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

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

Engineering Log - Borehole

Borehole No.: BH26

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555422.00
Northing: 6873815.00
RL: 19.69
Total Depth: 2.10
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		19.0	0.1	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, moist.		M	St	1			
						CH	**Silty CLAY**: As above but very stiff and no organics.		M	VSt	5 7 9 10			
			0.5	Residual		CI	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, moist.		M	VSt-H	9 9 8 9 11 8 7 9	0.5	U50	PP=350-400kPa
			1.0											
			1.3			CI	**Silty CLAY**: As above but grey brown.		M	VSt-H	7 6 10			
		18.0	1.6			CI	**Silty CLAY**: As above but with some fine to medium gravel.		M	VSt-H				
			1.9	Bedrock		CI	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey.		M	VSt-H				
			2.0			BAS	**BASALT**: As above but low strength.	XW		VLS				
			2			BAS		XW		LS				
							2.10m: BOREHOLE TERMINATED AT MAXIMUM TC REFUSAL							
		17.0	3.0											
		16.0	4.0											
		15.0	5.0											
		14.0	6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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Engineering Log - Borehole

Borehole No.: BH27

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555469.00
Northing: 6873204.00
RL: 23.08
Total Depth: 1.50
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		23.0	0.1	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, trace of fine to medium sized gravel, moist.		M	St	1			
						CH			M	VSt	5 7 6			
			0.4	Residual		CI	**Silty CLAY**: As above but very stiff and no organics.		M	VSt-H	8 9 6 7 5 8			
			1.0				**Silty CLAY**: .Very stiff to hard, medium plasticity, red brown, moist							
		22.0	1			CI	**Silty CLAY**: As above but grey brown.		M	VSt-H	8			
			1.1	Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, grey brown mottled grey.	XW		VLS	9 10 9			
			1.4			BAS	**BASALT**: As above but low strength.	XW		LS	11			
							1.50m: BOREHOLE TERMINATED AT MAXIMUM TC REFUSAL				8 9 10			
		21.0	2.0											
		20.0	3.0											
		19.0	4.0											
		18.0	5.0											
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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Engineering Log - Borehole

Borehole No.: BH28

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555425.00
Northing: 6873258.00
RL: 17.88
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		17.0	0.1	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, moist.		M	St	6			
						CH	**Silty CLAY**: As above but very stiff to hard and no organics.		M	VSt-H	10			
			0.5	Residual							11			
						CI	**Silty CLAY**: Hard, medium plasticity, red brown, moist.		M	H	9			
											13	0.5	U50	PP=>400kPa
											15		BS	Bulk Sample
		16.0	1.0											
			2.0											
			2.1			CI	**Silty CLAY**: As above but with some fine to medium sized gravel.		M	H				
		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
- Water level on date shown
- Water inflow
- Water outflow

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH29

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555435.00
Northing: 6873319.40
RL: 16.18
Total Depth: 16.80
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 16/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		16.0	0.0	Residual Slopewash		CH	**Silty CLAY**: Firm, high plasticity, red brown, trace of fine to medium sized gravel, moist.		M	F				
			0.3			Cl	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, with .some fine to medium sized gravel, moist		M	VSt-H				
			0.8			Cl	**Silty CLAY**: .As above but hard and no gravel		M	H				
			1.0									1	PP	400kPa
		15.0	1			Cl	**Silty CLAY**: .As above but brown		M	H			SPT	5,6,6, N=12
			1.4			Cl	**Gravelly CLAY**: Hard, medium plasticity, grey mottled dark grey and orange brown, fine to medium sized gravel, extremely .weathered basalt fragments, moist		M	H				
			2.0											
		14.0										2.5	SPT	3,9,20, N=29
			3.0											
Wash Bore - Rock Roller		13.0	3.8			Cl	**Silty CLAY**: Very stiff, medium plasticity, brown mottled grey and .orange brown, trace of fine sized gravel, moist		M	VSt				
			4.0									4	SPT	6,6,7, N=13
		12.0												
			5.0											
		11.0												
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH29

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555435.00
Northing: 6873319.40
RL: 16.18
Total Depth: 16.80
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 16/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller	SWL	10.0	6.2			Cl	**Silty CLAY**: Very stiff, medium plasticity, brown mottled grey and orange brown, trace of fine sized gravel, moist.		M	VSt		6 6.1	PP SPT	250kPa 6,9,12, N=21
						Cl	**Silty CLAY**: As above but orange brown mottled grey.		M	VSt				
		9.0	7.0									7 7.2	PP SPT	280kPa 3,4,6, N=10
		8.0	8			Cl	**Silty CLAY**: As above but stiff, grey mottled orange brown.		M	St		8.5 8.6	PP SPT	150kPa 1,3,3, N=6
		7.0	9.0											
		6.0	10.0									10 10.1	PP SPT	150kPa 3,3,3, N=6
		5.0	11.0											
			12.0									11.5	SPT	1,3,3, N=6

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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A.B.N. 051 009 878 899
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Engineering Log - Borehole

Borehole No.: BH29

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555435.00
Northing: 6873319.40
RL: 16.18
Total Depth: 16.80
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 16/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller		4.0	13.0			Cl	**Silty CLAY**: As above but stiff, grey mottled orange brown.		M	St				
		3.0	13.2			Cl	**Silty CLAY**: As above but brown mottled dark grey, with some very low strength, extremely weathered basalt rock layering.		M	St		13	SPT	5,10,18, N=28
			14.0											
		2.0	14.5			Cl	**Silty CLAY**: As above but dark grey mottled orange and brown, with some fine sized gravel.		M	St		14.5	SPT	3,6,7, N=13
		1.0	15.0											
			16.0									16	SPT	4,7,19, N=26
		0.0	16.6	Rock		BAS	**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown	DW		MS		16.5	PP	180kPa
			16.8											
		-1.0	17.0				**16.80m: COMMENCE NMLC CORING**							
			18.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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A.B.N. 051 009 878 899
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Engineering Log - Cored Borehole

Borehole No.: BH29

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555435.00
Northing: 6873319.40
RL: 16.18
Total Depth: 25.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 16/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
		4.0	12.5										
		3.5	13.0										
		3.0	13.5										
		2.5	14.0										
		2.0	14.5										
		1.5	15.0										
		1.0	15.5										
		0.5	16.0										
		0.0	16.5										
		-0.5					Commence NMLC Coring at 16.8m						
NMLC Coring		-1.0	17.0	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey, slightly fractured.	SW-Fr		15.29	90%		J10° Un/Ro,Cn,O J10° Un/Ro,Cn,O J20° Pl/Ro,Cn,O
		-1.5	17.5										J5° Un/Ro,Cn,O J10° Un/Ro,Cn,O J40° Un/Ro,Vr,O J20° Un/Ro,Cn,O
			17.8 18.0			BAS	**BASALT**:As above but medium strength, distinctly weathered.	DW					J40° Un/Ro,Cn,O J5° Un/Ro,St,O

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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Engineering Log - Cored Borehole

Borehole No.: BH29

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: GeotechInvestigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555435.00
Northing: 6873319.40
RL: 16.18
Total Depth: 25.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 16/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		-2.0				BAS	**BASALT**: As above but medium strength, distinctly weathered	DW		0.48			J40° Un/Ro,Cn,O J35° Un/Ro,Cn,O
			18.3										J5° Pl/Ro,Cn,O
			18.5			BAS	**BASALT**: Very high strength, slightly weathered to .fresh, grey	SW-Fr			90%		J5° Pl/Sm,Cn,O
		-2.5											J5° Pl/Sm,Cn,O
			19.0							7.70			J5° Un/Ro,Cn,O
		-3.0											J45° Un/Ro,Cn,O
			19.5							5.11			J5° Pl/Ro,Cn,O
		-3.5											J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O J40° Un/Ro,Cn,O
			20.0										J10° Un/Ro,Cn,O
		-4.0											J15° Un/Ro,Cn,O
			20.34										
			20.5			BAS	**BASALT**: Medium strength, distinctly weathered, grey, slightly fractured.	DW		0.98	87%		
		-4.5											J5° Un/Ro,Cn,O
			21.0										J10° Pl/Ro,Cn,O J10° Un/Ro,Vr,O
		-5.0								0.39			J5° Pl/Ro,Cn,O J10° Un/Ro,Cn,O J5° Un/Ro,Cn,O
			21.5										
		-5.5											
			22.0										J5° Pl/Ro,Cn,O
		-6.0											
			22.5										J15° Un/Ro,Cn,O J5° Un/Ro,Vr,O
		-6.5											SZ 20mm, MS & clay
			23.0										J5° Un/Ro,Cn,O
		-7.0								0.31	92%		
			23.5										J10° Un/Ro,Cn,O J10° Un/Ro,Cn,O
		-7.5											
			24.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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Engineering Log - Cored Borehole

Borehole No.: BH29

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555435.00
Northing: 6873319.40
RL: 16.18
Total Depth: 25.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 16/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
		-8.0	24.5			BAS	**BASALT**: Medium strength, distinctly weathered, aqua grey, slightly fractured.	DW			92%		J5° Un/Ro,Cn,O
		-8.5	25.0										J5° Un/Ro,Cn,O
			25				**25.00m: BOREHOLE TERMINATED**						
		-9.0	25.5										
		-9.5	26.0										
		-10.0	26.5										
		-10.5	27.0										
		-11.0	27.5										
		-11.5	28.0										
		-12.0	28.5										
		-12.5	29.0										
		-13.0	29.5										
		-13.5	30.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH29
BOREHOLE DEPTH: 16.8m TO 25.0m

END OF HOLE AT 25.0m

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

Engineering Log - Borehole

Borehole No.: BH30

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555405.00
Northing: 6873364.00
RL: 11.48
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		11.0	0.1	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, moist.		M	St	1			
						CH			M	VSt	4			
							Silty CLAY: As above but very stiff and no organics.				5			
			0.4	Residual							8			
		10.0				CI	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, moist.		M	VSt-H	9			
			1.0								7			
											5			
											8			
											7			
			2.0								8			
											9			
											6			
											7			
											8			
											8			
		9.0	2.4								7			
						CI	**Silty CLAY**: As above but grey brown.		M	VSt-H	8			
			3.0								9			
							3.00m: BOREHOLE TERMINATED							
		8.0												
			4.0											
		7.0												
			5.0											
		6.0												
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH31

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555411.00
Northing: 6873417.00
RL: 9.34
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		9.0	0.1	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, moist.		M	St	4			
						CH	**Silty CLAY**: As above but very stiff and no organics.		M	VSt	7			
			0.5								7			
				Residual		CI	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, moist.		M	VSt-H	8			
		8.0	1.0								9			
											9			
											10			
											11			
			2.0								10			
		7.0									9			
											12			
			2.4								10			
						CI	**Silty CLAY**: As above but grey brown.		M	VSt-H	12			
			3.0								15			
			3				**3.00m: BOREHOLE TERMINATED**							
		6.0												
			4.0											
		5.0												
			5.0											
		4.0												
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH32

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555422.00
Northing: 6873498.00
RL: 9.19
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		9.0	0.1	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown mottled grey, with organics, trace of fine to medium sized gravel, moist		M	St	2			
						CH			M	VSt	4			
			0.4	Residual		CI	**Silty CLAY**: As above but very stiff and no organics		M	VSt-H	7			
							Silty CLAY: Very stiff to hard, medium plasticity, red brown, moist				9			
			1.0								11			
		8.0									10			
											10			
											9			
											11			
											10			
											12			
											10			
											9			
											11			
											8			
											9			
			1.7								10			
		7.0	2.0			CI	**Silty CLAY**: As above but hard		M	H				
			2.5			CI	**Silty CLAY**: As above but brown and very stiff		M	VSt				
			3.0											
		6.0					**3.00m: BOREHOLE TERMINATED**							
			4.0											
		5.0												
			5.0											
		4.0												
			6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH33

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555466.00
Northing: 6873545.00
RL: 10.09
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		10.0	0.1	Slope wash		CH	**Silty CLAY**: .Stiff, high plasticity, red brown, with organics, moist		M	St	6			
						CH			M	VSt	10			
			0.3	Residual		CI	**Silty CLAY**: .As above but very stiff and no organics		M	VSt-H	9			
							Silty CLAY: .Very stiff to hard, medium plasticity, red brown, moist				7			
			1.0								11			
		9.0									14			
											13			
											10			
											11			
											9			
											10			
											10			
											15			
			1.7			CI	**Silty CLAY**: .As above but hard		M	H				
			2.0											
		8.0	2			CI	**Silty CLAY**: .As above but grey brown		M	H				
			3.0											
		7.0	3				**3.00m: BOREHOLE TERMINATED**							
			4.0											
		6.0												
			5.0											
		5.0												
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH34

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555541.00
Northing: 6873570.00
RL: 10.79
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		10.0	0.1	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, trace of fine to medium sized gravel, with organics, moist.		M	St	4			
						CH			M	VSt	9			
			0.4				**Silty CLAY**: .As above but very stiff and no organics				5			
				Residual		CI	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, trace of .fine to medium sized gravel moist		M	VSt-H	4			
			1.0								5			
											4			
											7			
											8			
			1								9			
						CI	**Silty CLAY**: .As above but no gravel		M	VSt-H	8			
		9.0	1.6			CI	**Silty CLAY**: .As above but hard		M	H				
			2.0 1.9			CI	**Silty CLAY**: .As above but red brown mottled grey		M	H				
		8.0	3.0											
			3				**3.00m: BOREHOLE TERMINATED**							
		7.0	4.0											
		6.0	5.0											
		5.0	6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH35

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555628.00
Northing: 6873575.00
RL: 9.85
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		9.0	0.1	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, trace of fine to medium sized gravel, with organics, moist		M	St	5			
						CH			M	VSt	8			
			0.4								7			
				Residual							9			
						CI	**Silty CLAY**: As above but very stiff, trace of fine to coarse sized gravel and no organics.		M	VSt-H	7			
							Silty CLAY: Very stiff to hard, medium plasticity, red brown, trace of fine to coarse sized gravel, moist.				7			
			1.0								9			
		8.0	1			CI	**Silty CLAY**: As above but no gravel.		M	VSt-H	8			
			2.0								9			
		7.0									9			
			3.0											
			3				**3.00m: BOREHOLE TERMINATED**							
		6.0	4.0											
		5.0	5.0											
		4.0	6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH36

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555699.00
Northing: 6873581.00
RL: 10.23
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		10.0	0.1	Slope wash		CH	**Silty CLAY**: .Stiff, high plasticity, red brown, with organics, moist		M	St	3			
						CH			M	VSt	3			
			0.4				**Silty CLAY**: .As above but very stiff and no organics				11			
				Residual		CI	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, with fine to medium sized gravel, moist.		M	VSt-H	8			
			1.0								6			
			1.1			CI	**Silty CLAY**: .As above but hard and no gravel		M	H	5			
		9.0									6			
											5			
			2.0								5			
											6			
											5			
		8.0	2.1			CI	**Silty CLAY**: As above but orange brown.		M	H	8			
											15			
			2.5			CI	**Silty CLAY**: .As above but brown		M	H				
			3.0											
			3				**3.00m: BOREHOLE TERMINATED**							
		7.0												
			4.0											
		6.0												
			5.0											
		5.0												
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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Engineering Log - Borehole

Borehole No.: BH37

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555837.00
Northing: 6873578.00
RL: 13.60
Total Depth: 4.50
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		13.0	0.1	Topsoil		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, moist.		M	St	3			
						CH			M	VSt	4	0.2 –	PP	150kPa
			0.4				**Silty CLAY**: .As above but very stiff and no organics				3			
				Residual		CI	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, moist.		M	VSt-H	3	0.4 –	PP	300kPa
			1.0								3			
											5			
											4			
											6			
											6			
											8			
											8			
											8			
			1.3								6			
		12.0				CI	**Silty CLAY**: As above but hard		M	H	6			
											8			
			1.6			CI	**Silty CLAY**: As above but brown.		M	H	8			
			2.0								9			
											9			
											9			
											9			
			2.1			CI	**Silty CLAY**: .As above but dark grey		M	H	9			
		11.0	2.5			CI	**Silty CLAY**: As above but stiff and grey brown.		M	St		2.5 –	PP	100kPa
			3.0											
			3.3			CI	**Silty CLAY**: .As above but very stiff		M	VSt				
		10.0	3.5			CI	**Silty CLAY**: As above but stiff.		M	St				
			4.0											
		9.0	4.5				**4.50m: BOREHOLE TERMINATED**							
		8.0	5.0											
			6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH38

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555888.00
Northing: 6873558.00
RL: 19.29
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		19.0	0.1	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, moist.		M	St	10			
						CH	**Silty CLAY**: As above but very stiff and no organics.		M	VSt	7			
			0.3	Residual		CI	**Silty CLAY**: Hard, medium plasticity, red brown, moist.		M	H	5			
											7			
											9			
											6			
											7			
			1.0								15			
		18.0	1			CI	**Silty CLAY**: As above but with some fine to medium gravel.		M	H				
		17.0	2.0											
			3.0											
		16.0	3				**3.00m: BOREHOLE TERMINATED**							
		15.0	4.0											
		14.0	5.0											
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH39

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555775.00
Northing: 6873551.00
RL: 18.86
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		18.0	0.1	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with some fine to medium sized gravel, with organics, moist.		M	St	6			
						CH			M	VSt	5			
			0.3				**Silty CLAY**: As above but very stiff and no organics.				4			
				Residual		CI	**Silty CLAY**: Hard, medium plasticity, red brown, with some fine to medium sized gravel, moist.		M	H	5			
			1.0								5			
											5			
											10			
											6			
											5			
		17.0	1.8								5			
											5			
											4			
			2.0			CI	**Silty CLAY**: As above but grey brown.		M	H	5			
											6			
											7			
		16.0	3.0								15/50			
			3				**3.00m: BOREHOLE TERMINATED**							
		15.0	4.0											
		14.0	5.0											
		13.0	6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH40

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555783.00
Northing: 6873508.00
RL: 23.01
Total Depth: 1.10
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with		23.0	0.1	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, moist.		M	St	10			
						CH	**Silty CLAY**: As above but very stiff to hard, with some fine to medium sized gravel, no organics and some cobbles.		M	VSt-H	7 7 8			
			0.4	Residual		CI	**Silty CLAY**: Hard, medium plasticity, red brown, with some fine to medium sized gravel, some cobbles, moist.		M	H	15			
			0.8	Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, red brown and grey.	XW		VLS				
		22.0	1.0			BAS	**BASALT**: As above but low strength.	XW		LS				
			1.1				**1.10m: BOREHOLE TERMINATED AT MAXIMUM TC REFUSAL**							
		21.0	2.0											
		20.0	3.0											
		19.0	4.0											
		18.0	5.0											
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH41

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555662.00
Northing: 6873513.00
RL: 22.59
Total Depth: 3.00
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		22.0	0.1	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with some fine to coarse sized gravels, with organics, moist.		M	St	1			
			0.2			CH			M	VSt	15			
				Residual		CI	**Silty CLAY**: As above but very stiff and no organics.		M	VSt-H	20/50			
			1.0				**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, with some fine to coarse sized gravel, moist.							
		21.0	2.0											
			2.4	Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, grey.	XW		VLS				
		20.0	3.0											
			3				**3.00m: BOREHOLE TERMINATED**							
		19.0	4.0											
		18.0	5.0											
		17.0	6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH42

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555666.00
Northing: 6873465.00
RL: 29.93
Total Depth: 1.40
Drilling Rig: Jehyco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		29.9	0.1	Residual		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with organics, moist.		M	St	5			
						CH			M	VSt	8			
			0.3				**Silty CLAY**: As above but very stiff and no organics.				4			
						CI	**Silty CLAY**: Very stiff, medium plasticity, red brown, moist.		M	VSt	3			
			0.6								4			
				Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, grey.	XW		VLS	4			
		29.0	1.0								4			
											5			
											15			
			1.3			BAS	**BASALT**: As above but low strength.	XW		LS				
			1.4				**1.40m: BOREHOLE TERMINATED AT MAXIMUM TC REFUSAL**							
		28.0	2.0											
		27.0	3.0											
		26.0	4.0											
		25.0	5.0											
		24.0	6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH43

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555522.10
Northing: 6873345.90
RL: 24.67
Total Depth: 1.50
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 05/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		24.0	0.3	Slopewash		CH	**Silty CLAY**: Very stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	VSt				
			0.5			CH	**Silty CLAY**: As above but with some cobbles.		M	VSt		0.4 –	PP	>600kPa
			1.0	Residual		CI	**Silty CLAY**: Hard, medium plasticity, red brown, with some cobbles, moist		M	H		1	SPT	17,10/20mm, bouncing on cobble
			1.2	Bedrock		BAS	**BASALT**: Medium strength, distinctly weathered, dark grey.	DW		MS				
			1.5				**1.50m: COMMENCE NMLC CORING**							
		23.0	2.0											
		22.0	3.0											
		21.0	4.0											
		20.0	5.0											
		19.0	6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH43

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555522.10
Northing: 6873345.90
RL: 24.67
Total Depth: 20.40
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 05/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		24.5	0.5				Commence NMLC Coring at 1.5m						
		24.0	1.0										
		23.5	1.5										
		23.0	2.0	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to fresh, dark grey, slightly fractured.	SW-Fr		10.67	44%		BZ 30mm SZ 10° 10mm, some VLS J10° Pl/Ro,Vr,O J5° Pl/Ro,Vr,O S5° 40mm, VLS & cly J20° Pl/Sm,St,C J35° Un/Sm,Cn,O J15° Un/Sm,St,C J25° Un/Sm,Cn,O BZ 80mm J90° Un/Ro,Cn,O J5° Pl/Sm,St,O J50° Un/Ro,Cn,O SZ 5° 10mm, VLS & cly J5° Pl/Ro,Vr,O SZ 5° 15mm, VLS J10° Un/Ro,Cn,O
		22.5	2.5										
		22.0	3.0										
		21.5	3.5							7.33			
		21.0	4.0										
		20.5	4.5								49%		J5° Pl/Sm,Cn,O SZ 5° 20mm, VLS & cly J10° Un/Ro,Vn,O J5° Unl/Ro,St,O SZ 5° 10mm, VLS SZ 5° 10mm, VLS & cly J2° Un/Ro,Cn,O BZ 280mm (moderately fractured)
		20.0	4.85				**BASALT**: As above but medium strength, distinctly weathered.	DW					SZ 15° 20mm, VLS
			5.0			BAS							J5° Un/Ro,Cn,O SZ 10° 15mm, VLS & clay J5° Un/Ro,Vr,O J30° Un/Ro,St,O SZ 20° 120mm, MS
		19.5	5			BAS	**BASALT**: As above but very high strength, slightly weathered to fresh.	SW-Fr		9.96			J20° Un/Ro,St,O J5° Pl/Ro,St,O
			5.3			BAS	**BASALT**: As above but medium strength to high strength, distinctly weathered to slightly weathered.	DW-SW			13%		J5° Pl/Ro,Vr,O J90° Un/Ro,Vr,O J20° Pl/Ro,St,O SZ 20° 40mm, MS SZ 5° 60mm, MS & clay SZ 40° 20mm, MS & clay
		19.0	5.5										
			6.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH43

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555522.10
Northing: 6873345.90
RL: 24.67
Total Depth: 20.40
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 05/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		18.5	6			BAS	**BASALT**: As above but very high strength, slightly weathered to fresh	SW-Fr					J10° Pl/Sm,Vr,O
			6.3			BAS	**BASALT**: As above but low strength, extremely weathered.	XW		0.46			BZ 350mm (highly fractured)
		18.0	6.5								13%		J30° Pl/Un,Ro,Vr,O
			6.85			BAS	**BASALT**:As above but very high strength, slightly weathered to fresh.	SW-Fr					J45° Pl/Ro,Cn,O
			7.0										J10° Pl/Sm,Cn,O
		17.5	7.05			BAS	**BASALT**: As above but medium strength, distinctly weathered	DW					SZ 10° 40mm, MS & clay
			7.35			BAS	**BASALT**: As above but very high strength, slightly weathered to fresh.	SW-Fr					SZ 10° 70mm, MS & clay
			7.5										J10° Pl/Ro,Cn,O
		17.0	7.8			BAS	**BASALT**:As above but medium strength, distinctly weathered.	DW					J5° Un/Sm,Cn,O
			8.0										J30° Un/Ro,Vr,O
			8			BAS	**BASALT**: Very high strength, slightly weathered to fresh, dark grey.	SW-Fr					SZ 30° 80mm, MS & clay
		16.5	8.25				CORE LOSS						SZ 10° 30mm, MS & clay
			8.35			BAS	**BASALT**: Very high strength, slightly weathered to fresh, dark grey.	SW-Fr					J10° Un/Ro,St,O
			8.5										SZ 5° 60mm, MS & clay
		16.0	8.9			BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey.	XW			45%		Core Loss 110mm
			9			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		11.73			J45° Pl/Sm,St,O
		15.5	9.0										J15° Un/Ro,St,O
			9.5										J5° Un/Ro,St,O
		15.0	9.77			BAS	**BASALT**: Low strength, extremely weathered, orange brown mottled grey.	XW					J5° Un/Ro,St,O
			10.0										SZ 15° 10mm, LS & clay
		14.5	10.35			BAS	**BASALT**: As above but very low strength.	XW			0%		J10° Pl/Ro,Vr,O
			10.5										J5° Un/Ro,St,O
		14.0	11.0										J5° Pl/Ro,Vr,O
		13.5	11.2				**CORE LOSS**						SZ 5° 130mm, VLS & clay
			11.5										SZ 10° 70mm, VLS & clay
		13.0	12.0										J10° Un/Ro,Vr,O
													J10° Un/Ro,Vr,O
													J5° Pl/Ro,Cn,O
													J5° Pl/Ro,Cn,O
													J5° Un/Ro,St,O
													LS
													VLS

