 Drilling Rig: Hydrapower Scout
Northings: 6873361.10 Driller: Redlands Drilling
RL: 25.40 Logged By: L. Bexley
Total Depth: 19.05 Date: 02/08/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|--|------------|--------------------|------------------------|-------|---------------------|--------------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| NMLC Coring | | | | | | | | | | | | | |
| | | | 13.0 | | | BAS | BASALT: As above but low strength and extremely weathered. | XW | | | 10% | | |
| | | | 12.5 | | | | | | | | | | |
| | | | 13.0 | | | BAS | BASALT: As above but very low strength, with some clay seams. | XW | | | 15% | | |
| | | | 12.0 | | | | | | | | | | |
| | | | 13.5 | | | | | | | | | | |
| | | | 13.6 | | | BAS | BASALT: As above but very high strength, fresh, dark grey vesicular, lenses of feldspar. | Fr | | | 100% | | |
| | | | 11.5 | | | | | | | | | | |
| | | | 14.0 | | | | | | | | | | |
| | | | 11.0 | | | | | | | | | | |
| | | | 14.5 | | | | | | | | | | |
| | | | 10.5 | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | |
| | | | 10.0 | | | | | | | | | | |
| | | | 15.4 | | | | | | | | | | |
| | | | 9.5 | | | | | | | | | | J20° Stp/Ro,Cn,O |
| | | | 16.0 | | | | | | | | | | J5° Pl/Ro,Cn,O |
| | | | 9.0 | | | | | | | | | | J5° Un/Ro,Cn,O |
| | | | 16.5 | | | | | | | | | | J20° Pl/Sm,Cn,O |
| | | | 8.5 | | | | | | | | | | J45° Pl/Sm,Cn,O |
| | | | 17.0 | | | | | | | | | | |
| | | | 8.0 | | | | | | | | | | |
| | | | 17.5 | | | | | | | | | | |
| | | | 7.5 | | | | | | | | | | |
| | | | 18.0 | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|---------------------------|-------------------------|---------------------|-----------------|--------------------|-----------------------------------|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet |
| Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | |
| | FR Fresh | H Hard | VD Very dense | HS High | |
| | | Moisture | | VHS Very high | |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Cored Borehole

Borehole No.: **BH7**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555540.70 Drilling Rig: Hydrapower Scout
Northing: 6873361.10 Driller: Redlands Drilling
RL: 25.40 Logged By: L. Bexley
Total Depth: 19.05 Date: 02/08/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|--|------------|--------------------|------------------------|-------|---------------------|--------------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| NMLC Coring | | | 7.0 18.5 | | | BAS | BASALT: As above but very high strength, fresh, dark grey vesicular, lenses of feldspar. | Fr | | 10.9 | 100% | | |
| | | | 6.5 19.0 | | | | | | | 4.9 | | | J30° Pl/Sm,Cn,O |
| | | | 10.05 | | | | 19.05m: BOREHOLE TERMINATED | | | | | | |
| | | | 6.0 19.5 | | | | | | | | | | |
| | | | 5.5 20.0 | | | | | | | | | | |
| | | | 5.0 20.5 | | | | | | | | | | |
| | | | 4.5 21.0 | | | | | | | | | | |
| | | | 4.0 21.5 | | | | | | | | | | |
| | | | 3.5 22.0 | | | | | | | | | | |
| | | | 3.0 22.5 | | | | | | | | | | |
| | | | 2.5 23.0 | | | | | | | | | | |
| | | | 2.0 23.5 | | | | | | | | | | |
| | | | 1.5 24.0 | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|--|--|--|---|--|-----------------------------------|
| Water level on date shown Water inflow Water outflow | RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh | VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet | VL Very loose L Loose MD Medium dense D Dense VD Very dense | ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high | Refer to Defect Description Sheet |

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH7
BOREHOLE DEPTH: 2.0m TO 19.05m





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Engineering Log - Borehole

Borehole No.: **BH8**

Page: 1 of 1

Job Number: GE18/144

Easting: 555637.00 Drilling Rig: Jeyhco Digga
Northing: 6873523.00 Driller: Morrison Geotechnic
RL: 20.20 Logged By: C. Lam
Total Depth: 3.00 Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|--------------------------------------|-------|------|----------------|----------------------|-------------|---------------------|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Solid Flight Auger with TC Bit | | 20.0 | 0.1 | Residual Slopewash | | CI | Sandy CLAY: Stiff, medium plasticity, red brown, fine to medium grained sand, moist Silty CLAY: Hard, high plasticity, red brown mottled grey, some fine to medium sized gravel, moist | | M | St | | 0.1 | BS | Bulk Sample |
| | | | | | | CH | | | M | H | | | | |
| | | 19.0 | 1.1 | Rock | | BAS | BASALT: Very low strength, extremely weathered, brown mottled grey, some low to medium strength fragments | XW | | VLS | | | | |
| | | 18.0 | 2.0 | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | 17.0 | | | | | 3.00m: BOREHOLE TERMINATED | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | 16.0 | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | 15.0 | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|--------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | LS Low | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | S Vane shear value kPa |
| | | H Hard | | VHS Very high | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | EHS Extremely high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH9**

Page: 1 of 1

Job Number: GE18/144






Easting: 555699.00
Northing: 6873542.00
RL: 17.70
Total Depth: 1.30

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|--------------------------------------|-------|----|----------------|----------------------|---|---------------------|--|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Solid Flight Auger with TC Bit | | | 0.15 | Slope wash |  | CI | Sandy CLAY: Stiff, medium plasticity, red brown, fine to medium grained sand, moist | | M | St | | | | |
| | | | 0.5 | Residual |  | CH | Silty CLAY: Hard, high plasticity, red brown mottled grey, some fine to medium sized gravel, moist | | M | H | | | | |
| | 17.0 | | 1.0 | Rock |  | BAS | BASALT: Very low strength, extremely weathered, brown mottled grey, some medium strength fragments | XW | | VLS | | | | |
| | | | 1.2 | |  | BAS | BASALT: As above but low strength | XW | | LS | | | | |
| | | | 1.3 | |  | | 1.30m: MAXIMUM TC REFUSAL | | | | | | | |
| | | | 16.0 | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | | 14.0 | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | | 13.0 | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | | 12.0 | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|--------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | L Low | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium High | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555711.00

Drilling Rig: Jeyhco Digga

Northing: 6873497.70

Driller: Morrison Geotechnic

RL: 25.10

Logged By: C. Lam

Total Depth: 3.00

Date: 08.03.2018

[illegible]

Comments:

Authorised by:

Date:

| Water | | Weathering | | Consistency | | Density | | Rock Strength | | Tests & Results | |
|-------|---------------|------------|----------------------|-----------------|------------|---------|--------------|---------------|----------------|-----------------|--|
| ▼ | Water level | RS | Residual soil | VS | Very soft | VL | Very loose | ELS | Extremely low | U50 | Undisturbed 50mm diam tube. |
| == | on date shown | XW | Extremely weathered | S | Soft | L | Loose | | | D | Disturbed sample. |
| ► | Water inflow | DW | Distinctly weathered | St | Stiff | MD | Medium dense | VLS | Very low | SPT | Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| ► | Water outflow | SW | Slightly weathered | VSt | Very stiff | D | Dense | MS | Medium | PP | Hand penetrometer estimate of unconfined compressive strength, kPa. |
| ► | | FR | Fresh | H | Hard | VD | Very dense | HS | High | S | Vane shear value kPa |
| | | | | Moisture | | | | VHS | Very high | DC | Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | D Dry | M Moist | W Wet | | EHS | Extremely high | | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |



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Engineering Log - Borehole

Borehole No.: **BH11**

Page: 1 of 1

Job Number: GE18/144

Easting: 555681.90
Northing: 6873421.00
RL: 26.70
Total Depth: 2.60

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|--------------------------------------|-------|------|----------------|----------------------|-------------|---------------------|--|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Solid Flight Auger with TC Bit | | | 0.1 | Slopewash | | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist | | M | H | 2 | | | |
| | | | | Residual | | CH | Silty CLAY: Stiff, high plasticity, red brown, moist | | M | St | 3 | | | |
| | | 26.0 | | | | | | | | | 8 | | | |
| | | | 0.8 | | | CH | Silty CLAY: As above but brown, some fine to medium sized gravel | | M | St | 15 | | | |
| | | | 1.0 | | | | | | | | | | | |
| | | | 1.5 | Rock | | BAS | BASALT: Very low strength, extremely weathered, brown mottled grey, some medium strength fragments | XW | | VLS | | | | |
| | | 25.0 | | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | |
| | | | 2.5 | Rock | | BAS | BASALT: As above but low strength | XW | | LS | | | | |
| | | | 2.6 | | | | 2.60m: MAXIMUM TC REFUSAL | | | | | | | |
| | | 24.0 | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | 23.0 | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | 22.0 | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | 21.0 | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|--------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | L Low | D Disturbed sample. |
| ► Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH12**

Page: 1 of 1

Job Number: GE18/144

Easting: 555644.00
Northing: 6873396.00
RL: 26.50
Total Depth: 1.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | | | | | |
|--------------------------------------|-------|------|----------------|----------------------|-------------|---------------------|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|--|--|--|--|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | | | | | |
| 100mm Solid Flight Auger with TC Bit | | 26.0 | 0.1 | Slope Residual | | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist Silty CLAY: Very stiff, high plasticity, red brown, trace fine to medium sized gravel, moist BASALT: Low strength, extremely weathered, grey, with medium strength fragments | | M | H | 2 | 0.5 | U50 | PP=350kPa | | | | | |
| | | | CH | | | 3 | | | | | | | | | | | | | |
| | | | | | | 3 | | | | | | | | | | | | | |
| | | | | | | 2 | | | | | | | | | | | | | |
| | | | | | | 3 | | | | | | | | | | | | | |
| | | | | 3 | | | | | | | | | | | | | | | |
| | | | | 3 | | | | | | | | | | | | | | | |
| | | | | 3 | | | | | | | | | | | | | | | |
| | | | | 6 | | | | | | | | | | | | | | | |
| | | | | 5 | | | | | | | | | | | | | | | |
| | | | | 7 | | | | | | | | | | | | | | | |
| | | | | 15 | | | | | | | | | | | | | | | |
| | | | 1.0 | | | | | | | | | | | | | | | | |
| | | | 1.3 | Rock | | BAS | XW | | LS | | | | | | | | | | |
| | | | 25.0 | | | | | | | | | | | | | | | | |
| 1.50m: MAXIMUM TC REFUSAL | | | | | | | | | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | | | | | | |
| | | | 24.0 | | | | | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | | | | | | |
| | | | 23.0 | | | | | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | | | | | | |
| | | | 22.0 | | | | | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | | | | | | |
| | | | 21.0 | | | | | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|--------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | LS Low | D Disturbed sample. |
| ► Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium high | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH13**

Page: 1 of 1

Job Number: GE18/144

Easting: 555580.70
Northing: 6873319.60
RL: 26.50
Total Depth: 1.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | | | | | |
|--------------------------------------|-------|------|----------------|----------------------|-------------|---------------------|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|--|--|--|--|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | | | | | |
| 100mm Solid Flight Auger with TC Bit | | 26.0 | 0.1 | Slopewash | | CH | Sandy CLAY: Hard, high plasticity, brown, fine to medium grained sand, with organics, moist | | M | H | 11 | | | | | | | | |
| | | | CH | | | 6 | | | | | | | | | | | | | |
| | | | | | | | | | | | 10 | | | | | | | | |
| | | | | | | | | | | | 4 | | | | | | | | |
| | | | | | | | | | | | 5 | | | | | | | | |
| | | | 0.7 | Residual | | | Silty CLAY: Hard, high plasticity, red brown, some fine to coarse sized gravel, moist | | | | 5 | | | | | | | | |
| | | | | | | | | | | | 6 | | | | | | | | |
| | | | | | | | | | | | 5 | | | | | | | | |
| | | | 1.0 | | | CH | | | | | 4 | | | | | | | | |
| | | | | | | | | | | | 3 | | | | | | | | |
| | | | | | | | | | | | 8 | | | | | | | | |
| | | | | | | | | | | | 15 | | | | | | | | |
| | | | 1.3 | Rock | | | BASALT: Low strength, extremely weathered, grey, with medium strength fragments | XW | | LS | | | | | | | | | |
| | | | | | | BAS | | | | | | | | | | | | | |
| | | | 1.5 | | | | | | | | | | | | | | | | |
| | | | 2.0 | | | | 1.50m: MAXIMUM TC REFUSAL | | | | | | | | | | | | |
| | | | 24.0 | | | | | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | | | | | | |
| | | | 23.0 | | | | | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | | | | | | |
| | | | 22.0 | | | | | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | | | | | | |
| | | | 21.0 | | | | | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D |
| ► Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | LS Low | MS Medium | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | D Dense | HS High | S Vane shear value kPa |
| | | H Hard | VD Very dense | VHS Very high | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | EHS Extremely high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555523.40

Drilling Rig: Jeyhco Digga

Northing: 6873320.10

Driller: Morrison Geotechnic

RL: 24.80

Logged By: C. Lam

Total Depth: 0.90






Date: 08.03.2018

[illegible]

Comments:

Authorised by:

Date:

| Water | | Weathering | | Consistency | | Density | | Rock Strength | | Tests & Results | |
|--|---------------|------------|----------------------|-----------------|------------|---------|--------------|---------------|----------------|-----------------|--|
|   | Water level | RS | Residual soil | VS | Very soft | VL | Very loose | ELS | Extremely low | U50 | Undisturbed 50mm diam tube. |
| | on date shown | | | S | Soft | L | Loose | | | | Disturbed sample. |
|  | Water inflow | XW | Extremely weathered | F | Firm | MD | Medium dense | VLS | Very low | SPT | Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | | | | St | Stiff | | | LS | Low | | |
|  | Water inflow | DW | Distinctly weathered | VSt | Very stiff | D | Dense | MS | Medium | PP | Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | | | | H | Hard | VD | Very dense | HS | High | S | Vane shear value kPa |
|  | Water outflow | SW | Slightly weathered | | | | | VHS | Very high | DC | Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | | | | | EHS | Extremely high | | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | FR | Fresh | Moisture | | | | | | | |
| | | | | D Dry | M Moist | W Wet | | | | | |



