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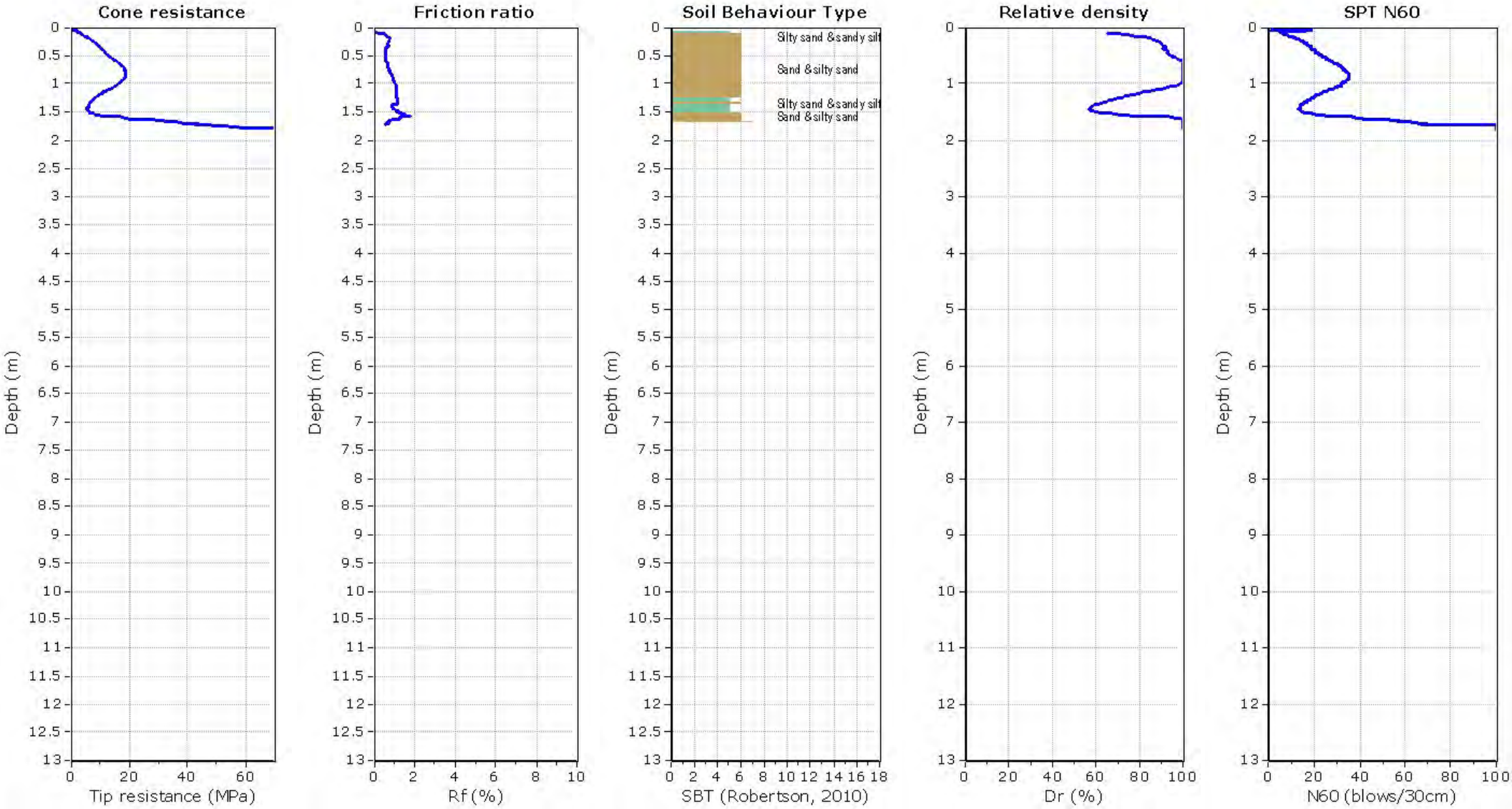
CPT 58
Total depth: 1.79 m, Date: 05/05/2017
Surface Elevation: 36.16 m
Coords: X:371275.22, Y:6509981.58
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 85MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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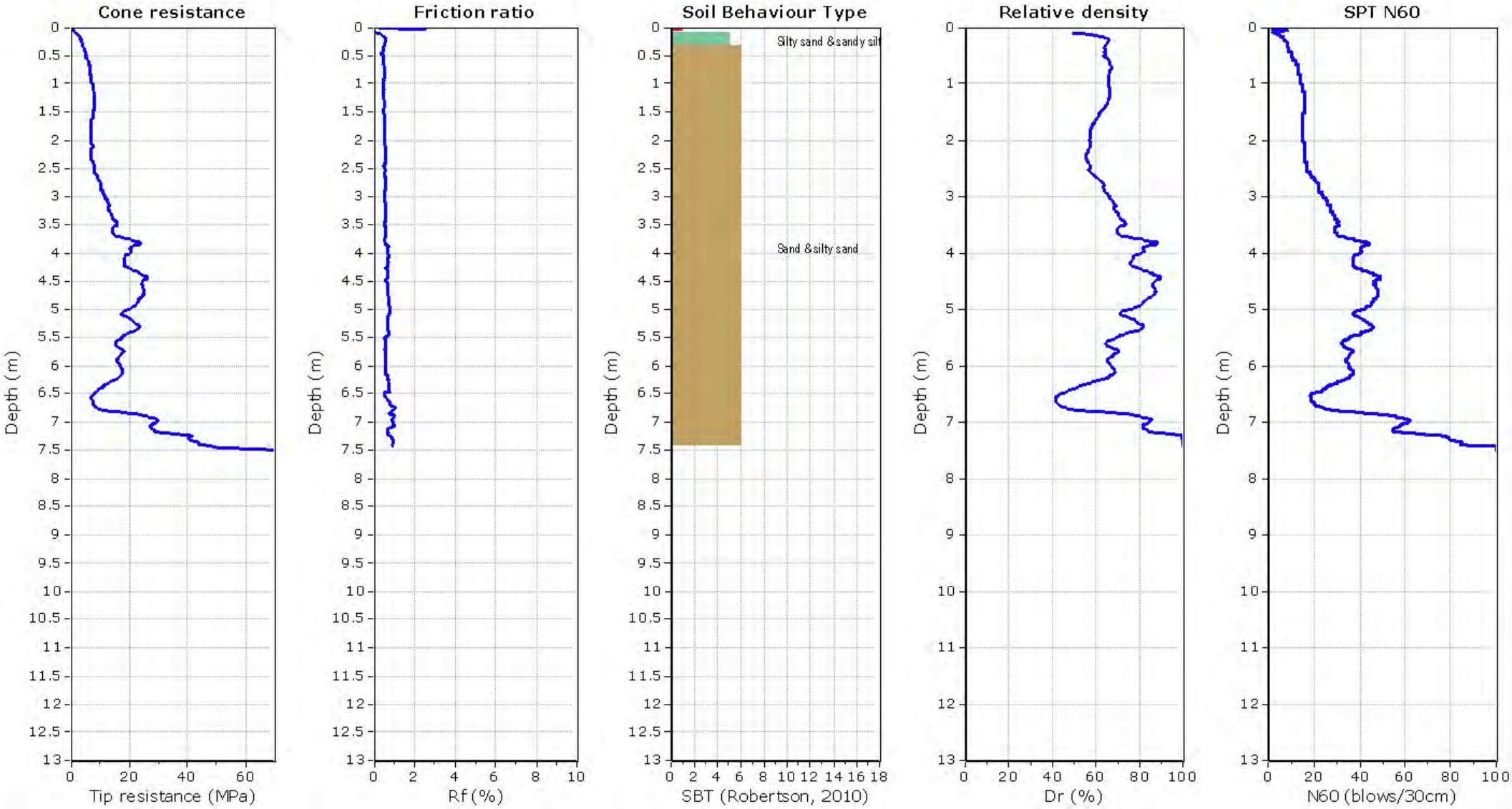
CPT 59
Total depth: 7.49 m, Date: 05/05/2017
Surface Elevation: 44.89 m
Coords: X:371244.14, Y:6510053.81
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 80MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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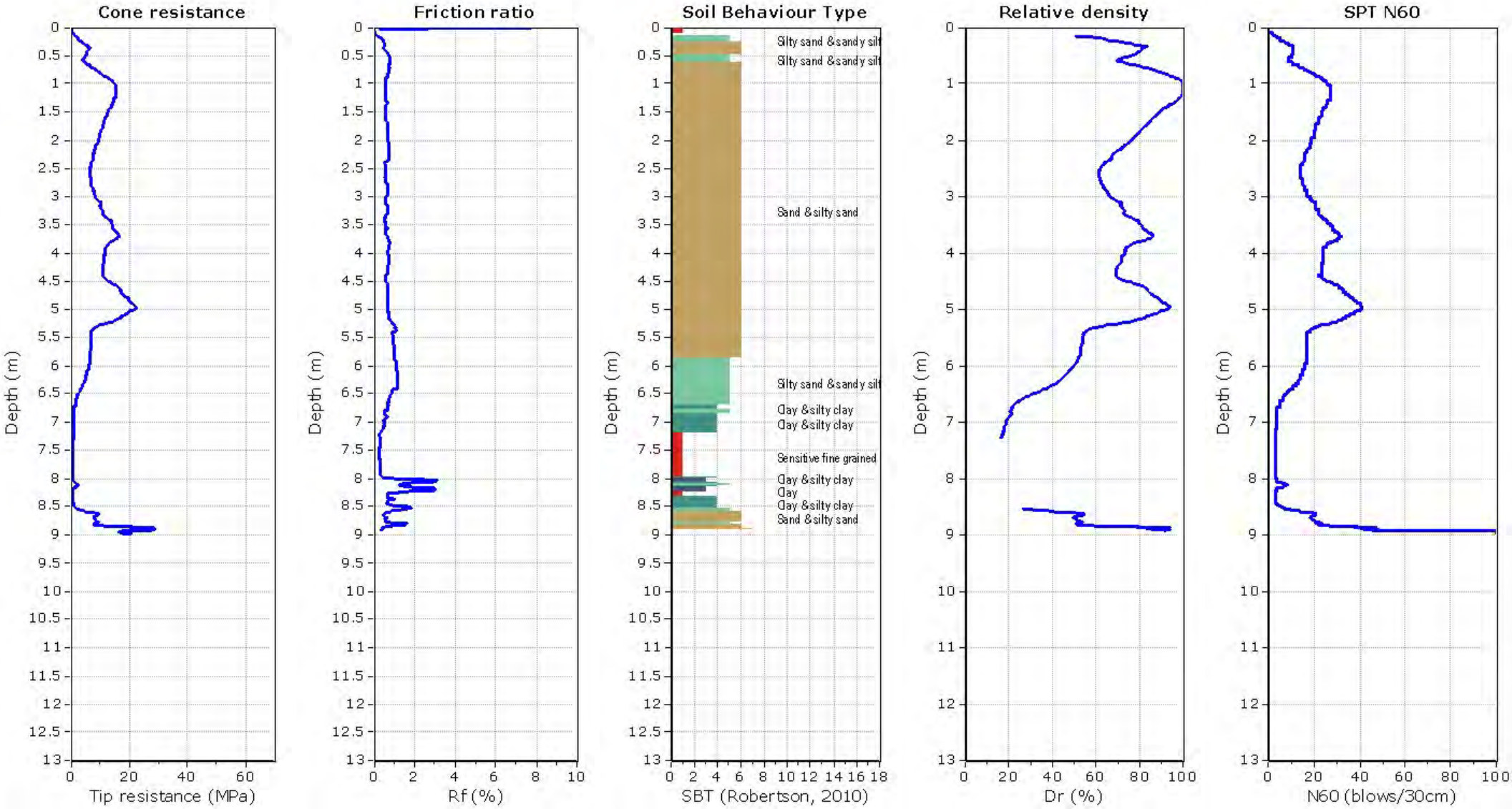
CPT 59-2
Total depth: 8.98 m, Date: 13/06/2017
Surface Elevation: 42.34 m
Coords: X:371288.70, Y:6510078.05
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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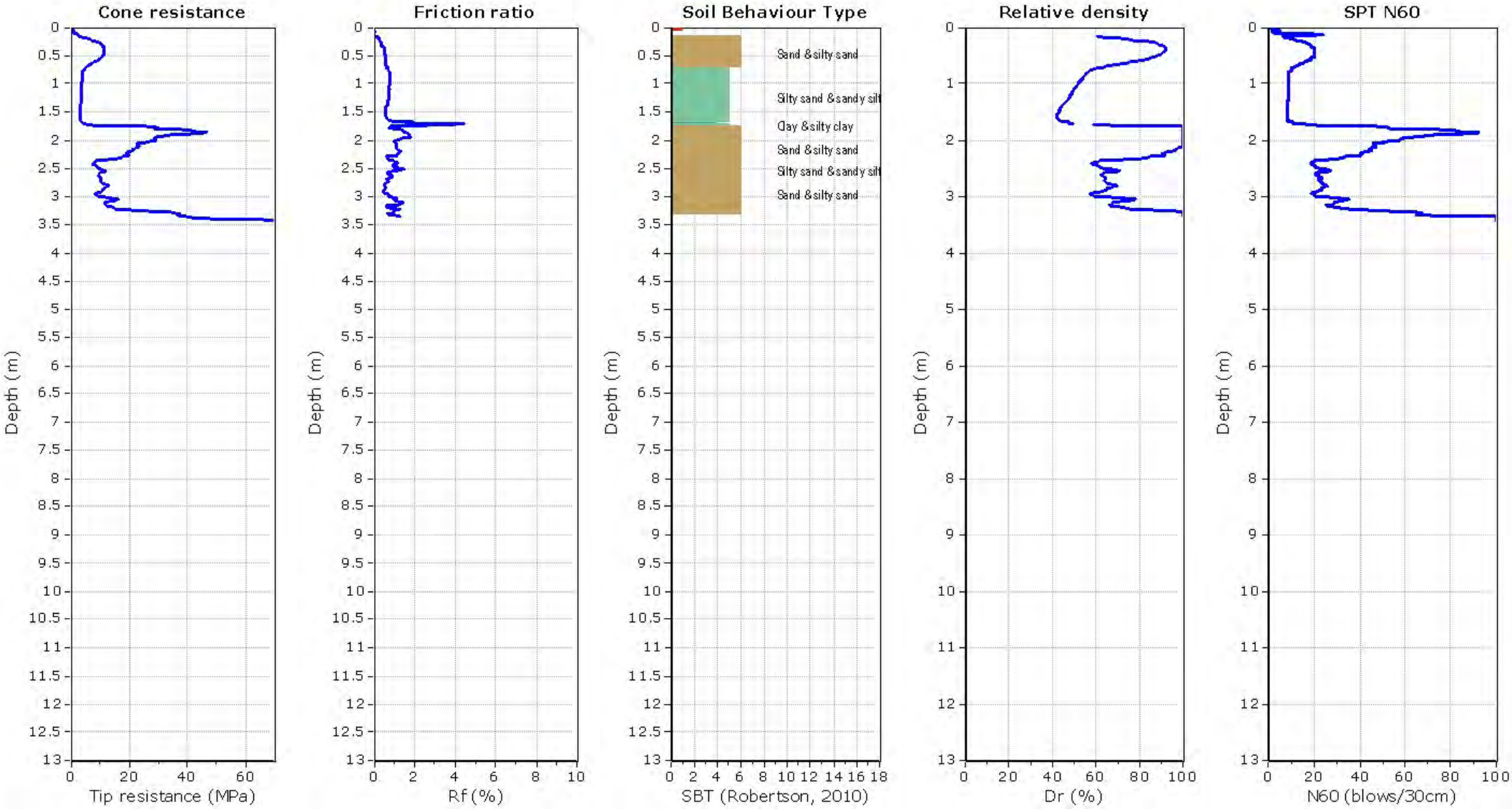
CPT 60
Total depth: 3.41 m, Date: 05/05/2017
Surface Elevation: 32.86 m
Coords: X:371267.24, Y:6510167.66
