Soil Surveys Engineering Pty. Limited
Specialist in Applied Geotechnics
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BOREHOLE RECORD SHEET

Location Number: BH 333
Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 22/02/2012

Easting: 502388 Northing: 6963165 RL: 21.96 m
Logger: BM / CB Operator: JB Machine: Scout

Depth	Description	Weathering	Rec (%)	RQD	Samples and Remarks
0.04	BITUMEN				
0.10	FILL Gravelly SAND (SP) Medium dense, fine to medium grained, yellow brown, fine to medium size gravel, moist.				
0.60	FILL Gravelly CLAY (CH) Stiff, high plasticity, red brown grey mottled, fine size gravel, moist.				
0.90	NATURAL CLAY (CH) Very stiff, high plasticity, red brown grey mottled, moist.				
1.0	Sandy CLAY (CL) Hard, low plasticity, yellow brown, fine to medium grained sand, moist.				
1.20	PHYLLITE (XW) Very weak, grey yellow brown.				SPT 22, 29, 30/130mm
2.0					
2.00	PHYLLITE, fine grained, grey mottled orange and light brown, non-intact, with some limonite staining.	XW			
2.90	CORE LOSS 1.70m (2.90-4.60)		35	0	
3.0					
4.0					
4.60	PHYLLITE, fine grained, light grey mottled orange and dark grey, foliated, fragmented, with some dark orange limonite staining, with 50mm thick extremely weak bands, with clay at 4.73m and 4.93m.	XW - DW	100	0	4.64 m; F, **12°,** P, S, O, W
5.0					4.86 m; J, **5°,** U, S, O, Z
5.00	PHYLLITE, fine grained, light grey mottled orange, dark grey and light brown, foliated, with closely spaced fractures, with trace quartz bands/lenses, with 50mm thick extremely weak bands, with clay at 5.50m, some light grey clay infill of defects.	DW	100	29	4.90 m; F, **30°,** P, S, O, C 5.05 m; F, **40°,** P, S, O, Z 5.10 m; F, **10°,** U, S, O, W
6.0			100	36	6.00-6.80 m; F, **25°,** P, S, O, C
7.0					
7.17	PHYLLITE, fine grained, grey mottled orange, green, dark grey and white, foliated, with closely spaced fractures, with trace quartz lenses.	DW - SW	91	31	7.24 m; J, **85°,** S, R, O, L 7.56 m; F, **20°,** P, S, O, Z 7.67 m; F, **35°,** S, R, O, L 7.73 m; F, **30°,** P, R, O, L
8.0					
8.00	PHYLLITE, fine grained, dark grey mottled orange, foliated, fragmented.	DW	100	17	
8.50	CORE LOSS 0.70m (8.50-9.20)				
9.0					
9.20	PHYLLITE, fine grained, dark grey with white and orange veins, foliated, with closely spaced fractures, with pygmatic folding.	DW - SW	68	34	
10.0		SW			

Drilling Method: TC, WB, RR, NMLC, Casing

Strength Estimated: RS, VW, W, MS, S, VS, ES
Defect Spacing: 20, 60, 200, 600

Comments:
1) Groundwater not observed. 2) ATV survey carried out.
3) Monitoring well installed to 12.5m on completion.

Water First Noted Water Steady Level

Defects - 1.54m : F,60°,P,R,O,C

Depth (m) | Type | Dip (deg) | Planarity | Roughness | Aperature | Infill

Type: B - Bedding, C - Clay seam, F - Foliation, H - Schistosity, J - Joint, L - Cleavage, R - Fracture, S - Shear zone, T - Contact, V - Vein, Z - Decomposed Zone, DI - Drilling Induced break

Planarity: C - Curvilinear, D - Discontinuous, P - Planar, S - Subplanar, T - Stepped, U - Undulating

Roughness: L - Slickensides, P - Polished, R - Rough, S - Smooth, V - Very rough

Aperature: C - Closed, F - Filled, N - Clean, O - Open, S - Stain

Infill: C - Clay, F - Iron Oxide, K - Calcite, L - Limonite, Q - Quartz, S- Secondary mineral, U - Unidentified mineral, W - Weathered rock, X - Carbonaceous, Z - Clean

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

Rock Strength
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

Samples
U50
SPT
Disturbed Sample

Approved:
Date:

SOIL SURVEYS 00 LIBRARY 2012-05.GLB Log SOIL SURVEY BOREHOLE LOG 111-12936 NEW.GPJ <<DrawingFile>> 21/05/2012 14:35 8.30.002 Developed by Datgel