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Engineering Log - Borehole

Borehole No.: **BH15**

Page: 1 of 1

Job Number: GE18/144



Easting: 555453.90
Northing: 6873347.90
RL: 18.20
Total Depth: 0.80

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | Test Samples | | | | |
|--------------------------------------|-------|------|----------------|---|---|---|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Solid Flight Auger with TC Bit | | 18.0 | 0.1 |  |  | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist | | M | H | | | | |
| | | | CH | | | Silty CLAY: Very stiff, high plasticity, red brown, some fine to medium sized gravel, moist | | M | VSt | | | | | |
| | | | | | | BASALT: Very low strength, extremely weathered, grey brown, some low to mediums strength fragments | | | VLS | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 0.6 | | | | | | | | | | | |
| | | | 0.7 | | | | | | | | | | | |
| | | | 0.8 | | | | | | | | | | | |
| | | | 1.0 | | | | 0.80m: MAXIMUM T.C REFUSAL | | | | | | | |
| | | | 17.0 | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | |
| | | | 16.0 | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | | 14.0 | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | | 13.0 | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | L Loose | L Loose | D Disturbed sample. | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH16**

Page: 1 of 1

Job Number: GE18/144

Easting: 555464.00
Northing: 6873295.00
RL: 20.80
Total Depth: 0.80

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | |
|--------------------------------------|-------|------|----------------|----------------------|-------------|---------------------|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | |
| 100mm Solid Flight Auger with TC Bit | | | 0.1 | Superficial Residual | | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist | | M | H | | | | | |
| | | | | | | CH | Silty CLAY: Very stiff, high plasticity, red brown, some fine to coarse sized gravel, moist | | M | VSt | | | | | |
| | | | 0.6 | Rock | | BAS | BASALT: Very low strength, extremely weathered, grey brown, some low to medium strength fragments | | | | | | | | |
| | | | 0.7 | | | BAS | BASALT: As above but low strength | XW | | VLS | | | | | |
| | | | 0.8 | | | BAS | | XW | | LS | | | | | |
| | | 20.0 | 1.0 | | | | 0.80m: MAXIMUM T.C. REFUSAL | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 19.0 | | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 18.0 | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 17.0 | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 16.0 | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| ► Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH17**

Page: 1 of 1

Job Number: GE18/144

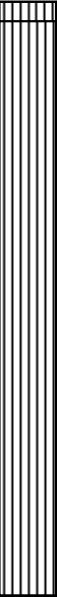
Easting: 555407.00
Northing: 6873296.10
RL: 14.70
Total Depth: 3.00

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

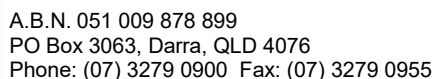
| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | | | | | | |
|--------------------------------------|----------------------------|------|----------------|----------------------|--|---------------------|--|--|----------|----------------------------------|-----------------|------------|-------|---------------|-----|--|--|--|--|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | | | | | | |
| 100mm Solid Flight Auger with TC Bit | | | 0.1 | Residual Slopewash |  | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist | | M | H | | 0.3 | BS | Bulk Sample | | | | | | |
| | | | 14.0 | | | CH | | Sandy CLAY: Very stiff, high plasticity, red brown, fine to medium grained sand, some fine to medium sized gravel, moist | | M | | | | | VSt | | | | | |
| | | | 1.0 | | | | | | | | | | | | | | | | | |
| | | | 13.0 | | | | | | | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | | | | | | | |
| | | | 12.0 | | | | | | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | | | | | | | |
| | 3.00m: BOREHOLE TERMINATED | | | | | | | | | | | | | | | | | | | |
| | | | 11.0 | | | | | | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | | | | | | | |
| | | 10.0 | | | | | | | | | | | | | | | | | | |
| | | 5.0 | | | | | | | | | | | | | | | | | | |
| | | 9.0 | | | | | | | | | | | | | | | | | | |
| | | 6.0 | | | | | | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



Page: 1 of 1

Location: Cudgen Road, Kingscliff

| | |
|---------------------|------------|
| Easting: | 555482.30 |
| Northing: | 6873253.70 |
| RL: | 23.40 |
| Total Depth: | 3.00 |

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

| | | | | | | | | | | | |
|--------------|------------------------------|-------------------|-------------------------|--------------------|------------|----------------|-----------------|----------------------|-------------------|-------------------------------------|--|
| Comments: | | | | | | | | | | Authorised by: Date: | |
| Water | | Weathering | | Consistency | | Density | | Rock Strength | | Tests & Results | |
| ▼ — | Water level on date shown | RS | Residual soil | VS | Very soft | VL | Very loose | ELS | Extremely low | U50 | Undisturbed 50mm diam tube. |
| ► | Water inflow | XW | Extremely weathered | S | Soft | L | Loose | VLS | Very low | D | Disturbed sample. |
| ► | Water outflow | DW | Distinctly weathered | F | Firm | MD | Medium dense | LS | Low | SPT | Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| ► | | SW | Slightly weathered | St | Stiff | | | MS | Medium | PP | Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | | FR | Fresh | VSt | Very stiff | D | Dense | HS | High | S | Vane shear value kPa |
| | | | | H | Hard | VD | Very dense | VHS | Very high | DC | Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | Moisture | | | | EHS | Extremely high | | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | D | Dry | M | Moist | | | | |
| | | | | | | W | Wet | | | | |



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Engineering Log - Borehole

Borehole No.: **BH19**

Page: 1 of 1

Job Number: GE18/144

Easting: 555396.00 Drilling Rig: Jeyhco Digga
Northing: 6873218.00 Driller: Morrison Geotechnic
RL: 17.10 Logged By: C. Lam
Total Depth: 3.00 Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | |
|--------------------------------------|-------|------|----------------|--|-------------|---|--|---|----------|----------------------------------|-----------------|------------|-------|---------------|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | |
| 100mm Solid Flight Auger with TC Bit | | 17.0 | 0.1 | <div>Slopewash</div> <div>Residual</div> | | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist | | M | H | 2 | 0.5 | U50 | PP=350kPa | |
| | | | CH | | | Silty CLAY: Very stiff, high plasticity, red brown, trace of fine to medium sized gravel, moist | | M | VSt | 6 | | | | | |
| | | | | | | | | | | 4 | | | | | |
| | | | | | | | | | | 4 | | | | | |
| | | | | | | | | | | 6 | | | | | |
| | | | | | | | | | | 5 | | | | | |
| | | | | | | | | | | 10 | | | | | |
| | | | | | | | | | | 6 | | | | | |
| | | | | | | | | | | 10 | | | | | |
| | | | | | | | | | | 15 | | | | | |
| | | | 16.0 | 1.1 | | CH | Silty CLAY: As above but brown and some fine to medium sized gravel | | M | VSt | | | | | |
| | | | | 1.5 | | CH | Silty CLAY: As above but brown mottled grey | | M | VSt | | | | | |
| | | | | 2.0 | | | | | | | | | | | |
| | | | 15.0 | 2.5 | Rock | | BAS | BASALT: Very low strength, extremely weathered, brown mottled grey, some low to medium strength fragments | XW | | VLS | | | | |
| | | | | 3.0 | | | | | | | | | | | |
| | | 14.0 | 3.00m | BOREHOLE TERMINATED | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | | |
| | | 13.0 | | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | | |
| | | 12.0 | | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|--------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | LS Low | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | HS High | S Vane shear value kPa |
| | | H Hard | | VHS Very high | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | EHS Extremely high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH20**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555434.90

Drilling Rig: Jeyhco Digga

Northing: 6873158.70





Driller: Morrison Geotechnic

RL: 21.10

Logged By: C. Lam

Total Depth: 2.60

Date: 08.03.2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|--------------------------------------|-------|------|------------------------------------|----------------------|---|---|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Solid Flight Auger with TC Bit | | 21.0 | 0.1 | Slopewash |  | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist | | M | H | 2 | | | |
| | | | CH | | | | | M | VSt | 3 | | | | |
| | | | 0.5 | Residual |  | CH | Silty CLAY: Very stiff, high plasticity, red brown, trace of fine to medium sized gravel, moist | | M | VSt | 3 | | | |
| | | | | | | | | | VSt | 3 | | | | |
| | | | 1.0 | Rock |  | CH | Silty CLAY: As above but with fine to coarse sized gravel and some cobbles | | | | 15 | | | |
| | | | 1 | | | | | M | VSt | | | | | |
| | | | 1.3 | Rock |  | BAS | BASALT: Very low strength, extremely weathered, brown mottled grey, some low to medium strength fragments | XW | | VLS | | | | |
| | | | 2.0 | | | | | | | | | | | |
| | | | 2.5 | | | | | | | | | | | |
| | | | 2.6 | | | | | | | | | | | |
| | | | | | BAS | BASALT: As above but low strength | XW | | LS | | | | | |
| | | | 2.60m: MAXIMUM T.C. REFUSAL | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|---------------------|-----------------|--------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | L Low | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | H Hard | VD Very dense | MS Medium High | S Vane shear value kPa |
| | | | | VHS Very high | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | EHS Extremely high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH21**

Page: 1 of 1

Job Number: GE18/144

Eastings: 555387.00 Drilling Rig: Jeyhco Digga
Northings: 6873134.00 Driller: Morrison Geotechnic
RL: 17.70 Logged By: C. Lam
Total Depth: 3.00 Date: 08.03.2018

Client: Wood & Grieve Engineers
Project: Geotechnical Invest - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | |
|--------------------------------------|----------------------------|------|----------------|----------------------|-------------|---------------------|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | |
| 100mm Solid Flight Auger with TC Bit | | | 0.1 | Slopewash | | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist | | M | H | 2 | 1 – | PP | 270kPa | |
| | | | | | CH | | | M | VSt | 2 | | | | | |
| | | | | | | | | | 3 | | | | | | |
| | | | | | | | | | 4 | | | | | | |
| | | | | | | | | | 4 | | | | | | |
| | | | 0.6 | Residual | | CH | Silty CLAY: Very stiff, high plasticity, red brown, some fine to medium sized gravel, moist | | M | VSt | 15 | | | | |
| | | | 1.0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 16.0 | | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | | |
| | 3.00m: BOREHOLE TERMINATED | | | | | | | | | | | | | | |
| | | | 14.0 | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | | |
| | | 13.0 | | | | | | | | | | | | | |
| | | 5.0 | | | | | | | | | | | | | |
| | | 12.0 | | | | | | | | | | | | | |
| | | 6.0 | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|--|--|--|---|--|---|
| <div> <div></div> <div>Water level on date shown</div> </div> <div> <div></div> <div>Water inflow</div> </div> <div> <div></div> <div>Water outflow</div> </div> | RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh | VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard | VL Very loose L Loose MD Medium dense D Dense VD Very dense | ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high | 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 |
| | | Moisture D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH22**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555738.00
Northing: 6873607.00
RL: 6.30
Total Depth: 0.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|--------------------------------------|-------|-----|----------------|----------------------|-------------|---------------------|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 10mm Solid Flight Auger with TCB Bit | | 6.0 | 0.05 | Slope wash | | CH | Sandy CLAY: Stiff, high plasticity, red brown, fine to medium grained sand, trace of fine to medium sized gravel, moist | | M | St | | 0.3 – | PP | 450kPa |
| | | | 0.5 | Residual | | CH | Silty CLAY: Hard, high plasticity, red brown, moist | | M | H | | | | |
| | | | 0.5 | | | | 0.50m: BOREHOLE TERMINATED FOR PERMEABILITY TEST | | | | | | | |
| | | | 1.0 | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | | 1.0 | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | Moisture | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Borehole

Borehole No.: **BH23**

Page: 1 of 1

Job Number: GE18/144

Easting: 555796.00
Northing: 6873615.00
RL: 7.20
Total Depth: 0.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | |
|-------------------------------|-------|-----|----------------|----------------------|-------------|---------------------|---|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm Solid Flight Auger with | | 7.0 | 0.05 | Slo pew | | CH | Silty CLAY: Stiff, high plasticity, red brown, trace of fine to medium sand, with organics, moist | | M | St | | 0.2 - | PP | 450kPa |
| | | | | | | | CH | | | | | | | |
| | | | 0.5 | Residual | | | 0.50m: BOREHOLE TERMINATED FOR PERMEABILITY TEST | | | | | | | |
| | | | 1.0 | | | | | | | | | | | |
| | | 6.0 | | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | |
| | | 5.0 | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | |
| | | 4.0 | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | |
| | | 3.0 | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | |
| | | 2.0 | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|----------------|-----------------|---------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| ► Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | EHS Extremely high | |
| | | | | | |



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Engineering Log - Borehole

Borehole No.: **BH24**

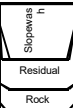

Page: 1 of 1

Job Number: GE18/144

Easting: 555467.40
Northing: 6873402.50
RL: 18.30
Total Depth: 0.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers
Project: Geotechnical Invest - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | |
|--|-------|------|----------------|---|---|---|--|------------|---|----------------------------------|-----------------|------------|-------|---------------|----|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | |
| 100mm Solid Flight Auger with T.C. Bit | | 18.0 | 0.1 |  |  | CH | Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist | | M | H | | | | | |
| | | | CH | | | Silty CLAY: Very stiff, high plasticity, red brown, some fine to medium sized gravel, moist | M | | VSt | | | | | | |
| | | | 0.4 | | | Residual | | | | | | | | | |
| | | | 0.5 | | | Rock | BAS | | BASALT: Very low strength, extremely weathered, grey brown, some low to medium strength fragments | VLS | | | | | XW |
| 0.50m: MAXIMUM T.C. REFUSAL | | | | | | | | | | | | | | | |
| | | | 1.0 | | | | | | | | | | | | |
| | | | 17.0 | | | | | | | | | | | | |
| | | | 2.0 | | | | | | | | | | | | |
| | | | 16.0 | | | | | | | | | | | | |
| | | | 3.0 | | | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | | | |
| | | | 4.0 | | | | | | | | | | | | |
| | | | 14.0 | | | | | | | | | | | | |
| | | | 5.0 | | | | | | | | | | | | |
| | | | 13.0 | | | | | | | | | | | | |
| | | | 6.0 | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|-----------------------------|-------------------------|---------------------|-----------------|---------------------|---|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| ► Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Borehole

Borehole No.: **BH25**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555600.30
Northing: 6873495.60
RL: 25.80
Total Depth: 1.55