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 75MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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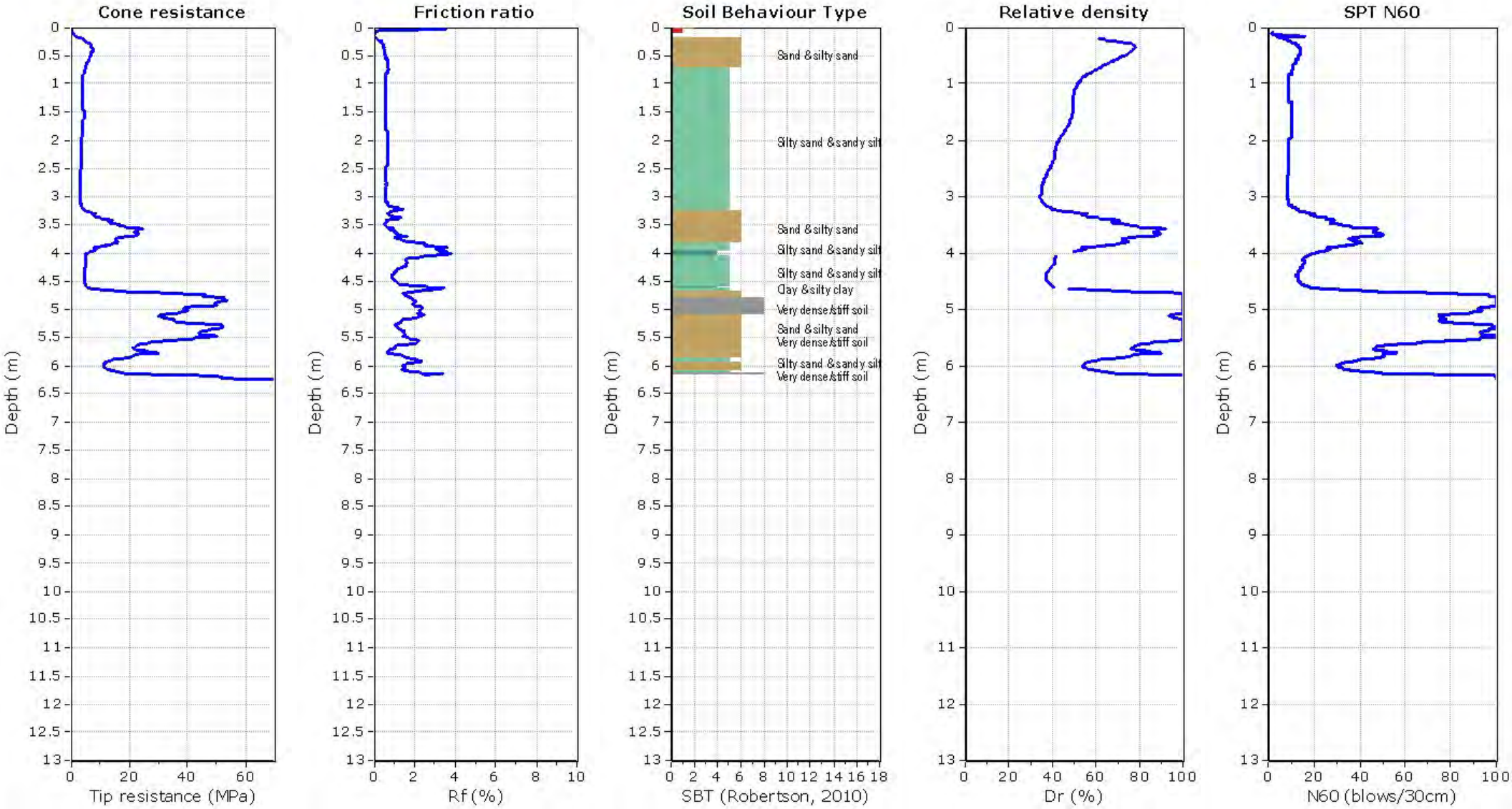
CPT 61
Total depth: 6.24 m, Date: 05/05/2017
Surface Elevation: 29.75 m
Coords: X:371237.80, Y:6510347.33
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 75MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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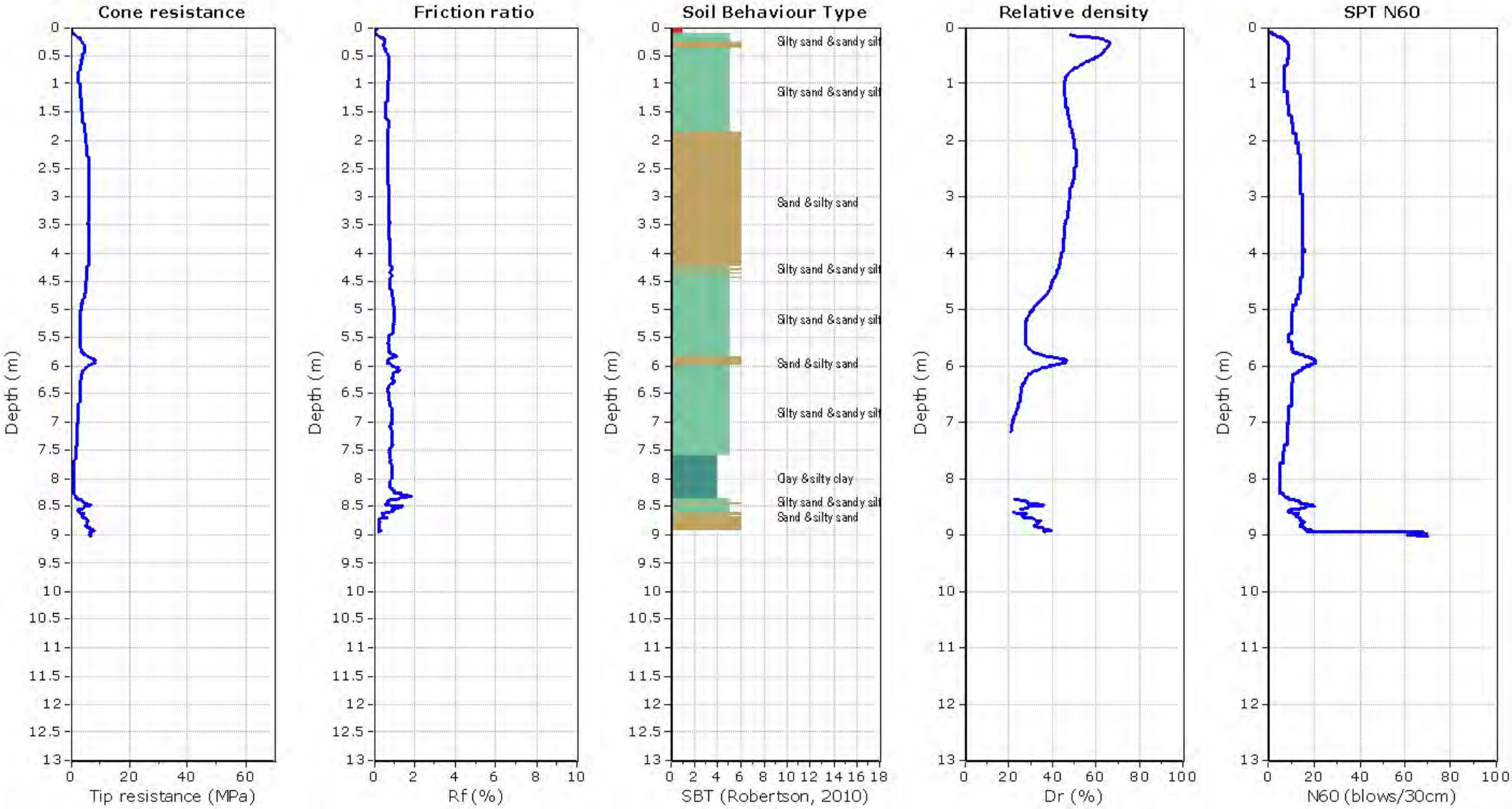
CPT 61-2
Total depth: 9.01 m, Date: 13/06/2017
Surface Elevation: 29.00 m
Coords: X:371235.77, Y:6510315.85
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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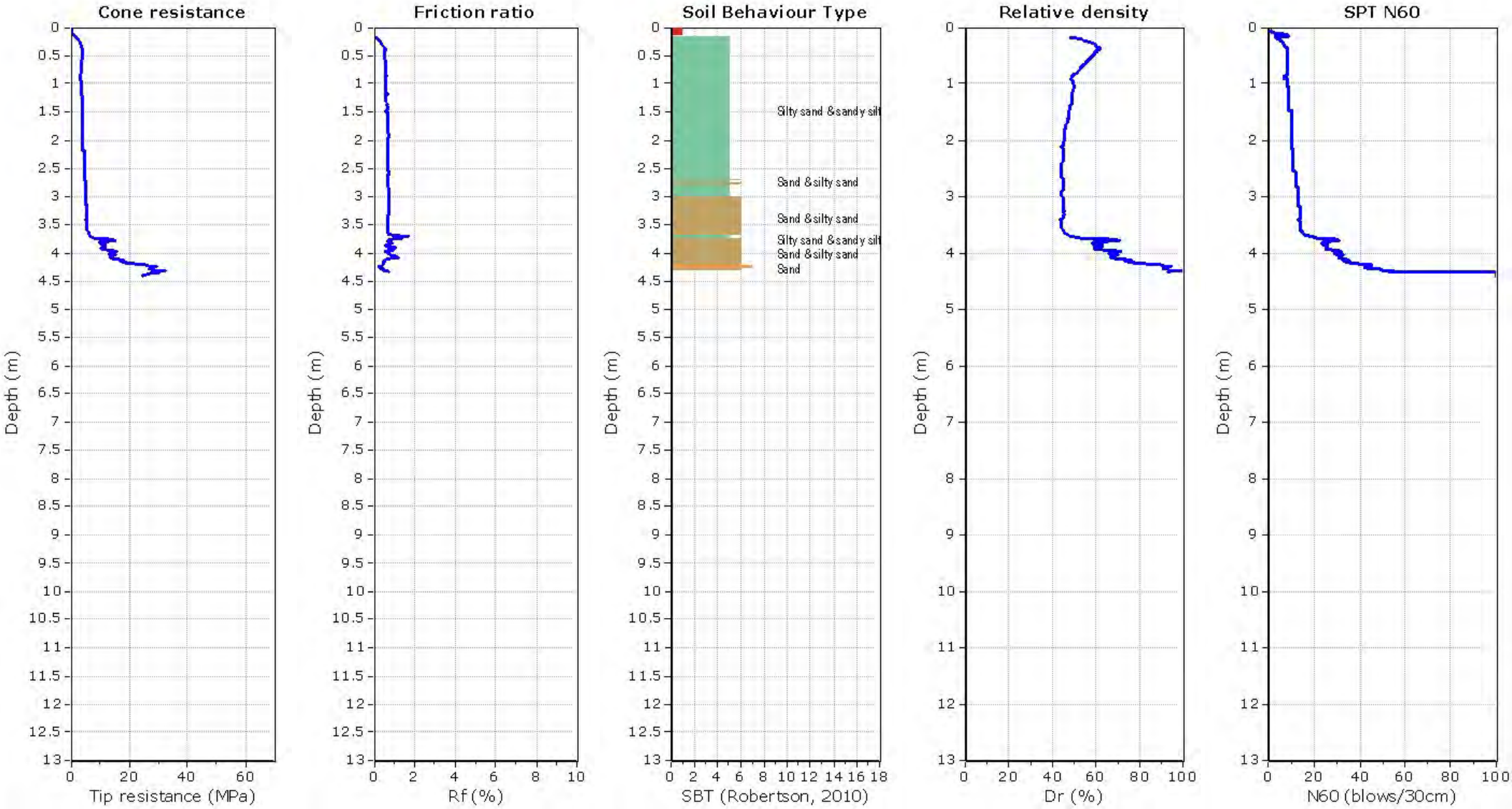
CPT 62
Total depth: 4.40 m, Date: 05/05/2017
Surface Elevation: 30.92 m
Coords: X:371243.66, Y:6510443.51
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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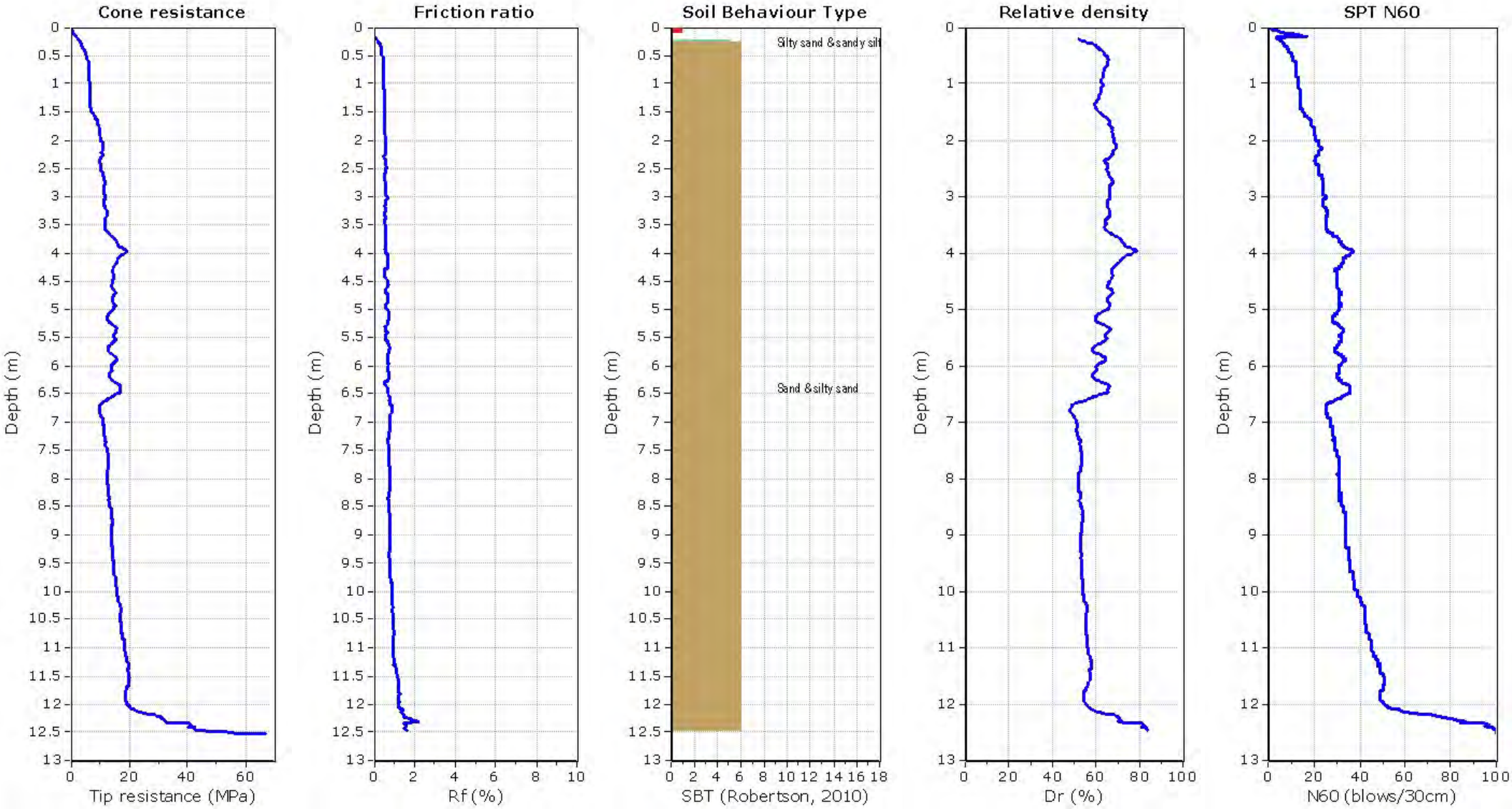
CPT 63
Total depth: 12.53 m, Date: 05/05/2017
Surface Elevation: 38.27 m
Coords: X:371249.64, Y:6510537.39