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BOREHOLE RECORD SHEET

Location Number: BH 333

Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 22/02/2012

Easting: 502388 Northing: 6963165 RL: 21.96 m
Logger: BM / CB Operator: JB Machine: Scout

Depth	Description	Weathering	Rec (%)	RQD	Samples and Remarks
10.53	PHYLLITE, fine grained, dark grey with white and orange veins, foliated, with closely spaced fractures, with pygmatic folding. *(continued)*	SW	68	34	
	PHYLLITE, fine grained, dark grey with white veins, foliated, with closely spaced fractures, with pygmatic folding, with some quartz lenses/bands from 11.52m, some limonite infilling of defects, with some 10mm to 50mm thick quartz veins at 14.27m, 14.70m, 14.87m, 15.45m, 15.70m and 15.86m, with a weak weathered zone from 15.16m to 15.23m.		100	50	9.46-13.20 m; F, **35°,** P, S, O, Z
			100	0	13.27 m; F, **65°,** S, R, O, Z 13.33 m; F, **70°,** P, S, O, L 13.43 m; F, **50°,** C, R, O, L 13.53 m; F, **70°,** S, S, O, L 13.58 m; F, **60°,** S, R, O, L 13.65 m; F, **80°,** P, S, O, L 13.82 m; F, **70°,** S, S, O, Z
			100	47	14.00 m; F, P, S, O, Z 14.07 m; J, **15°,** U, R, O, L 14.37 m; F, **52°,** U, S, O, Z 14.65 m; J, **41°,** U, R, O, L 14.73 m; J, **50°,** P, S, O, C 14.90 m; F, **50°,** S, S, O, Z
16.80		SW - FR			
	PHYLLITE, fine grained, dark grey with white veins, foliated, with closely spaced fractures, with pygmatic folding, with some bands/lenses of quartz, some of the quartz is discoloured to a light brown.		100	43	16.60 m; F, **60°,** S, S, O, Z 18.40 m; J, **85°,** S, R, O, Z
19.00					
	PHYLLITE, fine grained, dark grey with white veins, foliated, with closely spaced fractures, with pygmatic folding, with trace (approximately 10mm thick) lenses/bands/inclusions of quartz.		92	33	19.00-20.00 m; F, **50°,** P, R, O, Z

Drilling Method: TC, WB, RR, NMLC, Casing

Comments:
1) Groundwater not observed. 2) ATV survey carried out.
3) Monitoring well installed to 12.5m on completion.

Water First Noted Water Steady Level

Defects - 1.54m : F,60°,P,R,O,C

Depth (m) | Type | Dip (deg) | Planarity | Roughness | Aperature | Infill

Type: B - Bedding; C - Clay seam; F - Foliation; H - Schistosity; J - Joint; L - Cleavage; R - Fracture; S - Shear zone; T - Contact; V - Vein; Z - Decomposed Zone; DI - Drilling Induced break

Planarity: C - Curvilinear; D - Discontinuous; P - Planar; S - Subplanar; T - Stepped; U - Undulating

Roughness: L - Slickensides; P - Polished; R - Rough; S - Smooth; V - Very rough

Aperature: C - Closed; F - Filled; N - Clean; O - Open; S - Stain

Infill: C - Clay; F - Iron Oxide; K - Calcite; L - Limonite; Q - Quartz; S- Secondary mineral; U - Unidentified mineral; W - Weathered rock; X - Carbonaceous; Z - Clean

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

Rock Strength
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

Samples
U50
SPT
Disturbed Sample

Approved:
Date:

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BOREHOLE RECORD SHEET

Location Number: BH 333
Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 22/02/2012

Easting: 502388 Northing: 6963165 RL: 21.96 m
Logger: BM / CB Operator: JB Machine: Scout

Drilling Method (TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	Weathering	Strength Estimated (RS/VW/W/MS/S/VS/ES)	Defect Spacing (20 60 200 600)	Rec (%)	RQD	Samples and Remarks
NMLC	20.70		PHYLLITE, fine grained, dark grey with white veins, foliated, with closely spaced fractures, with pygmatic folding, with trace (approximately 10mm thick) lenses/bands/inclusions of quartz. *(continued)*	SW - FR			92	33	
NMLC	21.00		PHYLLITE, fine grained, dark grey with white veins, foliated, fragmented, with closely spaced fractures, with pygmatic folding, with trace (approximately 10mm thick) lenses/bands/inclusions of quartz.				71	0	
NMLC	21.20		CORE LOSS 0.20m (21.00-21.20)	SW - FR					
NMLC	22.70		PHYLLITE, fine grained, dark grey with white veins, foliated, with closely spaced fractures, with pygmatic folding.				100	20	21.20-22.70 m; F, **35°,** P, S, O, Z
			BOREHOLE BH 333 TERMINATED AT 22.70 m						

Comments:
1) Groundwater not observed. 2) ATV survey carried out.
3) Monitoring well installed to 12.5m on completion.