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 03/08/2018

| Drilling Information | | | | Material Description | | | | | | | Test Samples | | | | | | |
|------------------------------------|-------|----|---|--------------------------|-------------|---------------------|--|------------|----------|----------------------------------|-----------------|------------|-------|---------------|---|-----|----------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result | | | |
| 100mm Auger with Washbore | | | 25.0 1.0 1.2 1.45 1.55 | Slopewash Bedrock | | CH | Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, cobbles throughout, moist. | | M | St | | 0.3 - | PP | 150-200kPa | | | |
| | | | | | | BAS | BASALT: Very low strength, extremely weathered, grey mottled orange brown, with some residual clay lenses. | XW | | VLS | | | | | 1 | SPT | 16,22,12, N=34 |
| | | | | | | BAS | BASALT: As above but medium strength and distinctly weathered. | DW | | MS | | | | | | | |
| 1.55m: COMMENCE NMLC CORING | | | | | | | | | | | | | | | | | |
| | | | 24.0 2.0 23.0 3.0 22.0 4.0 21.0 5.0 20.0 6.0 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Tests & Results |
|---------------------------|-------------------------|----------------|-----------------|---------------------|---|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | U50 Undisturbed 50mm diam tube. |
| Water inflow | XW Extremely weathered | S Soft | L Loose | D Disturbed sample. | D Disturbed sample. |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | VLS Very low | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. |
| | SW Slightly weathered | St Stiff | D Dense | LS Low | PP Hand penetrometer estimate of unconfined compressive strength, kPa. |
| | FR Fresh | VSt Very stiff | VD Very dense | MS Medium | S Vane shear value kPa |
| | | H Hard | | HS High | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
| | | | | VHS Very high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
| | | | | EHS Extremely high | |
| | | | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH25**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555600.30
Northing: 6873495.60
RL: 25.80
Total Depth: 21.30

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 03/08/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|---|------------|--|------------------------|-------|----------------------------------|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| | | | | | | | | | ELS VLS LS MS HS VHS EHS | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness |
| NMLC Coring | | | 25.5 | | | | | | | | | | |
| | | | 25.0 | | | | | | | | | | |
| | | | 24.5 | | | | Commence NMLC Coring at 1.55m | | | | | | |
| | | | 24.0 | Bedrock | △ | BAS | BASALT: Very high strength, slightly weathered to fresh, dark grey with some orange brown staining, moderately fractured. | SW-Fr | | 8.66 | | | S5° 50mm some VLS -BZ 50mm J10° Pl/Sm,Cn,O J5° Un/Sm,Cn,O S15° 40mm S15° 10mm J60° Pl/Sm,St,O -BZ 30mm S10° 20mm S15° 10mm S30° 50mm |
| | | | 23.5 | | △ | BAS | BASALT: As above but high strength and distinctly weathered to slightly weathered. | DW- | | | | | |
| | | | 23.0 | | △ | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | 9.38 | 60% | | HFZ 180mm J15° Pl/Sm,St,O J50° Un/Ro, Vr,O J5° Pl/Sm,St,O -BZ 130mm |
| | | | 22.5 | | △ | | | | | | | | |
| | | | 22.0 | | △ | | | | | 9.8 | | | |
| | | | 21.5 | | △ | BAS | BASALT: As above but low strength, extremely weathered, grey mottled orange brown. | XW | | | 0% | | |
| | | | 21.0 | | | | CORE LOSS | | | | | | |
| | | | 20.5 | | △ | BAS | BASALT: Very low strength, extremely weathered, grey mottled orange brown, numerous broken zones. | XW | | | 0% | | |
| | | | 20.0 | | △ | | | | | | | | |
| | | | 6.0 | | △ | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|-----------------------------|-------------------------|---------------------|-----------------|--------------------|-----------------------------------|
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet |
| ▶ Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | |
| ▶ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | |
| | FR Fresh | H Hard | VD Very dense | HS High | |
| | | | | VHS Very high | |
| | | | | EHS Extremely high | |
| | | Moisture | | | |
| | | D Dry M Moist W Wet | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH25**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555600.30
Northing: 6873495.60
RL: 25.80
Total Depth: 21.30

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 03/08/2018

| Drilling Information | | | | Material Description | | | | | | Rock Mass Defects | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|---|------------|--------------------|------------------------|-------|---------------------|--------------------|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description |
| NMLC Coring | | | 19.5 | | | BAS | BASALT: Very low strength, extremely weathered, grey mottled orange brown, numerous broken zones. | XW | | | | | |
| | | | 6.5 | | | | | | | | | | |
| | | | 19.0 | | | | | | | | | | |
| | | | 7.0 | | | | | | | | | | |
| | | | 18.5 | | | | | | | | | | |
| | | | 7.5 | | | | | | | | | | |
| | | | 18.0 | | | | | | | | | | |
| | | | 8.0 | | | | | | | | | | |
| | | | 17.5 | | | | | | | | | | |
| | | | 8.5 | | | | | | | | | | |
| | | | 17.0 | | | | | | | | | | |
| | | | 9.0 | | | | | | | | | | |
| | | | 16.5 | | | | | | | | | | |
| | | | 9.15 | | | | | | | | | | |
| | | | 9.5 | | | | | | | | | | |
| | | | 9.4 | | | | | | | | | | |
| | | | 16.0 | | | BAS | BASALT: Very low strength, extremely weathered, grey mottled orange brown, numerous broken zones. | XW | | | | | |
| | | | 10.0 | | | | | | | | | | |
| | | | 15.5 | | | | | | | | | | |
| | | | 10.5 | | | | | | | | | | |
| | | | 15.0 | | | | | | | | | | |
| | | | 10.6 | | | BAS | BASALT: As above but low strength and extremely weathered. | XW | | | | | |
| | | | 11.0 | | | | | | | | | | |
| | | | 14.5 | | | BAS | BASALT: As above but very high strength and slightly weathered to fresh. | SW-Fr | | | | | |
| | | | 11.15 | | | | | | | | | | |
| | | | 11.5 | | | BAS | BASALT: As above but low strength and extremely weathered. | SW-Fr | | | | | |
| | | | 11.45 | | | | | | | | | | |
| | | | 11.6 | | | BAS | BASALT: As above but very high strength and fresh. | Fr | | | | | |
| | | | 14.0 | | | | | | | | | | |
| | | | 12.09 | | | BAS | BASALT: As above but low strength, extremely weathered, numerous broken zones. | XW | | | | | |

| | | | | | | | |
|-----------------------------|-------------------------|---------------------|-----------------|----------------------|-----------------------------------|----------------------|--|
| Comments: | | | | | | Authorised by: | |
| | | | | | | Date: | |
| Water | Weathering | Consistency | Density | Rock Strength | Defects | | |
| ▼ Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet | | |
| ► Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | | | |
| ◄ Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | | | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | | | |
| | FR Fresh | H Hard | VD Very dense | HS High | | | |
| | | Moisture | | VHS Very high | | | |
| | | D Dry M Moist W Wet | | EHS Extremely high | | | |



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Engineering Log - Cored Borehole

Borehole No.: **BH25**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555600.30

Drilling Rig: Hydrapower Scout

Northing: 6873495.60

Driller: Redlands Drilling

RL: 25.80

Logged By: L. Bexley

Total Depth: 21.30

Date: 03/08/2018

| Drilling Information | | | | Material Description | | | | | | | Rock Mass Defects | | | | | | | |
|----------------------|-------|----|----------------|----------------------|-------------|-------------|---|--|--------------------|--|-------------------|------------------------|----------------------------------|---|--------------------|--|--|--|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description | | | |
| | | | | | | | | ELS VLS LS MS HS VHS EHS | | | | | 30 100 300 1000 3000 | type, inclination, planarity, roughness, coating, thickness | | | | |
| NMLC Coring | | | | | | | | | | | | | | | | | | |
| | | | 13.5 | | | BAS | BASALT: As above but low strength, extremely weathered, numerous broken zones. | XW | | | | | 25% | | | | | |
| | | | 12.5 | | | | | | | | | | | | | | | |
| | | | 13.0 | | | | | | | | | | | | | | | |
| | | | 13.0 | | | | | | | | | | | | | | | |
| | | | 12.5 | | | | | | | | | | | | | | | |
| | | | 13.3 | | | BAS | BASALT: As above but medium strength and distinctly weathered. | DW | | | | | | | J15° Un/Ro,Cn,O | | | |
| | | | 13.5 | | | | | | | | | | | | J15° Un/Ro,Cn,O | | | |
| | | | 13.55 | | | BAS | BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered. | XW-DW | | | | | | | S30° 20mm VLS | | | |
| | | | 12.0 | | | | | | | | | | | | -BZ 550mm | | | |
| | | | 14.0 | | | | | | | | | | | | | | | |
| | | | 11.5 | | | | | | | | 0.17 | | | | J50° Pl/Sm,Ct,C | | | |
| | | | 14.5 | | | | | | | | | | | | J25° Pl/Sm,Cn,O | | | |
| | | | 14.55 | | | | | | | | | | | | J30° Pl/Sm,Cn,O | | | |
| | | | 11.0 | | | BAS | BASALT: As above but low strength and extremely weathered. | XW | | | | | | | J30° Pl/Sm,Cn,O | | | |
| | | | 15.0 | | | | | | | | | | | | J35° Pl/Sm,Cn,O | | | |
| | | | 10.5 | | | | | | | | | | | | | | | |
| | | | 15.5 | | | | | | | | | | | | | | | |
| | | | 15.55 | | | BAS | BASALT: As above but very low strength. | XW | | | | | | | | | | |
| | | | 10.0 | | | | | | | | | | | | | | | |
| | | | 16.0 | | | | | | | | | | | | | | | |
| | | | 9.5 | | | | | | | | | | | | | | | |
| | | | 16.5 | | | | | | | | | | | | | | | |
| | | | 16.55 | | | BAS | BASALT: As above but low strength. | < W | | | | | | | J5° Pl/Ro,Cn,O | | | |
| | | | 9.0 | | | BAS | BASALT: As above but very high strength, slightly weathered to fresh, vesicular dark grey. | SW-Fr | | | | | 40% | | J15° Pl/Sm,Cn,O | | | |
| | | | 17.0 | | | | | | | | | | | | -BZ 80mm | | | |
| | | | 8.5 | | | | | | | | | | | | J10° Pl/Sm,Cn,O | | | |
| | | | 17.54 | | | BAS | BASALT: As above but very low strength and extremely weathered. | < W | | | | | | | J5° Pl/Sm,Cn,O | | | |
| | | | 17.55 | | | | CORE LOSS | | | | 7.81 | | | | | | | |
| | | | 18.0 | | | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|---------------------------|-------------------------|---------------------|-----------------|--------------------|-----------------------------------|
| Water level on date shown | RS Residual soil | VS Very soft | VL Very loose | ELS Extremely low | Refer to Defect Description Sheet |
| Water inflow | XW Extremely weathered | S Soft | L Loose | VLS Very low | |
| Water outflow | DW Distinctly weathered | F Firm | MD Medium dense | LS Low | |
| | SW Slightly weathered | St Stiff | D Dense | MS Medium | |
| | FR Fresh | H Hard | VD Very dense | HS High | |
| | | Moisture | | VHS Very high | |
| | | D Dry M Moist W Wet | | EHS Extremely high | |



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Engineering Log - Cored Borehole

Borehole No.: **BH25**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555600.30 Drilling Rig: Hydrapower Scout
Northing: 6873495.60 Driller: Redlands Drilling
RL: 25.80 Logged By: L. Bexley
Total Depth: 21.30 Date: 03/08/2018

| Drilling Information | | | | Material Description | | | | | | | Rock Mass Defects | | | | | | | | | | |
|----------------------|-------|------|----------------|----------------------|-------------|-------------|---|------------|--------------------|----|-------------------|----|-----|---------------------------|-------|---------------------|--------------------|-----|-----|------------------------------------|---|
| Drill Method | Water | RL | Hole Depth (m) | Soil Origin | Graphic Log | Class. Code | Description | Weathering | Estimated Strength | | | | | IS ₍₅₀₎ MPa | RQD % | Defect Spacing (mm) | Defect Description | | | | |
| | | | | | | | | ELS | VLS | LS | MS | HS | VHS | | | EHS | 30 | 100 | 300 | 1000 | 3000 |
| NMLC Coring | | 7.5 | 18.15 | | V A | BAS | CORE LOSS | | | | | | | | | | | | | | |
| | | | 18.5 | | V A | | BASALT: Very high strength, slightly weathered, vesicular dark grey. | SW | | | | | | | | | | | | | J10° Pl/Ro,Cn,O J15° Pl/Ro,Cn,O |
| | | 7.0 | 19.0 | | V A | | | | | | | | | | | | | | | | J15° Pl/Sm,St,O J5° Un/Ro,Cn,O |
| | | 6.5 | 19.2 | | V A | | | | | | | | | | | | | | | | BZ |
| | | | 19.5 | | | | CORE LOSS | | | | | | | | | | | | | | |
| | | 6.0 | 19.6 | | V A | BAS | BASALT: Very high strength, slightly weathered to fresh, vesicular dark grey. | SW-FT | | | | | | | | | | | | | |
| | | | 19.8 | | V A | BAS | BASALT: As above but low strength and extremely weathered. | XW | | | | | | | | | | | | | BZ 205mm |
| | | | 20.0 | | V A | | | | | | | | | | | | | | | | J30° Stp/Ro,Ct,O S20° 70mm VLS & cly |
| | | 5.5 | 20.05 | | V A | BAS | BASALT: As above but very high strength and slightly weathered. | SW | | | | | | | | | | | | | S10° 100mm VLS & cly |
| | | 5.0 | 20.5 | | V A | | | | | | | | | | | | | | | | S20° 100mm VLS & cly |
| | | 21.0 | | V A | | | | | | | | | | | | | | | | HFZ 300mm | |
| | 4.5 | 21.3 | | V A | | | | | | | | | | | | | | | | J25° Pl/Sm,Cn,O J25° Pl/Sm,Cn,O | |
| | | | 21.3 | | | | 21.30m: BOREHOLE TERMINATED | | | | | | | | | | | | | | |
| | | 4.0 | 21.5 | | | | | | | | | | | | | | | | | | |
| | | | 22.0 | | | | | | | | | | | | | | | | | | |
| | | 3.5 | 22.5 | | | | | | | | | | | | | | | | | | |
| | | 3.0 | 23.0 | | | | | | | | | | | | | | | | | | |
| | | 2.5 | 23.5 | | | | | | | | | | | | | | | | | | |
| | | 2.0 | 24.0 | | | | | | | | | | | | | | | | | | |

Comments:

Authorised by:

Date:

| Water | Weathering | Consistency | Density | Rock Strength | Defects |
|--|--|--|---|--|-----------------------------------|
| Water level on date shown Water inflow Water outflow | RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh | VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet | VL Very loose L Loose MD Medium dense D Dense VD Very dense | ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high | Refer to Defect Description Sheet |

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION
- TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH25
BOREHOLE DEPTH: 1.55m TO 21.3m



Discontinuity Description: Refer to AS1726-1993, Table A10.

| Anisotropic Fabric | | Roughness (e.g. Planar, Smooth is abbreviated PI / Sm) | | | | Class | Other | |
|--------------------|------------------------------|--|-------------------------|-------------------------------------|----------|-------|-------|------------------|
| BED | Bedding | Stepped (Stp) | Rough or irregular (Ro) | | I | | Cly | Clay |
| FOL | Foliation | | Smooth (Sm) | | II | | Fe | Iron |
| LIN | Mineral lineation | | Slickensided (Sl) | | II | | Co | Coal |
| Defect Type | | Undulating (Un) | Rough (Ro) | | IV | | Carb | Carbonaceous |
| LM | Lamination Parting | | Smooth (Sm) | | V | | Sinf | Soil Infill Zone |
| BP | Bedding Parting | | Slickensided (Sl) | | VI | | Qz | Quartz |
| CLV | Cleavage / Foliation Parting | Planar (PI) | Rough (Ro) | | VII | | CA | Calcite |
| J, Js | Joint, Joints | | Smooth (Sm) | | VIII | | Chl | Chlorite |
| SZ | Sheared Zone | | Slickensided (Sl) | | IX | | Py | Pyrite |
| CZ | Crushed Zone | Infilling | | | Aperture | | Int | Intersecting |
| BZ | Broken Zone | Clean | Cn | No visible coating or infill | Closed | C | Inc | Incipient |
| HFZ | Highly Fractured Zone | Stain | St | Surfaces discoloured by mineral | Open | O | DI | Drilling Induced |
| AZ | Alteration Zone | Veneer | Vr | Visible mineral or soil infill <1mm | Filled | F | H | Horizontal |
| VN | Vein | Coating | Ct | Visible mineral or soil infill >1mm | Tight | T | V | Vertical |

Note: Describe 'Zones' and 'Coatings' in terms of composition and thickness (mm).