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 70MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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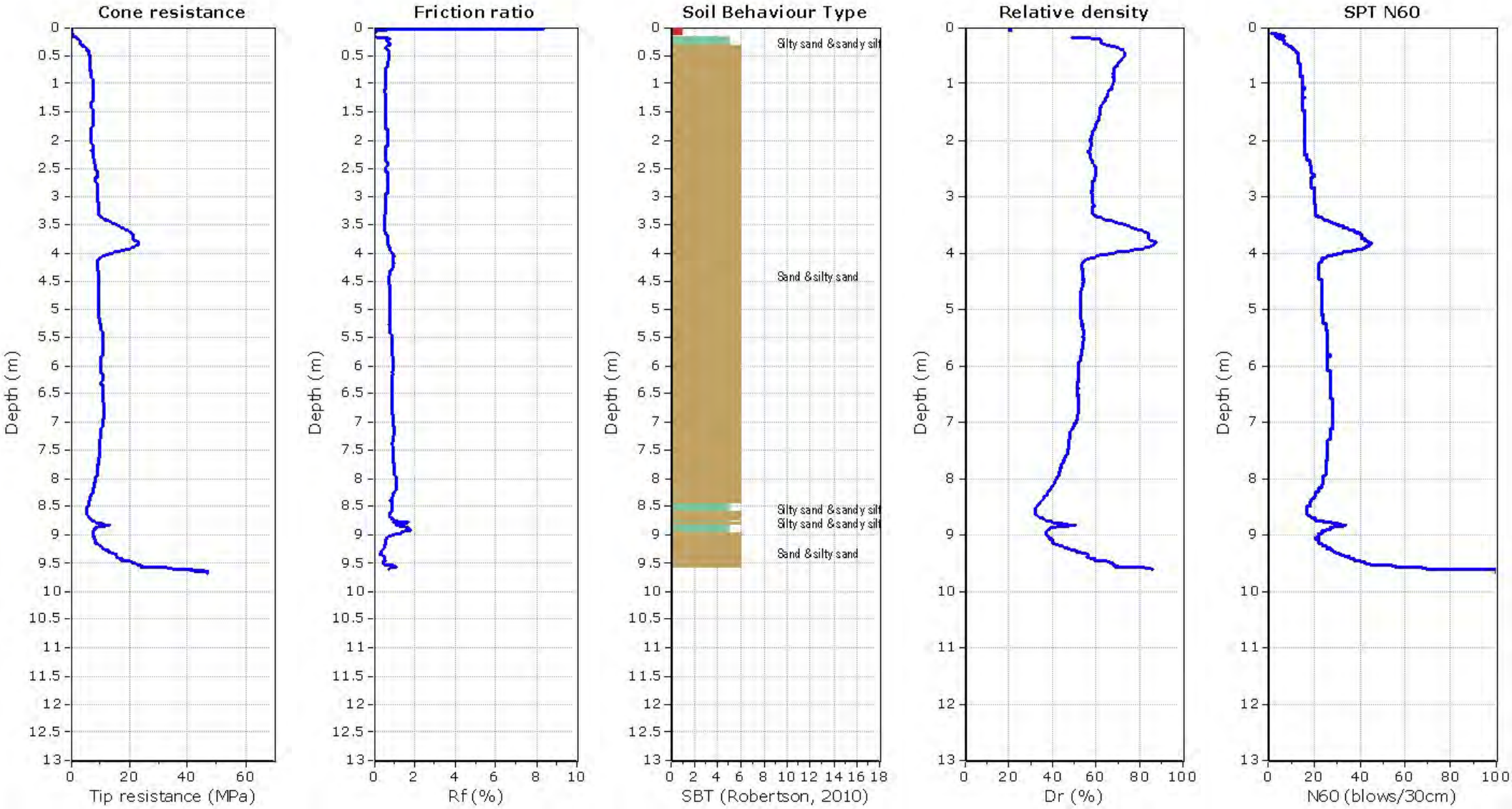
CPT 63-2
Total depth: 9.67 m, Date: 13/06/2017
Surface Elevation: 36.34 m
Coords: X:371250.61, Y:6510554.76
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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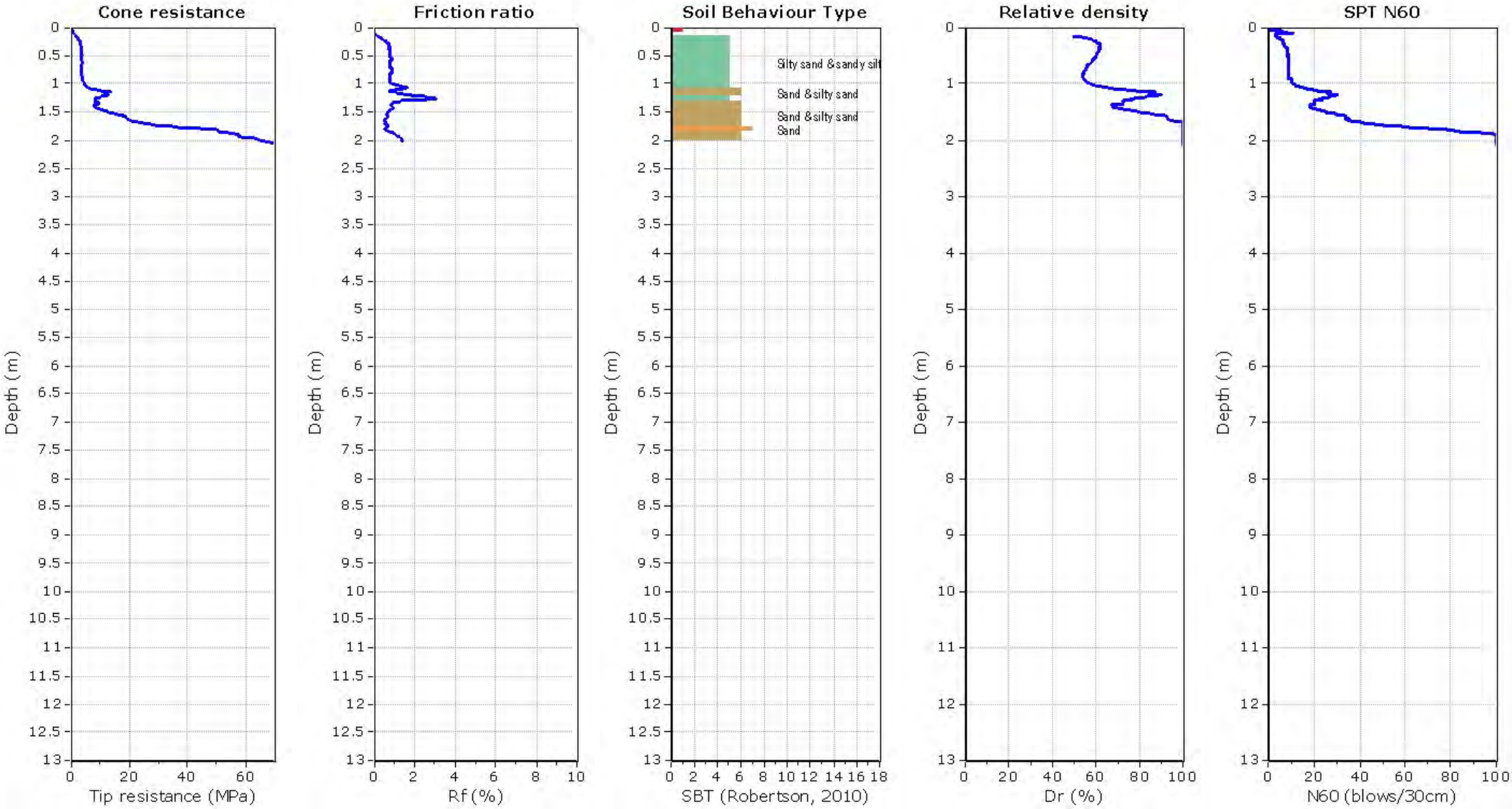
CPT 64
Total depth: 2.08 m, Date: 05/05/2017
Surface Elevation: 32.41 m
Coords: X:371259.88, Y:6510633.62
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 75MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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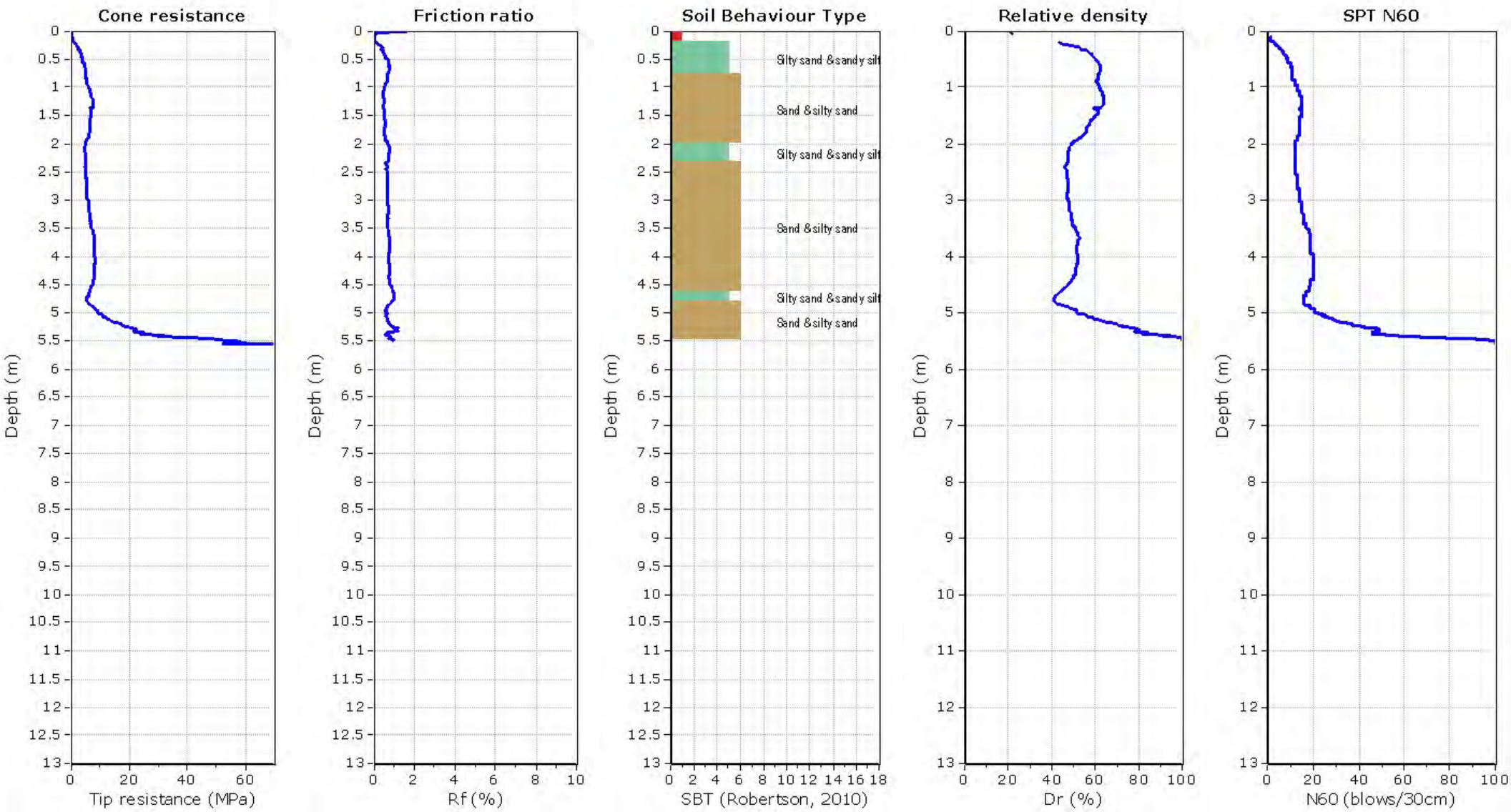
CPT 64-2
Total depth: 5.56 m, Date: 13/06/2017
Surface Elevation: 34.59 m
Coords: X:371250.12, Y:6510568.25
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 80MPa Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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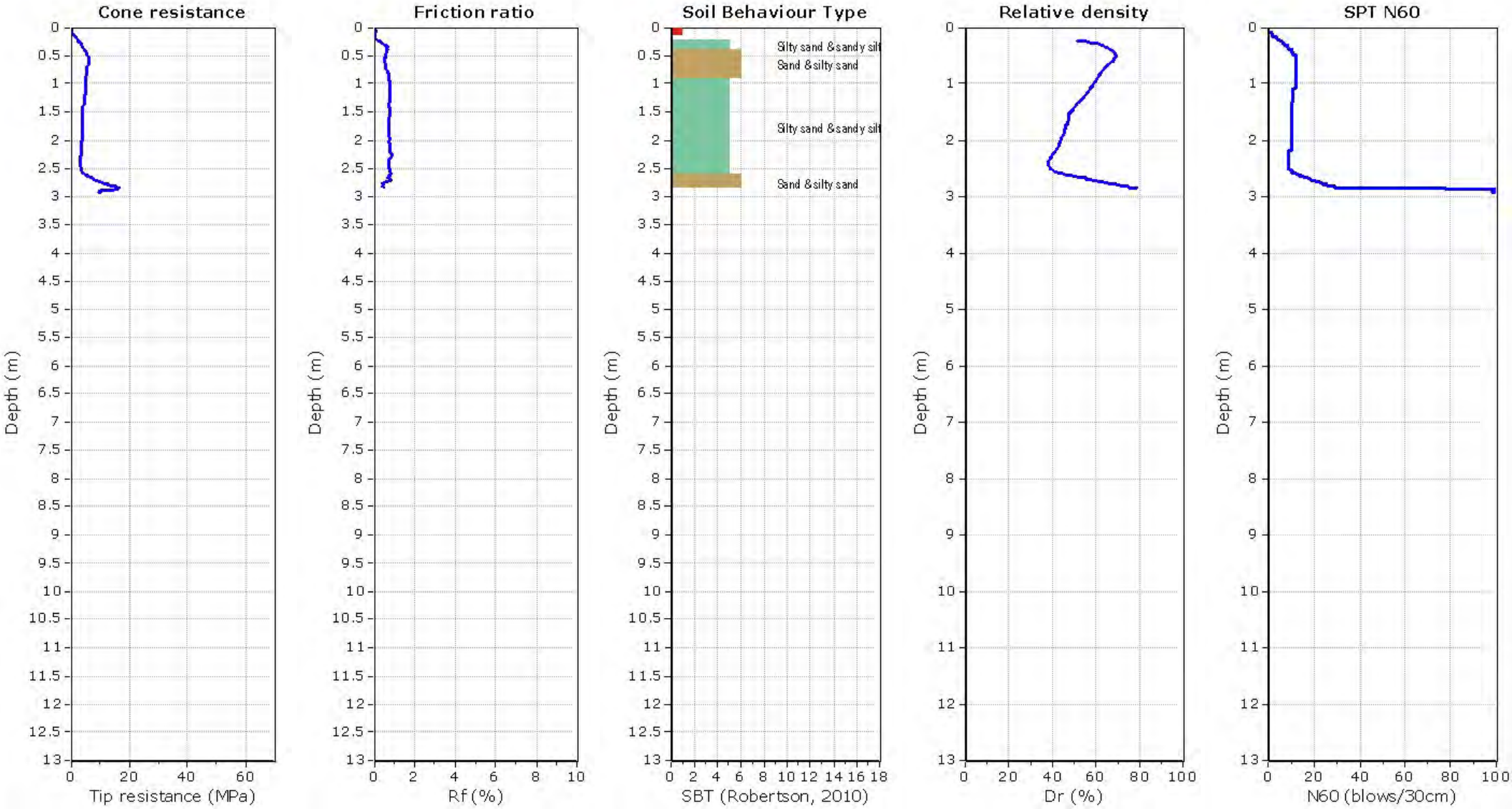
CPT 64-3
Total depth: 2.92 m, Date: 13/06/2017
Surface Elevation: 33.09 m
Coords: X:371251.52, Y:6510584.38