Water First Noted Water Steady Level

Defects - 1.54m : F,60°,P,R,O,C
Depth (m) | Type: B - Bedding, C - Clay seam, F - Foliation, H - Schistosity, J - Joint, L - Cleavage, R - Fracture, S - Shear zone, T - Contact, V - Vein, Z - Decomposed Zone, DI - Drilling Induced break | Dip (deg) | Planarity: C - Curvilinear, D - Discontinuous, P - Planar, S - Subplanar, T - Stepped, U - Undulating | Roughness: L - Slickensides, P - Polished, R - Rough, S - Smooth, V - Very rough | Aperature: C - Closed, F - Filled, N - Clean, O - Open, S - Stain | Infill: C - Clay, F - Iron Oxide, K - Calcite, L - Limonite, Q - Quartz, S- Secondary mineral, U - Unidentified mineral, W - Weathered rock, X - Carbonaceous, Z - Clean

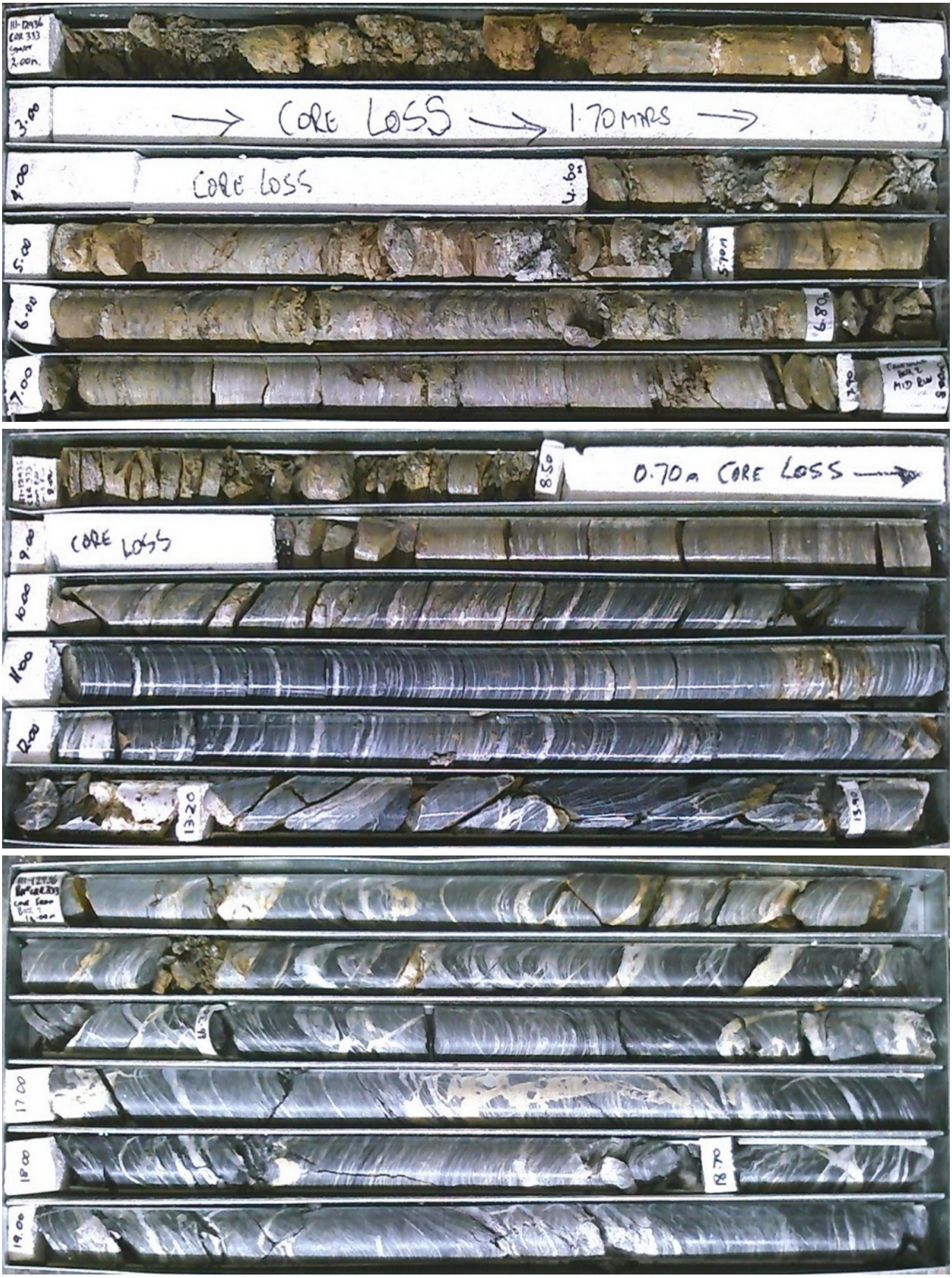
Weathering Grades
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