Discontinuity Spacing: On the geotechnical borehole log, a graphical representation of defect spacing Vs depth is shown. This representation takes into account all the natural rock defects occurring within a given depth interval, excluding breaks induced by the drilling / handling of core. Refer to AS1726-1993, BS5930-1999.

| Defect Spacing | | | Bedding Thickness (Sedimentary Rock Stratification) | | Defect Spacing in 3D | |
|--------------------|-----------------|--------|--|--------------------|---|--|
| Spacing/Width (mm) | Descriptor | Symbol | Descriptor | Spacing/Width (mm) | Term | Description |
| | | | Thinly Laminated | < 6 | Blocky | Equidimensional |
| <20 | Extremely Close | EC | Thickly Laminated | 6 – 20 | Tabular | Thickness much less than length or width |
| 20 – 60 | Very Close | VC | Very Thinly Bedded | 20 – 60 | Columnar | Height much greater than cross section |
| 60 – 200 | Close | C | Thinly Bedded | 60 – 200 | Defect Persistence (areal extent) | |
| 200 – 600 | Medium | M | Medium Bedded | 200 – 600 | | |
| 600 – 2000 | Wide | W | Thickly Bedded | 600 – 2000 | | |
| 2000 – 6000 | Very Wide | VW | Very Thickly Bedded | > 2000 | trace length of defect given in metres | |
| >6000 | Extremely Wide | EW | | | | |

Symbols: The list below provides an explanation of terms and symbols used on the geotechnical borehole, test pit and penetrometer logs.

| Test Results | | | | Test Symbols | |
|----------------|---------------------------------|---------------------------------|---------------------------------------|--------------|------------------------------------|
| PI | Plasticity Index | c' | Effective Cohesion | DCP | Dynamic Cone Penetrometer |
| LL | Liquid Limit | c _u | Undrained Cohesion | SPT | Standard Penetration Test |
| LI | Liquidity Index | c' _R | Residual Cohesion | CPTu | Cone Penetrometer (Piezocone) Test |
| DD | Dry Density | φ' | Effective Angle of Internal Friction | PANDA | Variable Energy DCP |
| WD | Wet Density | φ _u | Undrained Angle of Internal Friction | PP | Pocket Penetrometer Test |
| LS | Linear Shrinkage | φ' _R | Residual Angle of Internal Friction | U50 | Undisturbed Sample 50 mm diameter |
| MC | Moisture Content | c _v | Coefficient of Consolidation | U100 | Undisturbed Sample 100mm diameter |
| OC | Organic Content | m _v | Coefficient of Volume Compressibility | UCS | Uniaxial Compressive Strength |
| WPI | Weighted Plasticity Index | c _{az} | Coefficient of Secondary Compression | Pm | Pressuremeter |
| WLS | Weighted Linear Shrinkage | e | Voids Ratio | FSV | Field Shear Vane |
| DoS | Degree of Saturation | φ' _{cv} | Constant Volume Friction Angle | DST | Direct Shear Test |
| APD | Apparent Particle Density | q _t / q _c | Piezcone Resistance (Tip / Sleeve) | PR | Penetration Rate |
| s _u | Undrained Shear Strength | q _d | PANDA Cone Resistance | A | Point Load Test (axial) |
| q _u | Unconfined Compressive Strength | I _{s(50)} | Point Load Strength Index | D | Point Load Test (diametral) |
| R | Total Core Recovery | RQD | Rock Quality Designation | L | Point Load Test (irregular lump) |

Groundwater Symbols:

| | | | | | |
|--|-------------------------------------|---|--------------|---|---------------|
|  28/11/13 | Groundwater level on the date shown |  | Water Inflow |  | Water Outflow |
|--|-------------------------------------|---|--------------|---|---------------|

APPENDIX 'C'

LABORATORY TEST CERTIFICATES

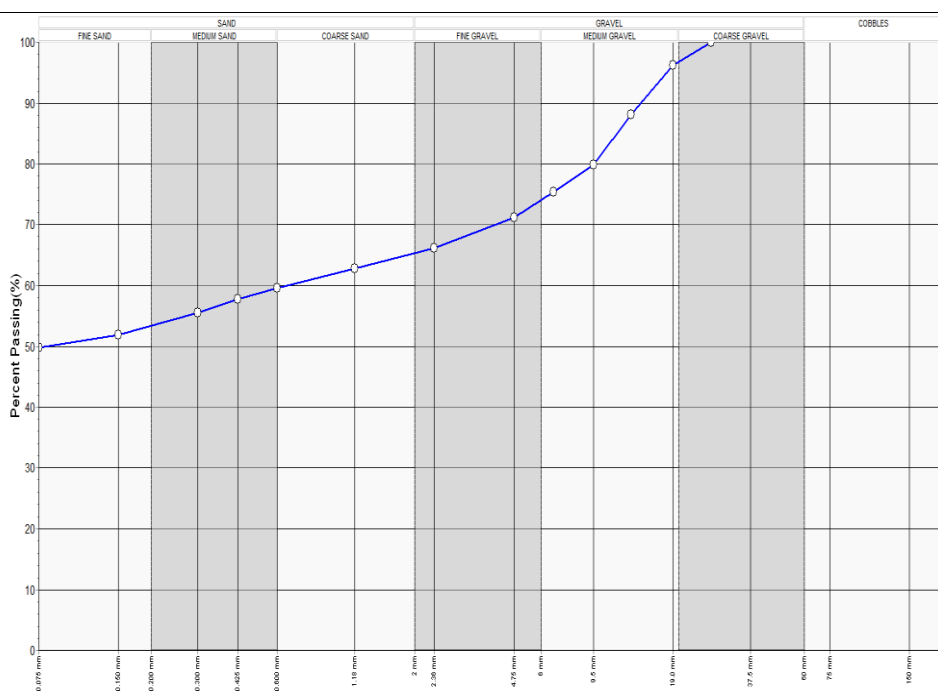


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Quality of Materials Report

| | | | |
|------------------|--|--------------------|---------------------|
| Client : | WOOD & GRIEVE ENGINEERS | Report Number: | GE18-144.1/1 |
| Address : | | Report Date : | 15/08/2018 |
| Project Name : | GEOTECHNICAL INVESTIGATION | Order Number : | |
| Project Number : | GE18/144 | Test Method : | AS1289.3.6.1 |
| Location: | TWEED VALLEY HOSPITAL, CUDGEN ROAD , KINGSCLIFF | Page 1 of 1 | |

| | | | |
|-------------------|------------------|--|--|
| Sample Number : | 245179 | SAMPLE LOCATION BH 3 1.5 - 2.5 DISTURBED SAMPLE | |
| Sampling Method : | - | | |
| Sampled By : | LEIGH BEXLEY | | |
| Date Sampled : | 3/08/2018 | | |
| Date Tested : | 13/08/2018 | | |
| Material Type : | DISTURBED SAMPLE | Test Number : | |
| Material Source : | INSITU | Lot Number : | |
| Remarks : | | Specification Number : | |

| AS Sieve Size(mm) | Percent Passing | Specification Limits |  |
|-------------------|-----------------|----------------------|---|
| 100 | | | |
| 75.0 | | | |
| 63.0 | | | |
| 53.0 | | | |
| 37.5 | | | |
| 26.5 | 100 | | |
| 19.0 | 96 | | |
| 16.0 | | | |
| 13.2 | 88 | | |
| 9.5 | 80 | | |
| 6.7 | 75 | | |
| 4.75 | 71 | | |
| 2.36 | 66 | | |
| 1.18 | 63 | | |
| 0.600 | 60 | | |
| 0.425 | 58 | | |
| 0.300 | 56 | | |
| 0.150 | 52 | | |
| 0.075 | 50 | | |

| | | Test Method | Results | | |
|------------------------|--|---------------------|------------|----------------------|-----------------------------|
| Liquid Limit (%) : | | AS1289.3.1.2 | 47 | Shrinkage Comments : | cracking and curling |
| Plastic Limit (%) : | | AS1289.3.2.1 | 33 | Mould Length (mm) : | 250.4 |
| Plasticity Index (%) : | | AS1289.3.3.1 | 14 | Sample History | |
| Linear Shrinkage (%) : | | AS1289.3.4.1 | 8.5 | | |
| Soil Description : | | | | | |

| | | | |
|---|---|--|--|
|  NATA <small>WORLD RECOGNISED ACCREDITATION</small> | Accredited for compliance with ISO/IEC 17025 - Testing. | | APPROVED SIGNATORY |
| | | |  IAN MASMAN - MANAGER NATA Accreditation Number 1169 |

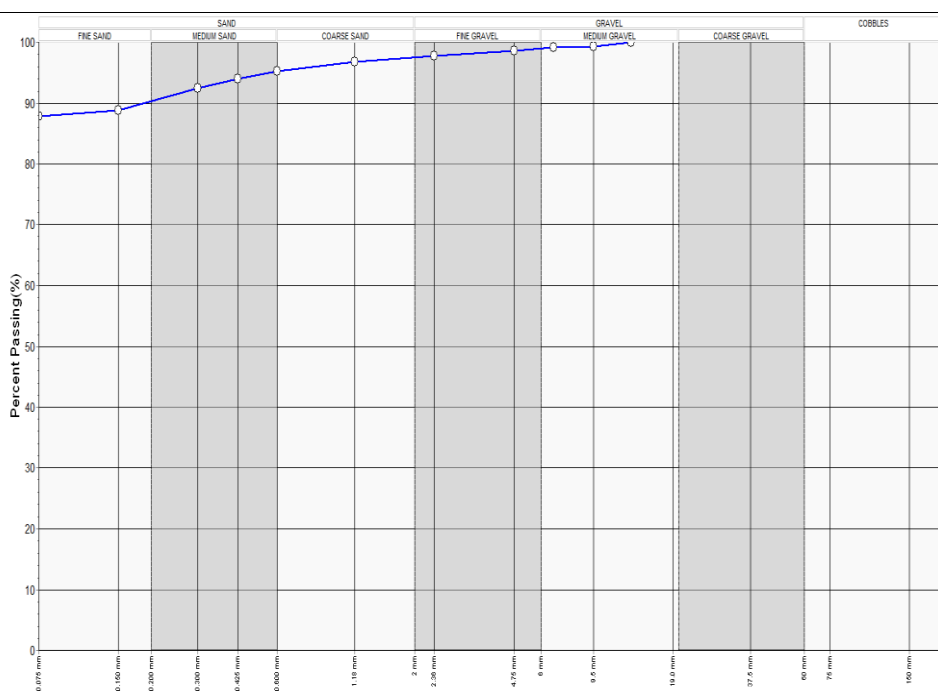
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Quality of Materials Report

| | | | |
|------------------|--|--------------------|---------------------|
| Client : | WOOD & GRIEVE ENGINEERS | Report Number : | GE18-144.2/1 |
| Address : | | Report Date : | 15/08/2018 |
| Project Name : | GEOTECHNICAL INVESTIGATION | Order Number : | |
| Project Number : | GE18/144 | Test Method : | AS1289.3.6.1 |
| Location : | TWEED VALLEY HOSPITAL, CUDGEN ROAD , KINGSCLIFF | Page 1 of 1 | |



| | | | |
|-------------------|--------------|------------------------|--|
| Sample Number : | 245181 | SAMPLE LOCATION | |
| Sampling Method : | - | BH 7 | |
| Sampled By : | LEIGH BEXLEY | 0.1 - 0.5 | |
| Date Sampled : | 3/08/2018 | DISTURBED | |
| Date Tested : | 13/08/2018 | SAMPLE | |
| Material Type : | DISTURBED | Test Number : | |
| Material Source : | INSITU | Lot Number : | |
| Remarks : | | Specification Number : | |

| AS Sieve Size(mm) | Percent Passing | Specification Limits | |
|-------------------|-----------------|----------------------|--|
| 100 | | | |
| 75.0 | | | |
| 63.0 | | | |
| 53.0 | | | |
| 37.5 | | | |
| 26.5 | | | |
| 19.0 | | | |
| 16.0 | | | |
| 13.2 | 100 | | |
| 9.5 | 99 | | |
| 6.7 | 99 | | |
| 4.75 | 99 | | |
| 2.36 | 98 | | |
| 1.18 | 97 | | |
| 0.600 | 95 | | |
| 0.425 | 94 | | |
| 0.300 | 92 | | |
| 0.150 | 89 | | |
| 0.075 | 88 | | |