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH43

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555522.10
Northing: 6873345.90
RL: 24.67
Total Depth: 20.40
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 05/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	12.5	12.1			BAS	**CORE LOSS** **BASALT**: Very low strength, extremely weathered, grey mottled orange brown, with some clay layering.	XW					
		12.0	12.5										
		11.5	13.0										
		11.0	13.5										
		10.5	14.0										
		10.0	14.5										
		9.5	14.9 15.0			BAS	**BASALT**: Very high strength, distinctly weathered to fresh, grey.	DW-Fr		5.80	100%		J20° Un/Ro,St,O
		9.0	15.5										
		8.5	16.0										J10° Un/Sm,Cn,O
		8.0	16.5							8.61			J15° Un/Ro,Cn,O
		7.5	17.0										
		7.0	17.5								100%		
			18.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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A.B.N. 051 009 878 899
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Engineering Log - Cored Borehole

Borehole No.: BH43

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555522.10
Northing: 6873345.90
RL: 24.67
Total Depth: 20.40
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 05/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		6.5	18.5			BAS	**BASALT**: Very high strength, distinctly weathered to fresh, grey.	DW-Fr		9.20	100%		J5° Pl/Ro,Cn,O
		6.0	19.0										J5° Pl/Ro,Cn,O
		5.5	19.5										J5° Pl/Sm,Cn,O
		5.0	20.0										
		4.5	20.4				**20.40m: BOREHOLE TERMINATED**						
		4.0	20.5										
		3.5	21.0										
		3.0	21.5										
		2.5	22.0										
		2.0	22.5										
		1.5	23.0										
		1.0	23.5										
			24.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH43
BOREHOLE DEPTH: 1.5m TO 20.4m

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

Engineering Log - Borehole

Borehole No.: BH44

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555502.00
Northing: 6873282.20
RL: 23.96
Total Depth: 1.15
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 21/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with		23.0	0.3	Slopewash		CH	**Silty CLAY**: Very stiff, high plasticity, red brown, trace of fine to medium sized gravel, moist.		M	VSt				
				Residual		CI	**Silty CLAY**: Very stiff, medium to high plasticity, red brown, with some fine to medium sized gravel, with some cobbles, moist.		M	VSt				
			1.0	Bedrock			**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown.					1	SPT	20/145mm, N*=42
			1			BAS		DW		MS				
			1.15				**1.15m: COMMENCE NMLC CORING**							
		22.0	2.0											
		21.0	3.0											
		20.0	4.0											
		19.0	5.0											
		18.0	6.0											

Comments:

Authorised by: ……

Date: ……..…..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH44

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555502.00
Northing: 6873282.20
RL: 23.96
Total Depth: 8.30
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 21/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		23.5	0.5				Commence NMLC Coring at 1.15m						
		23.0	1.0	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey with some orange staining.	SW-Fr		9.89			J5° Pl/Sm,Cn,O
		22.5	1.5										SZ 10° 20mm, MS
		22.0	2.0										SZ 5° 40mm, MS
			2.05			BAS	**BASALT**: Medium strength, distinctly weathered, grey and orange brown.	DW					SZ 5° 30mm, MS & clay
			2.2			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr			84%		J5° Pl/Ro,Ct,O J5° Pl/Ro,Ct,O J5° Pl/Ro,Ct,O
		21.5	2.5										J5° Pl/Sm,St,O
		21.0	3.0							10.74			SZ 10° 20mm, VLS J10° Pl/Sm,St,O
													J5° Pl/Ro,Ct,O, 5mm VLS
		20.5	3.5										J5° Pl/Sm,Ct,C, CA 4mm
													J50° Pl/Sm,Cn,O
		20.0	4.0								100%		J5° Pl/Sm,St,O J10° Pl/Sm,St,O
													J5° Un/Sm,St,O J5° Pl/Sm,Vr,O
		19.5	4.5										J15° Un/Ro,St,O J5° Pl/Ro,Cn,O
		19.0	5.0										J5° Pl/Sm,St,O
													J5° Pl/Ro,Cn,O
		18.5	5.5							12.02			J15° Pl/Sm,Vr,O J10° St/Sm,St,O J15° Pl/Sm,St,O
		18.0	6.0										J5° Pl/Sm,St,O J20° Pl/Sm,Vr,O

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH44

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555502.00
Northing: 6873282.20
RL: 23.96
Total Depth: 8.30
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 21/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		17.5	6.5			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr			100 %		J55° Pl/Sm,Cn,O J5° Pl/Sm,Vr,O J20° Pl/Sm,Cn,O J5° Pl/Sm,St,O J5° Pl/Sm,Cn,O
		17.0	7.0							10.64	67%		J30° Pl/Sm,Cn,O J5° Un/Ro,Cn,O J35° Pl/Sm,St,O
		16.5	7.5										J40° Pl/Sm,St,O SZ 5° 15mm, MS J5° Un/Sm,Cn,O J10° Un/Sm,Ch,O J5° Pl/Sm,St,O J5° Un/Sm,St,O J5° Pl/Sm,St,O J10° Pl/Sm,Vr,O
		16.0	8.0							11.09			J20° Pl/Sm,St,O J5° Pl/Sm,St,O
			8.3										
		15.5	8.5				**8.30m: BOREHOLE TERMINATED**						
		15.0	9.0										
		14.5	9.5										
		14.0	10.0										
		13.5	10.5										
		13.0	11.0										
		12.5	11.5										
		12.0	12.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH44
BOREHOLE DEPTH: 1.15m TO 8.3m

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

Engineering Log - Borehole

Borehole No.: BH45

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.20
Northing: 6873391.30
RL: 26.45
Total Depth: 1.45

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		26.0	0.25	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	St				
			0.6	Residual		CI	**Silty CLAY**: Very stiff, medium plasticity, red brown, with some fine to medium sized gravel, moist.		M	VSt				
			1.0			CI	**Silty CLAY**: As above but with some cobbles.		M	VSt		1	SPT	6,15,25, N=40
		25.0	1.3	Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, orange brown, mottled grey.	XW		VLS				
			1.45				**1.45m: COMMENCE NMLC CORING**							
		24.0	2.0											
		23.0	3.0											
		22.0	4.0											
		21.0	5.0											
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
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Engineering Log - Cored Borehole

Borehole No.: BH45

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.20
Northing: 6873391.30
RL: 26.45
Total Depth: 20.25
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 09/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		26.0	0.5				Commence NMLC Coring at 1.45m						
		25.5	1.0										
		25.0	1.5	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to fresh, dark grey with some orange brown staining, slightly fractured, with some .extremely weathered to moderately zones	SW-Fr		8.97			BZ 30mm BZ 25mm J30° Pl/Sm,Vr,O J40° St/Sm,St,O SZ 15° 10mm, some LS SZ 25° MS
		24.5	2.0										SZ 20° 15mm, MS J60° Pl/Sm,St,O J60° Pl/Ro,Vr,O BZ 80mm J20° Pl/Sm,St,O J15° Pl/Sm,Cn,O J5° Un/Ro,Cn,O J60° Pl/Sm,Vr,O SZ 10° 10mm, VLS SZ 10° 20mm, VLS SZ 5° 30mm, VLS J10° Pl/Sm,Vr,O J15° Pl/Sm,Cn,O SZ 10° 20mm, VLS
		24.0	2.5								38%		
		23.5	3.0										
		23.0	3.5										J25° Pl/Sm,St,O SZ 10° 50mm, VLS SZ 10° 80mm, VLS & cly SZ 15° 70mm, VLS J55° Pl/Sm,St,O J10° Un/Ro,St,O J15° Un/Ro,St,O SZ 10° 40mm, VLS SZ 10° 70mm, VLS & cly
		22.5	4.0										
		22.0	4.5							11.62			SZ 25° 25mm, VLS J5° Pl/Sm,St,O J20° Un/Ro,St,O SZ 10° 10mm, VLS SZ 5° 30mm, VLS
		21.5	5.0								38%		SZ 5° 15mm, VLS & cly SZ 5° 30mm, VLS BZ 50mm J5° Pl/Sm,St,O J5° Un/Ro,St,O SZ 5° 10mm, VLS SZ 25° 10mm, VLS
		21.0	5.5 5.4			BAS	**BASALT**: Medium strength to high strength, distinctly ,weathered, orange brown, mottled grey .highly fractured	DW		0.85			SZ 15° 60mm, VLS & cly SZ 35° 40mm, VLS SZ 5° 25mm, MS SZ 5° 40mm, LS-MS SZ 170mm, MS
		20.5	5.8 6.0			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey, slightly fractured.	SW-Fr					J5° Un/Ro,Cn,O

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

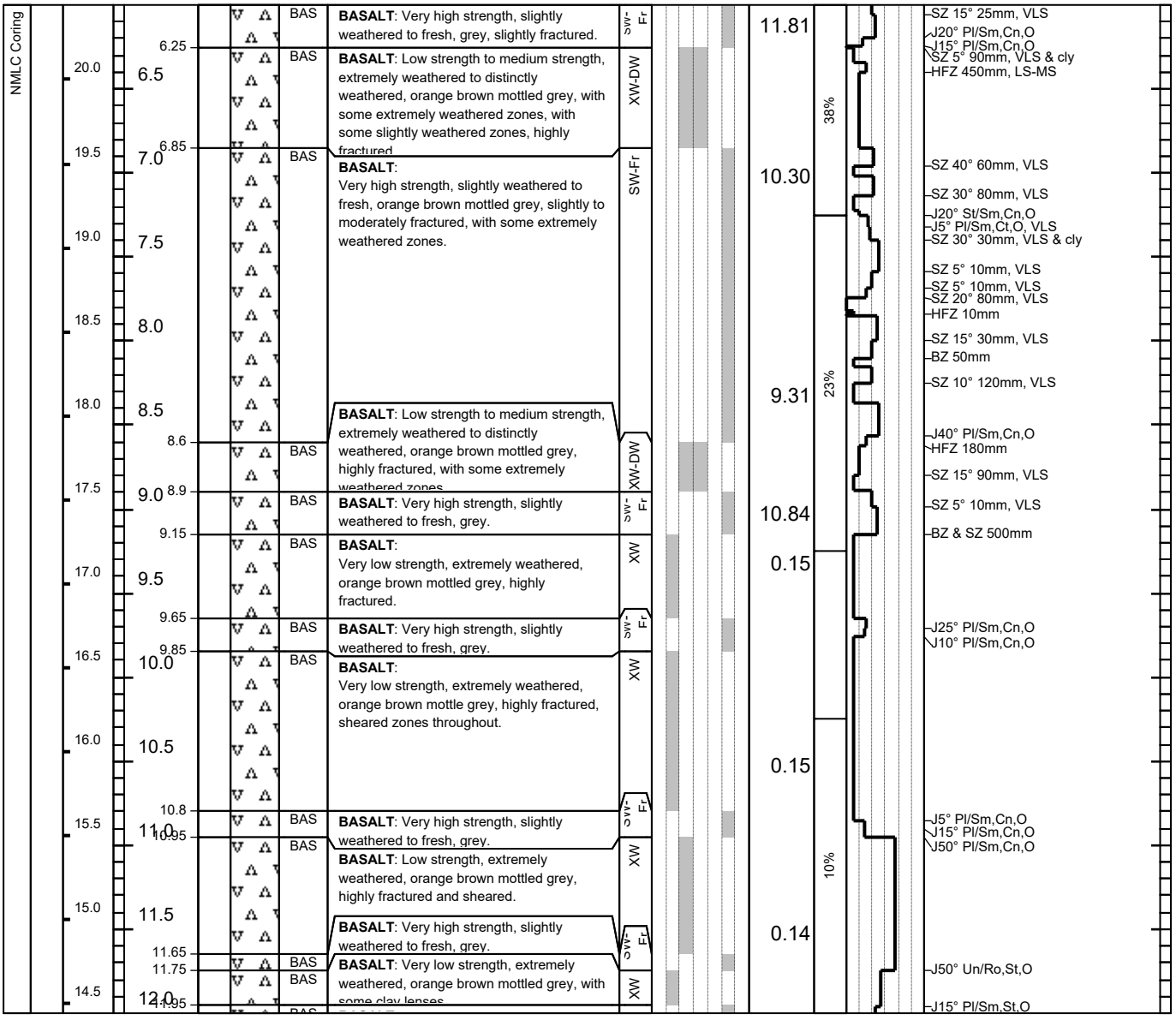
Morrison Geotechnic Pty Ltd
A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Cored Borehole

Borehole No.: BH45

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.20
Northing: 6873391.30
RL: 26.45
Total Depth: 20.25
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 09/11/2018



Comments:

Authorised by: ……

Date: ……..……..……..

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

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

Consistency
VS Very soft
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VSt Very stiff
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Moisture
D Dry M Moist W Wet

Density
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Rock Strength
ELS Extremely low
VLS Very low
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EHS Extremely high

Defects
Refer to Attached Defect Description Sheet

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Engineering Log - Cored Borehole

Borehole No.: BH45

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.20
Northing: 6873391.30
RL: 26.45
Total Depth: 20.25
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 09/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	14.0	12.3			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr					J5° Un/Sm,Cn,O SZ 15° 100mm, VLS & cly
		13.5	12.5			BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey, with some clay lenses, with some highly fractured zones	XW		0.13	10%		
		13.0	13.0										
		12.5	13.5										
		12.0	14.0										
		11.5	14.5										
		11.0	15.0							0.24	44%		
			15.25			BAS	**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown, mottled grey, vesicular.	DW					BZ 150mm
		10.5	15.5			BAS	**BASALT**: Very high strength, fresh, grey, feldspar lenses, vesicular.	Fr		2.44			J5° Un/Ro,Cn,O J15° Pl/Sm,Cn,O
		10.0	16.0										
		9.5	16.5							8.47			
		9.0	17.0							3.24	100%		**J5° Pl/Sm,Cn,O**
		8.5	17.5										J45° Pl/Ro,Cn,O
			18.0							9.61			

Comments:

Authorised by: ……

Date: ……

Water
- Water level on date shown
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- Water outflow

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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A.B.N. 051 009 878 899
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Engineering Log - Cored Borehole

Borehole No.: BH45

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.20
Northing: 6873391.30
RL: 26.45
Total Depth: 20.25
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 09/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		8.0	18.5			BAS	**BASALT**: Very high strength, fresh, grey, feldspar .lenses, vesicular	Fr		9.36	100%		J25° Un/Ro,Cn,O J15° St/Ro,Cn,O
		7.5	19.0										
		7.0	19.5										
		6.5	20.0							6.02			
			20.25										
		6.0	20.5				**20.25m: BOREHOLE TERMINATED**						
		5.5	21.0										
		5.0	21.5										
		4.5	22.0										
		4.0	22.5										
		3.5	23.0										
		3.0	23.5										
		2.5	24.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Defects
Refer to Attached 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: BH45
BOREHOLE DEPTH: 1.45m TO 20.25m

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

Engineering Log - Borehole

Borehole No.: BH46

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555491.70
Northing: 6873374.60
RL: 22.42
Total Depth: 2.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 06/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm		22.0	0.5	Slopewash		CH	**Silty CLAY**: Very stiff, high plasticity, red brown, with some fine to .coarse sized gravel, with some organics, moist		M	VSt				
			0.8	Residual		CI	**Silty CLAY**: Hard, medium plasticity, red brown, with some fine to coarse sized gravel, moist		M	H				
			1.0			CI	**Silty CLAY**: As above but with some cobbles.		M	H		1	SPT	8,20,15, N=35
Wash		21.0	1.7	Bedrock		BAS	**BASALT**: Medium strength, distinctly weathered, dark grey.	DW		MS				
			2.0				**2.00m: COMMENCE NMLC CORING**							
		20.0	3.0											
		19.0	4.0											
		18.0	5.0											
		17.0	6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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Engineering Log - Cored Borehole

Borehole No.: BH46

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555491.70
Northing: 6873374.60
RL: 22.42
Total Depth: 17.40
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 06/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		22.0	0.5				Commence NMLC Coring at 2.0m						
		21.5	1.0										
		21.0	1.5										
		20.5	2.0	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to .fresh, grey	SW-Fr		7.87			BZ 100mm, highly fractured J5° Pl/Sm,Cn,O SZ 30° 50mm, MS & cly J90° Un/Ro,Ct,O
		20.0	2.5										
		19.5	3.0										SZ 10° 100mm, MS & cly
		19.0	3.5							11.44	36%		J10° Pl/Sm,Cn,O J45° Un/Ro,Vr,O BZ 120mm, highly fractured
		18.5	4.0										J10° Un/Ro,Cn,O J5° Un/Ro,Vr,O J15° Un/Ro,Vr,O J5° Pl/Ro,St,O J5° Pl/Ro,Vr,O J5° Pl/Ro,St,O J5° Un/Ro,Vr,O
		18.0	4.2			BAS	**BASALT**: Medium strength, distinctly weathered to slightly weathered, orange brown mottled grey.	DW-SW					J5° Un/Ro,Vr,O J5° Un/Ro,Vr,O J5° Un/Ro,St,O J10° Pl/Ro,St,O J10° Un/Ro,St,O
			4.5			BAS	**BASALT**: Very high strength, slightly weathered to .fresh, grey	SW-Fr					SZ 10° 20mm, MS & cly
		17.5	5.0								20%		SZ 10° 20mm, MS & cly J10° Un/Ro,St,O J10° Un/Ro,St,O J20° Un/Sm,Cn,O
			5			BAS	**BASALT**: Medium strength, distinctly weathered to slightly weathered, brown mottled orange brown and grey	DW-SW					J5° Pl/Ro,Cn,O
		17.0	5.3			BAS	**BASALT**: Very high strength, slightly weathered to .fresh, grey	SW-Fr					J5° Pl/Ro,Vr,O J10° Un/Ro,Cn,O J5° Pl/Sm,Cn,O J5° Un/Ro,Cn,O J10° Pl/Sm,Cn,O HFZ 5° 150mm
			5.5										
		16.5	6.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
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Engineering Log - Cored Borehole

Borehole No.: BH46

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555491.70
Northing: 6873374.60
RL: 22.42
Total Depth: 17.40
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 06/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	16.0	6			BAS	**BASALT**: ,Medium strength, distinctly weathered .brown mottled orange brown	DW			20%		J45° Un/Ro,Vr,O J15° Un/Ro,St,O J10° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O J30° Un/Ro,Cn,O J10° Un/Ro,Cn,O J45° Un/Ro,Cn,O J5° Pl/Sm,Cn,O J10° Vr/Sm,Cn,O
		15.5	6.5										J5° Pl/Sm,Cn,O
			6.8			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		8.03			J10° Pl/Sm,Cn,O
			7.0										
		15.0	7.1			BAS	**BASALT**: Medium strength, distinctly weathered, brown mottled orange and grey.	DW			45%		J5° Un/Sm,Cn,O
			7.5										
			7.45			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		5.49			J10° Un/Ro,Cn,O J10° Vr/Ro,Cn,O J45° Un/Ro,Cn,O
			7.6			BAS	**BASALT**: Medium strength, distinctly weathered, brown mottled orange and grey.	DW					SZ 10° 30mm, MS & clay
		14.5	7.84			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr					SZ 5° 100mm, MS J5° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O J5° Pl/Ro,St,O
			8.0										
		14.0	8.5										SZ 5° 70mm, MS
		13.5	9.0							8.76	16%		SZ 25° 20mm, MS J45° Pl/Sm,St,O J45° Pl/Sm,St,O HFZ 550mm, LS-MS
			9			BAS	**BASALT**: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey.	XW-DW					
		13.0	9.5										
			9.55			BAS	**BASALT**: As above but very low strength and extremely weathered.	XW					BZ/SZ 200mm
		12.5	9.75				**CORE LOSS**						
			10.0										
		12.0	10.5										
		11.5	11.0										
			11			CL	**Silty CLAY/BASALT (XW)**: Hard, low plasticity, grey mottled orange brown, moist.				33%		
		11.0	11.5										
		10.5	12.0										

Comments:

Authorised by: ……

Date: ……..……..……..