Rock Strength
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

Samples
U50
SPT
Disturbed Sample

Approved:
Date:

SOIL_SURVEYS_00 LIBRARY 2012-05.GLB Log SOIL SURVEY BOREHOLE LOG 111-12936 NEW.GPJ <<DrawingFile>> 21/05/2012 14:35 8.30.002 Developed by Datgel



SOIL SURVEYS

TITLE	AECOM Brisbane Cross River Rail Core Photo - BH 333	DRAWN: DT	DATE: 26/04/2012
		CHECKED: CB	DATE: 26/04/2012
		SCALE: Not To Scale	A4
		PROJECT No: 110-12936	FIGURE No: 1/1

SOIL_SURVEYS_00 LIBRARY.GLB GrfcTbl DG PHOTO CORE PHOTO 4 PER PAGE 111-12936 NEW.GPJ <<DrawingFile>> 26/04/2012 14:48 8.2.856 Developed by Datgel

COMPOSITE LOG

BOREHOLE TELEVIEWER LOGS AND STRUCTURES

Hole Name	CRR333	**Drill Depth**	22m	**Grid Name**	N/A	**Logging Unit**	SV031
Field	Brisbane City	**Bit Size**	76mm	**Collar Easting**	N/A	**Engineer**	J.Mackay
Log Date	8th Mar,2012	**Casing Type**	PVC	**Collar Northing**	N/A	**Client Represent**	Julian Irons
Location	QLD	**Casing Depth**	N/A	**Reduced Level**	N/A	**Service Type**	Televiewer

TELEVIEWER LOGS

MF	Mag Field
GR	Gamma
INC	Tool Inclination (0 = Vertical Down)
AZIM	Tool Azimuth
TT	Travel Time Image
AMP	Amplitude Image
AMP - DYN1	Amplitude Image Dynamic 1

STRUCTURAL LOGS

DIPA	Structures Apparent (Sinusoid Presentation)
DIPT	Structures True (Tadpole Presentation)
PP - DIP	Polar Projection Dip (Schmidt)
RD - AZIM	Rose Diagram - Azimuth
CS	Cross Section

PROCESSED LOGS

CALI - ATV	Calliper Average from ATV	**RHI**	Rock Hardness Index

TADPOLES

- **Open Fracture**
- **Partially Open Fracture**
- **Closed Fracture**
- **Foliation/Banding/Bedding**

COMMENTS

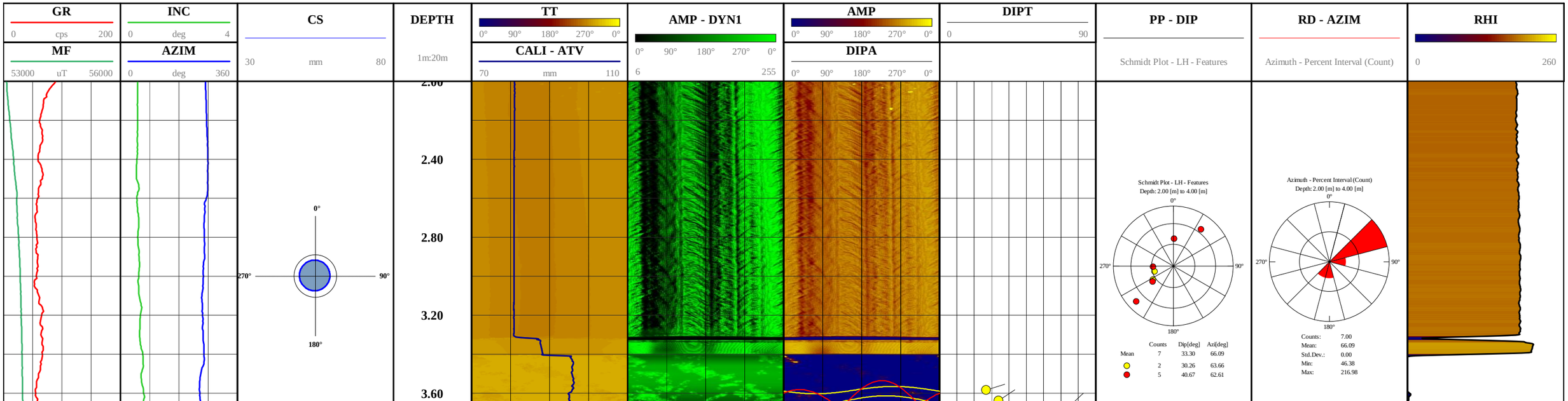
Image data is presented oriented to True North.