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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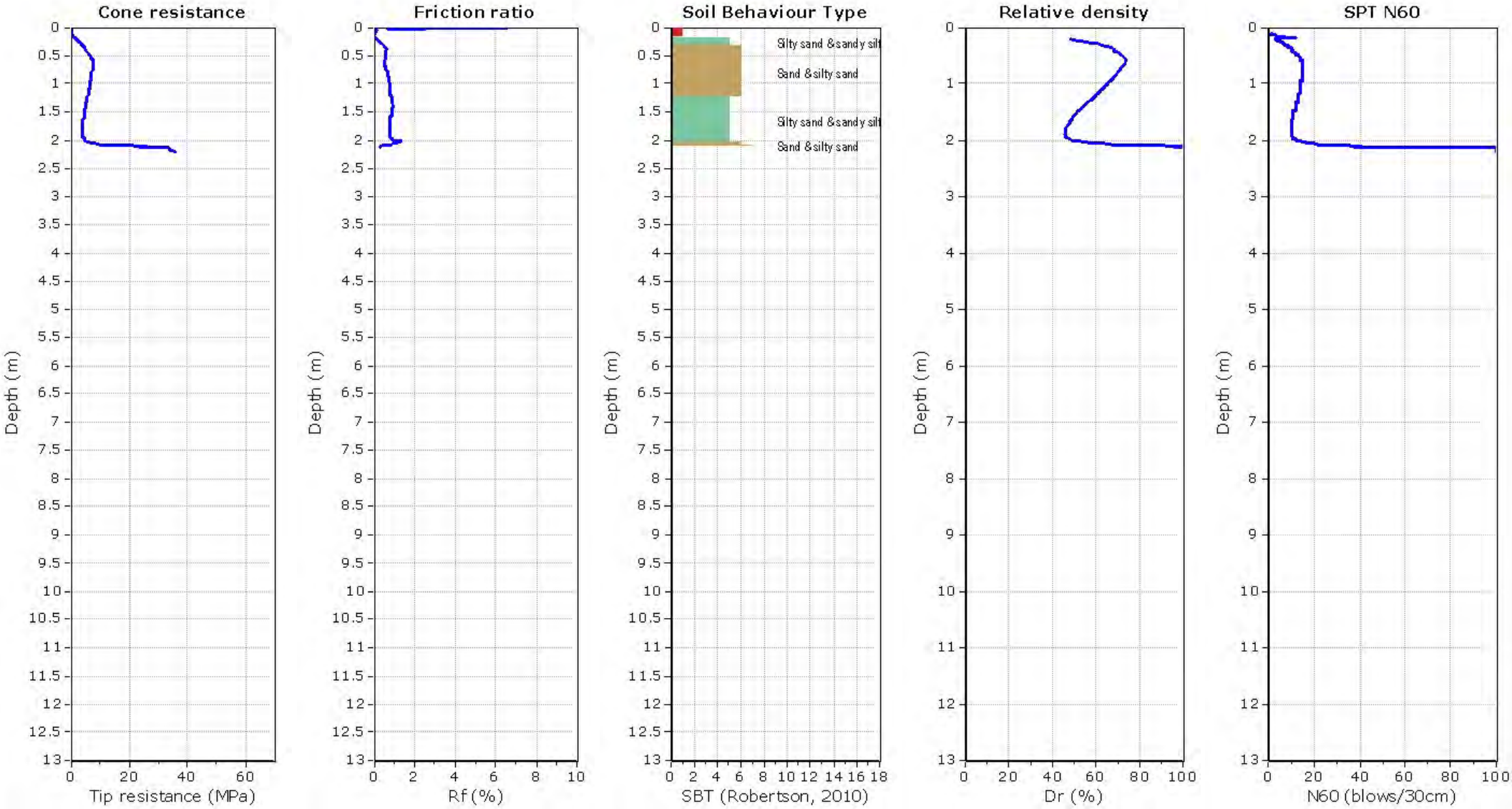
CPT 64-3A

Total depth: 2.20 m, Date: 13/06/2017
Surface Elevation: 33.02 m
Coords: X:371252.11, Y:6510586.72
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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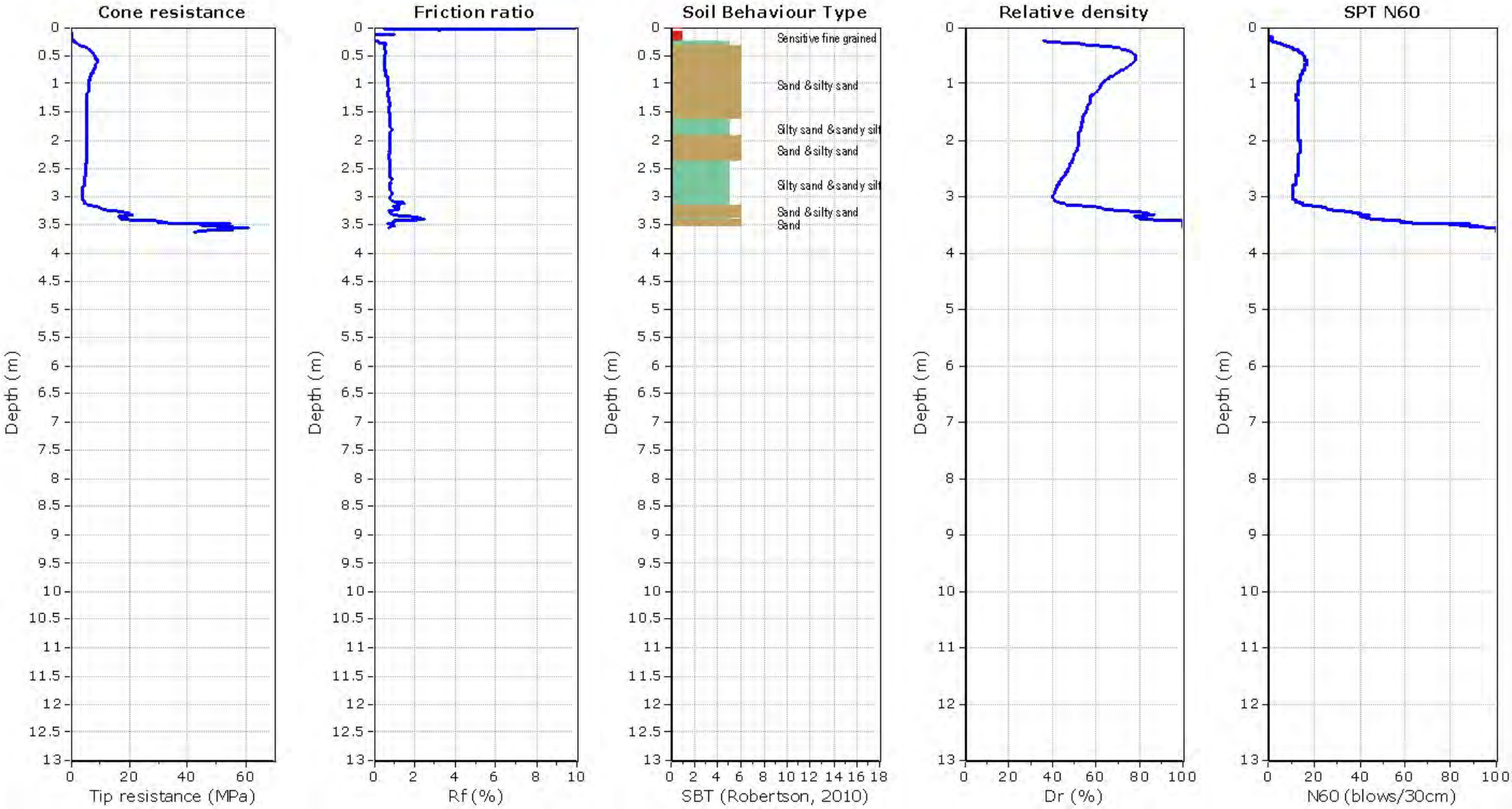
CPT 66
Total depth: 3.62 m, Date: 05/05/2017
Surface Elevation: 35.59 m
Coords: X:371260.81, Y:6510779.17
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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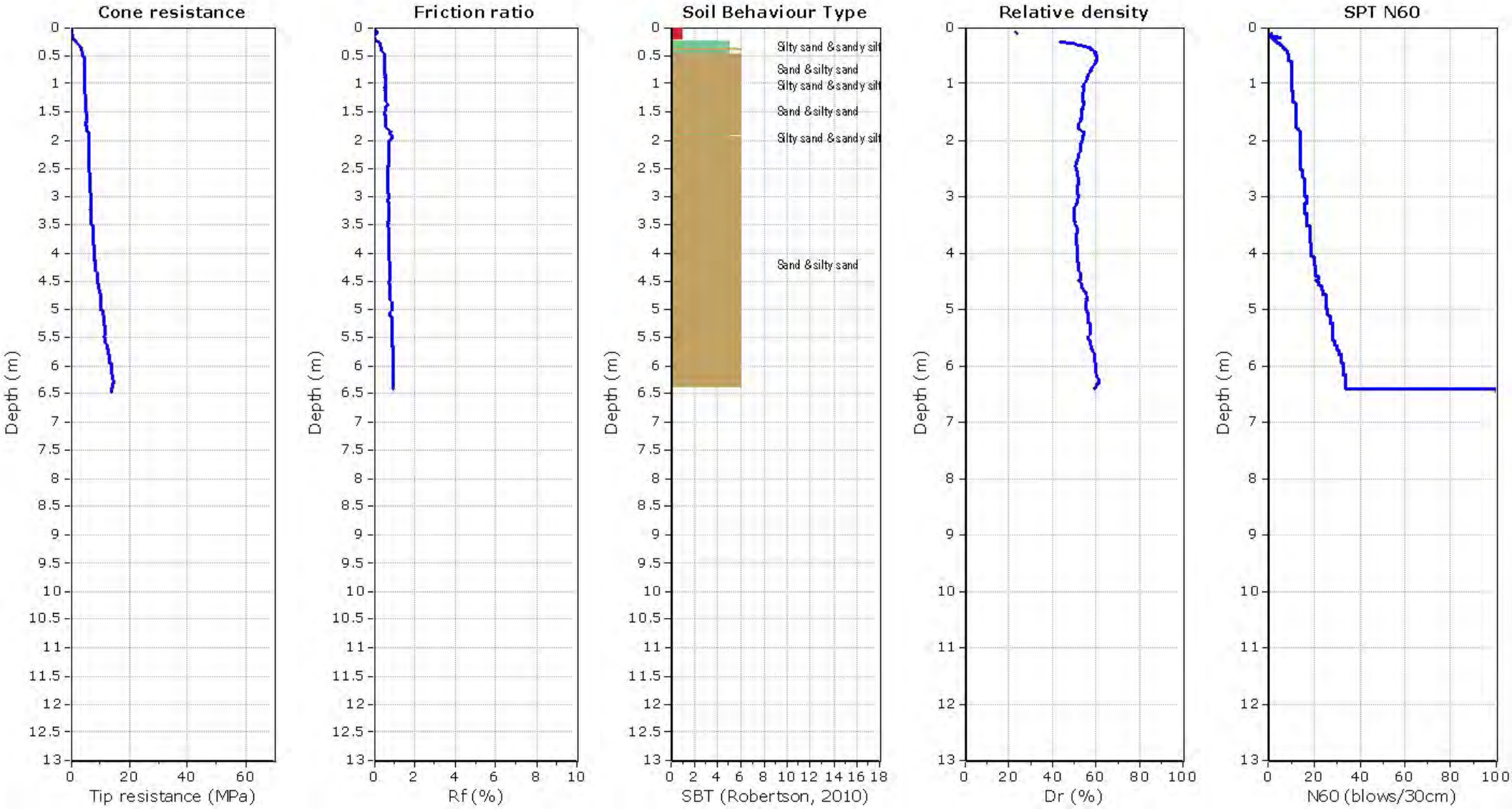
CPT 67
Total depth: 6.47 m, Date: 05/05/2017
Surface Elevation: 30.44 m
Coords: X:371267.91, Y:6510887.86
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: - Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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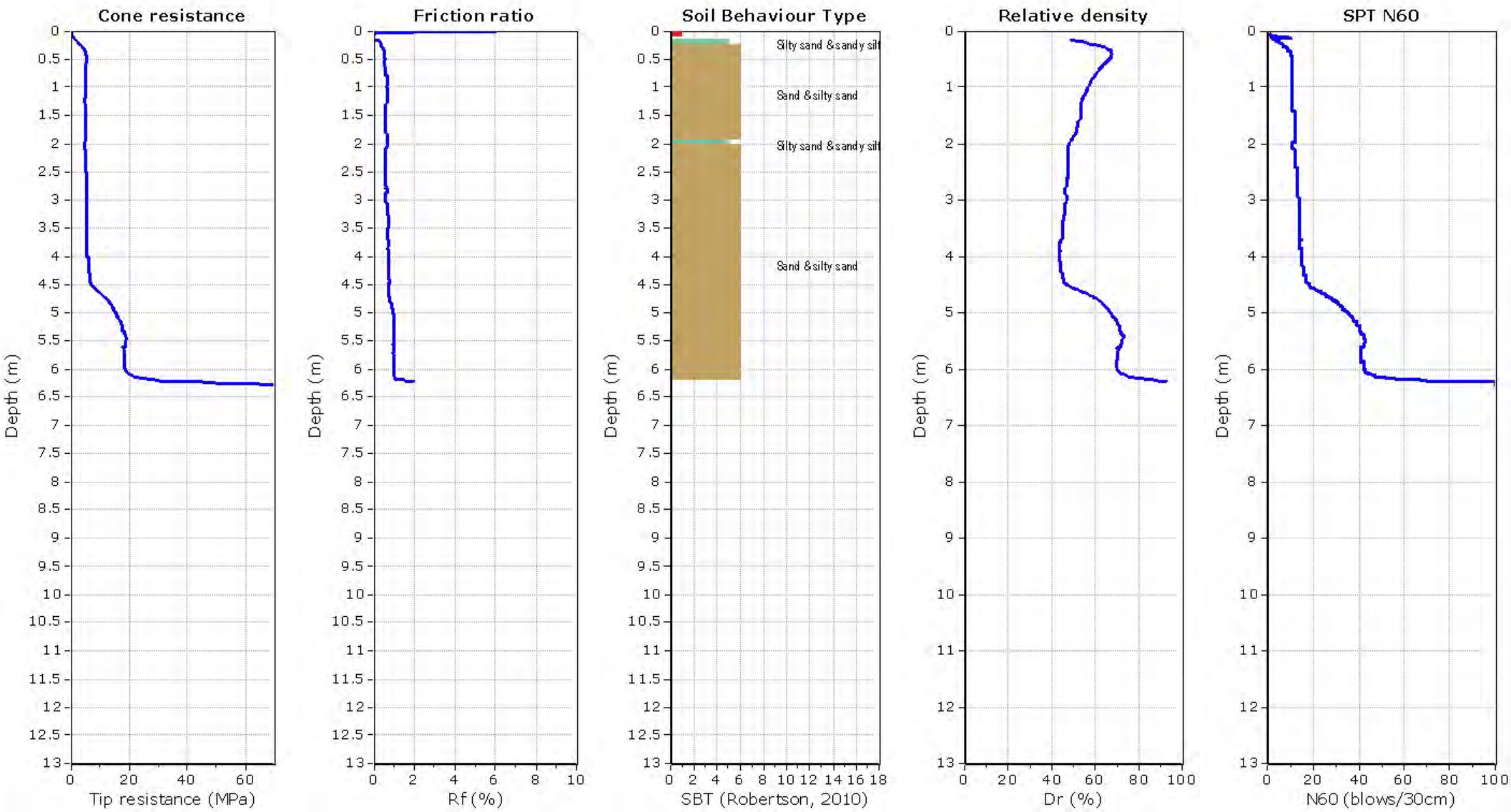
CPT 67-2
Total depth: 6.28 m, Date: 13/06/2017
Surface Elevation: 29.14 m
Coords: X:371269.88, Y:6510929.21