Water
- Water level on date shown
- Water inflow
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Weathering
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- XW Extremely weathered
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Consistency
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- VSt Very stiff
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Moisture
D Dry M Moist W Wet

Density
- VL Very loose
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Rock Strength
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- VLS Very low
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Defects
Refer to Attached Defect Description Sheet

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Engineering Log - Cored Borehole

Borehole No.: BH46

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555491.70
Northing: 6873374.60
RL: 22.42
Total Depth: 17.40

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: C. Lam
Date: 06/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		10.0	12.5			BAS	**BASALT**: Very low strength, extremely weathered, dark grey mottled orange brown.	XW			33%		
		9.5	13.0			BAS	**BASALT**: Very high strength, slightly weathered, dark grey, vesicular.	SW		7.35	99%		J10° Pl/Sm,Cn,O
		9.0	13.5										J5° St/Sm,Cn,O
		8.5	14.0										J35° Un/Ro,Cn,O
		8.0	14.5										
		7.5	15.0										
		7.0	15.5							6.43			J20° Un/Ro,Cn,O
		6.5	16.0										
		6.0	16.5										
		5.5	17.0										
		5.0	17.4							11.78			J30° Un/Ro,Cn,O
							17.40m: BOREHOLE TERMINATED						
		4.5	18.0										

Comments:

Authorised by: ……

Date: ……

Water
- Water level on date shown
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Defects
Refer to Attached 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: BH46
BOREHOLE DEPTH: 2.0m TO 17.4m

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A.B.N. 051 009 878 899
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Engineering Log - Borehole

Borehole No.: BH47

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555446.90
Northing: 6873412.00
RL: 14.37
Total Depth: 8.20
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 19/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with Wash Bore - Rock Roller		14.0	0.4	Slopewash		CH	**Silty CLAY**: Very stiff, high plasticity, red brown and orange brown, with some fine to medium sized gravel, trace of organics, moist.		M	VSt				
			1.0	Residual		Cl	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown mottled grey, with some fine to medium sized gravel, moist.		M	VSt-H		1	SPT	5,10,19, N=29: PP=>600kPa
		13.0	1.4			Cl	**Silty CLAY**: As above but with some extremely weathered basalt layers.		M	VSt-H				
			2.0									2.5	SPT	7,7,6, N=13: PP=400-600kPa
		12.0	3.0											
		11.0	3.7			Cl	**Silty CLAY**: As above but hard, pale grey mottled orange brown and no extremely weathered basalt layers.		M	H		4	SPT	5,9,11, N=20: PP=>400kPa
		10.0	4.0											
			5.0											
		9.0	5.1			Cl	**Silty CLAY**: As above but dark grey mottled orange brown and red brown.		M	H		5.5	SPT	5,11,16, N=27: PP=>600kPa
			6.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

Consistency
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- S Soft
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Moisture
D Dry M Moist W Wet

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

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

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Engineering Log - Borehole

Borehole No.: BH47

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555446.90
Northing: 6873412.00
RL: 14.37
Total Depth: 8.20
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 19/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller		8.0	7.0			Cl	**Silty CLAY**: As above but dark grey mottled orange brown and red brown.		M	H		7	SPT	3,3,4, N=7: PP=>400kPa
		7.0	8.0	Bedrock		BAS	**BASALT**: Medium strength, distinctly weathered, orange brown mottled grey.	DW		MS				
		6.0	8				**8.20m: COMMENCE NMLC CORING**							
		5.0	9.0											
		4.0	10.0											
		3.0	11.0											
			12.0											

8.2

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH47

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555446.90
Northing: 6873412.00
RL: 14.37
Total Depth: 16.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
		8.0	6.5				Commence NMLC Coring at 8.2m						
NMLC Coring		7.5	7.0										
		7.0	7.5										
		6.5	8.0										
		6.0	8.5	Bedrock		BAS	**BASALT**: Extremely high strength, slightly weathered .to fresh, dark grey, slightly fractured	SW-Fr		12.53	92%		J20° St/Sm,Cn,O J10° Un/Ro,St,O J20° Pl/Sm,Cn,O J25° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O
		5.5	8.85 9.0				**CORE LOSS**				0%		
		5.0	9.25 9.5			BAS	**BASALT**: Very high strength, slightly weathered, grey, moderately fractured.	SW			28%		BZ 30mm J25° Pl/Ro,Ct,O SZ 45° 10mm, VLS BZ 130mm
		4.5	9.75 10.0			BAS	**BASALT**: Low strength, extremely weathered, grey, interbedded very high strength zones.	XW					BZ 100mm
		4.0	10.5										
		3.5	10.85 11.0			BAS	**BASALT**: Very high strength, slightly weathered to fresh, dark grey, slightly fractured.	SW-Fr			87%		BZ 70mm, some XLS J60° Pl/Sm,Cn,O J45° Pl/Sm,St,O J40° Pl/Sm,St,O SZ 20mm, VLS
		3.0	11.5										
		2.5	11.5 12.0			BAS	**BASALT**: As above but fresh.	Fr		11.27			J40° Pl/Sm,Cn,O

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH47

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555446.90
Northing: 6873412.00
RL: 14.37
Total Depth: 16.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		2.0	12.5			BAS	**BASALT**: .As above but fresh	Fr					J45° Pl/Sm,Cn,O J30° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O
		1.5	13.0								87%		J50° Pl/Sm,Cn,O J35° Pl/Sm,Cn,O J30° Pl/Sm,Cn,O
		1.0	13.5										J25° Pl/Sm,Cn,O
		0.5	14.0							11.85			J20° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O J60° Pl/Sm,Cn,O
		0.0	14.5										
		-0.5	15.0								91%		J40° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O
		-1.0	15.5										
		-1.5	15.7			BAS	**BASALT**: As above but vesicular.	Fr		6.60			J10° Pl/Ro,Cn,O J40° Pl/Ro,Cn,O
		-2.0	16.0 16				**16.00m: BOREHOLE TERMINATED**						
		-2.5	16.5										
		-3.0	17.0										
		-3.5	17.5										
			18.0										

Comments:

Authorised by: ……

Date: ……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH47
BOREHOLE DEPTH: 8.2m TO 16.0m

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

Engineering Log - Borehole

Borehole No.: BH48

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555495.30
Northing: 6873426.30
RL: 22.24
Total Depth: 2.55
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 07/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		22.0	0.3	Slopewash		CH	**Silty CLAY**: Very stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist.		M	VSt				
				Residual		CI	**Silty CLAY**: Very stiff to hard, medium plasticity, red brown, with some fine to coarse sized gravel, moist.		M	VSt-H		1	SPT	4,7,9, N=16: PP=400kPa
		21.0	1.0											
Wash Bore - Rock			1.6	Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, orange brown, mottled dark grey.	XW		VLS				
		20.0	2.0											
			2.1			BAS	**BASALT**: As above but medium strength and distinctly weathered.	DW		MS				
			2.55				**2.55m: COMMENCE NMLC CORING**					2.5 –	SPT	30/50mm, no recovery
		19.0	3.0											
		18.0	4.0											
		17.0	5.0											
			6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH48

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555495.30
Northing: 6873426.30
RL: 22.24
Total Depth: 17.75
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 07/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		22.0	0.5				Commence NMLC Coring at 2.55m						
		21.5	1.0										
		21.0	1.5										
		20.5	2.0										
		20.0	2.5										
		19.5	3.0	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		11.72	71%		J5° Pl/Sm,Vr,O
		19.0	3.5			BAS	**BASALT**: Medium strength to high strength, distinctly weathered, orange brown, mottled grey, with some very high strength zones.	DW					J10° Pl/Ro,Vr,O J15° Pl/Sm,Vr,O J10° Pl/Sm,Vr,C J20° Pl/Sm,St,O J80° Un/Ro,Ct,O, 3mm cly J15° Pl/Sm,Ct,O, 3mm VLS J45° Pl/Sm,Vr,O J70° Un/Ro,Vr,O J15° Un/Ro,Vr,O J5° Pl/Sm,Vr,O
		18.5	4.0			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr					J10° Pl/Sm,Vr,O
		18.0	4.5			BAS	**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown.	DW					SZ 40° 30mm, LS J25° Pl/Sm,St,O J35° Pl/Sm,St,O J5° Pl/Sm,Vr,O BZ 300mm
		17.5	5.0			BAS	**BASALT**: Very low strength, extremely weathered, orange brown.	XW			60%		SZ 10° 15mm, VLS & cly
		17.0	5.5			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		11.51			J5° Pl/Ro,St,O SZ 35° 25mm, LS J5° Un/Ro,St,O
		16.5	6.0			BAS	**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown.	DW					J5° Pl/Sm,St,O J5° Pl/Sm,Ct,O, 2mm feldspar J10° St/Ro,St,O

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH48

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555495.30
Northing: 6873426.30
RL: 22.24
Total Depth: 17.75
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 07/11/2018

Drilling Information				Material Description								Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	16.0	6.5			BAS	**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown.	DW			60%		J60° Pl/Ro,St,O J70° Pl/Ro,St,O J70° Pl/Ro,St,O
		15.5	6.45			BAS	**BASALT**: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey.	XW-DW					HFZ & SZ 800mm
			7.0										
		15.0	7.25			BAS	**BASALT**: As above but very low strength, extremely weathered.	XW					
			7.5										
		14.5	7.9			BAS	**BASALT**: Low strength to medium strength, extremely weathered to distinctly weathered, grey and orange brown.	XW-DW		0.26			
			8.0										
		14.0											
			8.5										
		13.5	8.85			BAS	**BASALT**: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW			10%		
			9.0										
		13.0											
			9.5										
		12.5											
			10.0										
		12.0								0.17			
			10.5										
		11.5											
			11.0										
		11.0											
			11.5										
		10.5											
			12.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH48

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555495.30
Northing: 6873426.30
RL: 22.24
Total Depth: 17.75
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 07/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		10.0	12.35			BAS	**BASALT**: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW			10%		
		9.5	12.5				**CORE LOSS**						
			12.75			BAS	**BASALT**: Very high strength, fresh, dark grey, vesicular lenses of feldspar.	Fr					
		9.0	13.0										J40° Un/Ro,Cn,O
			13.5							8.83			J40° Un/Ro,Cn,O J30° Un/Ro,Cn,O J45° Pl/Ro,Cn,O J20° Un/Ro,Cn,O J20° Pl/Sm,Cn,O J15° Un/Sm,Cn,O
		8.5	14.0								87%		J20° Pl/Sm,Cn,O
		8.0								7.76			
			14.5										J5° Pl/Ro,Vr,O J5° Pl/Ro,Cn,O
		7.5	15.0										
		7.0	15.5										J50° Pl/Sm,Cn,O
		6.5	16.0										
		6.0											J20° Pl/Sm,Cn,O J25° Pl/Sm,Cn,O
			16.5								98%		J10° Pl/Sm,Cn,O
		5.5											
			17.0										
		5.0											
			17.5										
		4.5	17.75							7.05			
			18.0				**17.75m: BOREHOLE TERMINATED**						

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH48
BOREHOLE DEPTH: 2.55m TO 17.75m

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

Engineering Log - Borehole

Borehole No.: BH49

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555477.60
Northing: 6873444.50
RL: 18.80
Total Depth: 1.20
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 19/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
W 100mm Auger with		18.0	0.35	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, fine to coarse sized gravel, moist.		M	St				
			1.0	Residual		CI	**Silty CLAY**: Very stiff, medium to high plasticity, red brown with some grey mottling, fine to coarse sized gravel, with some cobbles, moist.		M	VSt				
			1.05	Bedrock		BAS	**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown.	DW		MS		1	SPT	15/100mm, bouncing on cobbles, no recovery
			1.2				**1.20m: COMMENCE NMLC CORING**							
		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
- Water level on date shown
- Water inflow
- Water outflow

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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Engineering Log - Cored Borehole

Borehole No.: BH49

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555477.60
Northing: 6873444.50
RL: 18.80
Total Depth: 14.55
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		18.5	0.5				Commence NMLC Coring at 1.2m						
		18.0	1.0										
		17.5	1.5	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered, grey, slightly fractured.	SW		9.72			SZ 5° 10mm, VLS & cly SZ 15° 40mm, VLS & cly SZ 5° 10mm, VLS J5° Pl/Sm,Ct,O, cly 3mm SZ 45° 10mm, VLS
		17.0	1.8			BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey, with some clay layering.	XW					
			2.0										J5° Pl/Sm,St,O
		16.5	2.05			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr			44%		J15° Pl/Sm,Ct,O, VLS 5mm J5° Un/Ro,St,O J5° Un/Ro,Cn,O J5° Pl/Ro,Cn,O
			2.5							10.48			
		16.0	2.7			BAS	**BASALT**: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, moderately fractured.	XW-DW					J5° Pl/Sm,Cn,O J15° Pl/Ro,St,O J10° Un/Ro,St,O J65° Pl/Sm,St,O J30° Pl/Sm,Cn,O
			3.0										
		15.5	3.25			BAS	**BASALT**: Very low strength to low strength, extremely weathered, grey mottled orange brown.	XW			7%		HFZ 1100mm
			3.5										
		15.0	4.0										
		14.5	4.35										
			4.5				**CORE LOSS**						
			4.65										
		14.0	5.0			BAS	**BASALT**: Very low strength to low strength, extremely weathered, orange brown mottled grey.	XW			7%		
		13.5	5.5										
		13.0	6.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH49

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555477.60
Northing: 6873444.50
RL: 18.80
Total Depth: 14.55
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	12.5	6				**CORE LOSS**						
		12.0	6.5										
		11.5	7.0										
		11.0	7.5			CI	**Silty CLAY**: Stiff to very stiff, medium plasticity, grey mottled orange brown, moist.						
		10.5	8.0			BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey.	XW			15%		HFZ 150mm
		10.0	8.5			BAS	**BASALT**: High strength, distinctly weathered to slightly weathered, grey mottled orange brown.	DW-SW					J25° Pl/Sm,St,O J30° Pl/Sm,St,O
		9.5	9.0			BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey.	XW					J5° Un/Ro,Cn,O
		9.0	9.5			BAS	**BASALT**: Very high strength, fresh, dark grey, intact.	Fr		10.59	91%		J5° Pl/Sm,Cn,O J5° Pl/Ro,Cn,O
		8.5	10.0										J20° Pl/Sm,Cn,O J30° Pl/Sm,Cn,O
		8.0	10.5										J30° Pl/Ro,St,O J25° Un/Ro,Cn,O J25° Pl/Sm,Cn,O J5° Pl/Ro,Cn,O
		7.5	11.0										J30° Pl/Sm,Cn,O
		7.0	11.5										J70° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O
			12.0										J15° Pl/Sm,Cn,O

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH49

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555477.60
Northing: 6873444.50
RL: 18.80
Total Depth: 14.55
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		6.5	12.5			BAS	**BASALT**: Very high strength, fresh, dark grey, intact.	Fr		10.35	37 %		J5° Pl/Sm,Cn,O
		6.0	13.0			BAS	**BASALT**: As above but high to very high strength and vesicular.	Fr					SZ 5° 20mm, VLS
		5.5	13.5								85%		J40° Pl/Sm,Cn,O
		5.0	14.0										J15° Un/Ro,Cn,O
		4.5	14.5										J20° Pl/Sm,Cn,O
			14.55							3.11			J15° Un/Ro,Cn,O J15° Pl/Sm,Cn,O
		4.0	15.0				**14.55m: BOREHOLE TERMINATED**						SZ 10° 15mm, VLS J90° Un/Ro,Cn,O
		3.5	15.5										
		3.0	16.0										
		2.5	16.5										
		2.0	17.0										
		1.5	17.5										
		1.0	18.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH49
BOREHOLE DEPTH: 1.2m TO 14.55m

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

Engineering Log - Borehole

Borehole No.: BH50

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555537.30
Northing: 6873419.40
RL: 24.47
Total Depth: 15.25
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 08/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		24.0	0.25	Slope wash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with some fine to medium sized gravel, with some organics, moist.		M	St		0.15 –	PP	180kPa
Wash Bore - Rock Roller				Residual		CI	**Silty CLAY**: Very stiff, medium plasticity, red brown, with some fine to coarse sized gravel, moist.		M	VSt		0.5 –	PP	300kPa
		23.0	1.0									1	SPT	3,6,5, N=11: PP=>600kPa
		22.0	2.0									2.5	SPT	4,5,5, N=10
			3.0	Rock		BAS	**BASALT**: Low strength extremely weathered, orange brown mottled grey.	XW		LS				
		21.0	3			BAS	**BASALT**: As above but medium strength and distinctly weathered.	DW		MS				
			3.3			BAS	**BASALT**: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS		4	SPT	10,12,18, N=30
		20.0	3.8											
			4.0											
			5.0			BAS	**BASALT**: As above but medium strength and distinctly weathered.	DW		MS				
		19.0	5											
			5.3			BAS	**BASALT**: As above but very low strength and extremely weathered.	XW		VLS		5.5	SPT	20,26,26, N=52
			6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH50

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555537.30
Northing: 6873419.40
RL: 24.47
Total Depth: 15.25
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 08/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller		18.0	7.0			BAS	**BASALT**: As above but very low strength and extremely weathered.	XW		VLS		7	SPT	22,30/110mm, N*=82
		17.0	7.1			BAS	**BASALT**: As above but low strength.	XW		LS				
			7.5			BAS	**BASALT**: As above but very low strength.	XW		VLS		8.5	SPT	30/130mm, N*=69
		16.0	8.0											
		15.0	9.0									10	SPT	18,15,19, N=34
			9.5			BAS	**BASALT**: As above but with some clay layering.	XW		VLS				
		14.0	10.0											
		13.0	10.8	Residual		CL	**Silty CLAY**: Stiff to very stiff, low to medium plasticity, grey mottled orange brown and dark grey, moist.		M	St-VSt		11.5	SPT	2,3,5, N=8: PP=180-300kPa
			11.0											
			12.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH50

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555537.30
Northing: 6873419.40
RL: 24.47
Total Depth: 15.25
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 08/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller	SWL	12.0	12			CL	**Silty CLAY**: As above but stiff.		M	St				
		11.0	13.0									13	SPT	3,3,5, N=8: PP=110-200kPa
		10.0	14.0											
			14.2	Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, grey mottled orange brown.	XW		VLS		14.5	SPT	22,30/120mm, N*=75
			15.0											
			14.9			BAS	**BASALT**: .As above but medium strength and distinctly weathered	DW		MS				
		9.0	15.25				**15.25m: COMMENCE NMLC CORING**							
		8.0	16.0											
		7.0	17.0											
			18.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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Engineering Log - Cored Borehole

Borehole No.: BH50

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555537.30
Northing: 6873419.40
RL: 24.47
Total Depth: 20.25
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 08/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	12.0	12.5				Commence NMLC Coring at 15.25m						
		11.5	13.0										
		11.0	13.5										
		10.5	14.0										
		10.0	14.5										
		9.5	15.0										
		9.0	15.5	Bedrock		BAS	**BASALT**: Very high strength, fresh, dark grey, with some minor vesicles and feldspars.	Fr		6.22			J5° Un/Ro,Cn,O J10° Pl/Ro,Cn,O J20° Un/Ro,Cn,O J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O
		8.5	15.8 16.0			BAS	**BASALT**: As above but no vesicles and trace of feldspar.	Fr			95%		J25° Pl/Sm,Cn,O
		8.0	16.5										
		7.5	17.0							11.38			J10° Un/Sm,Cn,O
		7.0	17.5										
		6.5	18.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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Engineering Log - Cored Borehole

Borehole No.: BH50

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555537.30
Northing: 6873419.40
RL: 24.47
Total Depth: 20.25

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 08/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		6.0	18.5			BAS	**BASALT**: As above but no vesicles and trace of feldspar.	Fr		13.24	95%		
		5.5	19.0			BAS	**BASALT**: As above but high strength to very high strength, slightly weathered to fresh, highly vesicular, with some feldspar lenses.	SW-Fr			86%		J10° Un/Ro,Cn,O J15° Un/Ro,Cn,O J10° Un/Ro,Cn,O J60° Pl/Ro,Cn,O J45° Pl/Ro,Cn,O SZ 15° 30mm, VLS J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O
		5.0	19.5										
		4.5	20.0							3.92			
		4.0	20.5				**20.25m: BOREHOLE TERMINATED**						
		3.5	21.0										
		3.0	21.5										
		2.5	22.0										
		2.0	22.5										
		1.5	23.0										
		1.0	23.5										
		0.5	24.0										

18.4
20.25

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH50
BOREHOLE DEPTH: 15.25m TO 20.25m

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

Engineering Log - Borehole

Borehole No.: BH51

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555565.40
Northing: 6873442.90
RL: 26.16
Total Depth: 10.80
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		26.0	0.0	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	St				
			0.3	Residual		CI	**Silty CLAY**: Very stiff, medium to high plasticity, red brown, trace of fine to coarse sized gravel, with some cobbles, moist.		M	VSt		1	SPT	3,7,6, N=13: PP=250-300kPa
		25.0	1.0											
			2.0									2.5	SPT	4,6,9, N=15: PP=250-500kPa
		24.0	2.8			CI	**Silty CLAY**: As above but hard, with some extremely weathered basalt layering.		M	H				
Wash Bore - Rock Roller		23.0	3.0	Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey.	XW		VLS				
			3.1			BAS	**BASALT**: As above but medium strength to high strength, distinctly weathered to slightly weathered, with some extremely weathered zones.	DW-SW		MS-HS				
			3.5			BAS	**BASALT**: As above but very low strength and extremely weathered.	XW		VLS		4	SPT	11,25,30/80mm, N*=81
		22.0	4.0			BAS	**BASALT**: As above but medium strength, distinctly weathered with some extremely weathered zones.	DW		MS				
			4.4											
		21.0	5.0											
			5.4			BAS	**BASALT**: As above but low strength and extremely weathered.	XW		LS		5.5	SPT	28/150mm, N*=56
			6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH51

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555565.40
Northing: 6873442.90
RL: 26.16
Total Depth: 10.80
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller		20.0				BAS	**BASALT**: As above but low strength and extremely weathered.	XW		LS				
			6.3			BAS	**BASALT**: As above but medium strength to high strength, distinctly weathered to slightly weathered, with some extremely weathered zones.	DW-SW		MS-HS				
		19.0	6.7			BAS	**BASALT**: As above but low strength, extremely weathered, with some medium strength and distinctly zones.	XW		LS		7	SPT	30/95mm, N*=95
			7.5			BAS	**BASALT**: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS		8.5	SPT	14,18,26, N=44
		18.0	8.0											
		17.0	9.0									10	SPT	15,20,17, N=37
		16.0	10.0											
			10.6			BAS	**BASALT**: As above but high strength and slightly weathered.	SW		HS				
			10.8				**10.80m: COMMENCE NMLC CORING**							
		15.0	11.0											
			12.0											

Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

Morrison Geotechnic Pty Ltd
A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
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Engineering Log - Cored Borehole

Borehole No.: BH51

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555565.40
Northing: 6873442.90
RL: 26.16
Total Depth: 20.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	20.0	6.5				Commence NMLC Coring at 10.8m						
		19.5	7.0										
		19.0	7.5										
		18.5	8.0										
		18.0	8.5										
		17.5	9.0										
		17.0	9.5										
		16.5	10.0										
		16.0	10.5										
		15.5	11.0	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey, with some very low strength and extremely weathered zones.	SW-Fr		9.97	36%		J35° St/Ro,Cn,O SZ 15° 50mm, VLS & cly
		15.0	11.5										SZ 10° 30mm, VLS & cly SZ 25° 20mm, VLS & cly SZ 25° 25mm, VLS
		14.5	12.0										SZ 5° 15mm, VLS SZ 15° 25mm, VLS SZ 45° 20mm, VLS

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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Drilling Rig: Hydrapower Scout
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Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		14.0	12			BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey, with some clay layers.	XW			36%		SZ 5° 50mm, VLS
		13.5	12.5				**CORE LOSS**						
		13.0	13.0										
		12.5	13.5			BAS	**BASALT**: Very low strength, extremely weathered grey mottled orange brown, with some clay .layering	XW		0.17	26%		
		12.0	14.0										
		11.5	14.5										
		11.0	15.0										
		10.5	15.15			BAS	**BASALT**: Very high strength, fresh, grey, vesicular .and feldspar lenses	Fr		6.35	100%		J15° Un/Ro,St,O J25° Pl/Sm,Cn,O
		10.0	15.5										
		9.5	16.0										
		9.0	16.5										J20° St/Pl,Cn,O
		8.5	17.0										
			17.5										
			17.65			BAS	**BASALT**: .As above but no vesicles	Fr		8.91			J45° Pl/Sm,Cn,O
			18.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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Engineering Log - Cored Borehole

Borehole No.: BH51

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555565.40
Northing: 6873442.90
RL: 26.16
Total Depth: 20.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		8.0	18.5			BAS	**BASALT**: As above but no vesicles.	Fr					
		7.5	19.0							6.73	100%		
		7.0	19.35										
			19.5			BAS	**BASALT**: As above but vesicular.	Fr					J20° Un/Ro,Cn,O
		6.5	20.0							3.58			J35° St/Pl,Cn,O
		6.0	20				**20.00m: BOREHOLE TERMINATED**						
			20.5										
		5.5	21.0										
		5.0	21.5										
		4.5	22.0										
		4.0	22.5										
		3.5	23.0										
		3.0	23.5										
		2.5	24.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH51
BOREHOLE DEPTH: 10.8m TO 20.0m

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

Engineering Log - Borehole

Borehole No.: BH52

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555609.70
Northing: 6873441.10
RL: 27.36
Total Depth: 3.95
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		27.0	0.3	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with some fine to medium sized gravel, trace of organics, moist.		M	St				
				Residual		CI	**Silty CLAY**: Very stiff, medium to high plasticity, red brown, moist.		M	VSt				
			1.0 0.9			CI	**Silty CLAY**: As above but with some cobbles.		M	VSt		1	SPT	5,7,15, N=22
		26.0	1.4	Bedrock		BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey.	XW		VLS				
Wash Bore - Rock Roller			1.8 2.0			BAS	**BASALT**: As above but low strength to medium strength, distinctly weathered.	DW		LS-MS				
		25.0	2.5			BAS	**BASALT**: As above but high strength, slightly weathered, grey.	SW		HS		2.5 –	SPT	15/30mm, N*=150, no recovery
			3.0 3			BAS	**BASALT**: As above but medium strength, distinctly weathered with some high strength layers.	DW		MS				
		24.0	3.8			BAS	**BASALT**: As above but high strength & slightly weathered.	SW		HS				
			4.0 3.95				**3.95m: COMMENCE NMLC CORING**							
		23.0	5.0											
		22.0	6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH52

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555609.70
Northing: 6873441.10
RL: 27.36
Total Depth: 23.55
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		27.0	0.5				Commence NMLC Coring at 3.95m						
		26.5	1.0										
		26.0	1.5										
		25.5	2.0										
		25.0	2.5										
		24.5	3.0										
		24.0	3.5										
		23.5	4.0	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to .fresh, grey, slightly fractured	SW-Fr		9.38	25%		J15° Pl/Sm,Vr,O J10° Pl/Ro,Vr,O J10° Pl/Sm,Cl,O, cly 10mm J15° Pl/Sm,St,O
		23.0	4.5										SZ 5° 50mm, VLS
		22.5	4.85 5.0			BAS	**BASALT**: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, highly fractured, with .some high strength zones	XW-DW					J15° Pl/Sm,St,O BZ 200mm J60° Un/Sm,St,O HFZ 230mm
		22.0	5.5										J20° Un/Ro,Cn,O SZ 35° 80mm, LS-MS
		21.5	6.0										J5° Pl/Sm,Cn,O BZ 250mm

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
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Engineering Log - Cored Borehole

Borehole No.: BH52

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555609.70
Northing: 6873441.10
RL: 27.36
Total Depth: 23.55
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		21.0	6.05			BAS	**BASALT**: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, highly fractured, with some high strength	XW-DW					HFZ & BZ 1400mm
						BAS	**BASALT**: Low strength, extremely weathered, orange brown mottled grey, highly fractured, with some high strength zones.	XW					
		20.5	6.5										
			7.0										
		20.0	7.45			BAS	**BASALT**: Very high strength, slightly weathered, grey, with some extremely weathered and distinctly weathered zones throughout.	SW					J10° Pl/Ro,Cn,O
			7.5										J5° Pl/Sm,Vr,O
		19.5	8.0										SZ 5° 100mm, LS & MS
										9.20			SZ 5° 30mm, VLS
													SZ 15° 100mm, LS
		19.0	8.5								25%		BZ 100mm
													SZ 5° 80mm, LS
			8.55			BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey.	XW					J25° Pl/Sm,Vr,O
		18.5	8.7			BAS	**BASALT**: Very high strength, slightly weathered, grey, with some extremely weathered and distinctly weathered zones throughout.	SW					J25° Pl/Sm,Cn,O
			9.0										J35° Un/Ro,Ct,O
													SZ 5° 25mm, VLS
		18.0											HFZ 360mm
			9.5										J5° Pl/Ro,Vr,O
													J5° Pl/Ro,Ct,O
		17.5	10.0							9.16			BZ 50mm
													J15° Un/Sm,Cn,O
													J20° Pl/Sm,Cn,O
		17.0	10.5										BZ 30mm
													BZ 150mm
			10.7			BAS	**BASALT**: Low strength, extremely weathered, orange brown mottled grey, with some high strength zones.	XW					J15° Pl/Sm,Cn,O
		16.5	11.0										SZ 25° 30mm, VLS
													J15° Pl/Sm,St,O
			11.2			BAS	**BASALT**: As above but very low strength.	XW			41%		J30° Pl/Sm,Cn,O
		16.0	11.5										J30° Pl/Sm,St,O
													J35° Un/Ro,Cn,O
		15.5	12.0										

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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A.B.N. 051 009 878 899
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Engineering Log - Cored Borehole

Borehole No.: BH52

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555609.70
Northing: 6873441.10
RL: 27.36
Total Depth: 23.55

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	15.0 14.5 14.0 13.5 13.0 12.5 12.0 11.5 11.0 10.5 10.0 9.5	12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0			BAS	**BASALT**: As above but very low strength.	XW		0.14 0.30	41%		
		16.45		Residual		CL	**Silty CLAY**: Hard, low plasticity, pale grey mottled orange brown, moist.						