Magnetic Declination = 10.97 deg

Cross Sections are plotted at 2m intervals: White : Tool Position, Light Blue : Nominal Hole Size and Blue : Actual Hole Size

IMPORTANT NOTE

The following interpretations are opinions based upon inferences from borehole logs,
Surtron Technologies (Australia) Pty Ltd cannot and does not guarantee the correctness or accuracy of any interpretations.
Therefore Surtron Technologies (Australia) Pty Ltd shall not be liable or responsible for any loss, damage, cost or expense incurred or sustained by anyone resulting from any interpretations.



4.00
4.40
4.80
5.20
5.60
6.00
6.40
6.80
7.20
7.60
8.00
8.40
8.80
9.20

0°
270°
90°
180°

Schmidt Plot - LH - Features
Depth: 4.00 [m] to 6.00 [m]

	Counts	Dip[deg]	Azi[deg]
Mean	42	45.68	62.06
	5	55.84	61.04
	36	44.93	61.72
	1	33.47	78.81

Azimuth - Percent Interval (Count)
Depth: 4.00 [m] to 6.00 [m]

Counts:	42.00
Mean:	62.06
Std.Dev.:	0.00
Min:	27.23
Max:	297.98

Schmidt Plot - LH - Features
Depth: 6.00 [m] to 8.00 [m]

	Counts	Dip[deg]	Azi[deg]
Mean	32	48.46	61.41
	26	46.16	61.58
	1	77.66	243.03
	3	69.52	61.96
	2	38.53	55.38

Azimuth - Percent Interval (Count)
Depth: 6.00 [m] to 8.00 [m]

Counts:	32.00
Mean:	61.41
Std.Dev.:	0.00
Min:	44.77
Max:	262.99

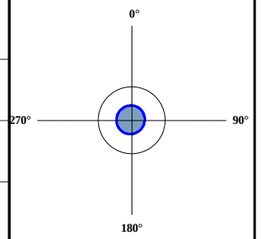
Schmidt Plot - LH - Features
Depth: 8.00 [m] to 10.00 [m]

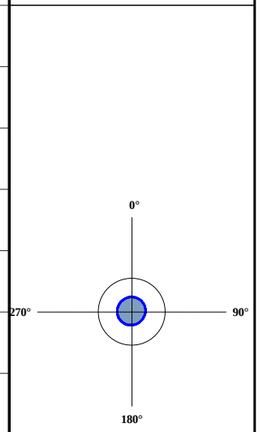
	Counts	Dip[deg]	Azi[deg]
Mean	23	32.34	54.17
	3	35.19	59.09
	17	30.66	52.25
	2	84.92	240.47
	1	29.49	41.60

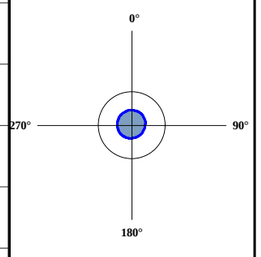
Azimuth - Percent Interval (Count)
Depth: 8.00 [m] to 10.00 [m]