AS Sieve Size(mm)

| | Test Method | Results | |
|------------------------|---------------------|-----------|--|
| Liquid Limit (%) : | AS1289.3.1.2 | 42 | Shrinkage Comments : cracking and curling |
| Plastic Limit (%) : | AS1289.3.2.1 | 27 | Mould Length (mm) : 250.1 |
| Plasticity Index (%) : | AS1289.3.3.1 | 15 | Sample History |
| Linear Shrinkage (%) : | AS1289.3.4.1 | 10 | |
| Soil Description : | | | |

| | | |
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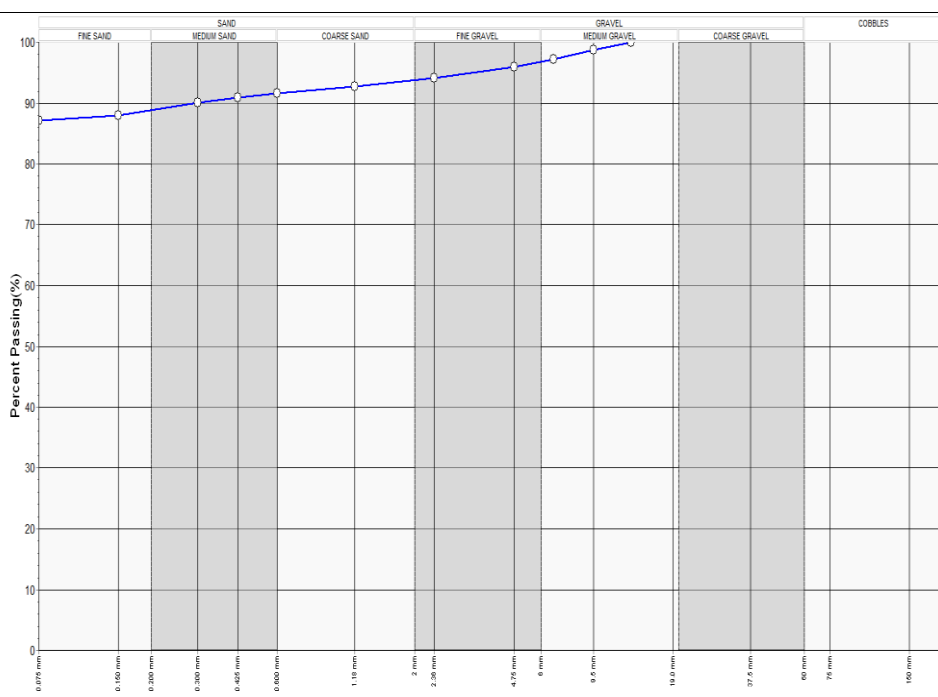
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Quality of Materials Report

| | | | |
|------------------|--|--------------------|---------------------|
| Client : | WOOD & GRIEVE ENGINEERS | Report Number: | GE18-144.3/1 |
| Address : | | Report Date : | 15/08/2018 |
| Project Name : | GEOTECHNICAL INVESTIGATION | Order Number : | |
| Project Number : | GE18/144 | Test Method : | AS1289.3.6.1 |
| Location: | TWEED VALLEY HOSPITAL, CUDGEN ROAD , KINGSCLIFF | Page 1 of 1 | |



| | | | |
|-------------------|--------------|------------------------|--|
| Sample Number : | 245183 | SAMPLE LOCATION | |
| Sampling Method : | - | BH 10 | |
| Sampled By : | LEIGH BEXLEY | 1.0 - 1.5 | |
| Date Sampled : | 3/08/2018 | BULK | |
| Date Tested : | 13/08/2018 | SAMPLE | |
| Material Type : | BULK SAMPLE | Test Number : | |
| Material Source : | INSITU | Lot Number : | |
| Remarks : | | Specification Number : | |

| AS Sieve Size(mm) | Percent Passing | Specification Limits | |
|-------------------|-----------------|----------------------|--|
| 100 | | | |
| 75.0 | | | |
| 63.0 | | | |
| 53.0 | | | |
| 37.5 | | | |
| 26.5 | | | |
| 19.0 | | | |
| 16.0 | | | |
| 13.2 | 100 | | |
| 9.5 | 99 | | |
| 6.7 | 97 | | |
| 4.75 | 96 | | |
| 2.36 | 94 | | |
| 1.18 | 93 | | |
| 0.600 | 92 | | |
| 0.425 | 91 | | |
| 0.300 | 90 | | |
| 0.150 | 88 | | |
| 0.075 | 87 | | |



AS Sieve Size(mm)

| | Test Method | Results | |
|------------------------|---------------------|-----------|--|
| Liquid Limit (%) : | AS1289.3.1.2 | 46 | Shrinkage Comments : cracking and curling |
| Plastic Limit (%) : | AS1289.3.2.1 | 29 | Mould Length (mm) : 250.1 |
| Plasticity Index (%) : | AS1289.3.3.1 | 17 | Sample History |
| Linear Shrinkage (%) : | AS1289.3.4.1 | 12 | |
| Soil Description : | | | |

| | | |
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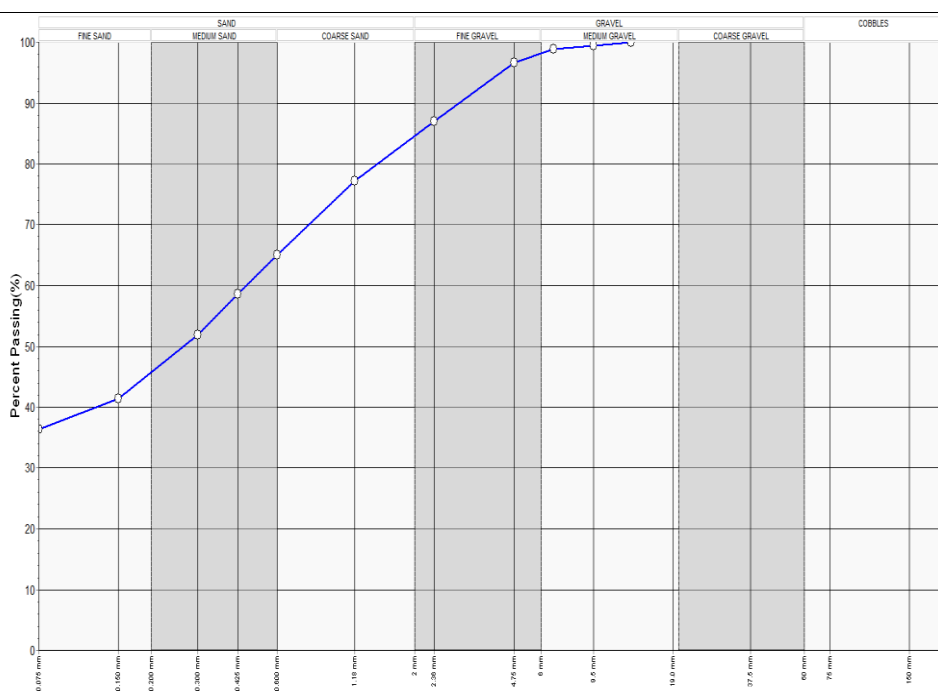
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Quality of Materials Report

| | | | |
|------------------|--|--------------------|---------------------|
| Client : | WOOD & GRIEVE ENGINEERS | Report Number: | GE18-144.4/1 |
| Address : | | Report Date : | 15/08/2018 |
| Project Name : | GEOTECHNICAL INVESTIGATION | Order Number : | |
| Project Number : | GE18/144 | Test Method : | AS1289.3.6.1 |
| Location: | TWEED VALLEY HOSPITAL, CUDGEN ROAD , KINGSCLIFF | Page 1 of 1 | |



| | | | |
|-------------------|--------------|------------------------|--|
| Sample Number : | 245185 | SAMPLE LOCATION | |
| Sampling Method : | - | BH 17 | |
| Sampled By : | LEIGH BEXLEY | 0.3 - 1.0 | |
| Date Sampled : | 3/08/2018 | BULK | |
| Date Tested : | 13/08/2018 | SAMPLE | |
| Material Type : | BULK SAMPLE | Test Number : | |
| Material Source : | INSITU | Lot Number : | |
| Remarks : | | Specification Number : | |

| AS Sieve Size(mm) | Percent Passing | Specification Limits | |
|-------------------|-----------------|----------------------|--|
| 100 | | | |
| 75.0 | | | |
| 63.0 | | | |
| 53.0 | | | |
| 37.5 | | | |
| 26.5 | | | |
| 19.0 | | | |
| 16.0 | | | |
| 13.2 | 100 | | |
| 9.5 | 99 | | |
| 6.7 | 99 | | |
| 4.75 | 97 | | |
| 2.36 | 87 | | |
| 1.18 | 77 | | |
| 0.600 | 65 | | |
| 0.425 | 59 | | |
| 0.300 | 52 | | |
| 0.150 | 41 | | |
| 0.075 | 36 | | |



AS Sieve Size(mm)

| | Test Method | Results | |
|------------------------|---------------------|------------|--|
| Liquid Limit (%) : | AS1289.3.1.2 | 40 | Shrinkage Comments : cracking and curling |
| Plastic Limit (%) : | AS1289.3.2.1 | 32 | Mould Length (mm) : 250.4 |
| Plasticity Index (%) : | AS1289.3.3.1 | 8 | Sample History |
| Linear Shrinkage (%) : | AS1289.3.4.1 | 5.5 | |
| Soil Description : | | | |

| | | |
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|---|--|--|

Shrink Swell Index Report

| | | | |
|------------------|--|--------------------|---------------------|
| Client : | WOOD & GRIEVE ENGINEERS | Report Number: | GE18-144.5/1 |
| Address : | | Report Date : | 15/08/2018 |
| Project Name : | GEOTECHNICAL INVESTIGATION | Order Number : | |
| Project Number : | GE18/144 | Test Method : | AS1289.7.1.1 |
| Location: | TWEED VALLEY HOSPITAL, CUDGEN ROAD , KINGSCLIFF | Page 1 of 1 | |

| | | | | |
|-------------------------------------|------------------------------------|-----------------------------------|------------------------------------|-----------------------------------|
| Sample Number : | 245178 | 245180 | 245184 | 245186 |
| Test Number : | | | | |
| Sampling Method : | - | - | - | - |
| Sampled By : | LEIGH BEXLEY | LEIGH BEXLEY | LEIGH BEXLEY | LEIGH BEXLEY |
| Date Sampled : | 3/08/2018 | 3/08/2018 | 3/08/2018 | 3/08/2018 |
| Date Tested : | 7/08/2018 | 7/08/2018 | 7/08/2018 | 7/08/2018 |
| Material Type : | UNDISTURBED SAMPLE | UNDISTURBED SAMPLE | UNDISTURBED SAMPLE | UNDISTURBED SAMPLE |
| Material Source : | INSITU | INSITU | INSITU | INSITU |
| Sample Location : | BH 2 0.15 - 0.24 U50 | BH 4 0.1 - 0.29 U50 | BH 12 0.5 - 0.76 U50 | BH 18 0.5 - 0.7 U50 |
| Inert Material Estimate (%) : | 0 | 0 | 0 | 0 |
| PP before (kPa) : | | | | |
| PP after (kPa) : | | | | |
| Shrinkage Moisture Content (%) : | 28.6 | 28 | 33.6 | 37 |
| Shrinkage (%) : | 2.3 | 2.5 | 2.2 | 6.3 |
| Swell Moisture Content Before (%) : | 29.3 | 27.2 | 34.9 | 32.4 |
| Swell Moisture Content After (%) : | 31.4 | 30.6 | 37.1 | 37.7 |
| Swell (%) : | 0 | 0 | 0 | 0 |
| Unit Weight (t/m ³) : | 1.69 | 1.62 | 1.83 | 1.76 |
| Shrink Swell Index Iss (%) : | 1.3 | 1.4 | 1.2 | 3.5 |
| Visual Classification : | Silty Clay - Brown | Silty Clay - Brown | Silty Clay - Brown | Silty Clay - Brown |
| Cracking : | Y | Y | Y | Y |
| Crumbling : | Y | Y | Y | Y |
| Remarks : | | | | |



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Document Code RFO161-7

California Bearing Ratio Report (1 Point)

| | | | |
|------------------|--|--------------------|---------------------|
| Client : | WOOD & GRIEVE ENGINEERS | Report Number: | GE18-144.6/1 |
| Address : | | Report Date : | 15/08/2018 |
| Project Number : | GE18/144 | Order Number : | |
| Project Name : | GEOTECHNICAL INVESTIGATION | Test Method : | AS1289.6.1.1 |
| Location: | TWEED VALLEY HOSPITAL, CUDGEN ROAD , KINGSCLIFF | Page 1 of 1 | |

| | | | |
|-------------------|--------------|-----------------|--|
| Sample Number : | 245182 | SAMPLE LOCATION | |
| Date Sampled : | 3/08/2018 | BH 8 | |
| Date Tested : | 10/08/2018 | 0.1 - 1.1 | |
| Sampled By : | LEIGH BEXLEY | BULK | |
| Sampling Method : | - | SAMPLE | |
| Material Source : | INSITU | Lot Number : | |
| Material Type : | BULK SAMPLE | Test Number : | |
| Remarks : | | | |

| | |
|--|---------------|
| Moisture Method : | AS 1289.2.1.1 |
| Maximum Dry Density (t/m ³) : | 1.579 |
| Optimum Moisture Content (%) : | 25.5 |
| Compactive Effort : | Standard |
| Nominated Percentage of MDD : | 100 |
| Nominated Percentage of OMC : | 100 |
| Achieved Percentage of MDD : | 99 |
| Achieved Percentage of OMC : | 100.0 |
| Dry Density Before Soak (t/m ³) : | 1.571 |
| Dry Density After Soak (t/m ³) : | 1.568 |
| Moisture Content Before Soak (%) : | 25.6 |
| Moisture Content After Soak (%) : | 29.0 |
| Density Ratio After Soak (%) : | 99 |
| Field Moisture Content (%) : | 28.0 |
| Top Moisture Content - After Penetration (%) : | 29.9 |
| Total Moisture Content - After Penetration (%) : | 27.0 |
| Soak Condition : | Soaked |
| Soak Period (days) : | 4 |
| Swell (%) : | 0.0 |