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH52

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555609.70
Northing: 6873441.10
RL: 27.36
Total Depth: 23.55
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		9.0	18.05			CL	**Silty CLAY**: Hard, low plasticity, pale grey mottled orange brown, moist. **CORE LOSS**				0%		
			18.5										
		8.5	19.0										
			19.1	Bedrock		BAS	**BASALT**: Medium strength, distinctly weathered, dark grey mottled orange brown	DW					J5° Pl/Ro,St,O J10° Un/Ro,St,O SZ 30° 80mm, VLS
		8.0	19.4			BAS	**BASALT**: Very high strength, slightly weathered to fresh, dark grey, vesicular, with some feldspar	SW-Fr					J30° St/Ro,Cn,O J15° Pl/Ro,St,O
		7.5	20.0										
		7.0	20.5										J5° Pl/Ro,St,O
		6.5	21.0							7.29			
		6.0	21.5								90%		J60° Un/Ro,Cn,O
			21.5			BAS	**BASALT**: As above but no vesicles	SW-Fr					J20° Pl/Sm,Cn,O
		5.5	22.0							9.37			J30° Pl/Sm,Cn,O J45° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O
		5.0	22.5										J90° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O
		4.5	23.0										J15° Pl/Sm,Cn,O
										11.93			
		4.0	23.5										J10° Un/Sm,Cn,O
			23.55				**23.55m: BOREHOLE TERMINATED**						
		3.5	24.0										

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH52
BOREHOLE DEPTH: 3.95m TO 23.55m

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

Engineering Log - Borehole

Borehole No.: BH53

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.70
Northing: 6873487.10
RL: 26.00
Total Depth: 3.90
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 23/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with Wash Bore - Rock Roller		26.0	0.0	Slopewash		CH	**Silty CLAY**: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	St				
			0.3			CH	**Silty CLAY**: As above but with some cobbles.		M	St				
			0.5	Residual		CI	**Silty CLAY**: Very stiff, medium plasticity, red brown, with some fine to coarse sized gravel, with some cobbles, moist.		M	VSt				
		25.0	1.0									1	SPT	4,13,10, N=23
		24.0	2.0											
			2.8	Bedrock		BAS	**BASALT**: Low strength extremely weathered, orange brown mottled grey.	XW		LS		2.5	SPT	7,13,25/110mm, N*=47
		23.0	3.0											
			3.2			BAS	**BASALT**: As above but medium strength, distinctly weathered to slightly weathered, with some high strength & slightly weathered layers.	DW-SW		MS				
		22.0	4.0 3.9				**3.90m: COMMENCE NMLC CORING**							
		21.0	5.0											
		20.0	6.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH53

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.70
Northing: 6873487.10
RL: 26.00
Total Depth: 25.10
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 23/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
		26.0											
		25.5	0.5										
		25.0	1.0										
		24.5	1.5										
		24.0	2.0										
		23.5	2.5										
		23.0	3.0										
		22.5	3.5										
							Commence NMLC Coring at 3.9m						
NMLC Coring		22.0	4.0	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered, grey with some orange brown mottling, with some extremely weathered zones.	SW					J40° Pl/Sm,St,O J5° Pl/Sm,St,O J5° Pl/Sm,St,O J5° Un/Ro,St,O HFZ 400mm
		21.5	4.5										
		21.0	4.9 / 5.0			BAS	**BASALT**: Medium strength, distinctly weathered, orange brown mottled grey, highly	DW		3.24	21%		SZ 25° 10mm, VLS BZ 180mm
			5.4				**BASALT**: Very high strength, slightly weathered, grey with some orange brown mottling, with some XW zones.						J5° Pl/Sm,St,O HFZ 250mm
		20.5	5.5			BAS		SW					
			5.6										
						BAS	**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown, with some extremely weathered and fresh zones, highly fractured	DW			23%		HFZ 1000mm
		20.0	6.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH53

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.70
Northing: 6873487.10
RL: 26.00
Total Depth: 25.10
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 23/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		20.0											
		19.5	6.5			BAS	**BASALT**: Medium strength, distinctly weathered, grey mottled orange brown, with some extremely weathered and fresh zones, highly fractured.	DW					
			6.55			BAS	**BASALT**: Very high strength, slightly weathered, grey, slightly fractured.	SW			23%		J20° Pl/Sm,Ct,O J5° Pl/Sm,St,O BZ 80mm
		19.0	7.0							2.98			
			7.3				**BASALT**: Very low strength to low strength, extremely weathered, grey mottled orange brown.	XW					SZ 5° 10mm HFZ/SZ 170mm, some VLS
		18.5	7.5			BAS							
			7.45			BAS	**BASALT**: Very high strength, slightly weathered, grey.	SW					J5° Pl/Ro,St,O J5° Pl/Ro,St,O HFZ 230mm, MS
			7.6			BAS	**BASALT**: Low strength to medium strength, distinctly weathered, grey and grey brown mottled orange brown, extremely fractured.	DW			12%		HFZ 500mm, LS, some HS
		18.0	8.0										
		17.5	8.5										
			8.4			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr					J5° Un/Ro,St,O VLS-LS Rock 800mm
			8.75			BAS	**BASALT**: Very low strength to low strength, extremely weathered, grey and grey brown mottled orange brown.	XW					
		17.0	9.0										
		16.5	9.5										
			9.55				**CORE LOSS**						Core Loss 300mm
			9.85			BAS	**BASALT**: Very low strength to low strength, extremely weathered, grey and grey brown mottled orange brown.	XW					VLS-LS Rock 150mm
		16.0	10.0										
			10			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr					J10° Un/Ro,St,O VLS-LS Rock 750mm
			10.15			BAS	**BASALT**: Very low strength to low strength, extremely weathered, grey and grey brown.	XW			10%		
		15.5	10.5										
		15.0	11.0										
			10.9				**CORE LOSS**						Core Loss 500mm
		14.5	11.5										
			11.4			BAS	**BASALT**: Very low strength, extremely weathered, grey brown mottled orange brown, with some clay layering.	XW			0%		VLS Rock 700mm, some clay
		14.0	12.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH53

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.70
Northing: 6873487.10
RL: 26.00
Total Depth: 25.10
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 23/11/2018

Drilling Information				Material Description								Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	▼	14.0											
		13.5	12.1			BAS	**BASALT**: Very low strength, extremely weathered, grey brown mottled orange brown, with some clay layering.	XW					Core Loss 1450mm
		13.0	12.5				**CORE LOSS**						
		12.5	13.0										
			13.5										
			13.55			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		11.16			SZ 5° 5mm J5° Un/Ro,Cn,O VLS Rock 1250mm, some clay
		12.0	13.9			BAS	**BASALT**: Very low strength, extremely weathered, grey brown mottled orange brown, with some clay layering.	XW			10%		
		11.5	14.0										
		11.0	14.5										
			15.0										
			15.15				**CORE LOSS**						Core Loss 350mm
		10.5	15.5										
			15.5			BAS	**BASALT**: Very low strength, extremely weathered, grey brown mottled orange brown, with some clay layering.	XW					
		10.0	16.0										
			16			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		7.06	55%		J10° Un/Ro,Cn,O J10° Pl/Ro,Cn,O
		9.5	16.5										
		9.0	17.0										
			17.15			BAS	**BASALT**: Very low strength, extremely weathered, grey and orange brown, with some clay layering.	XW					
		8.5	17.45			BAS	**BASALT**: Medium strength, distinctly weathered to slightly weathered, grey and orange staining.	DW-SW					
			17.8			BAS	**BASALT**: As above but medium strength to high strength, grey.	DW-SW		1.24	35%		SZ 10° 15mm, LS & clay SZ 5° 20mm, LS & clay SZ 5° 10mm, LS & clay J20° Un/Ro,Ct,O J30° Un/Ro,Cn,O
		8.0	18.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH53

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.70
Northing: 6873487.10
RL: 26.00
Total Depth: 25.10
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 23/11/2018

Drilling Information				Material Description								Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		8.0											
		7.5	18.5			BAS	**BASALT**: As above but medium strength to high strength, grey.	DW-SW			35%		J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O BZ 70mm, some XLS J5° Un/Ro,St,O J5° Un/Ro,St,O J5° Un/Ro,Cn,O J5° Pl/Ro,Cn,O
		7.0	19.0			BAS	**BASALT**: Medium strength, distinctly weathered, grey brown and orange staining.	DW		0.60			J10° Un/Ro,Cn,O J40° Un/Ro,Cn,O J5° Un/Ro,Ct,O J10° Un/Ro,Cn,O
		6.5	19.5			BAS	**BASALT**: Very low strength, extremely weathered, orange brown	XW					J45° Un/Ro,Ct,O BZ 60mm
		6.0	20.0			BAS	**BASALT**: High strength, slightly weathered to fresh, grey.	SW-Fr			74%		J40° Un/Ro,Cn,O J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O BZ 140mm
		5.5	20.5										J5° Un/Ro,Cn,O
		5.0	21.0			BAS	**BASALT**: As above but very high strength.	SW-Fr		7.88	100%		J5° Un/Sm,Cn,O
		4.5	21.5										
		4.0	22.0										J45° Un/Ro,Cn,O
		3.5	22.5										
		3.0	23.0										J45° Pl/Sm,Cn,O J10° Un/Ro,Cn,O
		2.5	23.5							10.84	98%		J40° Pl/Ro,Cn,O
		2.0	24.0										J10° Un/Ro,Cn,O

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH53

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555564.70
Northing: 6873487.10
RL: 26.00
Total Depth: 25.10
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 23/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		2.0											
		1.5	24.5			BAS	**BASALT**: As above but very high strength.	SW-Fr		10.01	98%		J5° Un/Ro,Cn,O
		1.0	25.0										
			25.1				**25.10m: BOREHOLE TERMINATED**						
		0.5	25.5										
		0.0	26.0										
		-0.5	26.5										
		-1.0	27.0										
		-1.5	27.5										
		-2.0	28.0										
		-2.5	28.5										
		-3.0	29.0										
		-3.5	29.5										
		-4.0	30.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH53
BOREHOLE DEPTH: 3.9m TO 25.1m

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

Engineering Log - Borehole

Borehole No.: BH54

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555511.60
Northing: 6873480.20
RL: 22.65
Total Depth: 5.30
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 20/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with Wash Bore - Rock Roller		22.0	0.3	Slope wash		CH	**Silty CLAY**: Very stiff, high plasticity, red brown, with some fine to coarse sized gravel, trace of organics, moist.		M	VSt				
				Residual		CI	**Silty CLAY**: Very stiff, medium to high plasticity, red brown, with some fine to medium sized gravel, moist.		M	VSt				
			0.7			CI	**Silty CLAY**: As above but with some cobbles.		M	VSt		1	SPT	4,6,8, N=14: PP=300kPa
		21.0	1.0											
			2.0									2.5	SPT	6,11,11, N=22: PP=300-400kPa
		20.0												
		19.0	3.0											
			4.0									4	SPT	12,25/90mm,N*=8 3
			4.15	Rock		BAS	**BASALT**: Very high strength, fresh, grey, (cobble).	Fr		VHS				
			4.25	Residual		CI	**Silty CLAY**: Hard, medium plasticity, orange brown mottled grey, moist.		M	H				
		18.0	5.0											
			5	Bedrock			**BASALT**: Very low strength, extremely weathered, grey mottled orange brown.							
						BAS		XW		VLS				
			5.2				**BASALT**: As above but medium strength to high strength, distinctly weathered.			MS-HS				
			5.3			BAS		DW						
		17.0	6.0				**5.30m: COMMENCE NMLC CORING**							

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH54

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555511.60
Northing: 6873480.20
RL: 22.65
Total Depth: 19.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 20/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		22.5	0.5				Commence NMLC Coring at 5.3m						
		22.0	1.0										
		21.5	1.5										
		21.0	2.0										
		20.5	2.5										
		20.0	3.0										
		19.5	3.5										
		19.0	4.0										
		18.5	4.5										
		18.0	5.0										
		17.5	5.5	Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey with some orange brown staining.	SW-Fr		9.32	0%		J15° Pl/Ro,St,O J55° Un/Ro,St,O SZ 10° 40mm, VLS SZ 15° 20mm, VLS HFZ 400mm
		17.0	5.7			BAS	**BASALT**: Medium strength, distinctly weathered, orange brown mottled grey, highly fractured.	DW					
			6.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH54

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555511.60
Northing: 6873480.20
RL: 22.65
Total Depth: 19.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 20/11/2018

Drilling Information				Material Description								Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	16.5	6.05			BAS	**BASALT**: ,Medium strength, distinctly weathered orange brown mottled grey, highly	XW					BZ 200mm
		16.0	6.5			BAS	**BASALT**: Low strength with some medium and very high strength zones and extremely weathered.				0%		HFZ 100mm J5° Un/Ro,Cn,O SZ 5° 20mm, VLS
		15.5	7.0										J5° Pl/Ro,Cn,O J5° Un/Ro,Cn,O
		15.0	7.5								5%		BZ 100mm J5° Pl/Ro,Cn,O
		14.5	8.0										J30° Pl/Ro,Cn,O J30° Pl/Ro,Cn,O J30° Pl/Ro,Cn,O BZ 450mm
		14.0	8.45				**CORE LOSS**				0%		
		13.5	9.0										
		13.0	9.3			BAS	**BASALT**: Very low strength to low strength, extremely weathered, grey brown mottled orange.	SW			0%		1200mm VLS-LS
		12.5	9.5										
		12.0	10.0										
		11.5	10.5				**CORE LOSS**				0%		Core Loss 1350mm
		11.0	11.0										
			11.5										
			11.85			BAS	**BASALT**: Very low strength to low strength, extremely weathered, grey brown.	SW			0%		1760mm VLS-LS
			12.0										

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Cored Borehole

Borehole No.: BH54

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555511.60
Northing: 6873480.20
RL: 22.65
Total Depth: 19.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 20/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		10.5	12.12			BAS	**BASALT**: Very low strength to low strength, extremely weathered, grey brown.	SW			0%		
						CI	**Silty CLAY**: Very stiff, medium plasticity, yellow brown, moist						
		10.0	12.5										
			12.54			CI	**Silty CLAY**: Stiff, medium plasticity, grey, moist.						
			12.8			BAS	**BASALT**: Very low strength to low strength, extremely weathered, grey brown.	XW					
		9.5	13.0										
			13.5										
		9.0	13.61			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		6.77	36%		J5° Un/Ro,Cn,O BZ 20mm J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O J10° Un/Ro,Cn,O J20° Un/Ro,Cn,O
		8.5	14.0										
		8.0	14.5										J5° Un/Ro,Cn,O
		7.5	15.0										J5° Un/Ro,Cn,O J10° Un/Ro,Cn,O J10° Un/Ro,Cn,O
		7.0	15.5							8.11	45%		
		6.5	16.0										
		6.0	16.5										J5° Un/Ro,Cn,O BZ 500mm
		5.5	17.0										SZ 10° 30mm, LS J10° Un/Ro,Cn,O
		5.0	17.5								20%		J5° Un/Ro,Cn,O SZ 10° 40mm, LS J30° Pl/Ro,Cn,O SZ 10° 30mm, MS SZ 10° 30mm, MS
			18.0							3.90			SZ 10° 20mm, MS SZ 10° 10mm, MS J10° Un/Ro,Cn,O

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH54

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555511.60
Northing: 6873480.20
RL: 22.65
Total Depth: 19.00
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 20/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		4.5	18.5			BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey.	SW-Fr		9.50	10%		J10° Un/Ro,Cn,O
		4.0	19.0										
		3.5	19.5				**19.00m: BOREHOLE TERMINATED**						
		3.0	20.0										
		2.5	20.5										
		2.0	21.0										
		1.5	21.5										
		1.0	22.0										
		0.5	22.5										
		0.0	23.0										
		-0.5	23.5										
		-1.0	24.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH54
BOREHOLE DEPTH: 5.3m TO 19.0m

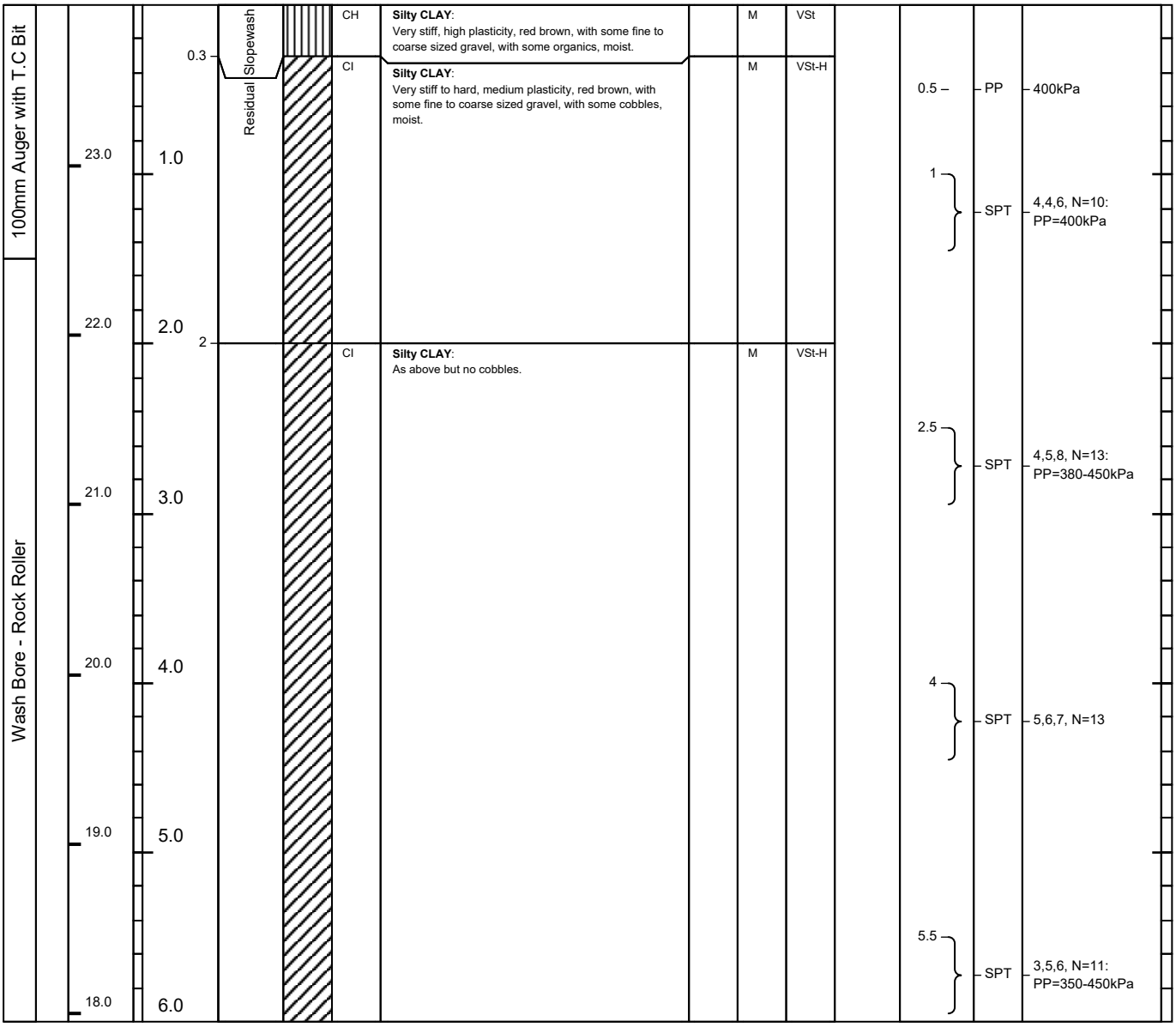
Morrison Geotechnic Pty Ltd
A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Borehole

Borehole No.: BH55

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555541.20
Northing: 6873509.90
RL: 23.95
Total Depth: 14.90
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 15/11/2018



Comments:

Authorised by: ……

Date: ……..…..……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH55

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555541.20
Northing: 6873509.90
RL: 23.95
Total Depth: 14.90
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 15/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller		17.0	7.0			CI	**Silty CLAY**: As above but no cobbles.		M	VSt-H		7	SPT	5,9,16, N=25
			7.4	Rock		BAS	**BASALT**: Very low strength, extremely weathered, orange brown mottled grey.	XW		VLS				
		16.0	8.0									8.5	SPT	23,26/150mm, N*=57
		15.0	9.0											
			9			BAS	**BASALT**: As above but low strength.	XW		LS				
		14.0	10.0									10	SPT	30/115mm, N*=78
			10.3	Residual		CL	**Silty CLAY**: Stiff, low to medium plasticity, dark grey mottled orange brown and pale grey, moist.		M	St				
		13.0	11.0											
												11.5	SPT	1,3,4, N=7: PP=150-300kPa
		12.0	12.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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

Engineering Log - Borehole

Borehole No.: BH55

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555541.20
Northing: 6873509.90
RL: 23.95
Total Depth: 14.90
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 15/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller	SWL	11.0	13.0	Residual		CL	**Silty CLAY**: Stiff, low to medium plasticity, dark grey mottled orange brown and pale grey, moist.		M	St		13	SPT	2,2,4, N=6: PP=120-200kPa
		10.0	14.0											
			14.45	Bedrock		BAS	**BASALT**: Medium strength, distinctly weathered, dark grey.	DW		MS		14.5 –	SPT	30/50mm, N*=180
		9.0	15.0				**14.90m: COMMENCE NMLC CORING**							
		8.0	16.0											
		7.0	17.0											
		6.0	18.0											

Comments:

Authorised by: ……

Date: ……

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

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

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

Moisture
D Dry M Moist W Wet

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

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

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

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Engineering Log - Cored Borehole

Borehole No.: BH55

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555541.20
Northing: 6873509.90
RL: 23.95
Total Depth: 19.95
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 15/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring	SWL	11.5	12.5										
		11.0	13.0										
		10.5	13.5										
		10.0	14.0										
		9.5	14.5										
		9.0	15.0				Commence NMLC Coring at 14.9m						
				Bedrock		BAS	**BASALT**: Very high strength, slightly weathered to fresh, grey, slightly vesicular.	SW-Fr		6.14	80%		J10° St/Sm,Cn,O
		8.5	15.5										
			15.75			BAS	**BASALT**: As above but no vesicles.	SW-Fr					J40° Pl/Sm,Cn,O
		8.0	16.0										J10° Pl/Sm,Cn,O
		7.5	16.5										J15° St/Sm,Cn,O
										9.89			J15° Pl/Sm,Cn,O
		7.0	17.0								100%		
		6.5	17.5										J20° Pl/Sm,Cn,O
		6.0	18.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached Defect Description Sheet

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

Engineering Log - Cored Borehole

Borehole No.: BH55

Job Number: GE18/144
Client: Wood & Grieve Engineers
Project: Geotech Investigation - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Easting: 555541.20
Northing: 6873509.90
RL: 23.95
Total Depth: 19.95
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 15/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC Coring		5.5	18.5			BAS	**BASALT**: As above but no vesicles.	SW-Fr		8.97	100%		J5° Pl/Sm,Cn,O
		5.0	19.0										
		4.5	19.5										
		4.0	20.0							8.78			
			19.95				**19.95m: BOREHOLE TERMINATED**						
		3.5	20.5										
		3.0	21.0										
		2.5	21.5										
		2.0	22.0										
		1.5	22.5										
		1.0	23.0										
		0.5	23.5										
		0.0	24.0										

Comments:

Authorised by: ……

Date: ……..……..……..