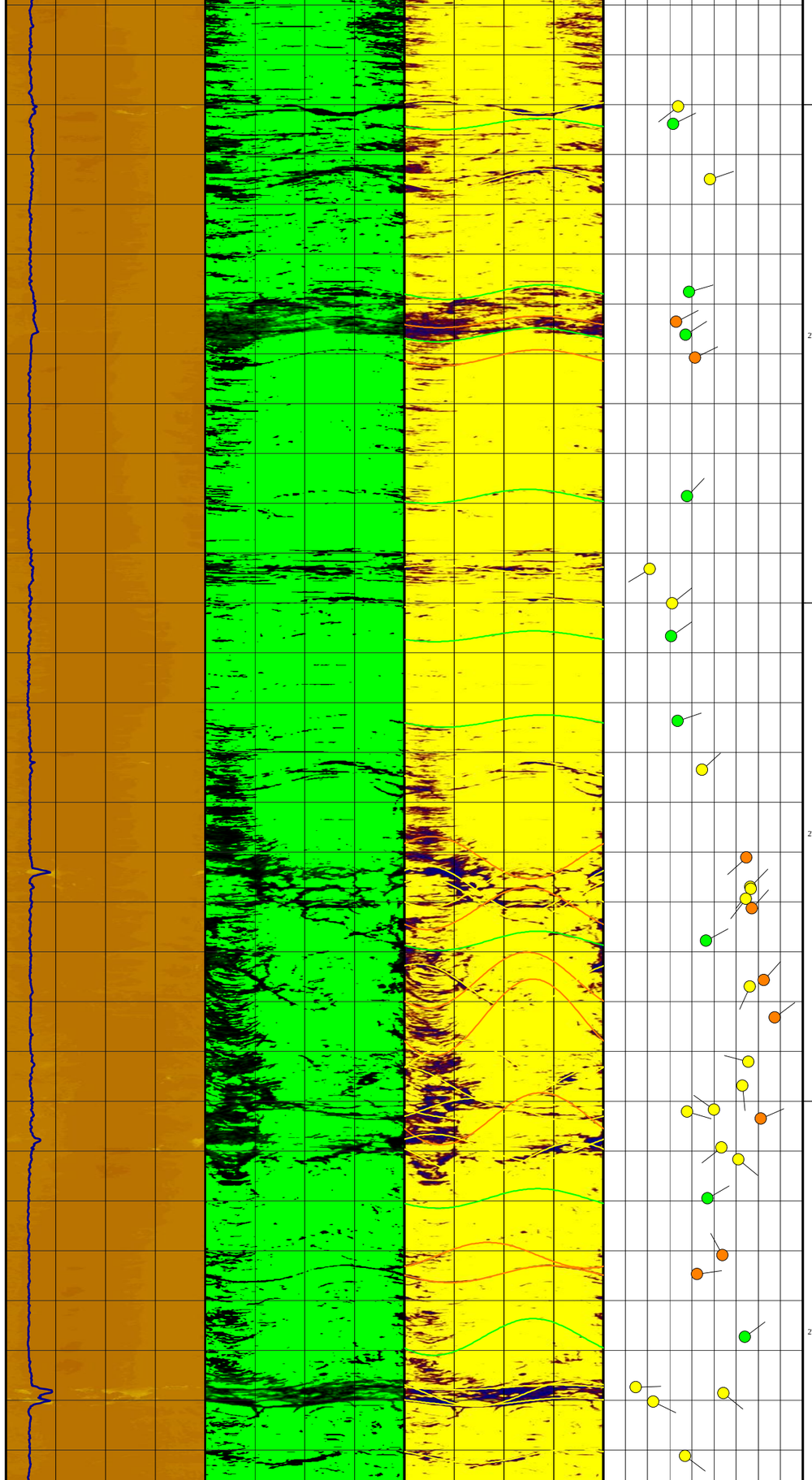
Counts:	23.00
Mean:	54.17
Std.Dev.:	0.00
Min:	13.02
Max:	310.39

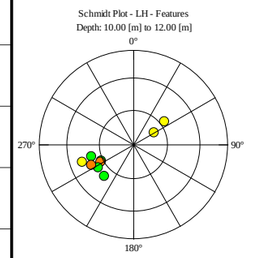
9.60
10.00
10.40
10.80
11.20
11.60
12.00
12.40
12.80
13.20
13.60
14.00
14.40
14.80
15.20



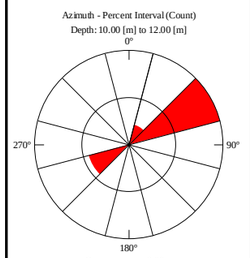




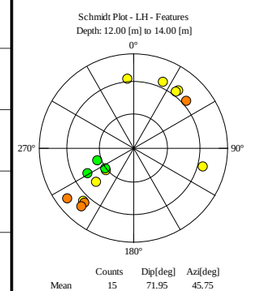




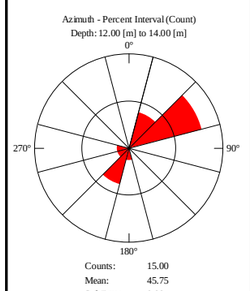
	Counts	Dip[deg]	Azi[deg]
Mean	9	30.46	63.42
	3	15.59	225.68
	4	35.82	59.55
	2	37.24	63.08