California Bearing Ratio Report (1 Point)

| | | | |
|------------------|--|--------------------|---------------------|
| Client : | WOOD & GRIEVE ENGINEERS | Report Number: | GE18-144.7/1 |
| Address : | | Report Date : | 15/08/2018 |
| Project Number : | GE18/144 | Order Number : | |
| Project Name : | GEOTECHNICAL INVESTIGATION | Test Method : | AS1289.6.1.1 |
| Location: | TWEED VALLEY HOSPITAL, CUDGEN ROAD , KINGSCLIFF | Page 1 of 1 | |

| | | | |
|-------------------|--------------|-----------------|--|
| Sample Number : | 245183 | SAMPLE LOCATION | |
| Date Sampled : | 3/08/2018 | BH 10 | |
| Date Tested : | 10/08/2018 | 1.0 - 1.5 | |
| Sampled By : | LEIGH BEXLEY | BULK | |
| Sampling Method : | - | SAMPLE | |
| Material Source : | INSITU | Lot Number : | |
| Material Type : | BULK SAMPLE | Test Number : | |
| Remarks : | | | |

| | |
|--|---------------|
| Moisture Method : | AS 1289.2.1.1 |
| Maximum Dry Density (t/m ³) : | 1.358 |
| Optimum Moisture Content (%) : | 36.7 |
| Compactive Effort : | Standard |
| Nominated Percentage of MDD : | 100 |
| Nominated Percentage of OMC : | 100 |
| Achieved Percentage of MDD : | 100 |
| Achieved Percentage of OMC : | 100.0 |
| Dry Density Before Soak (t/m ³) : | 1.358 |
| Dry Density After Soak (t/m ³) : | 1.359 |
| Moisture Content Before Soak (%) : | 36.7 |
| Moisture Content After Soak (%) : | 38.0 |
| Density Ratio After Soak (%) : | 100 |
| Field Moisture Content (%) : | 38.2 |
| Top Moisture Content - After Penetration (%) : | 38.5 |
| Total Moisture Content - After Penetration (%) : | 36.6 |
| Soak Condition : | Soaked |
| Soak Period (days) : | 4 |
| Swell (%) : | 0.0 |



| | | | |
|----------------------------------|-----|-----------------|---|
| CBR Surcharge (kg) : | 4.5 | CBR 2.5mm (%) : | 6 |
| Oversize (%) : | | CBR 5.0mm (%) : | 6 |
| Oversize Material Replaced (%) : | | CBR Value (%) : | 6 |

| | |
|--------------------|--|
| Site Selection : | |
| Soil Description : | |



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California Bearing Ratio Report (1 Point)

| | | | |
|------------------|--|--------------------|---------------------|
| Client : | WOOD & GRIEVE ENGINEERS | Report Number: | GE18-144.8/1 |
| Address : | | Report Date : | 15/08/2018 |
| Project Number : | GE18/144 | Order Number : | |
| Project Name : | GEOTECHNICAL INVESTIGATION | Test Method : | AS1289.6.1.1 |
| Location: | TWEED VALLEY HOSPITAL, CUDGEN ROAD , KINGSCLIFF | Page 1 of 1 | |

| | | | |
|-------------------|--------------|-----------------|--|
| Sample Number : | 245185 | SAMPLE LOCATION | |
| Date Sampled : | 3/08/2018 | BH 17 | |
| Date Tested : | 10/08/2018 | 0.3 - 1.0 | |
| Sampled By : | LEIGH BEXLEY | BULK | |
| Sampling Method : | - | SAMPLE | |
| Material Source : | INSITU | Lot Number : | |
| Material Type : | BULK SAMPLE | Test Number : | |
| Remarks : | | | |

| | |
|--|---------------|
| Moisture Method : | AS 1289.2.1.1 |
| Maximum Dry Density (t/m ³) : | 1.401 |
| Optimum Moisture Content (%) : | 34.8 |
| Compactive Effort : | Standard |
| Nominated Percentage of MDD : | 100 |
| Nominated Percentage of OMC : | 100 |
| Achieved Percentage of MDD : | 99 |
| Achieved Percentage of OMC : | 100.0 |
| Dry Density Before Soak (t/m ³) : | 1.393 |
| Dry Density After Soak (t/m ³) : | 1.395 |
| Moisture Content Before Soak (%) : | 34.7 |
| Moisture Content After Soak (%) : | 34.0 |
| Density Ratio After Soak (%) : | 100 |
| Field Moisture Content (%) : | 33.5 |
| Top Moisture Content - After Penetration (%) : | 37.5 |
| Total Moisture Content - After Penetration (%) : | 32.7 |
| Soak Condition : | Soaked |
| Soak Period (days) : | 4 |
| Swell (%) : | 0.0 |



| | | | |
|----------------------------------|-----|------------------------|------------|
| CBR Surcharge (kg) : | 4.5 | CBR 2.5mm (%) : | 4.0 |
| Oversize (%) : | | CBR 5.0mm (%) : | 4.5 |
| Oversize Material Replaced (%) : | | CBR Value (%) : | 4.5 |

| | |
|--------------------|--|
| Site Selection : | |
| Soil Description : | |



Accredited for compliance with ISO/IEC 17025 - Testing.

APPROVED SIGNATORY



IAN MASMAN - MANAGER
 NATA Accreditation Number :
 1169

POINT LOAD TEST REPORT

| | | | |
|-----------------|---|--------------|------------|
| Client: | Wood & Grieve Engineers | Report No: | GE18/144.1 |
| Client Address: | Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006 | Report Date: | 08.07.18 |
| Job No: | GE18/144 | Sample Date: | 03.08.18 |
| Project: | Geotechnical Investigation - Proposed Tweed Valley Hospital | Order No: | |
| Location: | Lot 102 on DP870722, Cudgen Road, Kingscliff | Test Method: | AS4133 4.1 |

Page 1 of 1

| Sample Number | Date of Test | Location | Depth (m) | Sample Type | Is (MPa) | Is (50) (MPa) | Loading Direction | Descriptive Term |
|---------------|--------------|--------------|-----------|-------------|----------|---------------|-------------------|------------------|
| 634 | 08.07.2018 | Borehole BH1 | 2.00 | Core | 7.95 | 7.84 | Diametral | VH |
| 635 | 08.07.2018 | Borehole BH1 | 3.40 | Core | 0.98 | 0.98 | Diametral | M - H |
| 636 | 08.07.2018 | Borehole BH1 | 5.30 | Core | 6.17 | 6.01 | Diametral | #VH |
| 637 | 08.07.2018 | Borehole BH1 | 6.20 | Core | 11.30 | 10.78 | Diametral | EH |
| 638 | 08.07.2018 | Borehole BH1 | 7.20 | Core | 9.75 | 9.40 | Diametral | VH |
| 639 | 08.07.2018 | Borehole BH1 | 10.00 | Core | 0.63 | 0.63 | Diametral | M |
| 640 | 08.07.2018 | Borehole BH1 | 14.60 | Core | 8.18 | 8.03 | Diametral | VH |
| 641 | 08.07.2018 | Borehole BH1 | 16.30 | Core | 10.10 | 10.00 | Diametral | VH - EH |
| 642 | 08.07.2018 | Borehole BH1 | 17.20 | Core | 8.96 | 8.63 | Diametral | VH |
| | | | | | | | | |

Remarks:

Samples are Basalt which are slightly weathered to fresh (SW-Fr).

Denotes sample failed along defect plane

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



Accredited for compliance with ISO/IEC 17025.

Approved Signatory



 Liam McDowall - Laboratory Manager
 (Brisbane)

 NATA Accreditation Number
 1162 / 1169

Form Number

ER0033

POINT LOAD TEST REPORT

| | | | |
|-----------------|---|--------------|------------|
| Client: | Wood & Grieve Engineers | Report No: | GE18/144.2 |
| Client Address: | Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006 | Report Date: | 08.08.18 |
| Job No: | GE18/144 | Sample Date: | 01.08.08 |
| Project: | Geotechnical Investigation - Proposed Tweed Valley Hospital | Order No: | |
| Location: | Lot 102 on DP870722, Cudgen Road, Kingscliff | Test Method: | AS4133 4.1 |

Page 1 of 1

| Sample Number | Date of Test | Location | Depth (m) | Sample Type | Is (MPa) | Is (50) (MPa) | Loading Direction | Descriptive Term |
|---------------|--------------|--------------|-----------|-------------|----------|---------------|-------------------|------------------|
| 643 | 07.08.2018 | Borehole BH2 | 3.73 | Core | 9.31 | 9.14 | Diametral | VH |
| 644 | 07.08.2018 | Borehole BH2 | 4.80 | Core | 10.43 | 10.24 | Diametral | VH - EH |
| 645 | 07.08.2018 | Borehole BH2 | 5.55 | Core | 12.99 | 12.51 | Diametral | EH |
| 646 | 07.08.2018 | Borehole BH2 | 6.55 | Core | 11.88 | 11.55 | Diametral | EH |
| 647 | 07.08.2018 | Borehole BH2 | 8.30 | Core | 7.59 | 7.45 | Diametral | VH |
| 648 | 07.08.2018 | Borehole BH2 | 9.25 | Core | 11.15 | 10.85 | Diametral | EH |
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Remarks:

Samples are Basalt which are slightly weathered to fresh (SW-Fr).

Denotes sample failed along defect plane

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



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 Liam McDowall - Laboratory Manager
 (Brisbane)

 NATA Accreditation Number
 1162 / 1169

Form Number

ER0033

POINT LOAD TEST REPORT

| | | | |
|------------------------|---|---------------------|------------|
| Client: | Wood & Grieve Engineers | Report No: | GE18/144.3 |
| Client Address: | Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006 | Report Date: | 08.08.18 |
| Job No: | GE18/144 | Sample Date: | 31.07.08 |
| Project: | Geotechnical Investigation - Proposed Tweed Valley Hospital | Order No: | |
| Location: | Lot 102 on DP870722, Cudgen Road, Kingscliff | Test Method: | AS4133 4.1 |

Page 1 of 1

| Sample Number | Date of Test | Location | Depth (m) | Sample Type | Is (MPa) | Is (50) (MPa) | Loading Direction | Descriptive Term |
|---------------|--------------|--------------|-----------|-------------|----------|---------------|-------------------|------------------|
| 649 | 07.08.2018 | Borehole BH4 | 1.20 | Core | 8.22 | 8.22 | Diametral | VH |
| 650 | 07.08.2018 | Borehole BH4 | 3.40 | Core | 8.53 | 8.14 | Diametral | VH |
| 651 | 07.08.2018 | Borehole BH4 | 4.95 | Core | 10.30 | 10.11 | Diametral | VH - EH |
| 652 | 07.08.2018 | Borehole BH4 | 6.45 | Core | 12.13 | 11.80 | Diametral | EH |
| 653 | 07.08.2018 | Borehole BH4 | 6.95 | Core | 11.97 | 11.97 | Diametral | EH |
| 654 | 07.08.2018 | Borehole BH4 | 7.90 | Core | 11.71 | 11.71 | Diametral | EH |
| 655 | 07.08.2018 | Borehole BH4 | 8.50 | Core | 14.17 | 14.04 | Diametral | EH |
| 656 | 07.08.2018 | Borehole BH4 | 9.80 | Core | 10.39 | 10.21 | Diametral | VH - EH |
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Remarks:

Samples are Basalt which are slightly weathered to fresh (SW-Fr).

Denotes sample failed along defect plane

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



Accredited for compliance with ISO/IEC 17025.

Approved Signatory



 Liam McDowall - Laboratory Manager
 (Brisbane)

 NATA Accreditation Number
 1162 / 1169

Form Number

ER0033

POINT LOAD TEST REPORT

| | | | |
|-----------------|---|--------------|------------|
| Client: | Wood & Grieve Engineers | Report No: | GE18/144.4 |
| Client Address: | Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006 | Report Date: | 08.08.18 |
| Job No: | GE18/144 | Sample Date: | 30.07.08 |
| Project: | Geotechnical Investigation - Proposed Tweed Valley Hospital | Order No: | |
| Location: | Lot 102 on DP870722, Cudgen Road, Kingscliff | Test Method: | AS4133 4.1 |

Page 1 of 1

| Sample Number | Date of Test | Location | Depth (m) | Sample Type | Is (MPa) | Is (50) (MPa) | Loading Direction | Descriptive Term |
|---------------|--------------|--------------|-----------|-------------|----------|---------------|-------------------|------------------|
| 657 | 06.08.2018 | Borehole BH5 | 1.35 | Core | 8.26 | 8.11 | Diametral | VH |
| 658 | 06.08.2018 | Borehole BH5 | 3.35 | Core | 12.73 | 12.49 | Diametral | EH |
| 659 | 06.08.2018 | Borehole BH5 | 4.95 | Core | 5.30 | 5.30 | Axial | VH |
| 660 | 06.08.2018 | Borehole BH5 | 6.40 | Core | 9.64 | 9.46 | Diametral | VH |
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Remarks:

Samples are Basalt which are slightly weathered to fresh (SW-Fr).

Denotes sample failed along defect plane

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



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Approved Signatory



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 (Brisbane)

 NATA Accreditation Number
 1162 / 1169

Form Number

ER0033

POINT LOAD TEST REPORT

| | | | |
|-----------------|---|--------------|------------|
| Client: | Wood & Grieve Engineers | Report No: | GE18/144.5 |
| Client Address: | Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006 | Report Date: | 08.08.18 |
| Job No: | GE18/144 | Sample Date: | 30.07.08 |
| Project: | Geotechnical Investigation - Proposed Tweed Valley Hospital | Order No: | |
| Location: | Lot 102 on DP870722, Cudgen Road, Kingscliff | Test Method: | AS4133 4.1 |

Page 1 of 1

| Sample Number | Date of Test | Location | Depth (m) | Sample Type | Is (MPa) | Is (50) (MPa) | Loading Direction | Descriptive Term |
|---------------|--------------|--------------|-----------|-------------|----------|---------------|-------------------|------------------|
| 661 | 06.08.2018 | Borehole BH6 | 8.40 | Core | 7.34 | 7.21 | Diametral | VH |
| 662 | 06.08.2018 | Borehole BH6 | 9.37 | Core | 11.23 | 10.92 | Diametral | EH |
| 663 | 06.08.2018 | Borehole BH6 | 12.70 | Core | 0.29 | 0.29 | Diametral | #L-M |
| 664 | 06.08.2018 | Borehole BH6 | 14.00 | Core | 0.27 | 0.27 | Diametral | #L-M |
| 665 | 06.08.2018 | Borehole BH6 | 14.45 | Core | 0.39 | 0.39 | Diametral | #M |
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Remarks:

Samples are Basalt which are distinctly weathered to fresh (DW-Fr).