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 80MPa Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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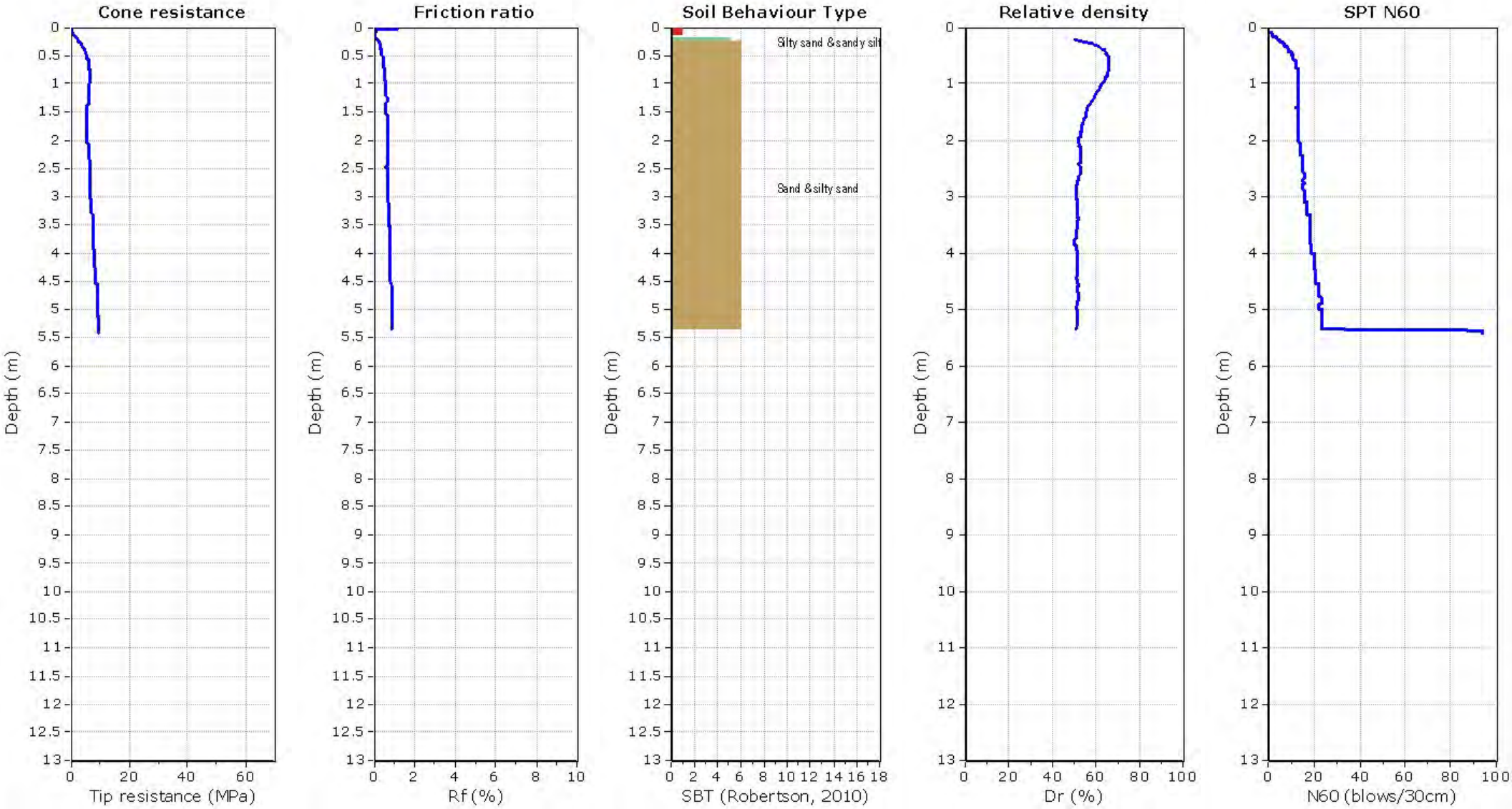
CPT 68
Total depth: 5.42 m, Date: 05/05/2017
Surface Elevation: 27.95 m
Coords: X:371274.23, Y:6510981.45
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: - Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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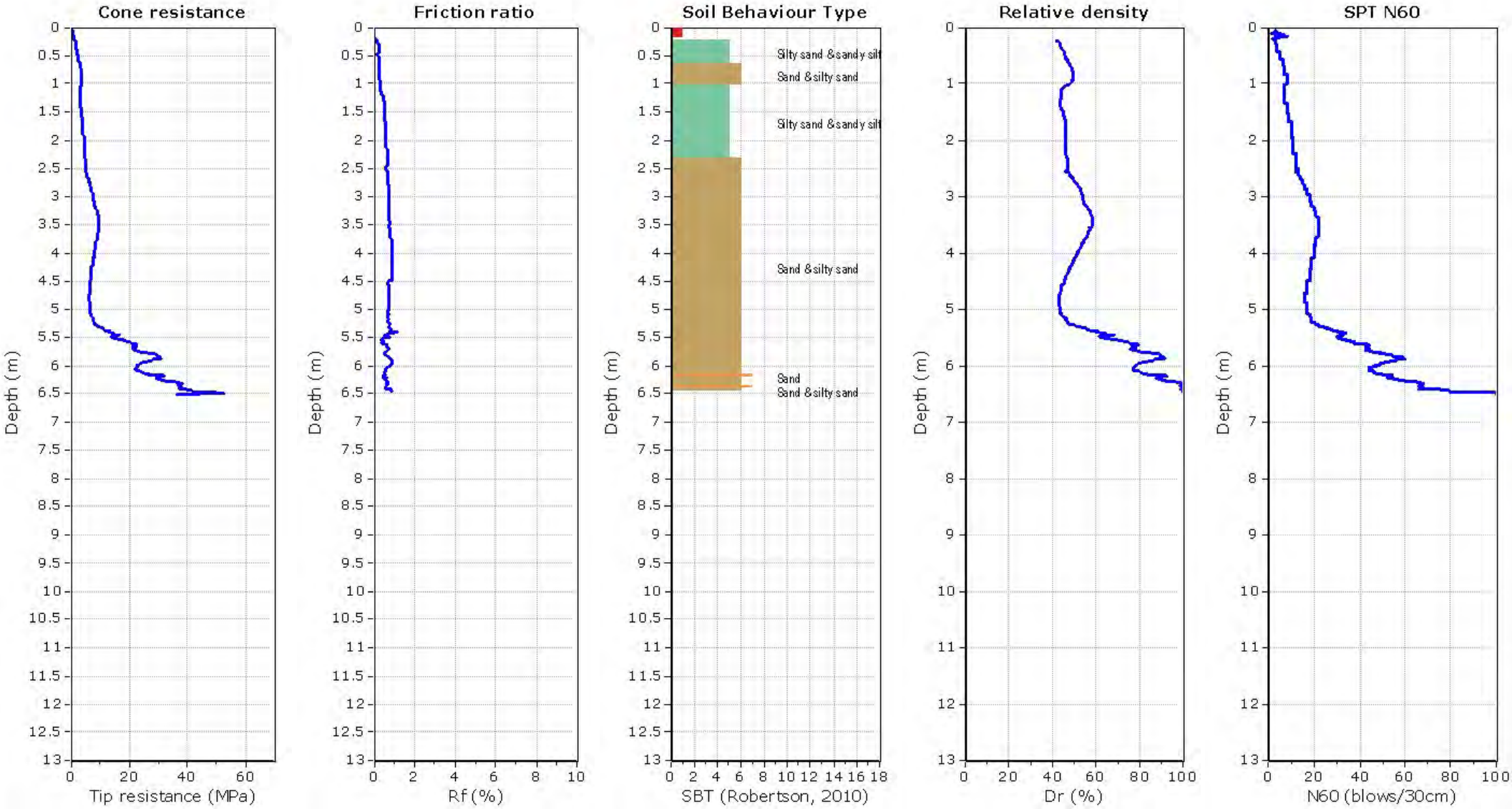
CPT 69
Total depth: 6.52 m, Date: 09/05/2017
Surface Elevation: 30.86 m
Coords: X:371236.51, Y:6511135.59
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: - Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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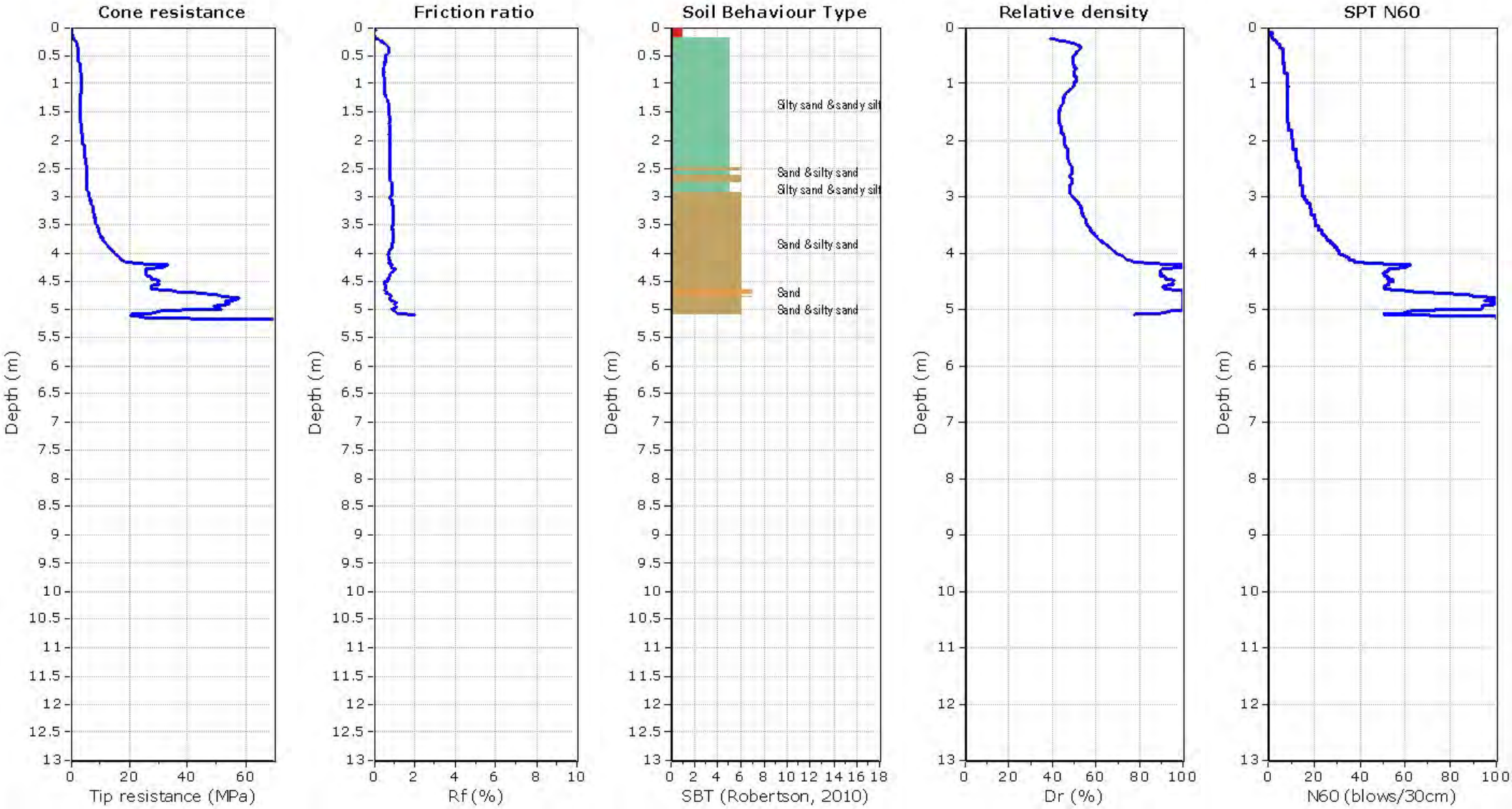
CPT 69-2
Total depth: 5.17 m, Date: 13/06/2017
Surface Elevation: 30.46 m
Coords: X:371251.23, Y:6511137.75
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 80MPa Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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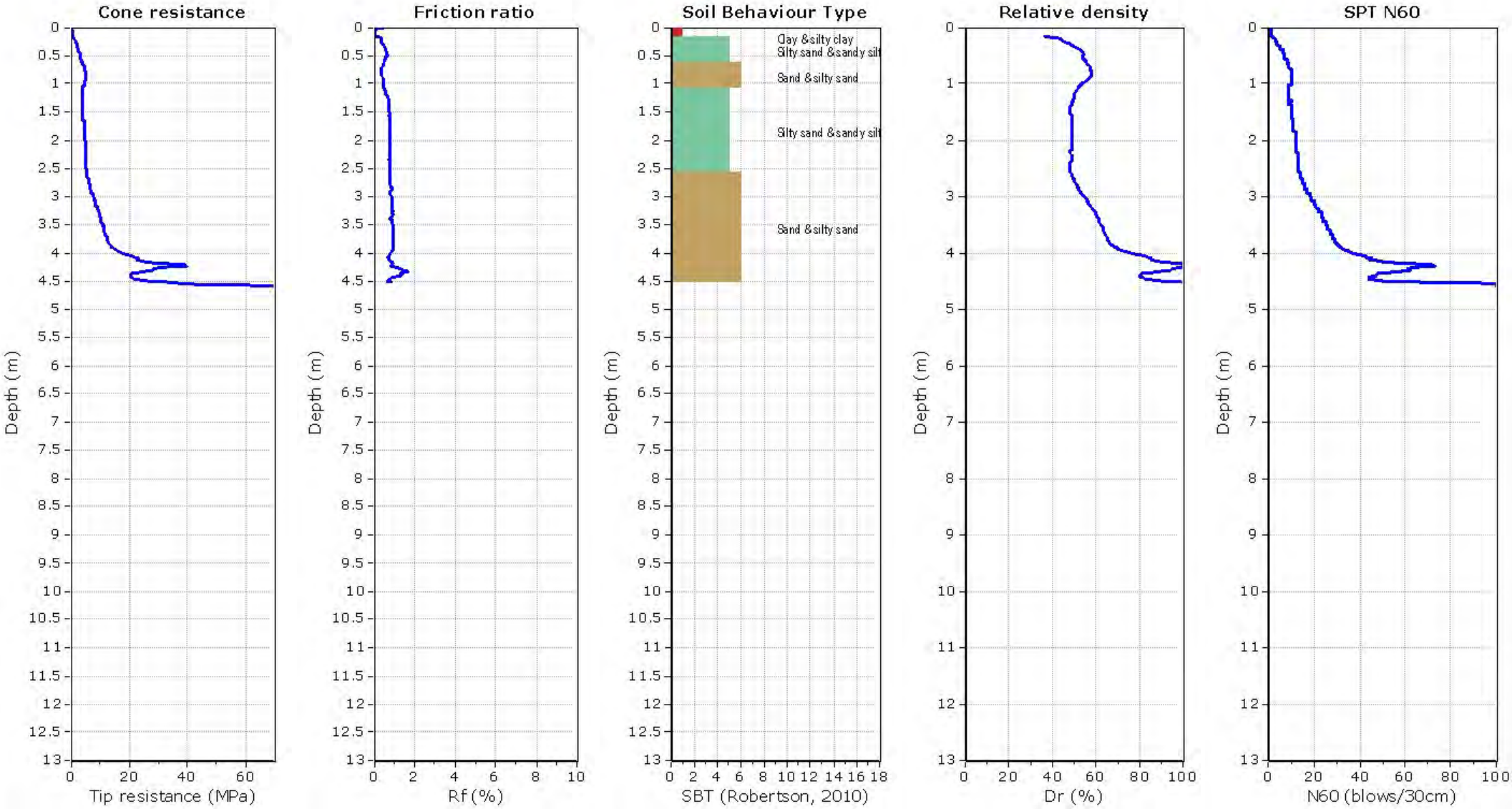
CPT 69-3
Total depth: 4.59 m, Date: 13/06/2017
Surface Elevation: 31.17 m