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

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

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

Moisture
D Dry M Moist W Wet

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

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

Defects
Refer to Attached 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: BH55
BOREHOLE DEPTH: 14.9m TO 19.95m

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

Anisotropic Fabric	
BED	Bedding
FOL	Foliation
LIN	Mineral lineation
Defect Type	
LM	Lamination Parting
BP	Bedding Parting
CLV	Cleavage / Foliation Parting
J, Js	Joint, Joints
SZ	Sheared Zone
CZ	Crushed Zone
BZ	Broken Zone
HFZ	Highly Fractured Zone
AZ	Alteration Zone
VN	Vein

Roughness (e.g. Planar, Smooth is abbreviated Pl / Sm)		Class
Stepped (Stp)	Rough or irregular (Ro)	I
	Smooth (Sm)	II
	Slickensided (Sl)	II
Undulating (Un)	Rough (Ro)	IV
	Smooth (Sm)	V
	Slickensided (Sl)	VI
Planar (Pl)	Rough (Ro)	VII
	Smooth (Sm)	VIII
	Slickensided (Sl)	IX

Infilling			Aperture	
Clean	Cn	No visible coating or infill	Closed	C
Stain	St	Surfaces discoloured by mineral	Open	O
Veneer	Vr	Visible mineral or soil infill <1mm	Filled	F
Coating	Ct	Visible mineral or soil infill >1mm	Tight	T

Other	
Cly	Clay
Fe	Iron
Co	Coal
Carb	Carbonaceous
Sinf	Soil Infill Zone
Qz	Quartz
CA	Calcite
Chl	Chlorite
Py	Pyrite
Int	Intersecting
Inc	Incipient
DI	Drilling Induced
H	Horizontal
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)	
Spacing/Width (mm)	Descriptor	Symbol	Descriptor	Spacing/Width (mm)
			Thinly Laminated	< 6
<20	Extremely Close	EC	Thickly Laminated	6 – 20
20 – 60	Very Close	VC	Very Thinly Bedded	20 – 60
60 – 200	Close	C	Thinly Bedded	60 – 200
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
>6000	Extremely Wide	EW		

Defect Spacing in 3D	
Term	**Description**
Blocky	Equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greater than cross section

Defect Persistence (areal extent)
trace length of defect given in metres

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

Test Results			
PI	Plasticity Index	c'	Effective Cohesion
LL	Liquid Limit	c_u	Undrained Cohesion
LI	Liquidity Index	c'_R	Residual Cohesion
DD	Dry Density	ϕ'	Effective Angle of Internal Friction
WD	Wet Density	ϕ_u	Undrained Angle of Internal Friction
LS	Linear Shrinkage	ϕ'_R	Residual Angle of Internal Friction
MC	Moisture Content	c_v	Coefficient of Consolidation
OC	Organic Content	m_v	Coefficient of Volume Compressibility
WPI	Weighted Plasticity Index	$c_{\alpha\varepsilon}$	Coefficient of Secondary Compression
WLS	Weighted Linear Shrinkage	e	Voids Ratio
DoS	Degree of Saturation	ϕ'_{cv}	Constant Volume Friction Angle
APD	Apparent Particle Density	q_t / q_c	Piezocone Resistance (Tip / Sleave)
s_u	Undrained Shear Strength	q_d	PANDA Cone Resistance
q_u	Unconfined Compressive Strength	$I_{s(50)}$	Point Load Strength Index
R	Total Core Recovery	*RQD*	Rock Quality Designation

Test Symbols	
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetration Test
CPTu	Cone Penetrometer (Piezocone) Test
PANDA	Variable Energy DCP
PP	Pocket Penetrometer Test
U50	Undisturbed Sample 50 mm diameter
U100	Undisturbed Sample 100mm diameter
UCS	Uniaxial Compressive Strength
Pm	Pressuremeter
FSV	Field Shear Vane
DST	Direct Shear Test
PR	Penetration Rate
A	Point Load Test (axial)
D	Point Load Test (diametral)
L	Point Load Test (irregular lump)

Groundwater Symbols:

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

A P P E N D I X 'C'

LABORATORY TEST CERTIFICATES

MORRISON GEOTECHNIC

Brisbane | Gold Coast | Maroochydore
Unit 1, 5 Brendan Drive (PO Box 2011), Nerang Q 4211 P (07) 5596 1599 F (07) 5527 2027
ABN 51 009 878 899
www.morrisongeo.com.au

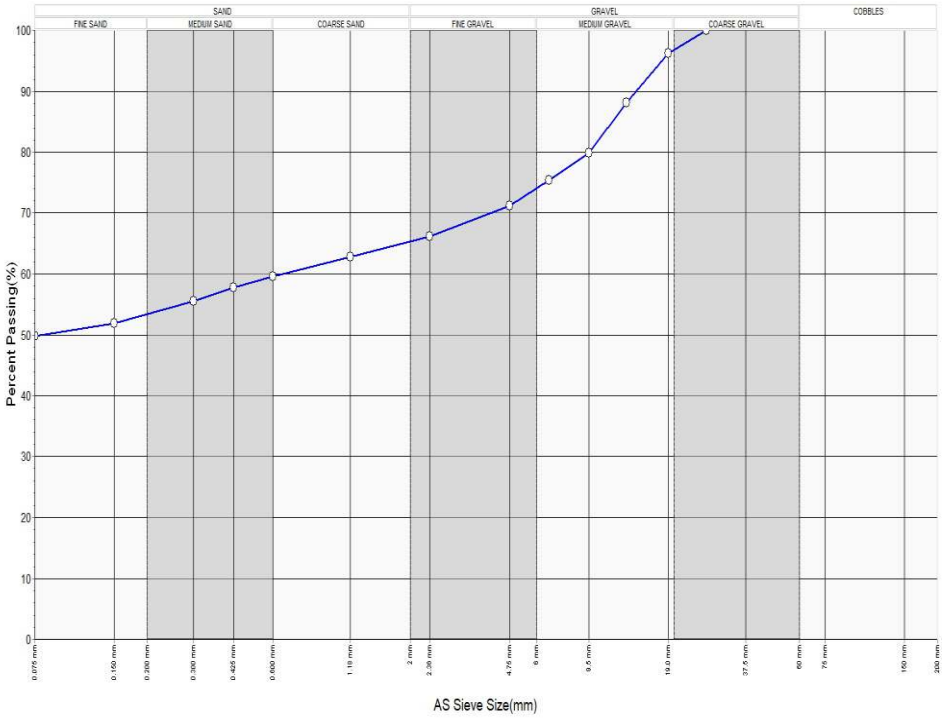
Quality of Materials Report

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
Sampling Method :	-
Sampled By :	LEIGH BEXLEY
Date Sampled :	3/08/2018
Date Tested :	13/08/2018
Material Type :	DISTURBED SAMPLE
Material Source :	INSITU
Remarks :	

SAMPLE LOCATION	
BH 3	
1.5 - 2.5	
DISTURBED	
SAMPLE	
Test Number :	
Lot Number :	
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 WORLD RECOGNISED ACCREDITATION

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APPROVED SIGNATORY

IAN MASMAN - MANAGER
NATA Accreditation Number
1169

MORRISON GEOTECHNIC

Brisbane | Gold Coast | Maroochydore
Unit 1, 5 Brendan Drive (PO Box 2011), Nerang Q 4211 P (07) 5596 1599 F (07) 5527 2027
ABN 51 009 878 899
www.morrisongeo.com.au

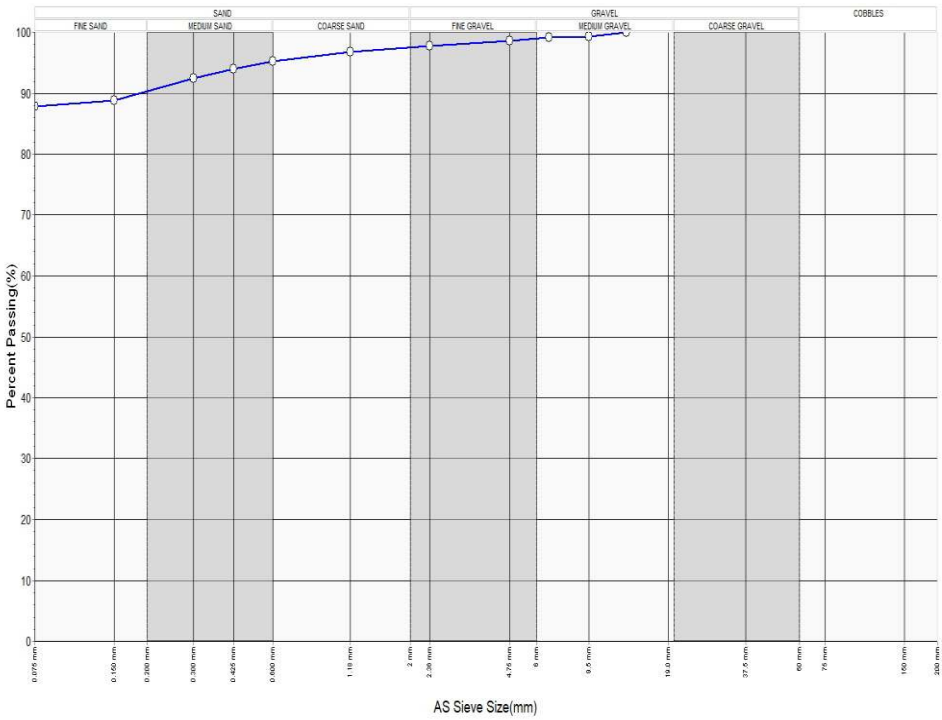
Quality of Materials Report

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
Sampling Method :	-
Sampled By :	LEIGH BEXLEY
Date Sampled :	3/08/2018
Date Tested :	13/08/2018
Material Type :	DISTURBED
Material Source :	INSITU
Remarks :	

SAMPLE LOCATION	
BH 7	
0.1 - 0.5	
DISTURBED	
SAMPLE	
Test Number :	
Lot Number :	
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**	



		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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1169

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Brisbane | Gold Coast | Maroochydore
Unit 1, 5 Brendan Drive (PO Box 2011), Nerang Q 4211 P (07) 5596 1599 F (07) 5527 2027
ABN 51 009 878 899
www.morrisongeo.com.au

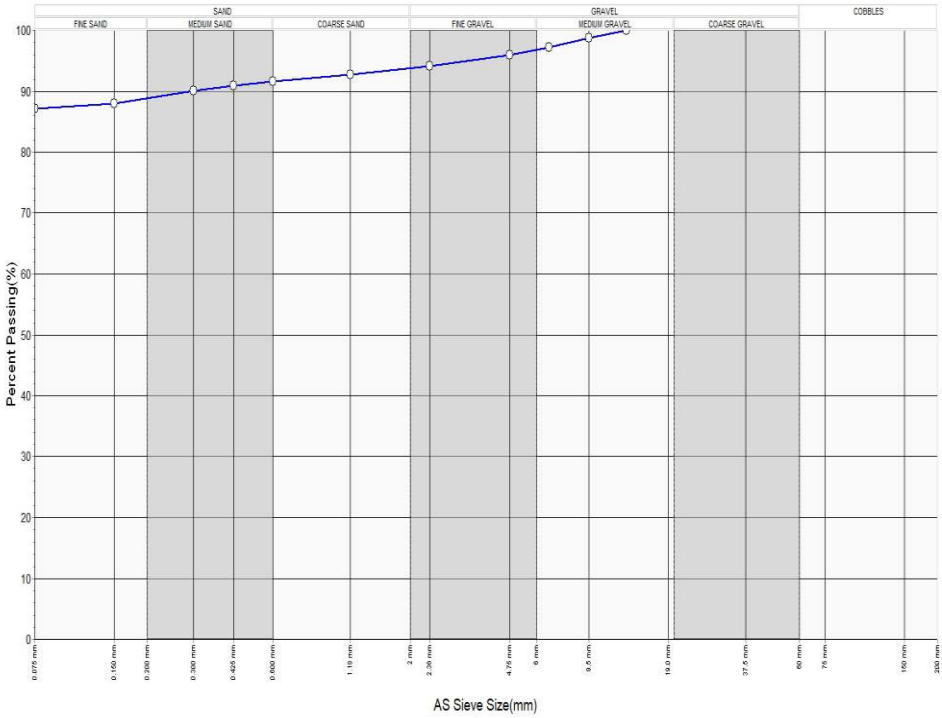
Quality of Materials Report

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
Sampling Method :	-
Sampled By :	LEIGH BEXLEY
Date Sampled :	3/08/2018
Date Tested :	13/08/2018
Material Type :	BULK SAMPLE
Material Source :	INSITU
Remarks :	

SAMPLE LOCATION	
BH 10	
1.0 - 1.5	
BULK	
SAMPLE	
Test Number :	
Lot Number :	
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**	



		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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Unit 1, 5 Brendan Drive (PO Box 2011), Nerang Q 4211 P (07) 5596 1599 F (07) 5527 2027
ABN 51 009 878 899
www.morrisongeo.com.au

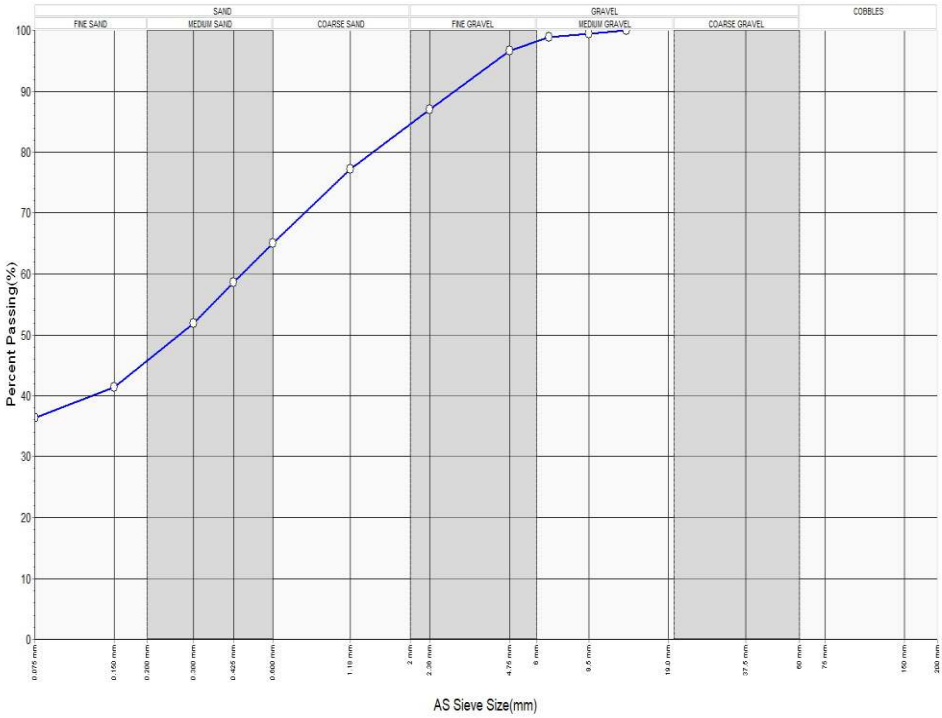
Quality of Materials Report

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
Sampling Method :	-
Sampled By :	LEIGH BEXLEY
Date Sampled :	3/08/2018
Date Tested :	13/08/2018
Material Type :	BULK SAMPLE
Material Source :	INSITU
Remarks :	

SAMPLE LOCATION	
BH 17	
0.3 - 1.0	
BULK	
SAMPLE	
Test Number :	
Lot Number :	
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**	



		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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Material Test Report

Report Number: **GE18/144-1A**
Issue Number: 1
Date Issued: 30/11/2018
Client: WOOD & GRIEVE ENGINEERS
LEVEL 2, 232 St PAULS TERRACE, FORTITUDE VALLEY QLD 4006
Project Number: GE18/144
Project Name: GEOTECHNICAL INVESTIGATION
Project Location: TWEED VALLEY HOSPITAL, CUDGEN ROAD, KINGSCLIFF
Work Request: 64
Sample Number: G18-64A
Date Sampled: 26/11/2018
Sample Location: **BH 40 RL 23.00 (0.4 - 0.8)**

MORRISON GEOTECHNIC
Brisbane | **Gold Coast** | Maroochydore
Morrison Geotechnic Pty Ltd
ABN: 51 009 878 899
Gold Coast Laboratory
Unit 1, 5 Brendan Drive Nerang QLD 4211
Phone: (07) 5596 1599
Email: goldcoastlab@morrisongeo.com.au

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Approved Signatory: Ian Masman
Branch Manager
NATA Accredited Laboratory Number: 1169

Particle Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
13.2 mm	**97**			3		
9.5 mm	**92**			5		
6.7 mm	**89**			3		
4.75 mm	**86**			3		
2.36 mm	**83**			3		
1.18 mm	**81**			2		
0.6 mm	**80**			1		
0.425 mm	**80**			0		
0.3 mm	**79**			1		
0.15 mm	**77**			2		
0.075 mm	**76**			1		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	50		
Plastic Limit (%)	34		
Plasticity Index (%)	**16**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	11.5		
Cracking Crumbling Curling	Cracking & Curling		

Material Test Report

Report Number: **GE18/144-1A**
Issue Number: 1
Date Issued: 30/11/2018
Client: WOOD & GRIEVE ENGINEERS
LEVEL 2, 232 St PAULS TERRACE, FORTITUDE VALLEY QLD 4006
Project Number: GE18/144
Project Name: GEOTECHNICAL INVESTIGATION
Project Location: TWEED VALLEY HOSPITAL, CUDGEN ROAD, KINGSCLIFF
Work Request: 64
Sample Number: G18-64B
Date Sampled: 26/11/2018
Sample Location: **BH 28 RL 17.88 (0.5 - 0.9)**

MORRISON GEOTECHNIC
Brisbane | **Gold Coast** | Maroochydore
Morrison Geotechnic Pty Ltd
ABN: 51 009 878 899
Gold Coast Laboratory
Unit 1, 5 Brendan Drive Nerang QLD 4211
Phone: (07) 5596 1599
Email: goldcoastlab@morrisongeo.com.au

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Approved Signatory: Ian Masman
Branch Manager
NATA Accredited Laboratory Number: 1169

Particle Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
13.2 mm	**100**			0		
9.5 mm	**98**			1		
6.7 mm	**97**			1		
4.75 mm	**96**			1		
2.36 mm	**94**			2		
1.18 mm	**92**			2		
0.6 mm	**91**			1		
0.425 mm	**90**			1		
0.3 mm	**89**			1		
0.15 mm	**87**			2		
0.075 mm	**86**			1		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	56		
Plastic Limit (%)	41		
Plasticity Index (%)	**15**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	7.0		
Cracking Crumbling Curling	None		

Material Test Report

Report Number: **GE18/144-1B**
Issue Number: 1
Date Issued: 03/12/2018
Client: WOOD & GRIEVE ENGINEERS
LEVEL 2, 232 St PAULS TERRACE, FORTITUDE VALLEY QLD 4006
Project Number: GE18/144
Project Name: GEOTECHNICAL INVESTIGATION
Project Location: TWEED VALLEY HOSPITAL, CUDGEN ROAD, KINGSCLIFF
Work Request: 64
Sample Number: G18-64A
Date Sampled: 26/11/2018
Sample Location: **BH 40 RL 23.00 (0.4 - 0.8)**

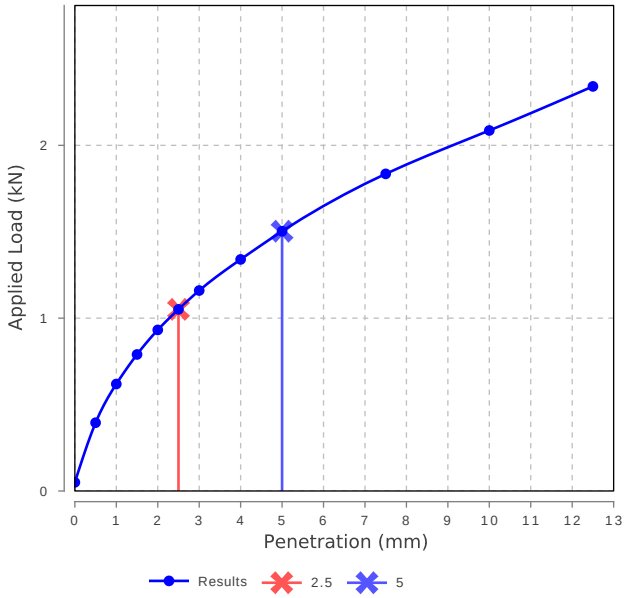
MORRISON GEOTECHNIC
Brisbane | **Gold Coast** | Maroochydore
Morrison Geotechnic Pty Ltd
ABN: 51 009 878 899
Gold Coast Laboratory
Unit 1, 5 Brendan Drive Nerang QLD 4211
Phone: (07) 5596 1599
Email: goldcoastlab@morrisongeo.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Ian Masman
Branch Manager
NATA Accredited Laboratory Number: 1169

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**8**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	visual		
Maximum Dry Density (t/m^3)	1.36		
Optimum Moisture Content (%)	35.0		
Laboratory Density Ratio (%)	99.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.35		
Field Moisture Content (%)	36.1		
Moisture Content at Placement (%)	35.0		
Moisture Content Top 30mm (%)	43.2		
Moisture Content Rest of Sample (%)	40.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	24		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

California Bearing Ratio



Particle Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
13.2 mm	**97**			3		
9.5 mm	**92**			5		
6.7 mm	**89**			3		
4.75 mm	**86**			3		
2.36 mm	**83**			3		
1.18 mm	**81**			2		
0.6 mm	**80**			1		
0.425 mm	**80**			0		
0.3 mm	**79**			1		
0.15 mm	**77**			2		
0.075 mm	**76**			1		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	50		
Plastic Limit (%)	34		
Plasticity Index (%)	**16**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	11.5		
Cracking Crumbling Curling	Cracking & Curling		

Material Test Report

Report Number: **GE18/144-1B**
Issue Number: 1
Date Issued: 03/12/2018
Client: WOOD & GRIEVE ENGINEERS
LEVEL 2, 232 St PAULS TERRACE, FORTITUDE VALLEY QLD 4006
Project Number: GE18/144
Project Name: GEOTECHNICAL INVESTIGATION
Project Location: TWEED VALLEY HOSPITAL, CUDGEN ROAD, KINGSCLIFF
Work Request: 64
Sample Number: G18-64B
Date Sampled: 26/11/2018
Sample Location: **BH 28 RL 17.88 (0.5 - 0.9)**

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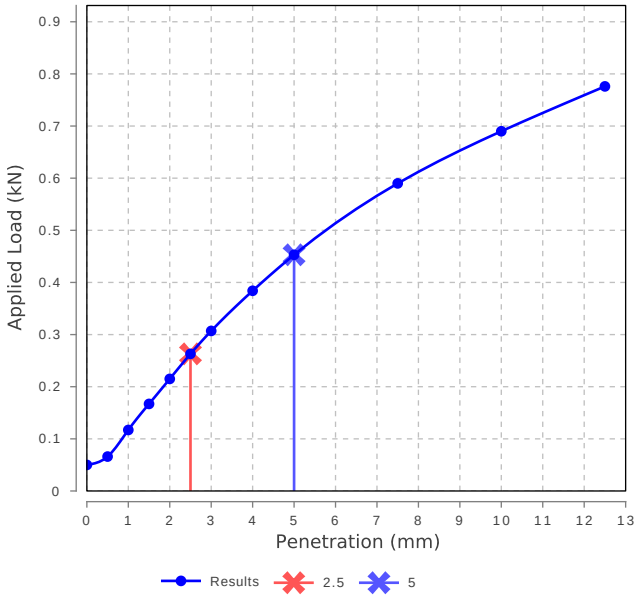
Morrison Geotechnic Pty Ltd
ABN: 51 009 878 899
Gold Coast Laboratory
Unit 1, 5 Brendan Drive Nerang QLD 4211
Phone: (07) 5596 1599
Email: goldcoastlab@morrisongeo.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Ian Masman
Branch Manager
NATA Accredited Laboratory Number: 1169

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**2.5**	100	100
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Tactile		
Maximum Dry Density (t/m^3)	1.27		
Optimum Moisture Content (%)	40.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.5		
Dry Density after Soaking (t/m^3)	1.27		
Field Moisture Content (%)	32.8		
Moisture Content at Placement (%)	39.7		
Moisture Content Top 30mm (%)	40.4		
Moisture Content Rest of Sample (%)	38.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	24		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

California Bearing Ratio



Particle Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
13.2 mm	**100**			0		
9.5 mm	**98**			1		
6.7 mm	**97**			1		
4.75 mm	**96**			1		
2.36 mm	**94**			2		
1.18 mm	**92**			2		
0.6 mm	**91**			1		
0.425 mm	**90**			1		
0.3 mm	**89**			1		
0.15 mm	**87**			2		
0.075 mm	**86**			1		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	56		
Plastic Limit (%)	41		
Plasticity Index (%)	**15**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	7.0		
Cracking Crumbling Curling	None		

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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/m³) :	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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APPROVED SIGNATORY

IAN MASMAN - MANAGER
NATA Accreditation Number
1169

Material Test Report

Report Number: **GE18/144-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 30/11/2018
Client: WOOD & GRIEVE ENGINEERS
LEVEL 2, 232 St PAULS TERRACE, FORTITUDE VALLEY QLD 4006
Project Number: GE18/144
Project Name: GEOTECHNICAL INVESTIGATION
Project Location: TWEED VALLEY HOSPITAL, CUDGEN ROAD, KINGSCLIFF
Work Request: 64

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Brisbane | **Gold Coast** | Maroochydore
Morrison Geotechnic Pty Ltd
ABN: 51 009 878 899
Gold Coast Laboratory
Unit 1, 5 Brendan Drive Nerang QLD 4211
Phone: (07) 5596 1599
Email: goldcoastlab@morrisongeo.com.au

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Approved Signatory: Ian Masman
Branch Manager
NATA Accredited Laboratory Number: 1169

Shrink Swell Index AS 1289 7.1.1 & 2.1.1		
Sample Number	G18-64C	G18-64D
Sampling Method	AS1289 1.3.1	AS1289 1.3.1
Date Sampled	26/11/2018	26/11/2018
Date Tested	26/11/2018	26/11/2018
Material Source	Insitu	Insitu
Sample Location	BH 26 RL 19.69 (0.5 - 0.8)	BH 28 RL 17.88 (0.5 - 0.85)
Inert Material Estimate (%)	0	0
Pocket Penetrometer before (kPa)	**	**
Pocket Penetrometer after (kPa)	**	**
Shrinkage Moisture Content (%)	32.2	32.7
Shrinkage (%)	**2.6**	**3.6**
Swell Moisture Content Before (%)	28.6	29.9
Swell Moisture Content After (%)	30.9	31.2
Swell (%)	**0.0**	**0.0**
Shrink Swell Index Iss (%)	**1.4**	**2.0**
Visual Description	Sandy Gravelly Clay, red/brown	Sandy Gravelly Clay, red/brown
Cracking	Moderately Cracked	Moderately Cracked
Crumbling	No	No
Remarks	**	**

Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.
NATA Accreditation does not cover the performance of pocket penetrometer readings.