Denotes sample failed along defect plane

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



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 Liam McDowall - Laboratory Manager
 (Brisbane)

 NATA Accreditation Number
 1162 / 1169

Form Number

ER0033

POINT LOAD TEST REPORT

| | | | |
|------------------------|---|---------------------|------------|
| Client: | Wood & Grieve Engineers | Report No: | GE18/144.6 |
| Client Address: | Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006 | Report Date: | 08.08.18 |
| Job No: | GE18/144 | Sample Date: | 30.07.08 |
| Project: | Geotechnical Investigation - Proposed Tweed Valley Hospital | Order No: | |
| Location: | Lot 102 on DP870722, Cudgen Road, Kingscliff | Test Method: | AS4133 4.1 |

Page 1 of 1

| Sample Number | Date of Test | Location | Depth (m) | Sample Type | Is (MPa) | Is (50) (MPa) | Loading Direction | Descriptive Term |
|---------------|--------------|--------------|-----------|-------------|----------|---------------|-------------------|------------------|
| 666 | 06.08.2018 | Borehole BH7 | 2.20 | Core | 6.51 | 6.51 | Diametral | VH |
| 667 | 06.08.2018 | Borehole BH7 | 3.75 | Core | 2.56 | 2.56 | Diametral | H |
| 668 | 06.08.2018 | Borehole BH7 | 6.25 | Core | 6.48 | 6.36 | Diametral | VH |
| 669 | 06.08.2018 | Borehole BH7 | 8.95 | Core | 9.85 | 9.58 | Diametral | VH |
| 670 | 06.08.2018 | Borehole BH7 | 10.30 | Core | 10.93 | 10.83 | Diametral | EH |
| 671 | 06.08.2018 | Borehole BH7 | 13.15 | Core | 0.15 | 0.16 | Diametral | #L |
| 672 | 06.08.2018 | Borehole BH7 | 17.65 | Core | 8.21 | 8.29 | Diametral | VH |
| 673 | 06.08.2018 | Borehole BH7 | 18.50 | Core | 10.81 | 10.91 | Diametral | EH |
| 674 | 06.08.2018 | Borehole BH7 | 18.85 | Core | 4.95 | 4.90 | Diametral | VH |
| | | | | | | | | |

Remarks:

Samples are Basalt which are distinctly weathered to fresh (DW-Fr).

Denotes sample failed along defect plane

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



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 Liam McDowall - Laboratory Manager
 (Brisbane)

 NATA Accreditation Number
 1162 / 1169

Form Number

ER0033

POINT LOAD TEST REPORT

| | | | |
|------------------------|---|---------------------|------------|
| Client: | Wood & Grieve Engineers | Report No: | GE18/144.7 |
| Client Address: | Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006 | Report Date: | 08.08.18 |
| Job No: | GE18/144 | Sample Date: | 03.08.18 |
| Project: | Geotechnical Investigation - Proposed Tweed Valley Hospital | Order No: | |
| Location: | Lot 102 on DP870722, Cudgen Road, Kingscliff | Test Method: | AS4133 4.1 |

Page 1 of 1

| Sample Number | Date of Test | Location | Depth (m) | Sample Type | Is (MPa) | Is (50) (MPa) | Loading Direction | Descriptive Term |
|---------------|--------------|---------------|-----------|-------------|----------|---------------|-------------------|------------------|
| 675 | 06.08.2018 | Borehole BH25 | 1.60 | Core | 8.82 | 8.66 | Diametral | VH |
| 676 | 06.08.2018 | Borehole BH25 | 2.90 | Core | 9.74 | 9.38 | Diametral | VH |
| 677 | 06.08.2018 | Borehole BH25 | 3.70 | Core | 10.17 | 9.80 | Diametral | VH |
| 678 | 06.08.2018 | Borehole BH25 | 11.80 | Core | 16.36 | 15.60 | Diametral | EH |
| 679 | 06.08.2018 | Borehole BH25 | 14.35 | Core | 0.17 | 0.17 | Diametral | L |
| 680 | 06.08.2018 | Borehole BH25 | 17.80 | Core | 7.95 | 7.81 | Diametral | VH |
| 681 | 06.08.2018 | Borehole BH25 | 18.65 | Core | 1.38 | 1.37 | Diametral | H |
| 682 | 06.08.2018 | Borehole BH25 | 19.70 | Core | 7.95 | 7.87 | Diametral | VH |
| 683 | 06.08.2018 | Borehole BH25 | 21.20 | Core | 6.58 | 6.42 | Diametral | VH |
| | | | | | | | | |

Remarks:

Samples are Basalt which are slightly weathered to fresh (SW-Fr).

Denotes sample failed along defect plane

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



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Approved Signatory



 Liam McDowall - Laboratory Manager
 (Brisbane)

 NATA Accreditation Number
 1162 / 1169

Form Number

ER0033

PERMEABILITY - Percolation Test

Project Tweed Valley Hospital

Project Number

Date _____

| | |
|----------------------|------|
| Test Location | BH23 |
|----------------------|------|

Tester

BE

Depth of Hole _____ 500 mm

Diameter of Hole 100 mm

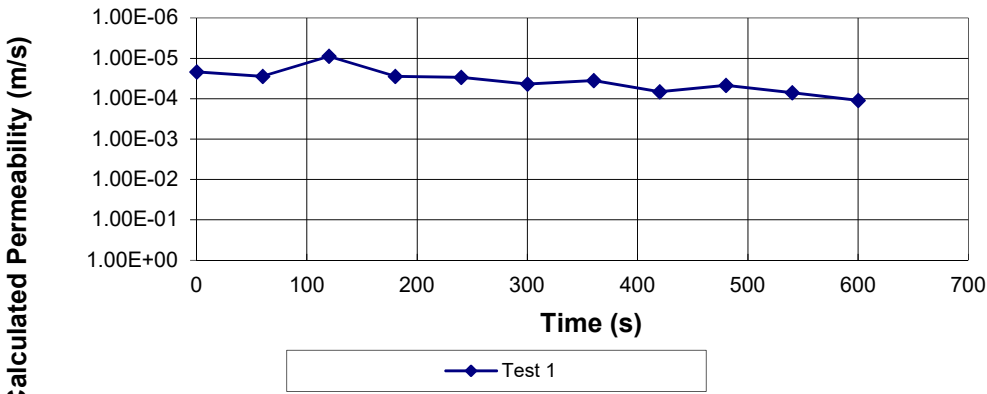
Length of Test Section 400 mm

[illegible]

Time for 25mm drop

| | |
|------------------------------------|---------|
| Permeability (m/s) mm/hr | 5.7E-05 |
| | 203.5 |

Permeability Test



PERMEABILITY - Percolation Test

Project Tweed Valley Hospital

Date _____

Tester

BE

Depth of Hole _____ 500 mm

Diameter of Hole 100 mm

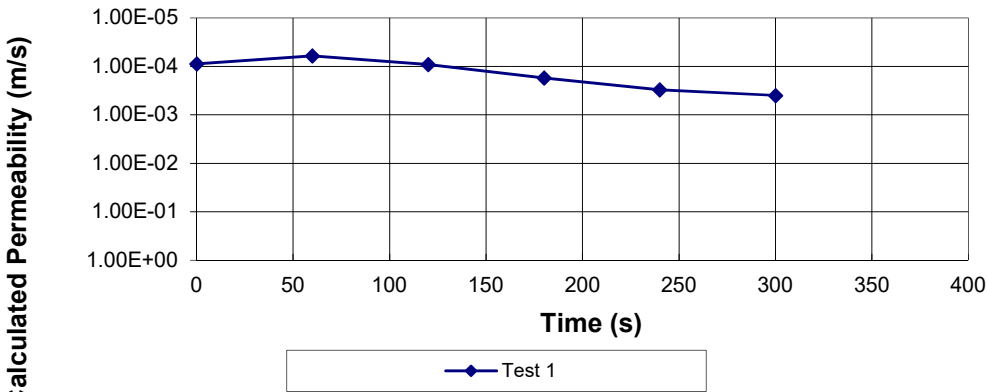
Length of Test Section 400 mm

[illegible]

Time for 25mm drop

| | |
|---------------------------|---------|
| Permeability (m/s) | 1.9E-04 |
| mm/hr | 670.3 |

Permeability Test



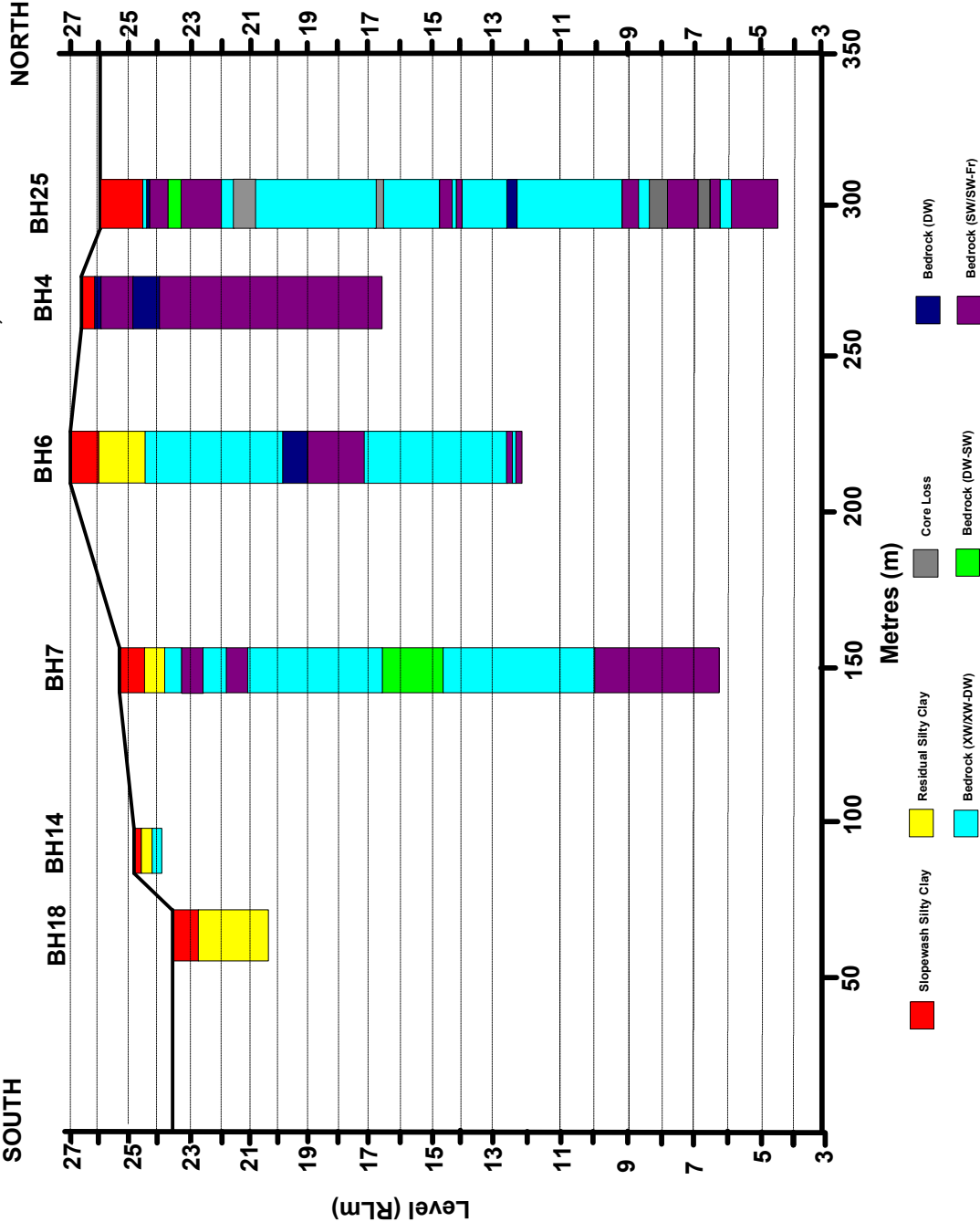
APPENDIX 'D'

CROSS SECTIONS OF BOREHOLES – SECTIONS A, B AND C



INFERRED CROSS SECTION A

PROPOSED TWEED VALLEY HOSPITAL - CUDGEN ROAD, KINGSCLIFF



ABN: 51 009 878 899
Unit 1/5 Brendan Drive Nerang 4211 Ph: 5596 1599
Email: goldcoastlab@morrisongeo.com.au Fax: 5527 2027

MORRISON
GEOTECHNIC



Engineers: D.Riley, J.Daly, S.Wynne, D.Dragun, B.Taylor
D.Vanderhor & B.Elsmore
Geologists: L.Bexley & R.Howchin