Coords: X:371219.16, Y:6511134.65
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 70MPa Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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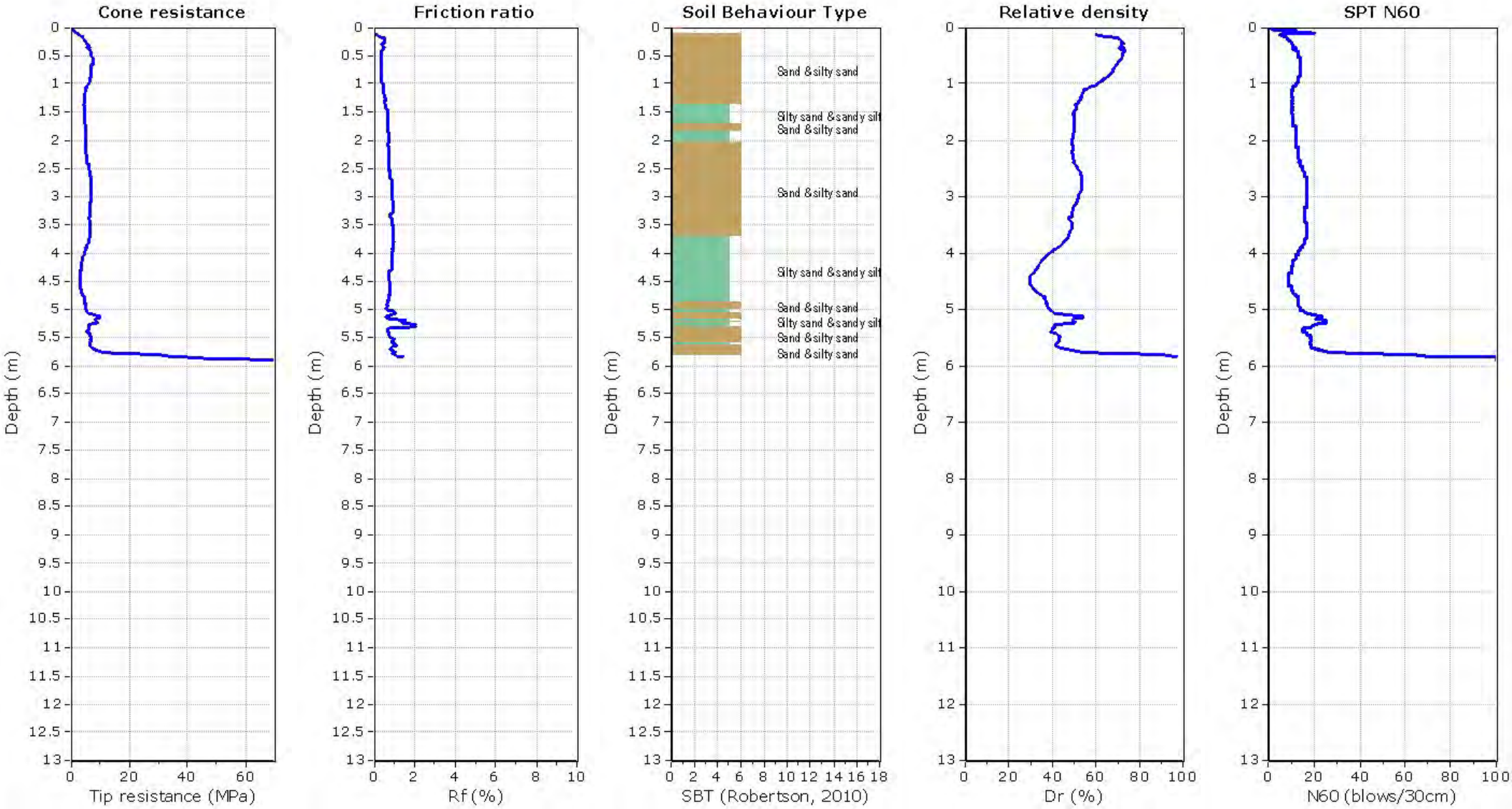
CPT 69A
Total depth: 5.90 m, Date: 05/05/2017
Surface Elevation: 31.50 m
Coords: X:371238.82, Y:6511066.07
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 80MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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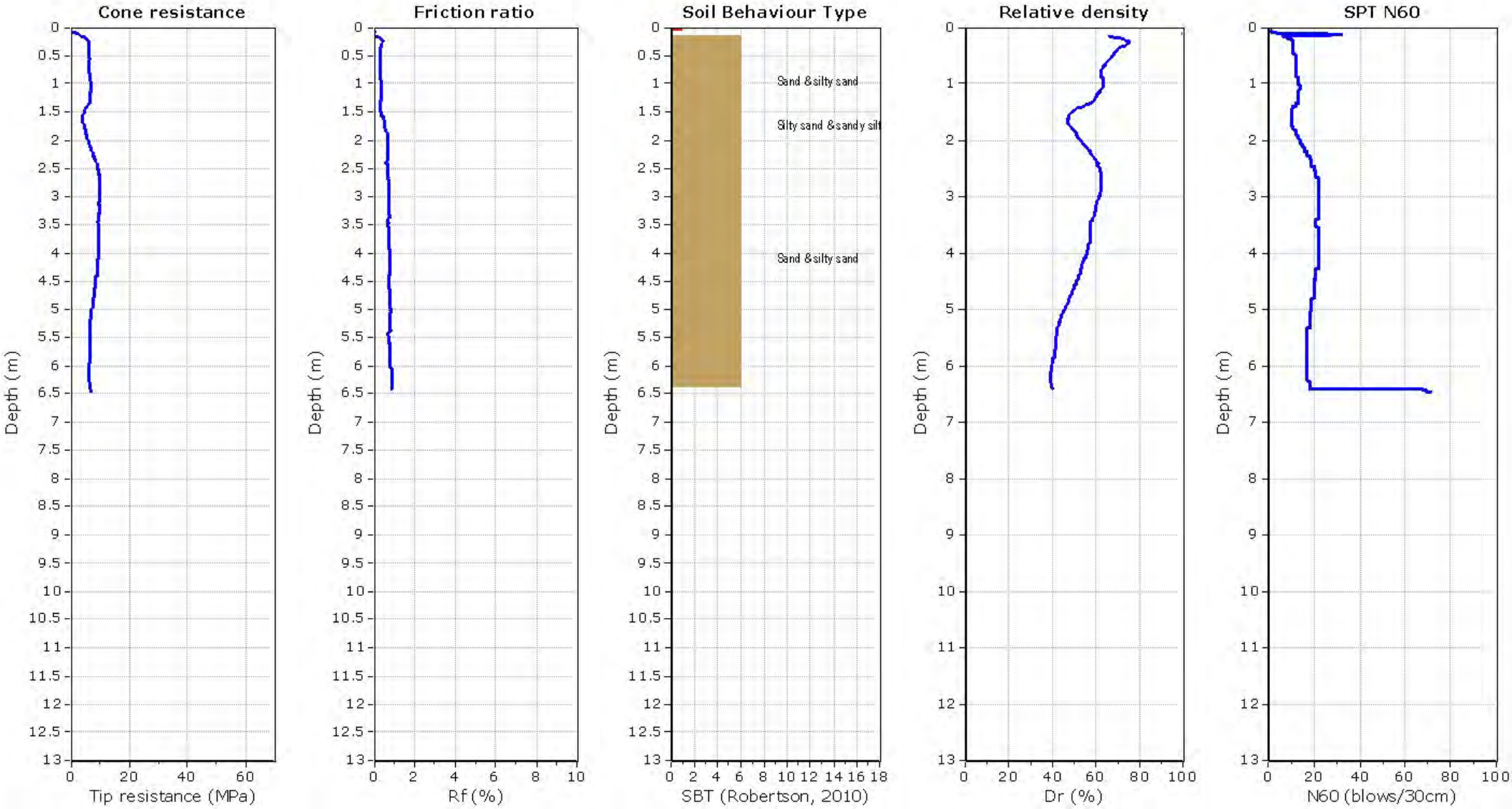
CPT 70
Total depth: 6.47 m, Date: 09/05/2017
Surface Elevation: 28.59 m
Coords: X:371234.53, Y:6511251.35
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: - Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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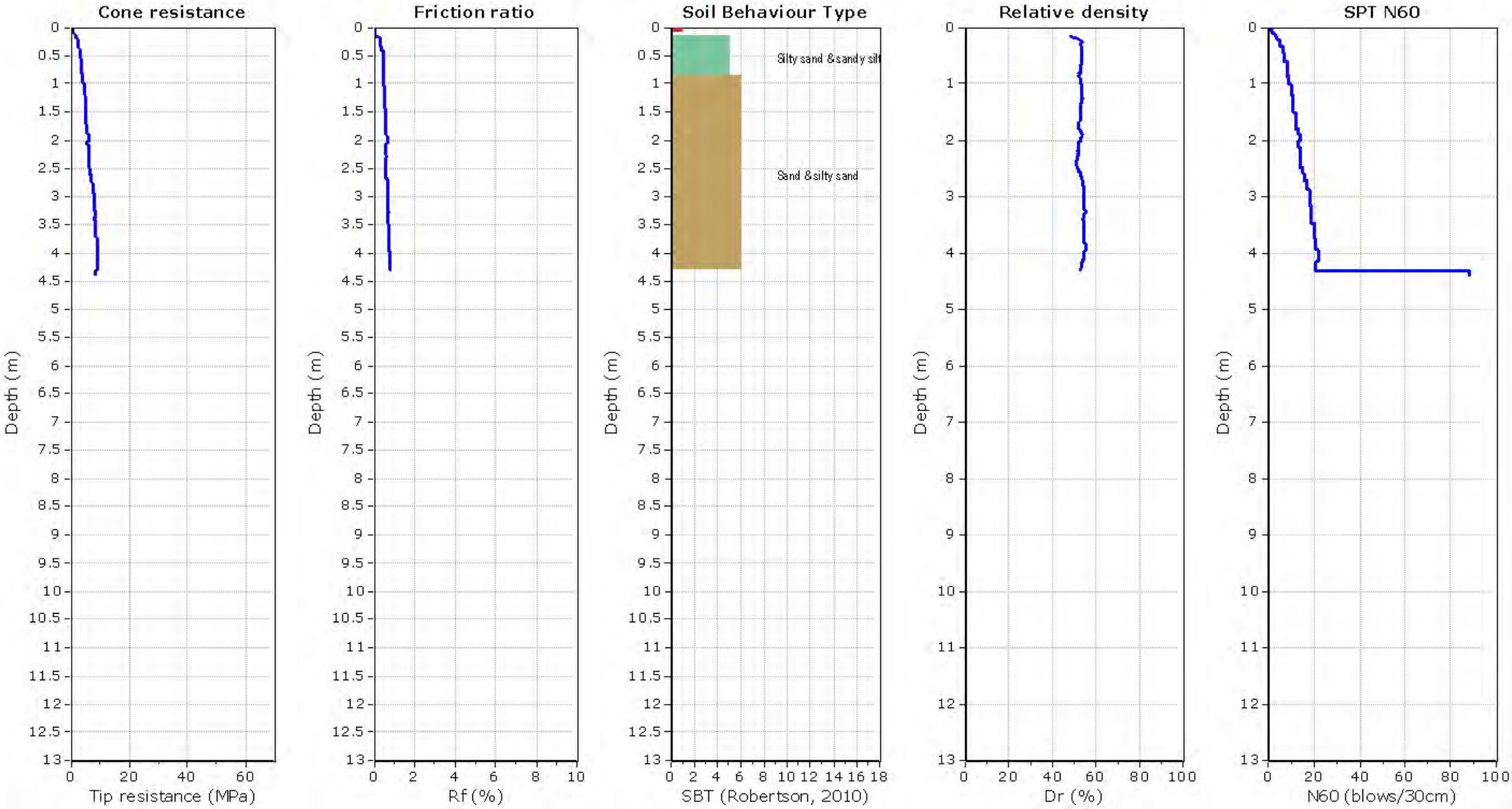
CPT 70A
Total depth: 4.38 m, Date: 09/05/2017
Surface Elevation: 22.99 m
Coords: X:371295.76, Y:6511463.67
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: - Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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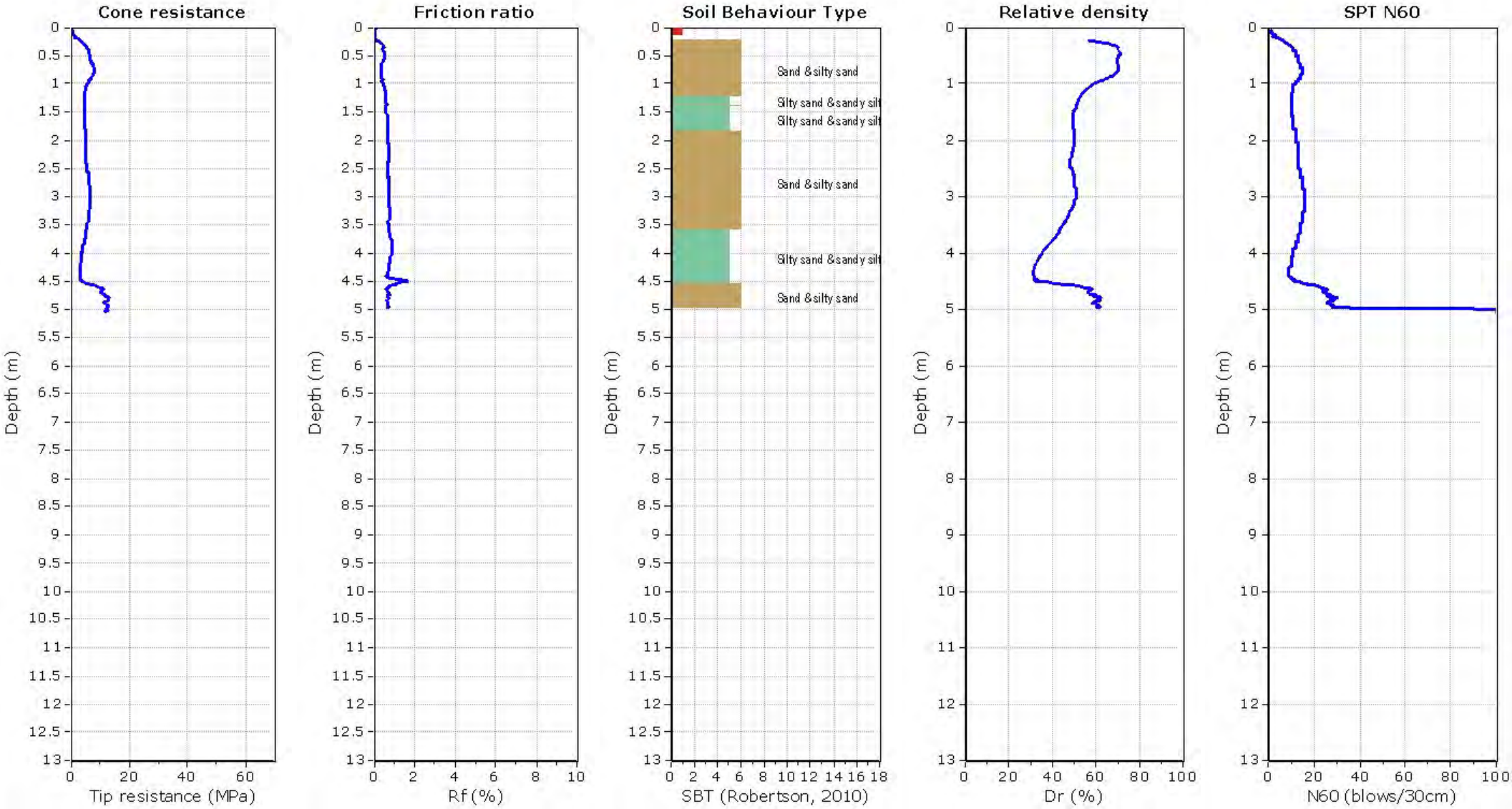