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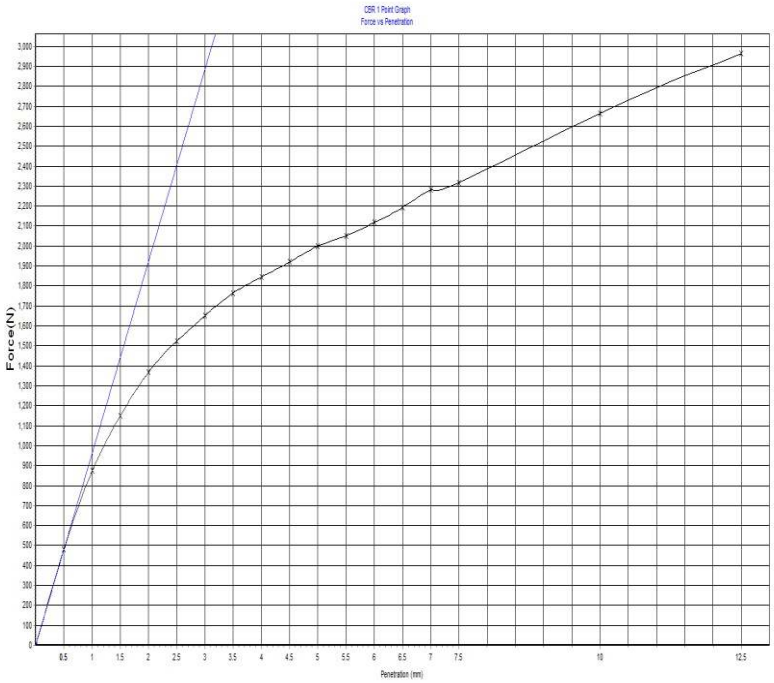
California Bearing Ratio Report (1 Point)

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 LOCATION
Sample Number :	245182	
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/m³) :	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/m³) :	1.571
Dry Density After Soak (t/m³) :	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



CBR Surcharge (kg) :	4.5	CBR 2.5mm (%) :	12
Oversize (%) :		CBR 5.0mm (%) :	**10**
Oversize Material Replaced (%) :		**CBR Value (%) :**	**12**

Site Selection :	
Soil Description :	

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APPROVED SIGNATORY

IAN MASMAN - MANAGER
NATA Accreditation Number : 1169

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Unit 1, 5 Brendan Drive (PO Box 2011), Nerang Q 4211 P (07) 5596 1599 F (07) 5527 2027
ABN 51 009 878 899
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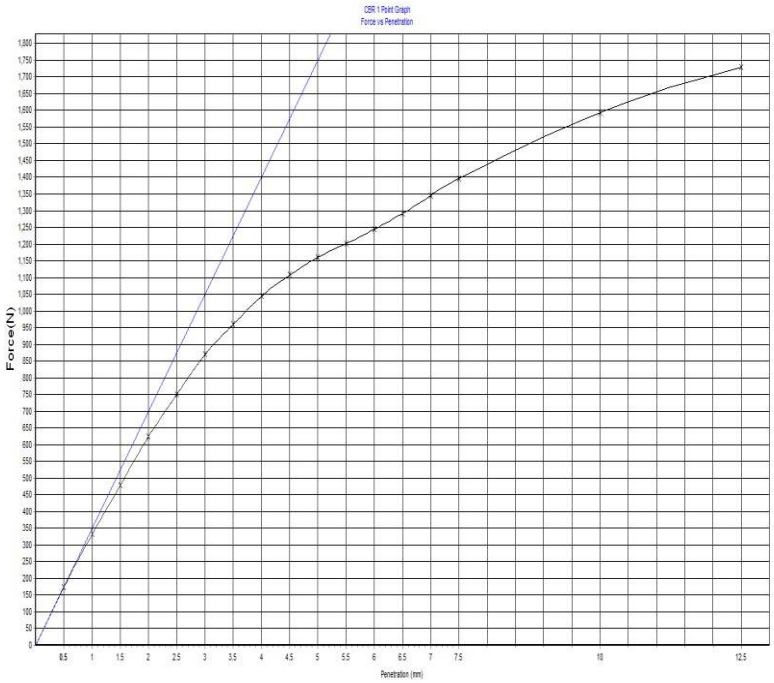
California Bearing Ratio Report (1 Point)

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 LOCATION
Sample Number :	245183	
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/m³) :	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/m³) :	1.358
Dry Density After Soak (t/m³) :	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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ABN 51 009 878 899
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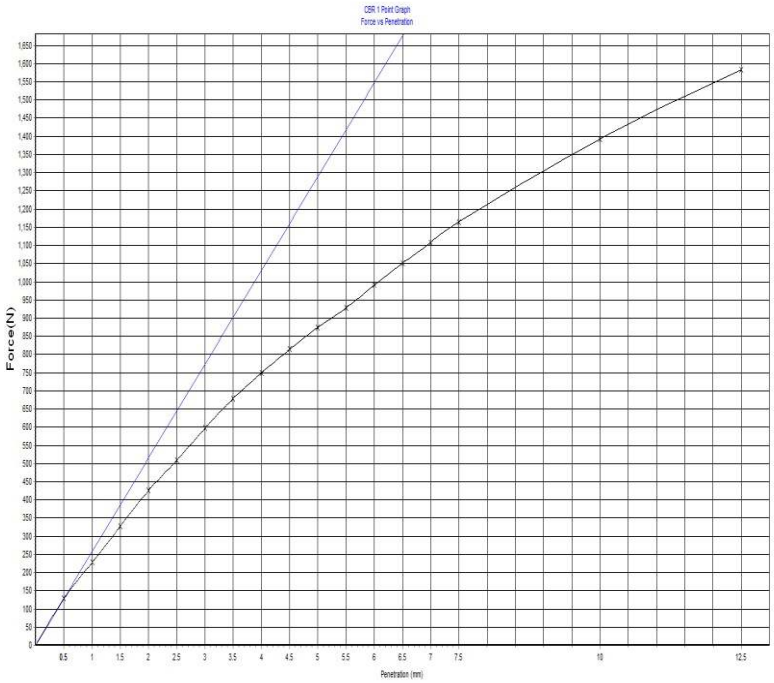
California Bearing Ratio Report (1 Point)

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 LOCATION
Sample Number :	245185	
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/m³) :	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/m³) :	1.393
Dry Density After Soak (t/m³) :	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 :	

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NATA Accreditation Number : 1169

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Brisbane | Gold Coast | Brendale | Maroochydore
Unit 1, 35 Limestone Street (PO Box 3063), Darra Q 4076 P (07) 3279 0900 F (07) 3279 0955
ABN 51 009 878 899
www.morrisongeo.com.au

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**

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**

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Approved Signatory	Form Number
Liam McDowall - Laboratory Manager (Brisbane) NATA Accreditation Number 1162 / 1169	**ER0033**

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Brisbane | Gold Coast | Brendale | Maroochydore
Unit 1, 35 Limestone Street (PO Box 3063), Darra Q 4076 P (07) 3279 0900 F (07) 3279 0955
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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

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

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	Form Number
Liam McDowall - Laboratory Manager (Brisbane) NATA Accreditation Number 1162 / 1169	**ER0033**

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Brisbane | Gold Coast | Brendale | Maroochydore
Unit 1, 35 Limestone Street (PO Box 3063), Darra Q 4076 P (07) 3279 0900 F (07) 3279 0955
ABN 51 009 878 899
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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

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

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	Form Number
Liam McDowall - Laboratory Manager (Brisbane) NATA Accreditation Number 1162 / 1169	**ER0033**

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Brisbane | Gold Coast | Brendale | Maroochydore
Unit 1, 35 Limestone Street (PO Box 3063), Darra Q 4076 P (07) 3279 0900 F (07) 3279 0955
ABN 51 009 878 899
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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

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

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	Form Number
Liam McDowall - Laboratory Manager (Brisbane) NATA Accreditation Number 1162 / 1169	**ER0033**

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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

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

Remarks:

Samples are Basalt which are distrinctly 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**

NATA WORLD RECOGNISED ACCREDITATION

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Approved Signatory	Form Number
Liam McDowall - Laboratory Manager (Brisbane) NATA Accreditation Number 1162 / 1169	**ER0033**

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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

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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Approved Signatory	Form Number
Liam McDowall - Laboratory Manager (Brisbane) NATA Accreditation Number 1162 / 1169	**ER0033**

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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

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 slighlty 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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POINT LOAD TEST REPORT

Client:	**Wood & Grieve Engineers**	**Report No:**	**GE18/144.8**
Client Address:	**Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006**	**Report Date:**	**28.11.18**
Job No:	**GE18/144**	**Sample Date:**	**BH29: 16.11.18 / BH43: 5.11.18**
Project:	**Geotechnical Investigation - Proposed Tweed Valley Hospital**	**Order No:**	
Location:	**Lot 102 on DP870722, Cudgen Road, Kingscliff**	**Test Method:**	**AS4133 4.1**

Sample Number	Date of Test	Location	Depth (m)	Sample Type	Is (MPa)	Is (50) (MPa)	Loading Direction	Descriptive Term
724	23.11.18	Borehole BH29	16.90	Core	15.57	15.29	Diametral	EH
725	23.11.19	Borehole BH29	18.10	Core	0.49	0.48	Diametral	M
726	23.11.20	Borehole BH29	18.95	Core	7.85	7.70	Diametral	VH
727	23.11.21	Borehole BH29	19.41	Core	5.20	5.11	Diametral	VH
728	23.11.22	Borehole BH29	20.60	Core	1.00	0.98	Diametral	M
729	23.11.23	Borehole BH29	21.20	Core	0.40	0.39	Diametral	M
730	23.11.24	Borehole BH29	22.98	Core	0.31	0.31	Diametral	M
731	23.11.25	Borehole BH43	1.55	Core	10.87	10.67	Diametral	EH
732	23.11.26	Borehole BH43	3.31	Core	7.47	7.33	Diametral	VH
733	23.11.27	Borehole BH43	5.12	Core	10.15	9.96	Diametral	VH
734	23.11.18	Borehole BH43	6.34	Core	0.47	0.46	Diametral	M
735	23.11.19	Borehole BH43	9.30	Core	11.94	11.73	Diametral	EH
736	23.11.20	Borehole BH43	15.20	Core	5.91	5.80	Diametral	VH
737	23.11.21	Borehole BH43	16.41	Core	8.77	8.61	Diametral	VH
738	23.11.22	Borehole BH43	18.74	Core	9.38	9.20	Diametral	VH

Remarks:

All samples are basalt rock.

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

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Approved Signatory	Form Number
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POINT LOAD TEST REPORT

Client:	Wood & Grieve Engineers	**Report No:**	GE18/144.9
Client Address:	Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006	**Report Date:**	28.11.18
Job No:	GE18/144	**Sample Date:**	BH43: 5.11.18 / BH44: 21.11.18 / BH45: 9.11.18
Project:	Geotechnical Investigation - Proposed Tweed Valley Hospital	**Order No:**	
Location:	Lot 102 on DP870722, Cudgen Road, Kingscliff	**Test Method:**	AS4133 4.1

Sample Number	Date of Test	Location	Depth (m)	Sample Type	Is (MPa)	Is (50) (MPa)	Loading Direction	Descriptive Term
739	23.11.23	Borehole BH44	1.20	Core	10.07	9.89	Diametral	VH
740	23.11.24	Borehole BH44	2.95	Core	10.94	10.74	Diametral	EH
741	23.11.25	Borehole BH44	5.38	Core	12.24	12.02	Diametral	EH
742	23.11.26	Borehole BH44	7.12	Core	10.84	10.64	Diametral	EH
743	23.11.27	Borehole BH44	8.25	Core	11.29	11.09	Diametral	EH
744	23.11.18	Borehole BH45	1.50	Core	9.13	8.97	Diametral	VH
745	23.11.19	Borehole BH45	4.23	Core	11.84	11.62	Diametral	EH
746	23.11.20	Borehole BH45	5.76	Core	0.87	0.85	Diametral	M
747	23.11.21	Borehole BH45	6.00	Core	12.03	11.81	Diametral	EH
748	23.11.22	Borehole BH45	7.06	Core	10.49	10.30	Diametral	EH
749	23.11.23	Borehole BH45	8.20	Core	9.48	9.31	Diametral	VH
750	23.11.24	Borehole BH45	9.00	Core	11.04	10.84	Diametral	EH
751	23.11.25	Borehole BH45	9.35	Core	0.16	0.15	Diametral	L
752	23.11.26	Borehole BH45	10.50	Core	0.15	0.15	Diametral	L
753	23.11.27	Borehole BH45	11.52	Core	0.14	0.14	Diametral	L

Remarks:

All samples are basalt rock.

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

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POINT LOAD TEST REPORT

Client:	Wood & Grieve Engineers	**Report No:**	GE18/144.11
Client Address:	Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006	**Report Date:**	28.11.18
Job No:	GE18/144	**Sample Date:**	BH45: 9.11.18 / BH46: 6.11.18
Project:	Geotechnical Investigation - Proposed Tweed Valley Hospital	**Order No:**	
Location:	Lot 102 on DP870722, Cudgen Road, Kingscliff	**Test Method:**	AS4133 4.1

Sample Number	Date of Test	Location	Depth (m)	Sample Type	Is (MPa)	Is (50) (MPa)	Loading Direction	Descriptive Term
754	23.11.18	Borehole BH45	12.96	Core	0.13	0.13	Diametral	L
755	23.11.19	Borehole BH45	14.84	Core	0.24	0.24	Diametral	L
756	23.11.20	Borehole BH45	15.54	Core	2.48	2.44	Diametral	H
757	23.11.21	Borehole BH45	16.40	Core	8.63	8.47	Diametral	VH
758	23.11.22	Borehole BH45	16.80	Core	3.30	3.24	Diametral	VH
759	23.11.23	Borehole BH45	17.60	Core	9.79	9.61	Diametral	VH
760	23.11.24	Borehole BH45	18.40	Core	9.53	9.36	Diametral	VH
761	23.11.25	Borehole BH45	20.10	Core	6.13	6.02	Diametral	VH
762	23.11.26	Borehole BH46	2.05	Core	8.02	7.87	Diametral	VH
763	23.11.27	Borehole BH46	3.35	Core	11.65	11.44	Diametral	EH
764	23.11.18	Borehole BH46	7.06	Core	8.18	8.03	Diametral	VH
765	23.11.19	Borehole BH46	7.45	Core	5.59	5.49	Diametral	VH
766	23.11.20	Borehole BH46	8.85	Core	8.92	8.76	Diametral	VH
767	23.11.21	Borehole BH46	13.16	Core	7.49	7.35	Diametral	VH
768	23.11.22	Borehole BH46	15.73	Core	6.55	6.43	Diametral	VH
769	23.11.23	Borehole BH46	17.35	Core	12.00	11.78	Diametral	EH

Remarks:

All samples are basalt rock.

***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	**ER0033**

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POINT LOAD TEST REPORT

Client:	Wood & Grieve Engineers	**Report No:**	GE18/144.12
Client Address:	Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006	**Report Date:**	28.11.18
Job No:	GE18/144	**Sample Date:**	BH47: 19.11.18 / BH48: 7.11.18 / BH49: 19.11.18
Project:	Geotechnical Investigation - Proposed Tweed Valley Hospital	**Order No:**	
Location:	Lot 102 on DP870722, Cudgen Road, Kingscliff	**Test Method:**	AS4133 4.1

Sample Number	Date of Test	Location	Depth (m)	Sample Type	Is (MPa)	Is (50) (MPa)	Loading Direction	Descriptive Term
770	23.11.24	Borehole BH47	8.62	Core	12.76	12.53	Diametral	EH
771	23.11.25	Borehole BH47	11.80	Core	11.48	11.27	Diametral	EH
772	23.11.26	Borehole BH47	13.90	Core	12.07	11.85	Diametral	EH
773	23.11.27	Borehole BH47	15.90	Core	6.73	6.60	Diametral	VH
774	23.11.18	Borehole BH48	2.65	Core	11.94	11.72	Diametral	EH
775	23.11.19	Borehole BH48	5.45	Core	11.72	11.51	Diametral	EH
776	23.11.20	Borehole BH48	8.27	Core	0.26	0.26	Diametral	L
777	23.11.21	Borehole BH48	10.30	Core	0.17	0.17	Diametral	L
778	23.11.22	Borehole BH48	13.35	Core	8.99	8.83	Diametral	VH
779	23.11.23	Borehole BH48	14.10	Core	7.90	7.76	Diametral	VH
780	23.11.24	Borehole BH48	17.70	Core	7.18	7.05	Diametral	VH
781	23.11.25	Borehole BH49	1.25	Core	9.90	9.72	Diametral	VH
782	23.11.26	Borehole BH49	2.64	Core	10.68	10.48	Diametral	EH
783	23.11.27	Borehole BH49	10.00	Core	10.78	10.59	Diametral	EH
784	23.11.18	Borehole BH49	12.30	Core	10.54	10.35	Diametral	EH
785	23.11.19	Borehole BH49	14.25	Core	3.17	3.11	Diametral	VH

Remarks:

All samples are basalt rock.

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

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POINT LOAD TEST REPORT

Client:	**Wood & Grieve Engineers**	**Report No:**	**GE18/144.14**
Client Address:	**Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006**	**Report Date:**	**28.11.18**
Job No:	**GE18/144**	**Sample Date:**	**BH50: 8.11.18 / BH51 13.11.18 / BH52: 23.11.18**
Project:	**Geotechnical Investigation - Proposed Tweed Valley Hospital**	**Order No:**	
Location:	**Lot 102 on DP870722, Cudgen Road, Kingscliff**	**Test Method:**	**AS4133 4.1**

Sample Number	Date of Test	Location	Depth (m)	Sample Type	Is (MPa)	Is (50) (MPa)	Loading Direction	Descriptive Term
786	23.11.20	Borehole BH50	15.27	Core	6.34	6.22	Diametral	VH
787	23.11.21	Borehole BH50	16.82	Core	11.59	11.38	Diametral	EH
788	23.11.22	Borehole BH50	18.08	Core	13.48	13.24	Diametral	EH
789	23.11.23	Borehole BH50	20.15	Core	3.99	3.92	Diametral	VH
790	23.11.24	Borehole BH51	10.82	Core	10.16	9.97	Diametral	VH
791	23.11.25	Borehole BH51	14.10	Core	0.17	0.17	Diametral	L
792	23.11.26	Borehole BH51	15.70	Core	6.47	6.35	Diametral	VH
793	23.11.27	Borehole BH51	17.85	Core	9.07	8.91	Diametral	VH
794	23.11.18	Borehole BH51	19.00	Core	6.86	6.73	Diametral	VH
795	23.11.19	Borehole BH51	19.90	Core	3.65	3.58	Diametral	VH
796	23.11.20	Borehole BH52	4.27	Core	9.56	9.38	Diametral	VH
797	23.11.21	Borehole BH52	8.10	Core	9.38	9.20	Diametral	VH
798	23.11.22	Borehole BH52	9.68	Core	9.33	9.16	Diametral	VH
799	23.11.23	Borehole BH52	12.31	Core	0.14	0.14	Diametral	L
800	23.11.24	Borehole BH52	15.70	Core	0.30	0.30	Diametral	L-M
801	23.11.25	Borehole BH52	20.70	Core	7.42	7.29	Diametral	VH

Remarks:

All samples are basalt rock.

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

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POINT LOAD TEST REPORT

Client:	**Wood & Grieve Engineers**	**Report No:**	**GE18/144.15**
Client Address:	**Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006**	**Report Date:**	**28.11.18**
Job No:	**GE18/144**	**Sample Date:**	**BH52: 13.11.18 / BH53: 21.11.18 / BH54: 20/11/18**
Project:	**Geotechnical Investigation - Proposed Tweed Valley Hospital**	**Order No:**	
Location:	**Lot 102 on DP870722, Cudgen Road, Kingscliff**	**Test Method:**	**AS4133 4.1**

Sample Number	Date of Test	Location	Depth (m)	Sample Type	Is (MPa)	Is (50) (MPa)	Loading Direction	Descriptive Term
802	23.11.26	Borehole BH52	21.80	Core	9.55	9.37	Diametral	VH
803	23.11.27	Borehole BH52	23.00	Core	12.15	11.93	Diametral	EH
804	23.11.18	Borehole BH53	4.83	Core	3.30	3.24	Diametral	VH
805	23.11.19	Borehole BH53	7.22	Core	3.04	2.98	Diametral	H
806	23.11.20	Borehole BH53	13.70	Core	11.37	11.16	Diametral	EH
807	23.11.21	Borehole BH53	16.20	Core	7.13	7.06	Diametral	VH
808	23.11.22	Borehole BH53	17.83	Core	1.27	1.24	Diametral	H
809	23.11.23	Borehole BH53	19.10	Core	0.61	0.60	Diametral	M
810	23.11.24	Borehole BH53	21.32	Core	8.03	7.88	Diametral	VH
811	23.11.25	Borehole BH53	23.50	Core	11.04	10.84	Diametral	EH
812	23.11.26	Borehole BH53	24.54	Core	10.20	10.01	Diametral	EH
813	23.11.27	Borehole BH54	5.35	Core	9.50	9.32	Diametral	VH
814	23.11.18	Borehole BH54	13.90	Core	6.89	6.77	Diametral	VH
815	23.11.19	Borehole BH54	16.05	Core	8.26	8.11	Diametral	VH
816	23.11.20	Borehole BH54	17.90	Core	3.97	3.90	Diametral	VH
817	23.11.21	Borehole BH54	18.75	Core	9.68	9.50	Diametral	VH

Remarks:

All samples are basalt rock.