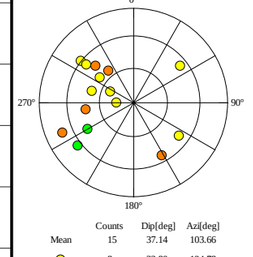
Counts:	9.00
Mean:	63.42
Std.Dev.:	0.00
Min:	43.31
Max:	238.67



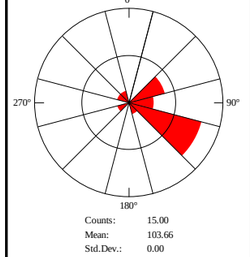
	Counts	Dip[deg]	Azi[deg]
Mean	15	71.95	45.75
	8	83.23	216.10
	3	36.77	62.35
	4	81.41	46.18



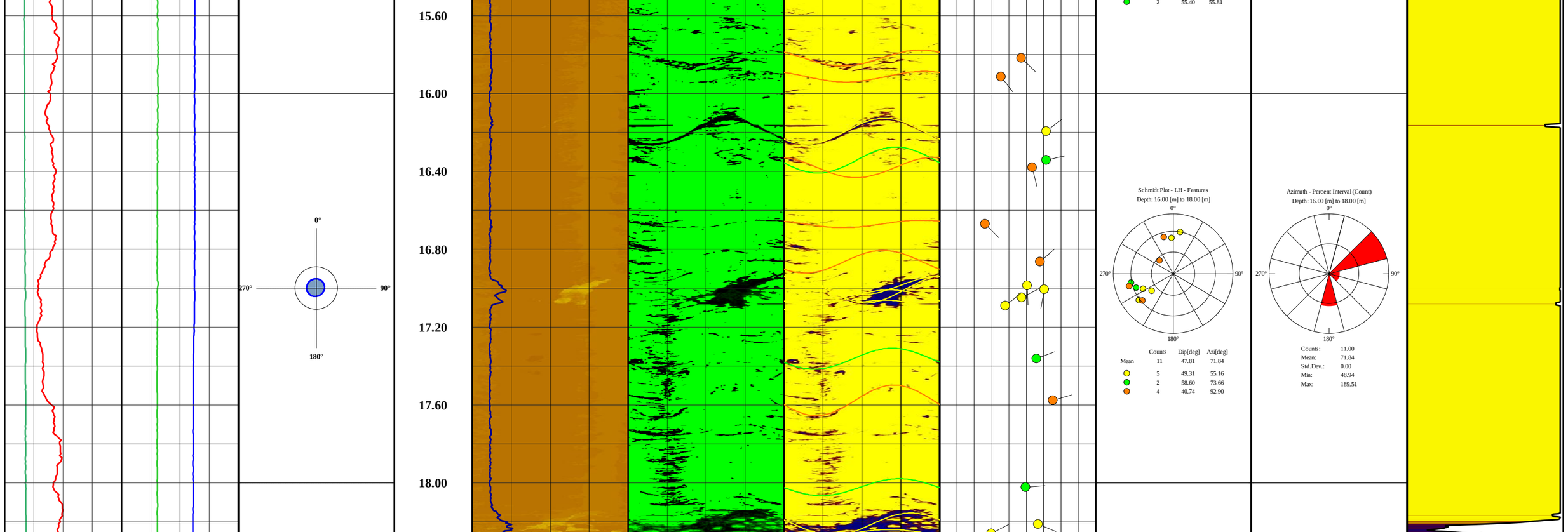
Counts:	15.00
Mean:	45.75
Std.Dev.:	0.00
Min:	41.87
Max:	284.84



	Counts	Dip[deg]	Azi[deg]
Mean	15	37.14	103.66
	8	33.80	124.78
	5	41.85	102.05



Counts:	15.00
Mean:	103.66
Std.Dev.:	0.00
Min:	52.46
Max:	331.75



MF	AZIM	CS	DEPTH	CALI - ATV	AMP - DYN1	DIPA		PP - DIP	RD - AZIM	RHI
53000 uT 56000	0 deg 360			70 mm 110	0° 90° 180° 270° 0°	0° 90° 180° 270° 0°				
GR	INC			TT		AMP	DIPT			
0 cps 200	0 deg 4	30 mm 80	1m:20m	0° 90° 180° 270° 0°	6 255	0° 90° 180° 270° 0°	0 90	Schmidt Plot - LH - Features	Azimuth - Percent Interval (Count)	0 260