CPT 71
Total depth: 5.04 m, Date: 09/05/2017
Surface Elevation: 28.20 m
Coords: X:371225.58, Y:6511581.22
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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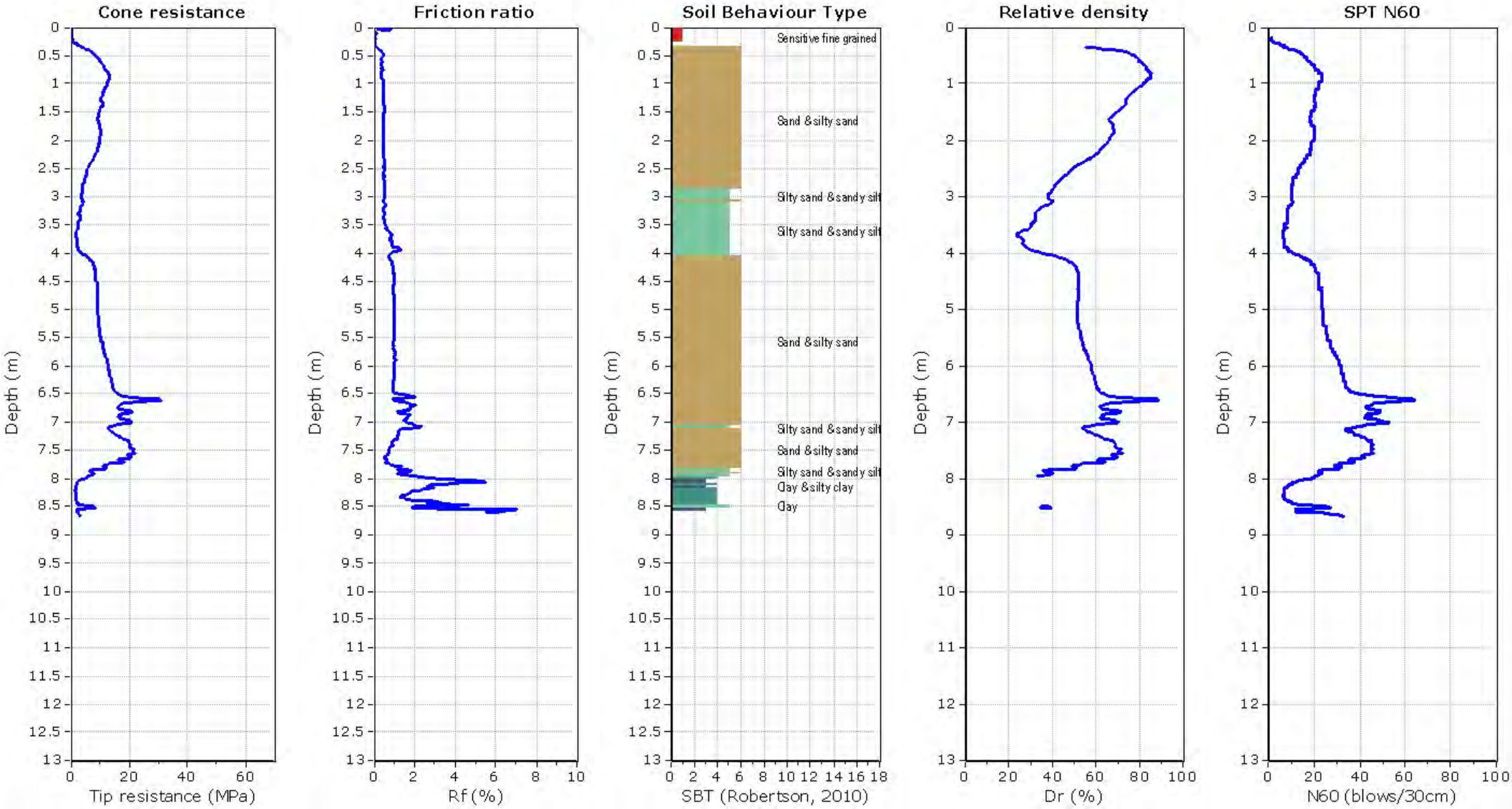
CPT 72
Total depth: 8.66 m, Date: 05/05/2017
Surface Elevation: 45.81 m
Coords: X:376131.21, Y:6500830.63
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: - Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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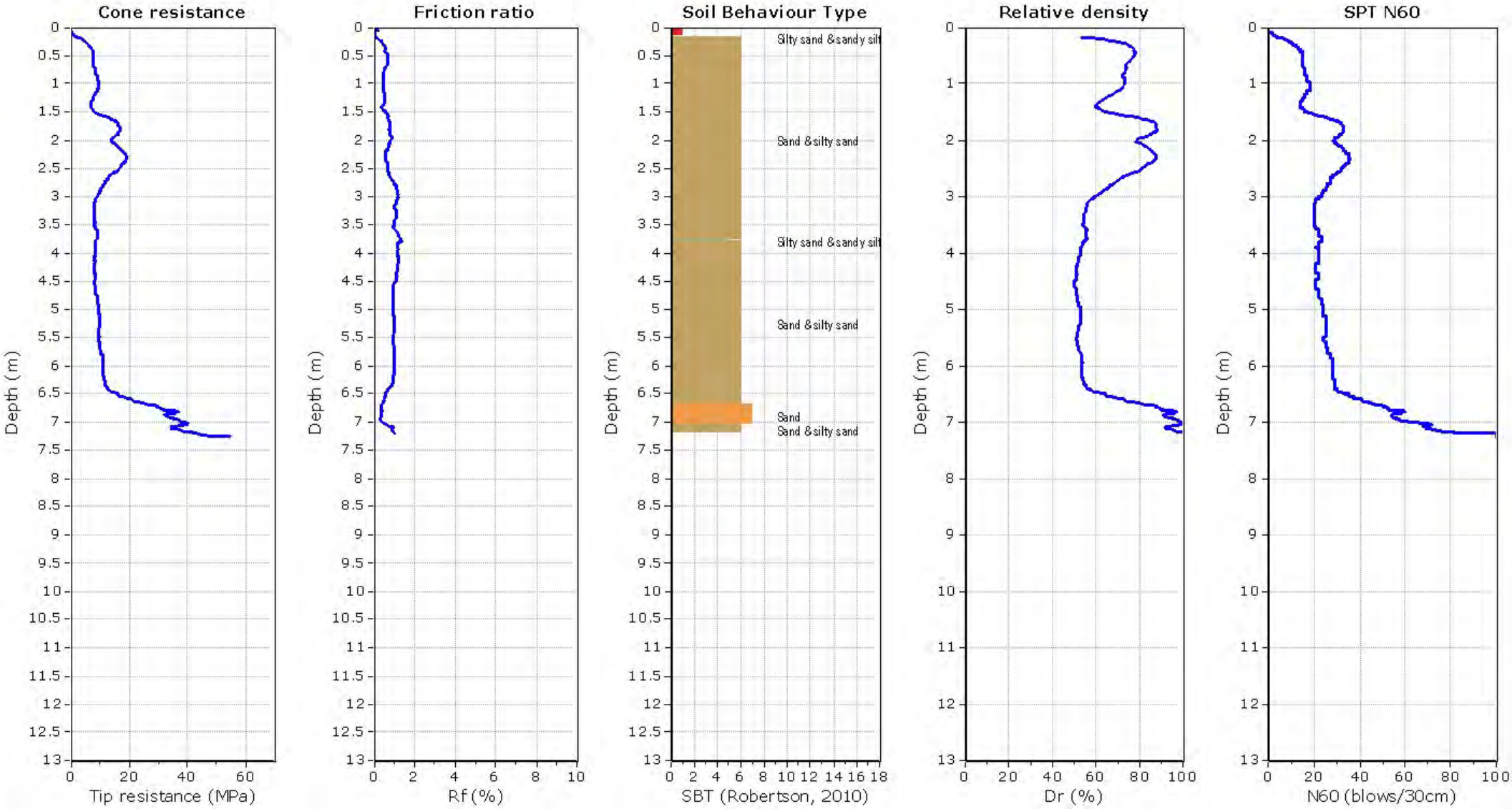
CPT 72-2
Total depth: 7.26 m, Date: 13/06/2017
Surface Elevation: 46.16 m
Coords: X:376145.56, Y:6500846.70
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: Inclination Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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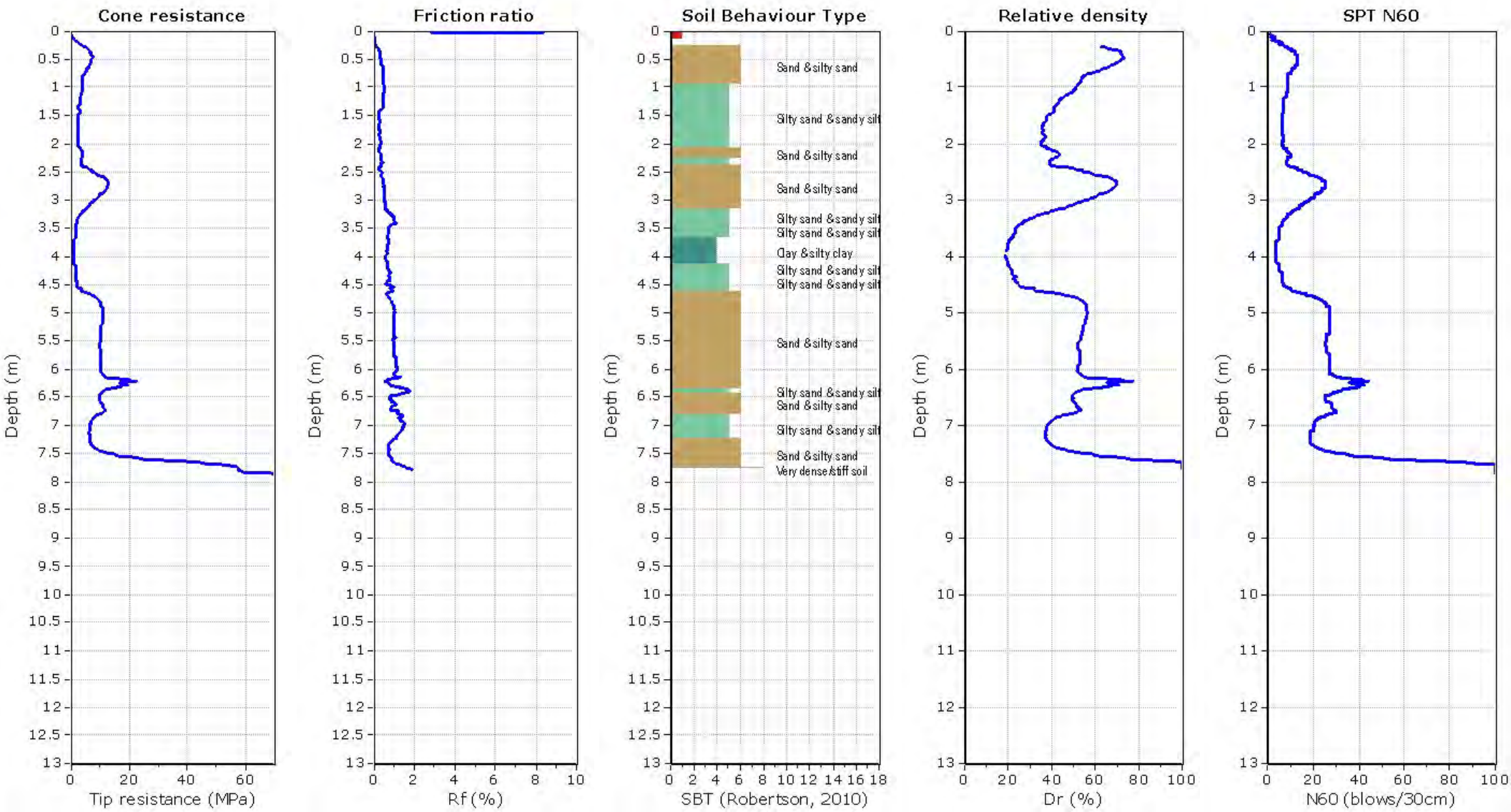
CPT 72-3
Total depth: 7.85 m, Date: 13/06/2017
Surface Elevation: 46.04 m
Coords: X:376123.61, Y:6500812.57
