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**BOREHOLE RECORD SHEET**

**Location Number: BH 310**

**Project Number: 110-12936**

**Project Name: Cross River Rail**

**Location: Brisbane**

**Client: AECOM**

**Date: 19/12/2011**

**Page: 1 OF 5**

Easting: 503217      Northing: 6961004      RL: -10.52 m  
Logger: DA/CB      Operator: DA      Machine: Scout 2

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NM/LC									
				1.0		Silty CLAY (CH) Very soft, high plasticity, dark grey.						
				2.0								
				2.40								
				3.0		SAND (SP) Medium dense, fine to coarse grained, grey and brown.						
				4.0								
				4.80								
				5.0		Clayey SAND (SC) Loose, fine to medium grained, dark grey, high plasticity fines, some organics.						
				5.60								
				6.0		Gravelly SAND (SP) Medium dense, fine to coarse grained, grey and brown, fine to medium size gravel.						
				7.0								
				8.0								
				9.0								
				10.0								

**Comments:**

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NM/LC. 3) Borehole grouted on completion.

Water First Noted      Water Steady Level

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

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 310

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 19/12/2011

Page: 2 OF 5

Easting: 503217 Northing: 6961004 RL: -10.52 m  
Logger: DA/CB Operator: DA Machine: Scout 2

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NM/LC									
				11.0		Gravelly SAND (SP) Medium dense, fine to coarse grained, grey and brown, fine to medium size gravel. (continued)						
				12.0								
				12.50								
				13.0		Sandy GRAVEL (GP) Medium dense, fine to coarse size, grey and brown, fine to coarse grained sand.						
				14.0								
				15.0								
				15.20								
				16.0		Sandy GRAVEL (GP) Medium dense, fine to coarse size, grey and brown, fine to coarse grained sand, with some cobbles.						
				17.0								
				18.0								
				18.10								
				19.0		TUFF (DW) Moderately strong, yellow brown, highly fractured, with Clayey Sand bands.						
				20.0								

### Comments:

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NM/LC. 3) Borehole grouted on completion.