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

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POINT LOAD TEST REPORT

Client:	**Wood & Grieve Engineers**	**Report No:**	**GE18/144.17**
Client Address:	**Level 2, 232 St Pauls Terrace, Fortitude Valley QLD 4006**	**Report Date:**	**28.11.18**
Job No:	**GE18/144**	**Sample Date:**	**BH55: 15.11.18**
Project:	**Geotechnical Investigation - Proposed Tweed Valley Hospital**	**Order No:**	
Location:	**Lot 102 on DP870722, Cudgen Road, Kingscliff**	**Test Method:**	**AS4133 4.1**

Sample Number	Date of Test	Location	Depth (m)	Sample Type	Is (MPa)	Is (50) (MPa)	Loading Direction	Descriptive Term
818	23.11.22	Borehole BH55	15.23	Core	6.25	6.14	Diametral	VH
819	23.11.23	Borehole BH55	16.60	Core	10.07	9.89	Diametral	VH
820	23.11.24	Borehole BH55	18.44	Core	9.13	8.97	Diametral	VH
821	23.11.25	Borehole BH55	19.90	Core	8.94	8.78	Diametral	EH

Remarks:

All sample are basalt rock.

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

NATA WORLD RECOGNISED ACCREDITATION

CONSULT AUSTRALIA

Accredited for compliance with ISO/IEC 17025.

Approved Signatory	Form Number
Liam A McDowall Liam McDowall - Laboratory Manager (Brisbane) NATA Accreditation Number 1162 / 1169	**ER0033**

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PERMEABILITY BY FALLING HEAD TEST REPORT

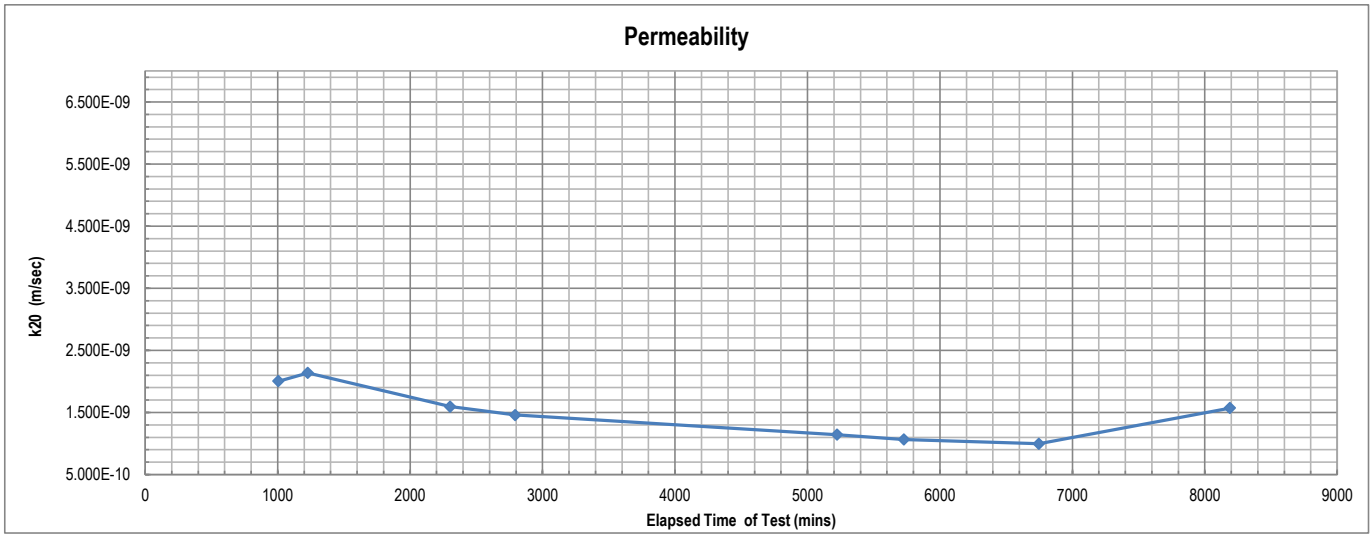
Test Method AS 1289 6.7.2, 5.1.1 , KH2 (Based on K H Head (1988) Manual of Laboratory Testing,10.7)

Client	Morrison Geotechnic Pty Ltd	**Report No.**	18110281-FHPT
		Workorder No.	0005126
Address	PO Box 2011 Nerang QLD 4211	**Test Date**	14/11/18-21/11/18
		Report Date	21/11/2018
Project	GE18/216 - Tweed Valley Hospital - Lot 102 Cudgen Rd, Kingscliff		
Client ID	BH7	**Depth (m)**	0.20-0.80
Description	Silty CLAY-red	**Sample Type**	Remoulded Soil Specimen

RESULTS OF TESTING

Compaction Method	**AS1289.5.1.1 - Standard Compaction**		
Maximum Dry Density (t/m^3)	**1.31**	Hydraulic Gradient	**9.4**
Optimum Moisture Content (%)	**31.5**	Surcharge (kPa)	**3.0**
Placement Moisture Content (%)	**31.4**	Head Pressure Applied (kPa)	**10.79**
Moisture Ratio (%)	**99.5**	Water Type	**Deaerated**
Placement Wet Density (t/m^3)	**1.69**	Percentage Material Retained/Sieve Size (mm)	**0 % /9.5 mm**
Density Ratio (%)	**98.2**	Sample Height and Diameter (mm)	**116.63 / 101.14 mm**

PERMEABILITY $k_{(20)}$ = 1.6×10^{-09} (m/sec)



Remarks: The above specimen was remoulded at 98% Standard Dry Density and at Optimum Moisture Content as advised by the client

Sample/s supplied by client The compaction data was supplied by the client.

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

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Park

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated.
Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.
Trilab Pty Ltd ABN 25 065 630 506

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PERMEABILITY BY FALLING HEAD TEST REPORT

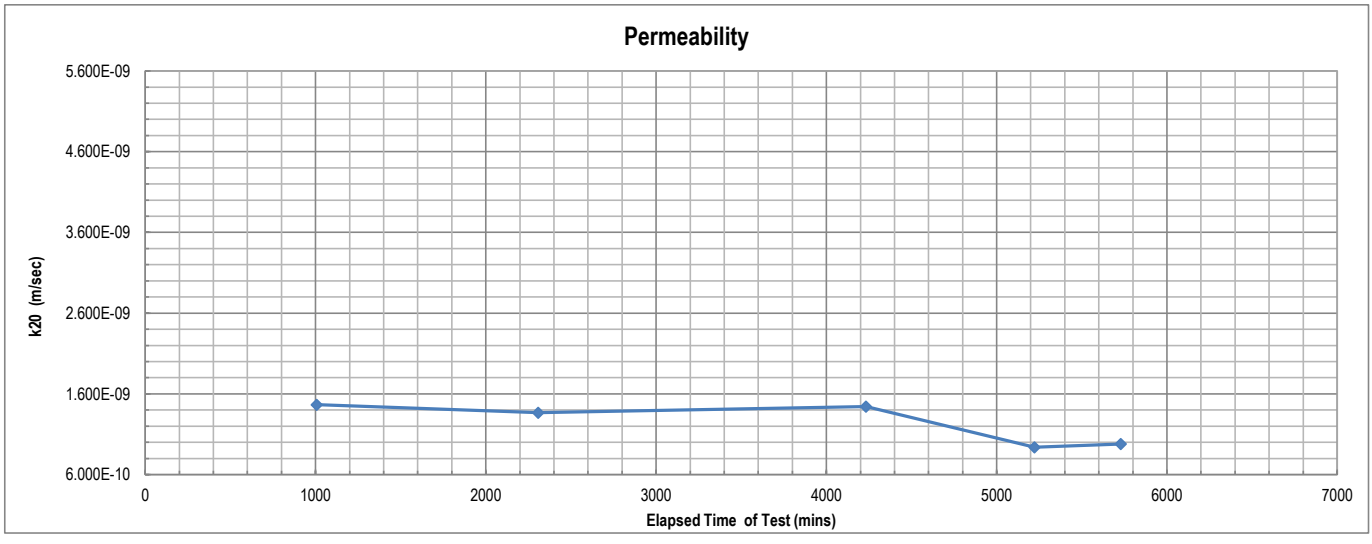
Test Method AS 1289 6.7.2, 5.1.1 , KH2 (Based on K H Head (1988) Manual of Laboratory Testing,10.7)

Client	Morrison Geotechnic Pty Ltd	**Report No.**	18110282-FHPT
		Workorder No.	0005126
Address	PO Box 2011 Nerang QLD 4211	**Test Date**	14/11/2018
		Report Date	20/11/2018
Project	GE18/216 - Tweed Valley Hospital - Lot 102 Cudgen Rd, Kingscliff		
Client ID	BH10	**Depth (m)**	0.20-0.80
Description	SILTY CLAY-red brown	**Sample Type**	Remoulded Soil Specimen

RESULTS OF TESTING

Compaction Method	**AS1289.5.1.1 - Standard Compaction**		
Maximum Dry Density (t/m^3)	**1.41**	Hydraulic Gradient	**9.4**
Optimum Moisture Content (%)	**31.5**	Surcharge (kPa)	**3.0**
Placement Moisture Content (%)	**31.2**	Head Pressure Applied (kPa)	**10.79**
Moisture Ratio (%)	**99.2**	Water Type	**De-ionized**
Placement Wet Density (t/m^3)	**1.82**	Percentage Material Retained/Sieve Size (mm)	**0 % /9.5 mm**
Density Ratio (%)	**98.2**	Sample Height and Diameter (mm)	**116.41 / 100.58 mm**

PERMEABILITY $k_{(20)} =$ **9.6×10^{-10} (m/sec)**



Remarks: The above specimen was remoulded to a target of 98% of Standard Dry Density and at 100% of Optimum Moisture Content.

Sample/s supplied by client The compaction data was supplied by the client.

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

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Channon

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated.
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Trilab Pty Ltd ABN 25 065 630 506

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

PERMEABILITY - Percolation Test

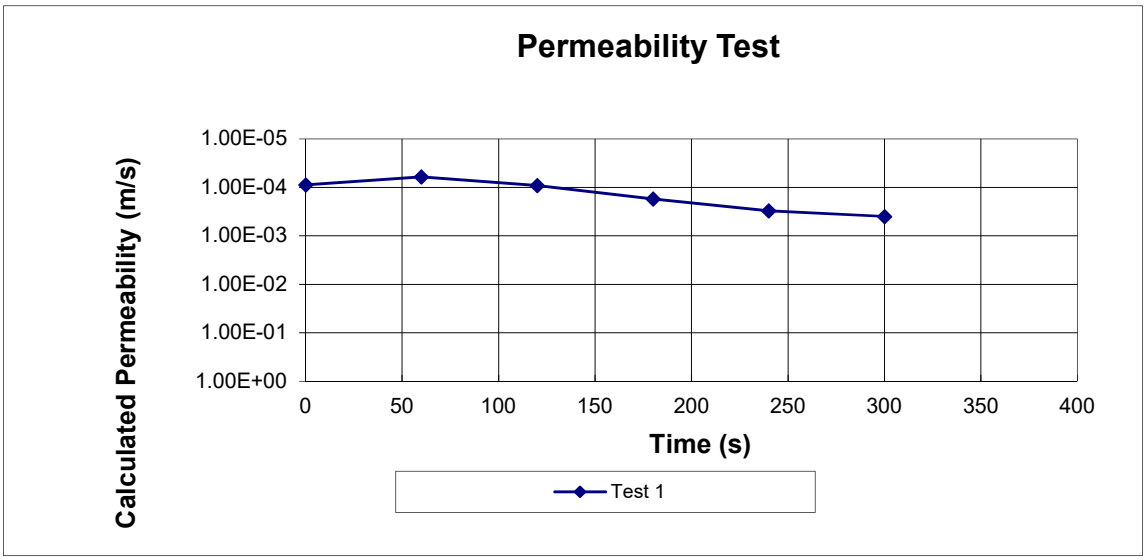
Project	Tweed Valley Hospital		
Project Number	Test 1	**Date**	3/08/2018
Test Location	BH22	**Tester**	BE

Depth of Hole	500	mm
Diameter of Hole	100	mm
Length of Test Section	400	mm

Date	Time	Time since start of test (t) (s)	Depth of water from Reference level (d) (mm)	Δt	Δd	Permeability (P) (m/s)
3/8/18	12:00:00	0	340	0	0	
	12:01:00	60	270	60	70	8.87E-05
	12:02:00	120	230	60	40	6.07E-05
	12:03:00	180	180	60	50	9.09E-05
	12:04:00	240	110	60	70	1.74E-04
	12:05:00	300	40	60	70	3.05E-04
	12:06:00	360	0	60	40	3.98E-04

Time for 25mm drop

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


Permeability Test
Calculated Permeability (m/s)
1.00E-05
1.00E-04
1.00E-03
1.00E-02
1.00E-01
1.00E+00
0
50
100
150
200
250
300
350
400
Time (s)
Test 1

PERMEABILITY - Percolation Test

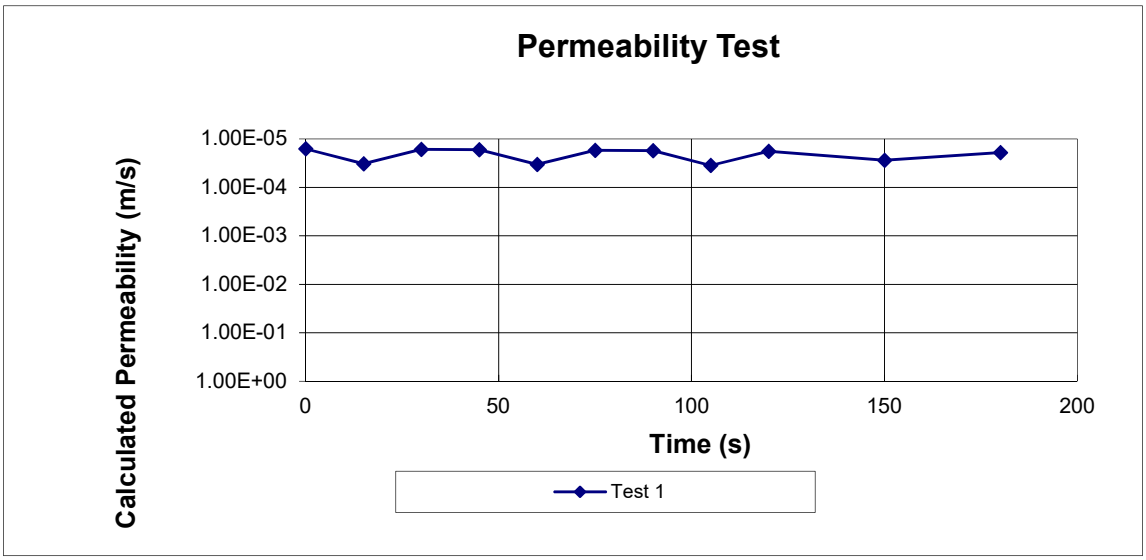
Project	Tweed Valley Hospital		
Project Number	Test 2	**Date**	24/10/2018
Test Location	BH22	**Tester**	CL

Depth of Hole	500	mm
Diameter of Hole	100	mm
Length of Test Section	400	mm

Date	Time	Time since start of test (t) (s)	Depth of water from Reference level (d) (mm)	Δt	Δd	Permeability (P) (m/s)
24/10/18	11:45:00	0	500	0	0	
	11:45:15	15	495	15	5	1.59E-05
	11:45:30	30	485	15	10	3.24E-05
	11:45:45	45	480	15	5	1.64E-05
	11:46:00	60	475	15	5	1.66E-05
	11:46:15	75	465	15	10	3.37E-05
	11:46:30	90	460	15	5	1.71E-05
	11:46:45	105	455	15	5	1.73E-05
	11:47:00	120	445	15	10	3.51E-05
	11:47:30	150	435	30	10	1.79E-05
	11:48:00	180	420	30	15	2.76E-05
	11:48:30	210	410	30	10	1.89E-05
	11:49:00	240	395	30	15	2.92E-05
	11:49:30	270	385	30	10	2.01E-05
	11:50:00	300	375	30	10	2.06E-05
	11:50:30	330	365	30	10	2.11E-05
	11:51:00	360	350	30	15	3.27E-05
	11:51:30	390	340	30	10	2.25E-05
	11:52:10	420	330	40	10	2.31E-05

Time for 25mm drop

Permeability (m/s)	2.3E-05
mm/hr	83.5


Permeability Test
Calculated Permeability (m/s)
1.00E-05
1.00E-04
1.00E-03
1.00E-02
1.00E-01
1.00E+00
0
50
100
150
200
Time (s)
Test 1

PERMEABILITY - Percolation Test

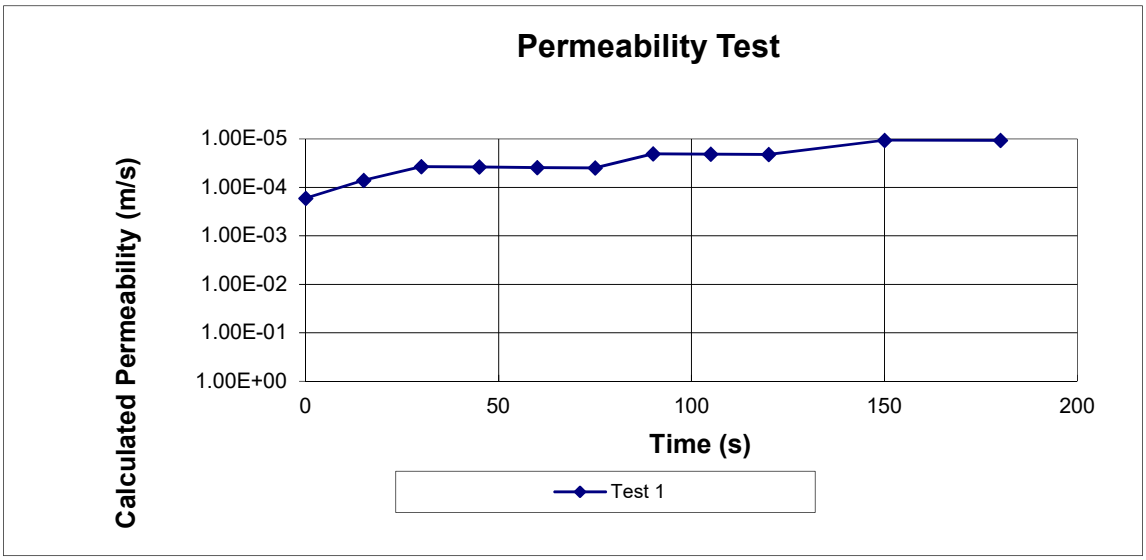
Project	Tweed Valley Hospital		
Project Number	Test 3	**Date**	24/10/2018
Test Location	BH22	**Tester**	CL

Depth of Hole	500	mm
Diameter of Hole	100	mm
Length of Test Section	400	mm

Date	Time	Time since start of test (t) (s)	Depth of water from Reference level (d) (mm)	Δt	Δd	Permeability (P) (m/s)
24/10/18	11:45:00	0	500	0	0	
	11:45:15	15	450	15	50	1.67E-04
	11:45:30	30	430	15	20	7.17E-05
	11:45:45	45	420	15	10	3.70E-05
	11:46:00	60	410	15	10	3.79E-05
	11:46:15	75	400	15	10	3.88E-05
	11:46:30	90	390	15	10	3.97E-05
	11:46:45	105	385	15	5	2.02E-05
	11:47:00	120	380	15	5	2.05E-05
	11:47:30	150	370	30	10	2.08E-05
	11:48:00	180	365	30	5	1.06E-05
	11:48:30	210	360	30	5	1.08E-05
	11:49:00	240	350	30	10	2.19E-05
	11:49:30	270	335	30	15	3.40E-05
	11:50:00	300	320	30	15	3.55E-05
	11:50:30	330	310	30	10	2.45E-05
	11:51:00	360	300	30	10	2.53E-05
	11:51:30	390	290	30	10	2.60E-05
	11:52:10	420	270	40	20	5.47E-05

Time for 25mm drop

Permeability (m/s)	4.1E-05
mm/hr	149.0


Permeability Test
Calculated Permeability (m/s)
1.00E-05
1.00E-04
1.00E-03
1.00E-02
1.00E-01
1.00E+00
0
50
100
150
200
Time (s)
Test 1

PERMEABILITY - Percolation Test

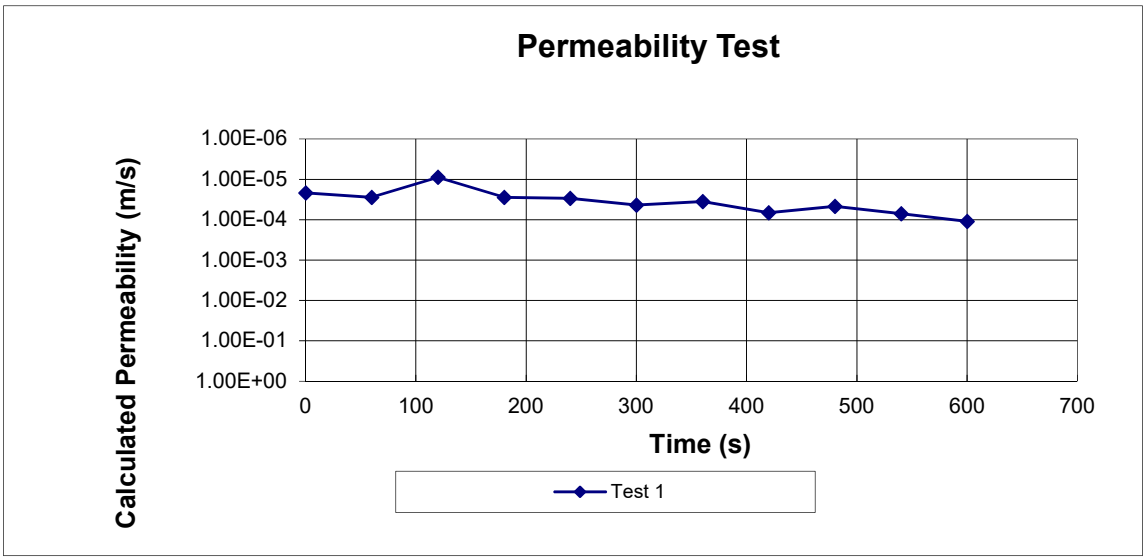
Project	Tweed Valley Hospital		
Project Number	Test 1	**Date**	3/08/2018
Test Location	BH23	**Tester**	BE

Depth of Hole	500	mm
Diameter of Hole	100	mm
Length of Test Section	400	mm

Date	Time	Time since start of test (t) (s)	Depth of water from Reference level (d) (mm)	Δt	Δd	Permeability (P) (m/s)
3/8/18	11:45:00	0	510	0	0	
	11:46:00	60	483	60	27	2.16E-05
	11:47:00	120	450	60	33	2.80E-05
	11:48:00	180	440	60	10	8.87E-06
	11:49:00	240	410	60	30	2.78E-05
	11:50:00	300	380	60	30	2.98E-05
	11:51:00	360	340	60	40	4.33E-05
	11:52:00	420	310	60	30	3.57E-05
	11:53:00	480	260	60	50	6.74E-05
	11:54:00	540	230	60	30	4.63E-05
	11:55:00	600	190	60	40	7.11E-05
	11:56:00	660	140	60	50	1.10E-04
	11:57:00	720	80	60	60	1.88E-04

Time for 25mm drop

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


Permeability Test
Calculated Permeability (m/s)
1.00E-06
1.00E-05
1.00E-04
1.00E-03
1.00E-02
1.00E-01
1.00E+00
0
100
200
300
400
500
600
700
Time (s)
Test 1