Map Description : **INFERRED CROSS SECTION A**

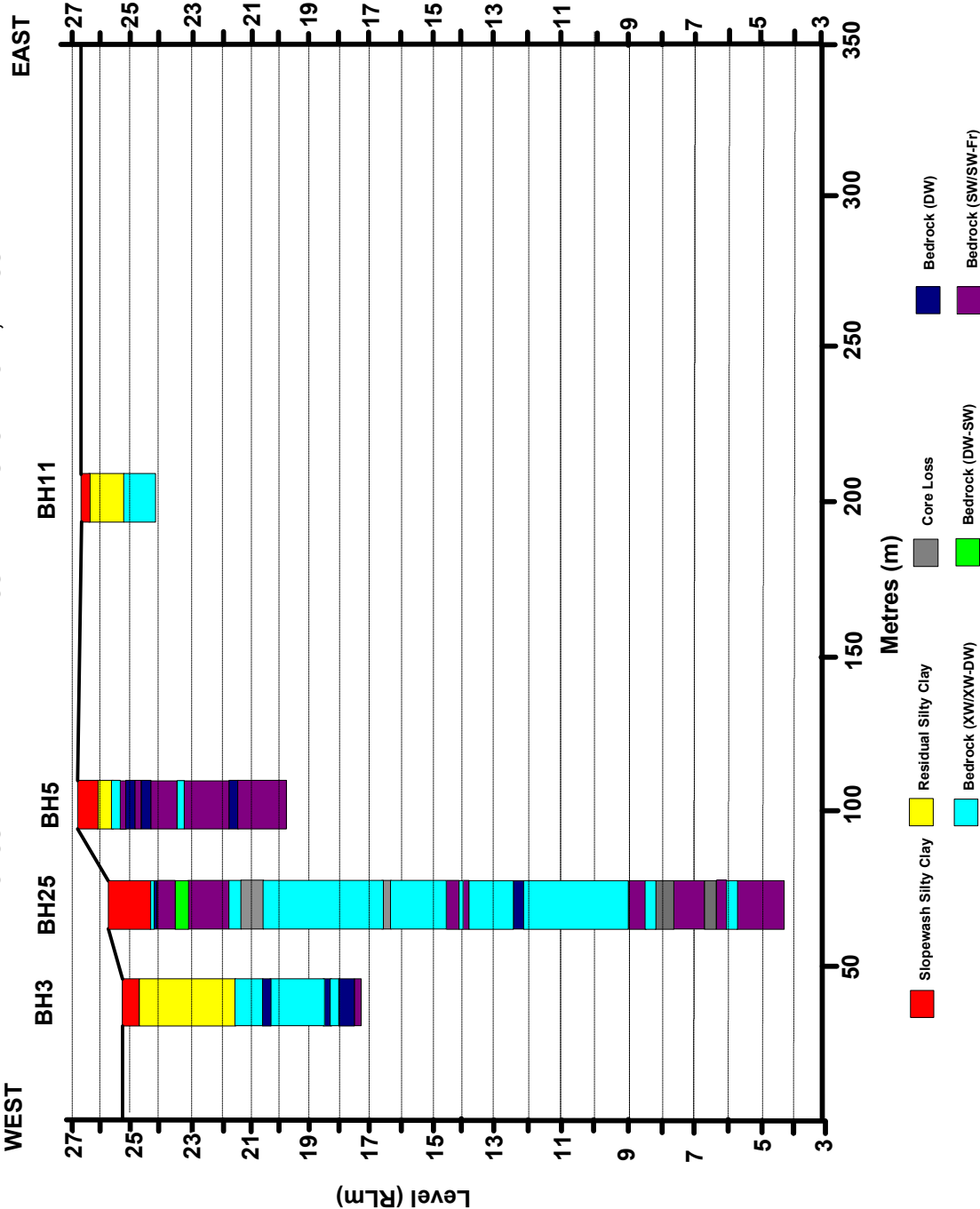
Client : **WOOD & GRIEVE ENGINEERS**

Project : **TWEED VALLEY HOSPITAL, KINGSCLIFF**

Project No : **GE18/144** Date: **15/08/18** Scale : Not to Scale

INFERRED CROSS SECTION B

PROPOSED TWEED VALLEY HOSPITAL - CUDGEN ROAD, KINGSCLIFF



ABN: 51 009 878 899
Unit 1/5 Brendan Drive Nerang 4211 Ph: 5596 1599
Email: goldcoastlab@morrisongeo.com.au Fax: 5527 2027
Engineers: D.Riley, J.Daly, S.Wynne, D.Dragun, B.Taylor
D.Vanderhor & B.Elsmore
Geologists: L.Bexley & R.Howchin

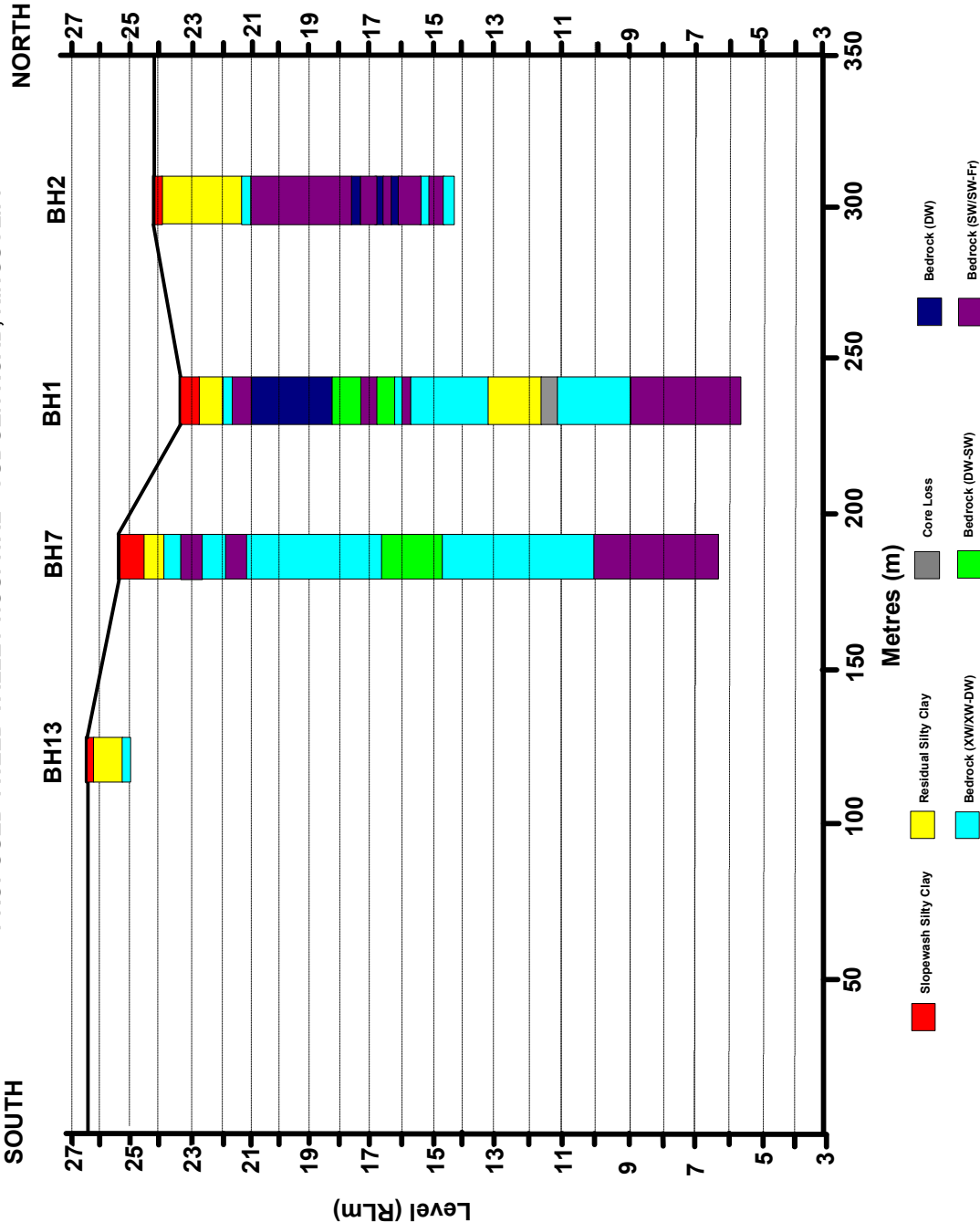
MORRISON
GEOTECHNIC



| | | | |
|-------------------|-----------------------------------|----------------|----------------------|
| Map Description : | INFERRED CROSS SECTION B | | |
| Client : | WOOD & GRIEVE ENGINEERS | | |
| Project : | TWEED VALLEY HOSPITAL, KINGSCLIFF | | |
| Project No : | GE18/144 | Date: 15/08/18 | Scale : Not to Scale |

INFERRED CROSS SECTION C

PROPOSED TWEED VALLEY HOSPITAL - CUDGEN ROAD, KINGSCLIFF



ABN: 51 009 878 899
Unit 1/5 Brendan Drive Nerang 4211 Ph: 5596 1599
Email: goldcoastlab@morrisongeo.com.au Fax: 5527 2027

Engineers: D.Riley, J.Daly, S.Wynne, D.Dragun, B.Taylor
D.Vanderhor & B.Elsmore
Geologists: L.Bexley & R.Howchin

MORRISON
GEOTECHNIC



Map Description : **INFERRED CROSS SECTION C**

Client : **WOOD & GRIEVE ENGINEERS**

Project : **TWEED VALLEY HOSPITAL, KINGSCLIFF**

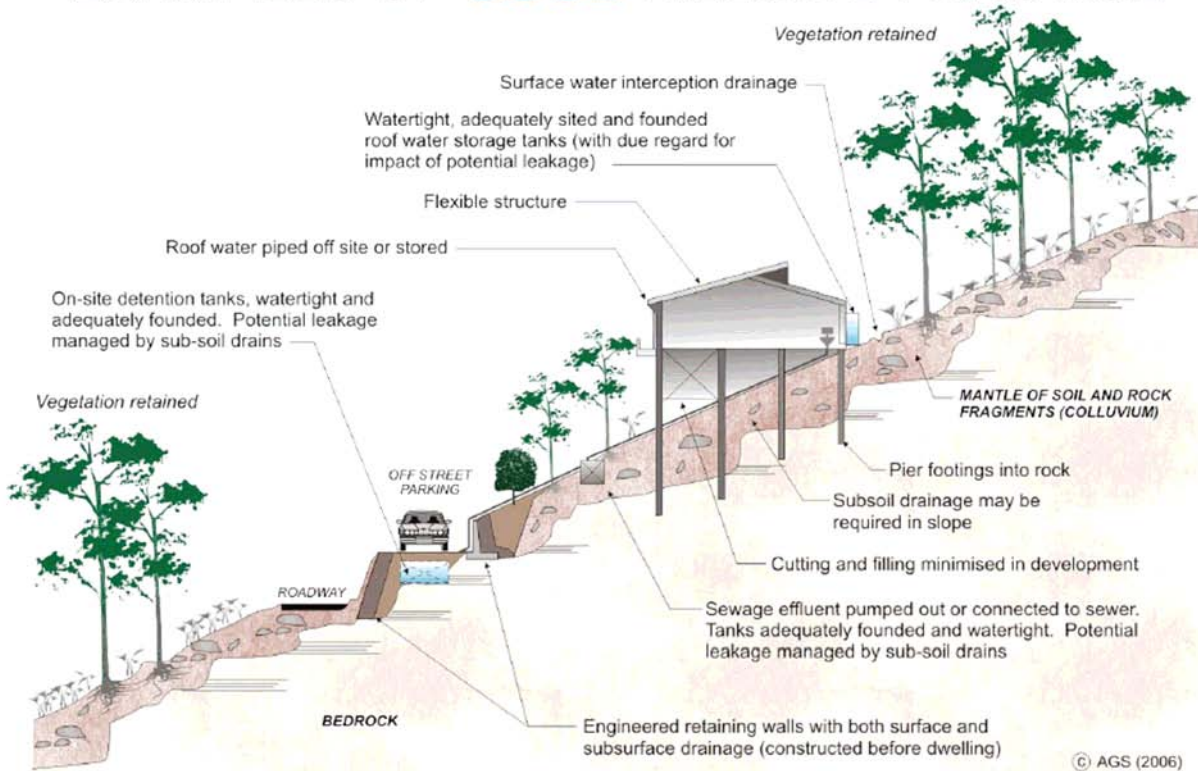
Project No : **GE18/144** Date: **15/08/18** Scale : Not to Scale

APPENDIX 'E'

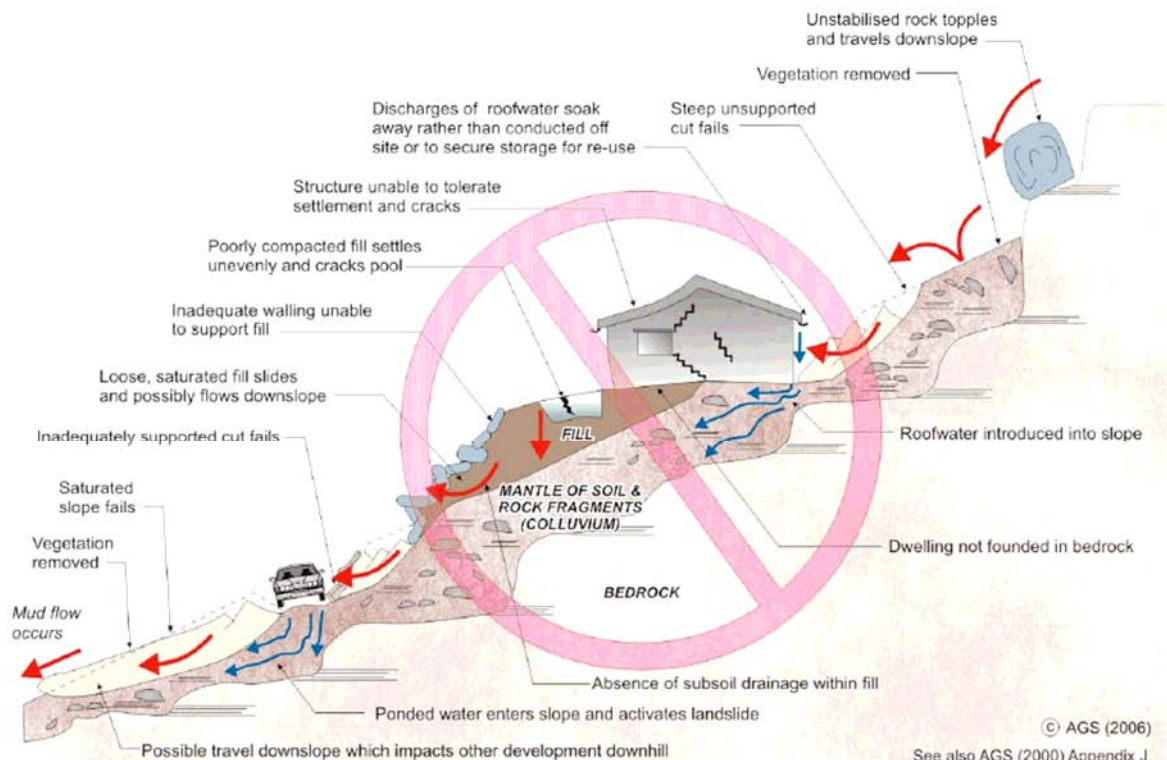
GUIDELINES FOR HILLSIDE CONSTRUCTION



EXAMPLES OF GOOD HILLSIDE PRACTICE



EXAMPLES OF POOR HILLSIDE PRACTICE



Important Information about Your Geotechnical Engineering Report

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

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

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

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

Read the Full Report

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

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

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

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

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

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

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

Subsurface Conditions Can Change

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

Most Geotechnical Findings Are Professional Opinions

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

A Report's Recommendations Are *Not* Final

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

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

A Geotechnical Engineering Report Is Subject to Misinterpretation

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

Do Not Redraw the Engineer's Logs

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

Give Contractors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

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

Obtain Professional Assistance To Deal with Mold

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

Rely on Your ASFE-Member Geotechnical 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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