Water First Noted Water Steady Level

### Defects - 1.54m : F,60° P,R,O,C

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

### 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 310

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 19/12/2011

Easting: 503217

Northing: 6961004

RL: -10.52 m

Logger: DA/CB

Operator: DA

Machine: Scout 2

Page: 3 OF 5

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NMLC									
				20.40	x x x	TUFF (DW) Moderately strong, yellow brown, highly fractured, with Clayey Sand bands. (continued)						
				21.0	x x x	MUDSTONE (DW) Weak, dark grey.						
				21.10								
				22.0	o o o	CONGLOMERATE, coarse grained, grey, granular, massively bedded, moderately widely spaced fractures. Clasts are coarse sand to medium gravel size, subangular to sub-rounded of siltstone, sandstone and quartz. Clast supported.	SW - FR			97	72	21.25 m; DI, 20°, T, R, O, W 21.34 m; J, 35°, U, R, O, W 21.44 m; J, 50°, P, V, O, Z
				22.26	o o o	CONGLOMERATE, coarse grained, grey, granular, massively bedded, moderately widely spaced fractures. Clasts are coarse sand to medium gravel size, subangular and sub-rounded of siltstone, sandstone and quartz. Clast supported, with some coarse size gravel.	FR					21.77 m; DI, 10°, U, R, O, Z
				23.0	o o o	CONGLOMERATE, coarse grained, light brown with grey, dark grey and white clasts, granular, massively bedded, widely spaced fractures. Clasts are fine to coarse sized gravel, subangular to sub-rounded of siltstone, sandstone and quartz. Clast supported.						22.57m, Is50 = 0.86 MPa
				23.20	o o o							23.09m, Is50 = 1.4 MPa
				24.0	o o o					98	87	23.62 m; J, 20°, C, R, O, Z 24.07m, Is50 = 1.37 MPa 24.17 m; J, 15°, P, S, O, Z 24.44 m; DI, 20°, T, R, O, Z
				25.0	o o o							25.30 m; DI, 30°, P, R, O, Z 25.53m, Is50 = 1.93 MPa
				25.54	o o o	Interlaminated SILTSTONE and SANDSTONE, fine grained, alternating pale light grey and dark grey, sandstone is granular, fine grained, thinly laminated, very closely spaced to moderately widely spaced fractures.						25.54-25.64 m; B, 10°, P, S, O, Z 25.78m, Is50 = 0.3 MPa 25.90 m; DI, 25°, P, S, O, Z
				26.0	o o o							26.08 m; J, 80°, P, S, O, Z 26.10 m; DI, 10°, P, R, O, Z 26.24 m; B, 15°, P, S, O, Z 26.36m, Is50 = 0.73 MPa 26.28 m; B, 25°, P, R, O, Z 26.53 m; DI, 25°, P, R, O, Z 26.63 m; DI, 3°, P, R, O, Z
				26.95	o o o	SILTSTONE, fine grained, dark grey, laminated, moderately widely spaced fractures, with some thinly laminated bands of pale grey, fine grained sandstone.				99	82	26.96 m; B, 10°, P, R, O, Z
				27.0	o o o							27.52m, Is50 = 1.62 MPa 27.46 m; B, 15°, P, R, O, Z
				27.75	o o o	Interlaminated SILTSTONE and SANDSTONE, fine grained, alternating pale light grey and dark grey, sandstone is granular, fine grained, thinly laminated, very closely spaced to moderately widely spaced fractures.						27.72 m; B, 30°, P, R, O, Z
				27.90	o o o							28.33 m; B, 20°, P, R, O, C
				28.0	o o o	SILTSTONE, fine grained, dark grey, laminated, moderately widely spaced fractures, with some thinly laminated bands of pale grey, fine grained sandstone.						28.59 m; J, 80°, P, R, O, U 28.77 m; B, 20°, S, S, O, Z 28.88m, Is50 = 0.32 MPa 28.81 m; B, 20°, S, S, O, Z 28.85 m; V, 5°, P, C, K 28.86 m; V, 5°, P, C, K
				29.0	o o o					99	94	29.54 m; B, 15°, P, S, O, Z
				30.0	o o o							29.90 m; B, 20°, P, R, O, Z

### Comments:

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NMLC. 3) Borehole grouted on completion.

Water First Noted Water Steady Level

### Defects - 1.54m : F, 60°, P, R, O, C

Depth (m)	Type	Size (mm)	Planarity	Roughness	Aperture	Notes
	B - Bedding		C - Curvilinear	D - Discontinuous	P - Polished	F - Filled
	C - Clay seam		F - Foliation	P - Planar	R - Rough	N - Clean
	H - Schistosity		J - Joint	L - Cleavage	R - Fracture	S - Shear zone
	T - Contact		V - Vein	Z - Decomposed Zone	DI - Drilling induced break	

### 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 310

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 19/12/2011

Page: 4 OF 5

Easting: 503217 Northing: 6961004 RL: -10.52 m  
Logger: DA/CB Operator: DA Machine: Scout 2