PERMEABILITY - Percolation Test

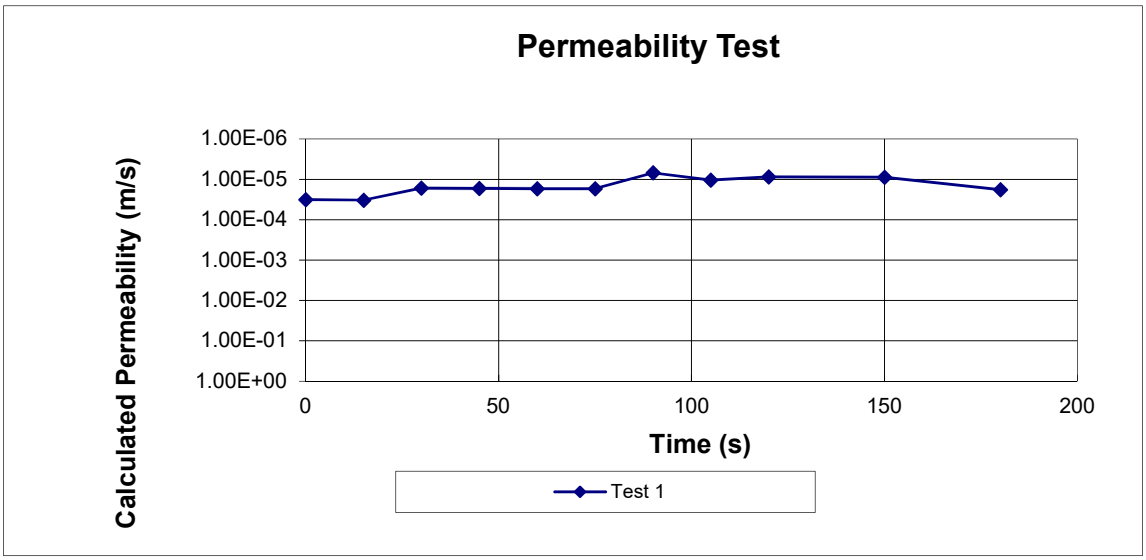
Project	Tweed Valley Hospital		
Project Number	Test 2	**Date**	24/10/2018
Test Location	BH23	**Tester**	CL

Depth of Hole	500	mm
Diameter of Hole	100	mm
Length of Test Section	400	mm

Date	Time	Time since start of test (t) (s)	Depth of water from Reference level (d) (mm)	Δt	Δd	Permeability (P) (m/s)
24/10/18	11:45:00	0	500	0	0	
	11:45:15	15	490	15	10	3.21E-05
	11:45:30	30	480	15	10	3.27E-05
	11:45:45	45	475	15	5	1.66E-05
	11:46:00	60	470	15	5	1.68E-05
	11:46:15	75	465	15	5	1.69E-05
	11:46:30	90	460	15	5	1.71E-05
	11:46:45	105	458	15	2	6.89E-06
	11:47:00	120	455	15	3	1.04E-05
	11:47:30	150	450	30	5	8.73E-06
	11:48:00	180	445	30	5	8.82E-06
	11:48:30	210	435	30	10	1.79E-05
	11:49:00	240	425	30	10	1.83E-05
	11:49:30	270	420	30	5	9.31E-06
	11:50:00	300	410	30	10	1.89E-05
	11:50:30	330	405	30	5	9.63E-06
	11:51:00	360	395	30	10	1.96E-05
	11:51:30	390	390	30	5	9.98E-06
	11:52:10	420	380	40	10	2.03E-05

Time for 25mm drop

Permeability (m/s)	1.7E-05
mm/hr	60.9


Permeability Test
Calculated Permeability (m/s)
1.00E-06
1.00E-05
1.00E-04
1.00E-03
1.00E-02
1.00E-01
1.00E+00
0
50
100
150
200
Time (s)
Test 1

PERMEABILITY - Percolation Test

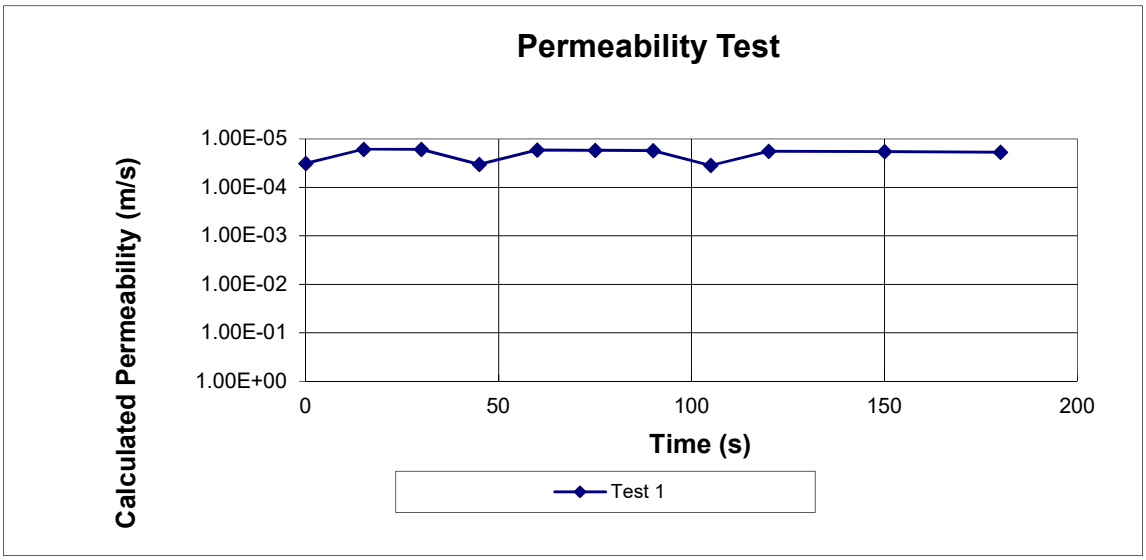
Project	Tweed Valley Hospital		
Project Number	Test 3	**Date**	24/10/2018
Test Location	BH23	**Tester**	CL

Depth of Hole	500	mm
Diameter of Hole	100	mm
Length of Test Section	400	mm

Date	Time	Time since start of test (t) (s)	Depth of water from Reference level (d) (mm)	Δt	Δd	Permeability (P) (m/s)
24/10/18	0:45:00	0	500	0	0	
	0:45:15	15	490	15	10	3.21E-05
	0:45:30	30	485	15	5	1.63E-05
	0:45:45	45	480	15	5	1.64E-05
	0:46:00	60	470	15	10	3.33E-05
	0:46:15	75	465	15	5	1.69E-05
	0:46:30	90	460	15	5	1.71E-05
	0:46:45	105	455	15	5	1.73E-05
	0:47:00	120	445	15	10	3.51E-05
	0:47:30	150	435	30	10	1.79E-05
	0:48:00	180	425	30	10	1.83E-05
	0:48:30	210	415	30	10	1.87E-05
	0:49:00	240	405	30	10	1.92E-05
	0:49:30	270	395	30	10	1.96E-05
	0:50:00	300	385	30	10	2.01E-05
	0:50:30	330	375	30	10	2.06E-05
	0:51:00	360	360	30	15	3.19E-05
	0:51:30	390	350	30	10	2.19E-05
	0:52:10	420	340	40	10	2.25E-05

Time for 25mm drop

Permeability (m/s)	2.2E-05
mm/hr	77.6

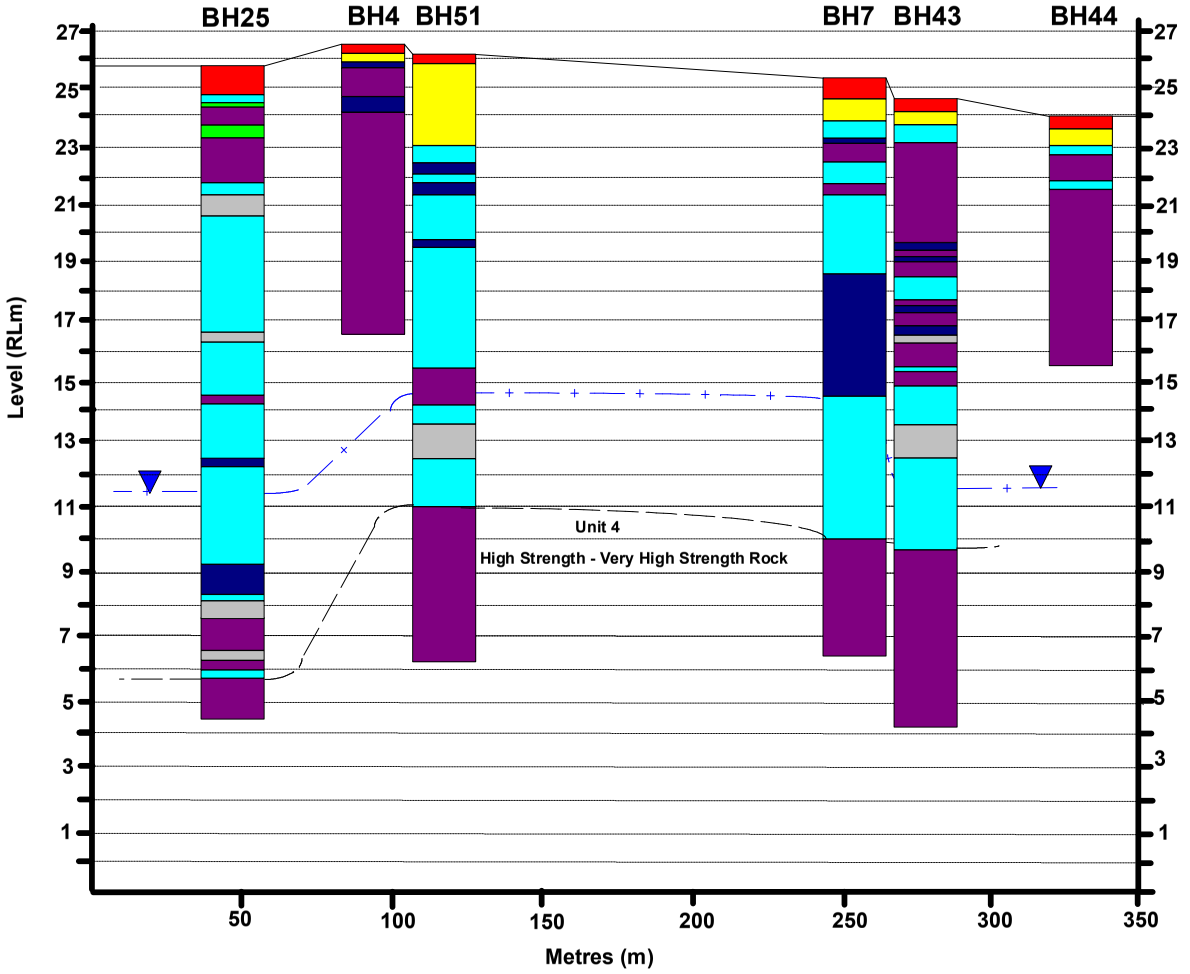

Permeability Test
Calculated Permeability (m/s)
1.00E-05
1.00E-04
1.00E-03
1.00E-02
1.00E-01
1.00E+00
0
50
100
150
200
Time (s)
Test 1

A P P E N D I X 'D'

CROSS SECTIONS OF BOREHOLES – SECTIONS A, B, C AND D)

INFERRED CROSS SECTION A

PROPOSED TWEED VALLEY HOSPITAL - CUDGEN ROAD, KINGSCLIFF



MORRISON GEOTECHNIC

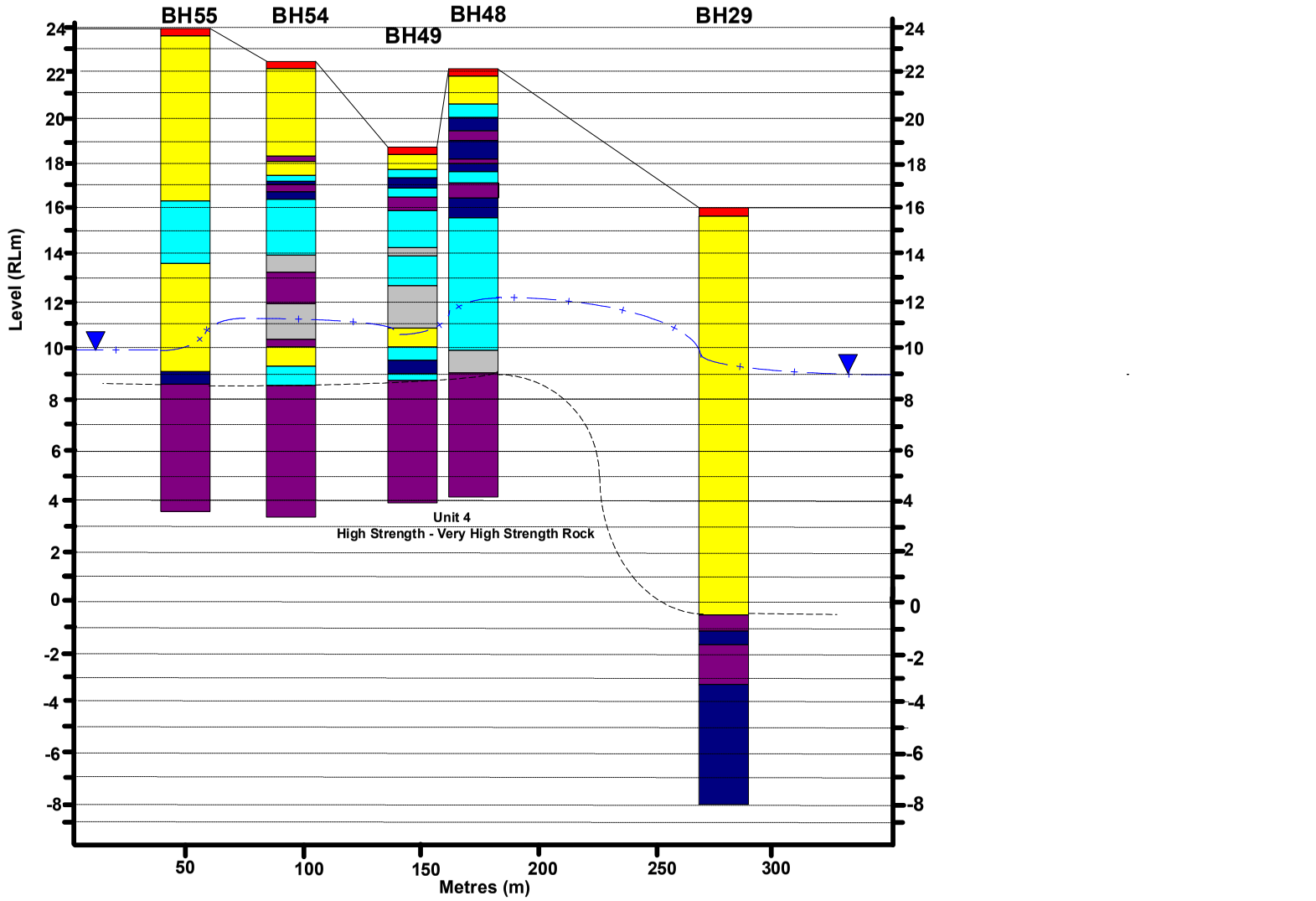
ABN: 51 009 878 899
Unit 1/5 Brendan Drive Nerang 4211 Ph: 5596 1599
Email: goldcoastlab@morrisongeo.com.au Fax: 5527 2027

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

Map Description :	**INFERRED CROSS SECTION A**		
Client :	**WOOD & GRIEVE ENGINEERS**		
Project :	**TWEED VALLEY HOSPITAL, KINGSCLIFF**		
Project No :	**GE18/144**	Date: **28/11/18**	Scale : Not to Scale

INFERRED CROSS SECTION B

PROPOSED TWEED VALLEY HOSPITAL - CUDGEN ROAD, KINGSCLIFF



MORRISON GEOTECHNIC

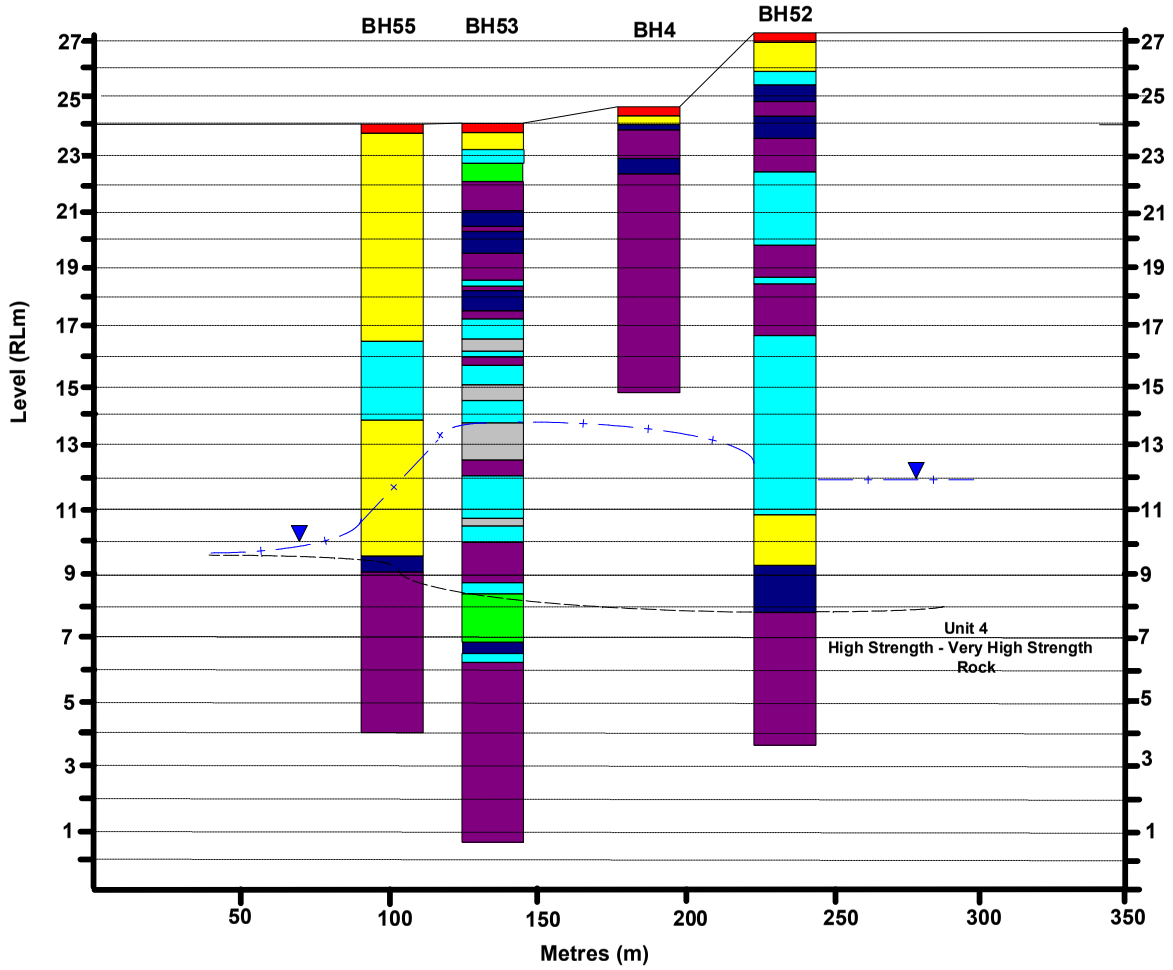
ABN: 51 009 878 899
Unit 1/5 Brendan Drive Nerang 4211 Ph: 5596 1599
Email: goldcoastlab@morrisongeo.com.au Fax: 5527 2027

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

Map Description :	**INFERRED CROSS SECTION A**		
Client :	**WOOD & GRIEVE ENGINEERS**		
Project :	**TWEED VALLEY HOSPITAL, KINGSCLIFF**		
Project No :	**GE18/144**	Date: **28/11/18**	Scale : Not to Scale

INFERRED CROSS SECTION C

PROPOSED TWEED VALLEY HOSPITAL - CUDGEN ROAD, KINGSCLIFF



MORRISON GEOTECHNIC

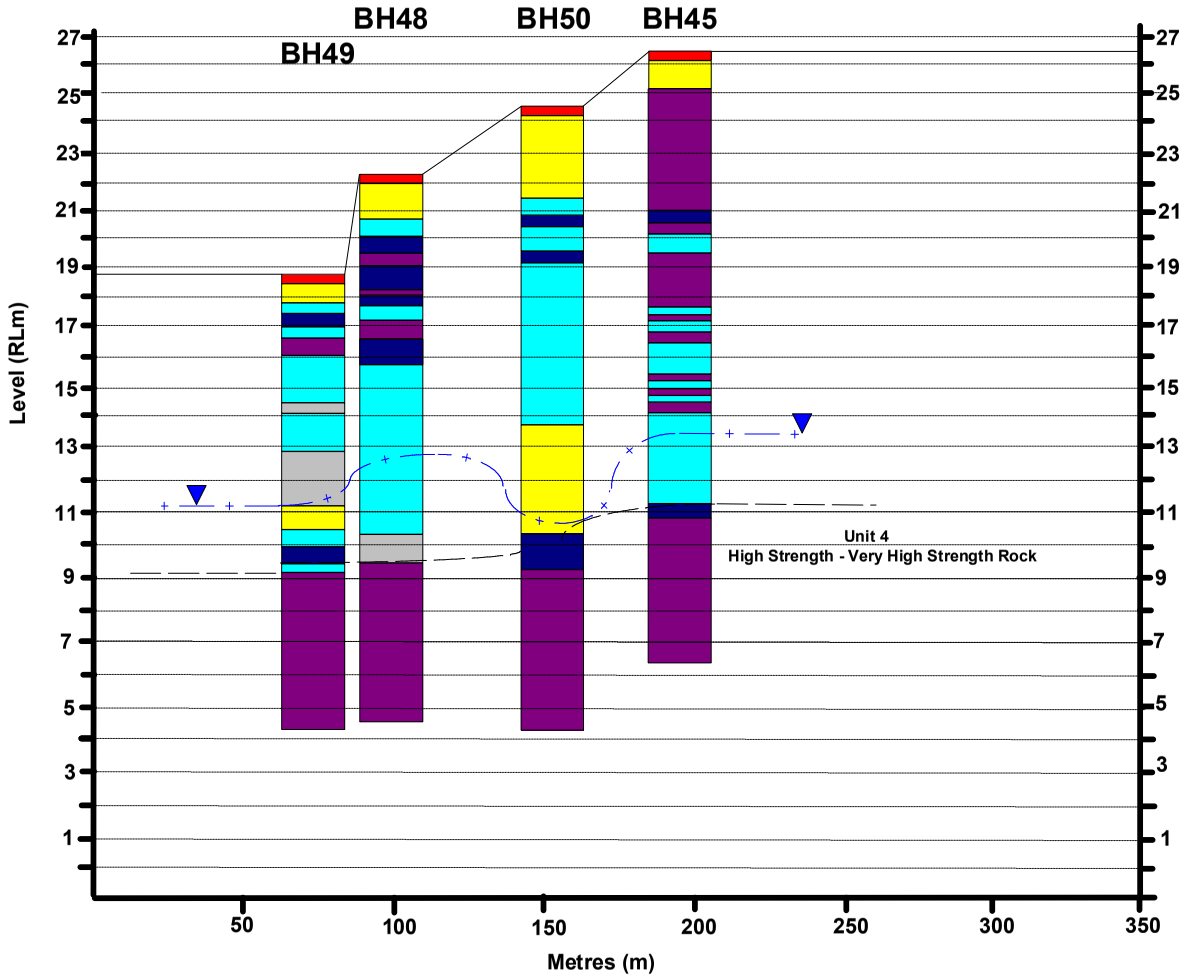
ABN: 51 009 878 899
Unit 1/5 Brendan Drive Nerang 4211 *Ph: 5596 1599*
Email: goldcoastlab@morrisongeo.com.au *Fax: 5527 2027*

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

Map Description :	**INFERRED CROSS SECTION C**		
Client :	**WOOD & GRIEVE ENGINEERS**		
Project :	**TWEED VALLEY HOSPITAL, KINGSCLIFF**		
Project No :	**GE18/144**	Date: **28/11/18**	Scale : Not to Scale

INFERRED CROSS SECTION D

PROPOSED TWEED VALLEY HOSPITAL - CUDGEN ROAD, KINGSCLIFF



Slopewash Silty Clay | Residual Silty Clay | Bedrock (XW/XW-DW) | Bedrock (DW) | Bedrock (DW-SW) | Bedrock (SW/SW-Fr) | Core Loss

MORRISON GEOTECHNIC

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

Map Description :	**INFERRED CROSS SECTION C**		
Client :	**WOOD & GRIEVE ENGINEERS**		
Project :	**TWEED VALLEY HOSPITAL, KINGSCLIFF**		
Project No :	**GE18/144**	Date: **28/11/18**	Scale : Not to Scale