IN-SITU PACKER PERMEABILITY TEST RESULT

PROJECT: CRR
PROJECT No.: 110-12936
BH No.: 333
Test No.: 1
Date: 24/02/2012

Packer type: Double
Packer pressure: 3000kPa
Gauge pressures measured in: kPa
Tested by: CB

Vertical depth to:

Top of test section (m):	15.00
Base of test section (m):	16.50
Centre of test section(m):	15.75
Base of casing (m):	14.00
Ground water (m)	NR

Depth of centre of test section (m)	15.75
Length of test section (m):	1.50

Gauge Height above ground level	0.00
Hole Diameter in test section (mm	75

1st period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2590.0	2604.4	2604.5	2604.6	Flow (l/min)
100	Water Take	0.00	14.40	0.10	0.10	0.973
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2632.0	2699.0	2777.6	2856.0	Flow (l/min)
200	Water Take	0.00	67.00	78.60	78.40	14.933
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2892.0	3011.0	3107.0	3207.0	Flow (l/min)
300	Water Take	0.00	119.00	96.00	100.00	21.000
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	3269.0	3350.0	3437.0	3514.0	Flow (l/min)
200	Water Take	0.00	81.00	87.00	77.00	16.333
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	3524.0	3579.0	3625.5	3677.0	Flow (l/min)
100	Water Take	0.00	55.00	46.50	51.50	10.200

Period	Flow (q) (l/min)	Gauge Press (kPa)	Gauge Press (m of water)	Friction Loss (m)*		Total Head (m)	Lugeon Value	Perm. (m/s)
				Basic	In extra rods			
1st	0.973	100.00	10.220	0.000	0.000	25.970	2.552	2.44E-07
2nd	14.933	200.00	20.440	0.000	0.000	36.190	28.102	2.69E-06
3rd	21.000	300.00	30.660	0.000	0.000	46.410	30.816	2.95E-06
4th	16.333	200.00	20.440	0.000	0.000	36.190	30.737	2.94E-06
5th	10.200	100.00	10.220	0.000	0.000	25.970	26.748	2.56E-06

*Where friction loss is assumed to be negligible.

N.B. Pressure Conversion: 1 bar = 100 kPa = 14.503 psi

Note - Possible flowmeter jammed in period 1

SOIL SURVEYS ENGINEERING

IN-SITU PACKER PERMEABILITY TEST RESULT

PROJECT: CRR
PROJECT No.: 110-12936
BH No.: 333
Test No.: 2
Date: 24/02/2012

Packer type: Double
Packer pressure: 3000kPa
Gauge pressures measured in: kPa
Tested by: CB

Vertical depth to:

Top of test section (m):	10.50
Base of test section (m):	12.00
Centre of test section(m):	11.25
Base of casing (m):	9.50
Ground water (m)	NR

Depth of centre of test section (m)	11.25
Length of test section (m):	1.50

Gauge Height above ground level	0.00
Hole Diameter in test section (mm	75

1st period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	3679.0	3682.8	3686.0	3689.2	Flow (l/min)
100	Water Take	0.00	3.80	3.20	3.20	0.680
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	3691.0	3695.0	3698.0	3701.6	Flow (l/min)
200	Water Take	0.00	4.00	3.00	3.60	0.707
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	3703.0	3710.0	3719.6	3739.8	Flow (l/min)
400	Water Take	0.00	7.00	9.60	20.20	2.453
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	3733.0	3740.5	3742.7	3752.0	Flow (l/min)
200	Water Take	0.00	7.50	2.20	9.30	1.267
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	3753.0	3757.0	3761.7	3765.7	Flow (l/min)
100	Water Take	0.00	4.00	4.70	4.00	0.847

Period	Flow (q) (l/min)	Gauge Press (kPa)	Gauge Press (m of water)	Friction Loss (m)*		Total Head (m)	Lugeon Value	Perm. (m/s)
				Basic	In extra rods			
1st	0.680	100.00	10.220	0.000	0.000	21.470	2.157	2.06E-07
2nd	0.707	200.00	20.440	0.000	0.000	31.690	1.519	1.45E-07
3rd	2.453	400.00	40.880	0.000	0.000	52.130	3.205	3.07E-07
4th	1.267	200.00	20.440	0.000	0.000	31.690	2.722	2.60E-07
5th	0.847	100.00	10.220	0.000	0.000	21.470	2.686	2.57E-07

*Where friction loss is assumed to be negligible.

N.B. Pressure Conversion: 1 bar = 100 kPa = 14.503 psi

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