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NM/LC									
				31.0		SILTSTONE, fine grained, dark grey, laminated, moderately widely spaced fractures, with some thinly laminated bands of pale grey, fine grained sandstone. (continued)	FR			99	94	30.74m, Is50 = 0.99 MPa 30.67 m; B, 15°, P, S, O, Z 30.79 m; DI, 12°, S, R, O, Z
				31.77		SILTSTONE, fine grained, dark grey, laminated, with very closely spaced fractures, with some thinly laminated bands of pale grey, fine grained sandstone.  SILTSTONE, fine grained, dark grey, laminated, closely spaced fractures, with some thinly laminated bands of pale grey, fine grained sandstone.						31.69m, Is50 = 1.54 MPa
				32.0								31.77-32.22 m; B, 10°, P, R, O, Z
				32.23								32.36 m; B, 10°, S, S, O, Z 32.50 m; B, 10°, P, R, O, Z 32.52 m; B, 10°, P, R, O, Z
				33.0								32.81 m; B, 20°, P, S, O, Z 33.21m, Is50 = 1.52 MPa
				34.0		SILTSTONE, fine grained, dark grey with pale light grey banding, laminated, moderately widely spaced fractures.						33.54 m; B, 15°, P, S, O, Z
				34.00								34.42 m; B, 10°, S, R, O, Z
				35.0								35.11 m; B, 5°, P, S, O, Z 35.22m, Is50 = 0.62 MPa 35.13 m; B, 15°, P, R, O, Z 35.42 m; B, 18°, S, S, O, Z
				36.0								35.77 m; B, 4°, P, S, O, Z 35.78 m; DI, 2°, P, S, O, Z
				36.70		SILTSTONE, fine grained, dark grey with pale light grey banding, laminated, fragmented.						36.15 m; DI, 20°, S, S, O, Z 36.27 m; B, 10°, S, R, O, Z 36.4m, Is50 = 0.86 MPa
				36.90								36.50 m; DI, 5°, P, S, O, Z
				37.0		SILTSTONE, fine grained, dark grey with pale light grey banding, laminated, with closely spaced fractures.						37.20 m; B, 30°, P, R, O, Z 37.35 m; J, 75°, P, O
				37.73								37.49 m; B, 30°, P, S, O, C
				38.0		Interlaminated SILTSTONE and SANDSTONE, fine grained, grey, sandstone is granular, fine grained, laminated, closely spaced fractures, with thin clay infill from 37.49m to 37.73m.						37.79 m; DI, 5°, P, R, O, Z 38.10 m; J, 22°, S, R, O, Z 38.29m, Is50 = 0.5 MPa
				38.46								38.44 m; J, 60°, P, S, O, Z 38.46 m; J, 50°, U, R, O, Z 38.66m, Is50 = 0.76 MPa
				38.59		QUARTZITE, fine grained, light grey and white, cryptocrystalline.						38.60 m; J, 42°, P, R, O, Z 38.76 m; J, 40°, P, S, O, Z
				39.0		CONGLOMERATE, coarse grained, grey with dark grey, light grey, white and pale light grey clasts, granular, massively bedded, moderately widely spaced fractures, clasts are medium to coarse sized sub-rounded gravel of siltstone, phyllite, sandstone and quartz. Clast supported.						39.14 m; DI, 5°, U, R, O, Z 39.28m, Is50 = 1.11 MPa
				40.0								39.52 m; J, 50°, T, S, O, Z 39.66 m; J, 20°, P, R, O, Z
												39.83 m; J, 60°, U, R, O, Z

### Comments:

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NM/LC. 3) Borehole grouted on completion.

Water First Noted Water Steady Level

### Defects - 1.54m : F, 60° P, R, O, C

Depth (m)	Type	Defect	Remarks
31.0	B	Bedding	
31.77	C	Clay seam	
32.0	F	Foliation	
32.23	H	Schistosity	
32.50	J	Joint	
32.52	L	Crack	
32.81	R	Fracture	
33.21	S	Shear zone	
33.54	T	Contact	
34.42	V	Vein	
35.11	Z	Decomposed zone	
35.22	DI	Drilling induced break	

### Weathering Grades

RS - Residual Soil	FR - Fresh
XW - Extremely weathered	W - Weak
DW - Distinctly weathered	MS - Medium strong
SW - Slightly weathered	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 310

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 19/12/2011

Easting: 503217 Northing: 6961004 RL: -10.52 m

Logger: DA/CB Operator: DA Machine: Scout 2

Page: 5 OF 5

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NM/LC									
				40.17		BOREHOLE BH 310 TERMINATED AT 40.17 m	FR			100	80	39.88 m; J, 48°, C, R, O, Z
				41.0								
				42.0								
				43.0								
				44.0								
				45.0								
				46.0								
				47.0								
				48.0								
				49.0								
				50.0								

### Comments:

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NM/LC. 3) Borehole grouted on completion.

Water First Noted Water Steady Level

### Defects - 1.54m : F, 60°, P, R, O, C

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

### Weathering Grades

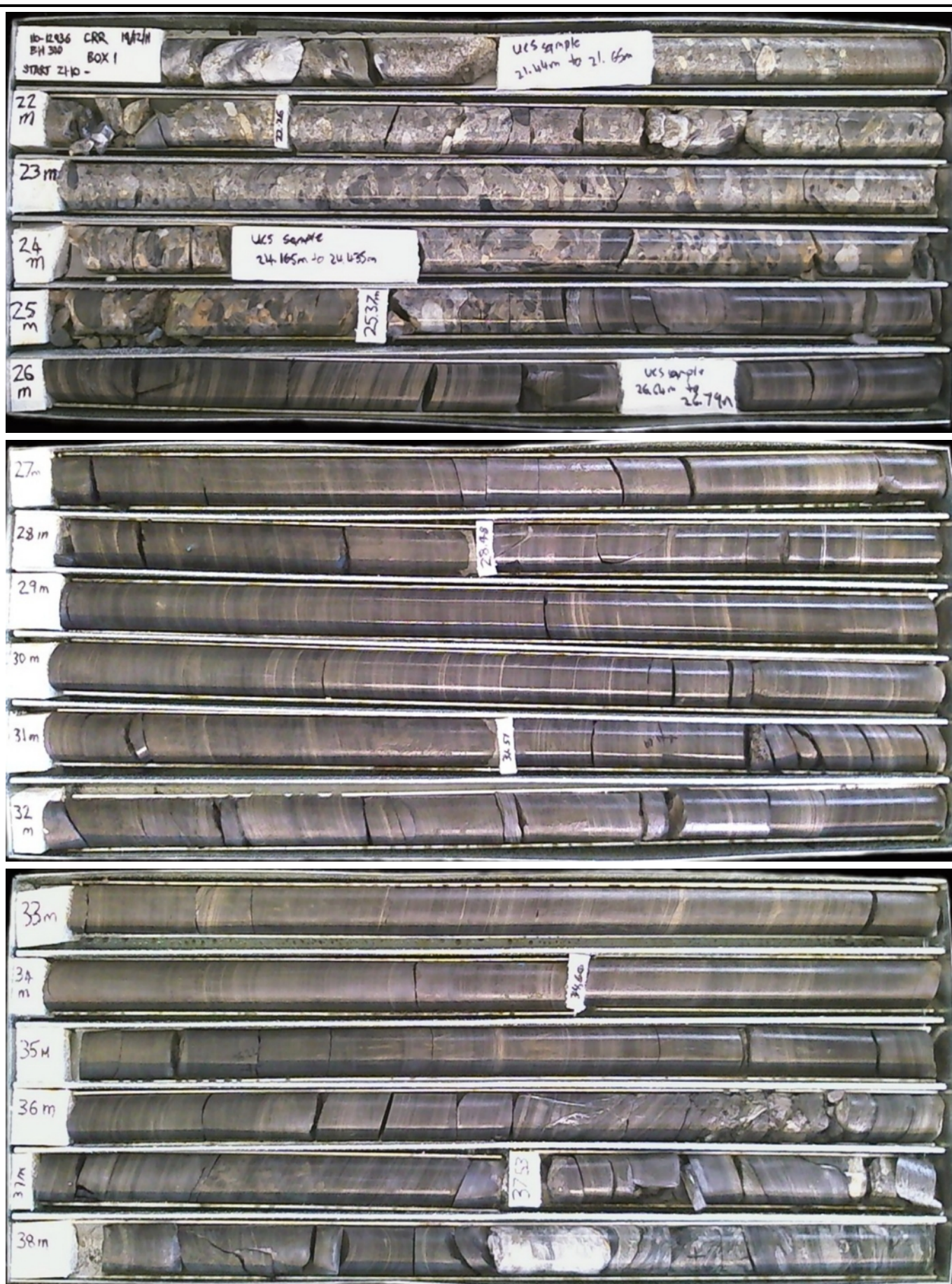
RS - Residual Soil  
XW - Extremely weathered  
DW - Distinctly weathered  
SW - Slightly weathered  
FR - Fresh  
**Rock Strength**  
VW - Very weak  
W - Weak  
MS - Medium strong  
S - Strong  
VS - Very strong  
ES - Extremely strong

### Samples

U50  
SPT  
Disturbed Sample

Approved:  
Date:





TITLE

AECOM  
Brisbane  
Cross River Rail  
Core Photo - BH 310

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

## IN-SITU PACKER PERMEABILITY TEST RESULT

**PROJECT:** **CRR**  
**PROJECT No.:** **110-12936**

**BH No.:** **310**  
**Test No.:** **1**  
**Date:** **20/12/2011**

Packer type: Double  
Packer pressure: 2000kPa  
Gauge pressures measured in: kPa  
Tested by: CB

Vertical depth to:  
(below river bed)

Top of test section (m):	31.00
Base of test section (m):	33.50
Centre of test section(m):	32.25
Base of casing (m):	30.00
Ground water (m)	TIDAL

Depth of centre of test section (m):	32.25
Length of test section (m):	2.50

Gauge Height above ground level (m):	
Hole Diameter in test section (mm)	75

1st period	Time (mins)	0	5	10	15	Average
Gauge Pressure 100	Flow reading	866.0	867.7	868.0	868.0	Flow (l/min)
	Water Take	0.00	1.70	0.30	0.00	0.133
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	870.2	870.2	870.4	870.4	Flow (l/min)
	Water Take	0.00	0.00	0.20	0.00	0.013
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 300	Flow reading	871.5	871.7	817.7	872.0	Flow (l/min)
	Water Take	0.00	0.20	-54.00	54.30	0.033
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 400	Flow reading	872.8	873.2	873.6	873.8	Flow (l/min)
	Water Take	0.00	0.40	0.40	0.20	0.067
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	872.6	872.8	872.8	873.0	Flow (l/min)
	Water Take	0.00	0.00	0.00	0.20	0.013

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	0.133	100.00	10.220	0.000	0.000	42.470	0.128	1.40E-08
2nd	0.013	200.00	20.440	0.000	0.000	52.690	0.010	1.13E-09
3rd	0.033	300.00	30.660	0.000	0.000	62.910	0.022	2.36E-09
4th	0.067	400.00	40.880	0.000	0.000	73.130	0.037	4.06E-09
5th	0.013	200.00	20.440	0.000	0.000	52.690	0.010	1.13E-09

\*Where friction loss is assumed to be negligible.

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



## IN-SITU PACKER PERMEABILITY TEST RESULT

**PROJECT:** CRR  
**PROJECT No.:** 110-12936  
**BH No.:** 310  
**Test No.:** 2  
**Date:** 20/12/2011

Packer type: Double  
Packer pressure: 2000kPa  
Gauge pressures measured in: kPa  
Tested by: CB

Vertical depth to:  
(below river bed)

Top of test section (m):	24.00
Base of test section (m):	26.50
Centre of test section(m):	25.25
Base of casing (m):	23.00
Ground water (m)	TIDAL

Depth of centre of test section (m):	25.25
Length of test section (m):	2.50

Gauge Height above ground level (m):	
Hole Diameter in test section (mm)	75

1st period	Time (mins)	0	5	10	15	Average
Gauge Pressure 100	Flow reading	877.4	877.4	877.5	877.8	Flow (l/min)
	Water Take	0.00	0.00	0.10	0.30	0.027
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	880.4	880.4	880.5	880.6	Flow (l/min)
	Water Take	0.00	0.00	0.10	0.10	0.013
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 300	Flow reading	881.5	881.9	882.0	882.0	Flow (l/min)
	Water Take	0.00	0.40	0.10	0.00	0.033
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 400	Flow reading	882.5	883.0	883.0	883.5	Flow (l/min)
	Water Take	0.00	0.50	0.00	0.50	0.067
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	881.0	881.0	881.0	881.0	Flow (l/min)
	Water Take	0.00	0.00	0.00	0.00	0.000

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	0.027	100.00	10.220	0.000	0.000	35.470	0.031	3.35E-09
2nd	0.013	200.00	20.440	0.000	0.000	45.690	0.012	1.30E-09
3rd	0.033	300.00	30.660	0.000	0.000	55.910	0.024	2.65E-09
4th	0.067	400.00	40.880	0.000	0.000	66.130	0.041	4.49E-09
5th	0.000	200.00	20.440	0.000	0.000	45.690	0.000	0.00E+00

\*Where friction loss is assumed to be negligible.

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