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 70MPa Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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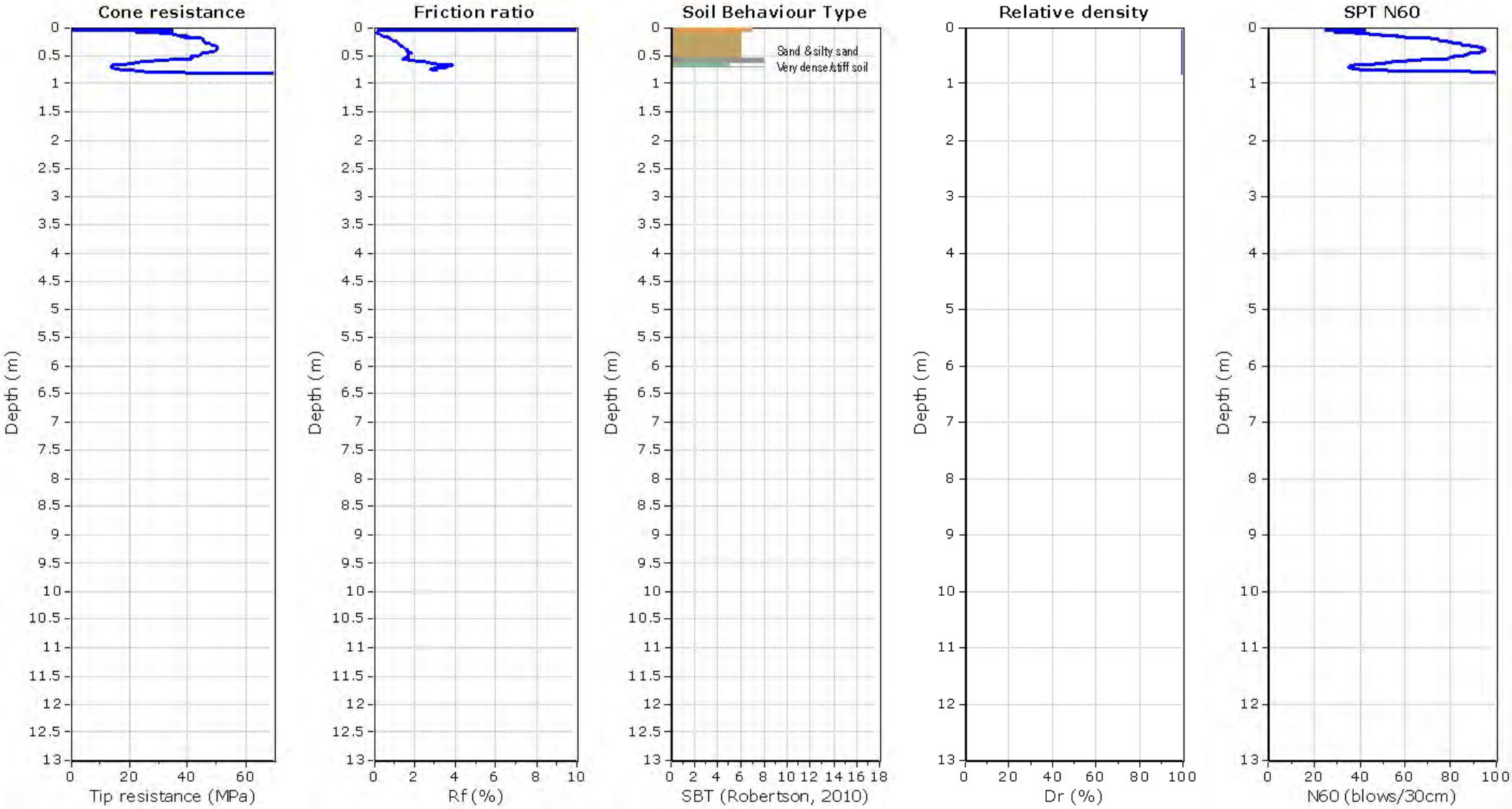
CPT 73
Total depth: 0.84 m, Date: 05/05/2017
Surface Elevation: 48.50 m
Coords: X:376180.98, Y:6500701.03
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:

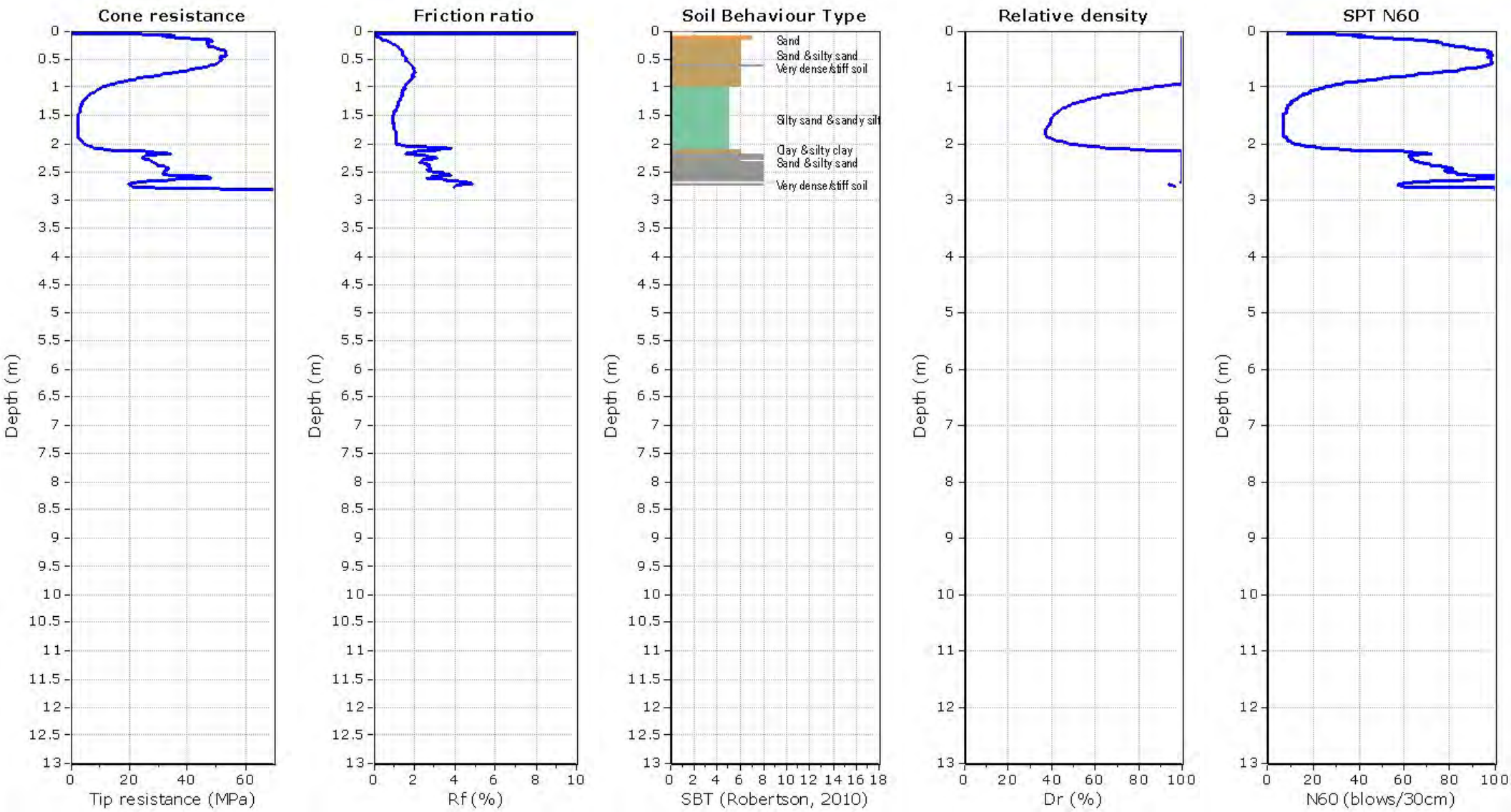


Water Table (m): - Refusal: 90MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPT 73 (2)
Total depth: 2.82 m, Date: 05/05/2017
Surface Elevation: 48.43 m
Coords: X:376182.79, Y:6500696.46
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:

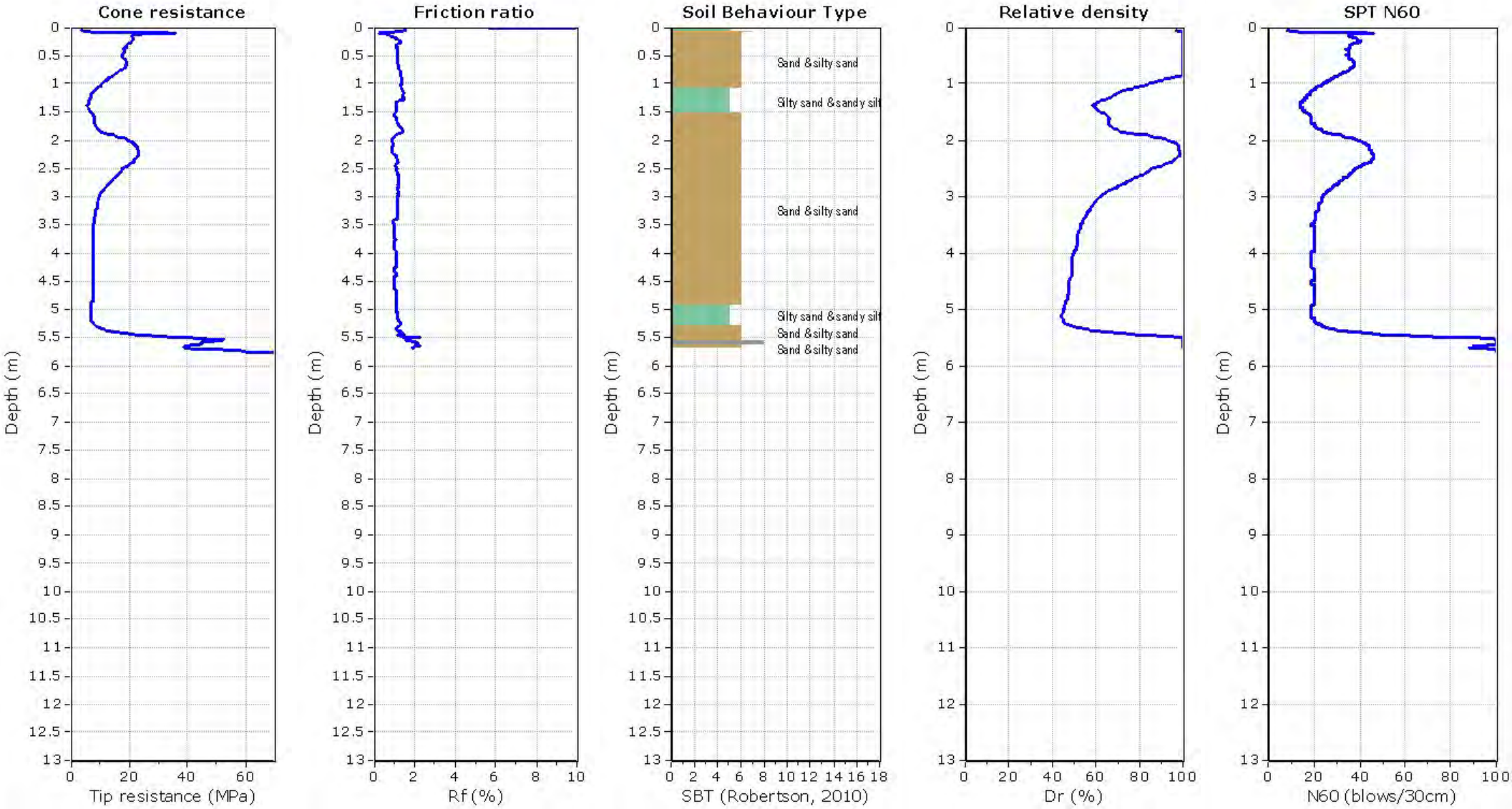


Water Table (m): - Refusal: 100MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPT 74
Total depth: 5.75 m, Date: 05/05/2017
Surface Elevation: 49.83 m
Coords: X:376224.81, Y:6500601.72
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:

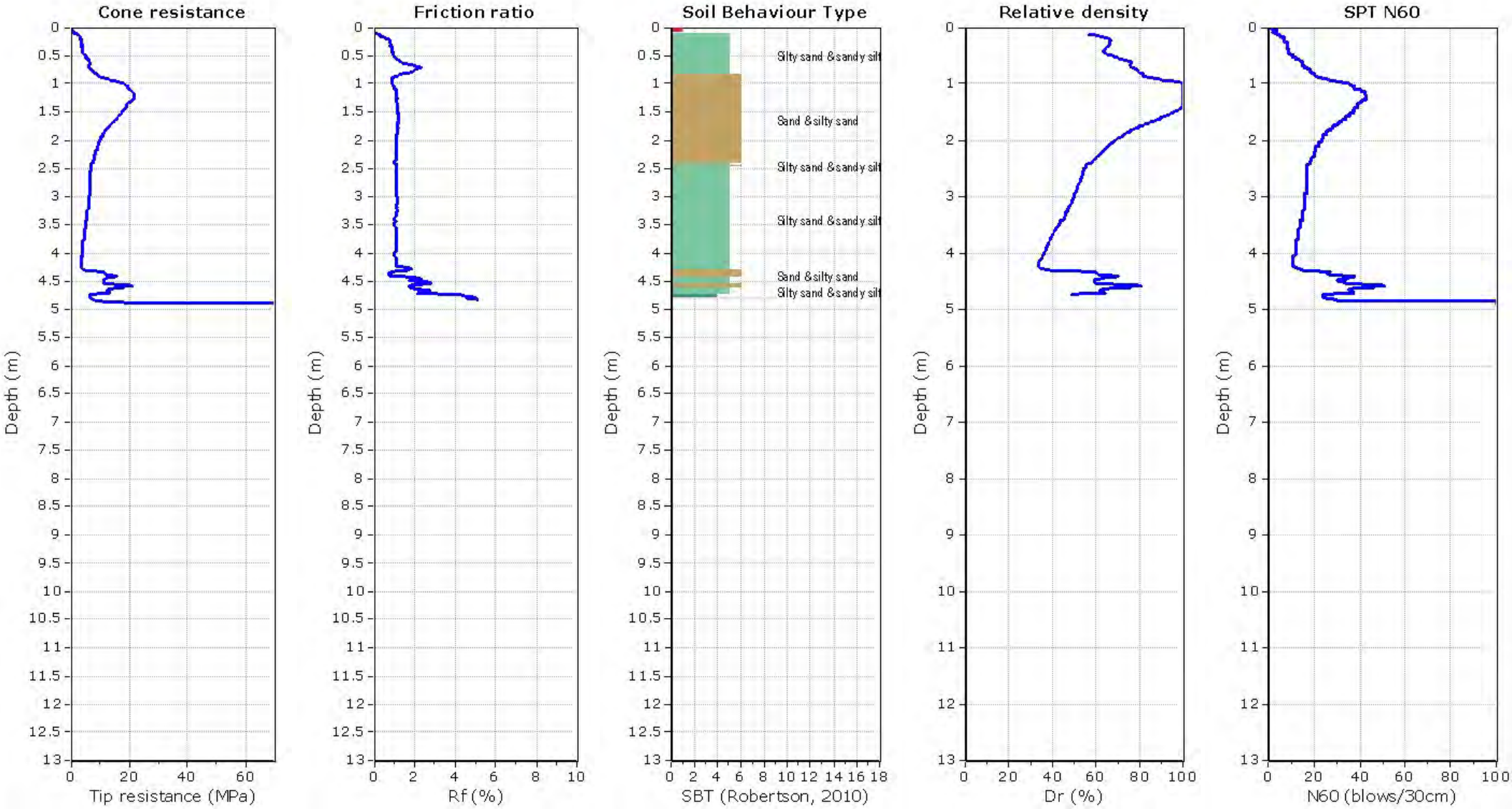


Water Table (m): - Refusal: 75MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPT 75
Total depth: 4.90 m, Date: 05/05/2017
Surface Elevation: 50.78 m
Coords: X:376386.63, Y:6500232.17
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:

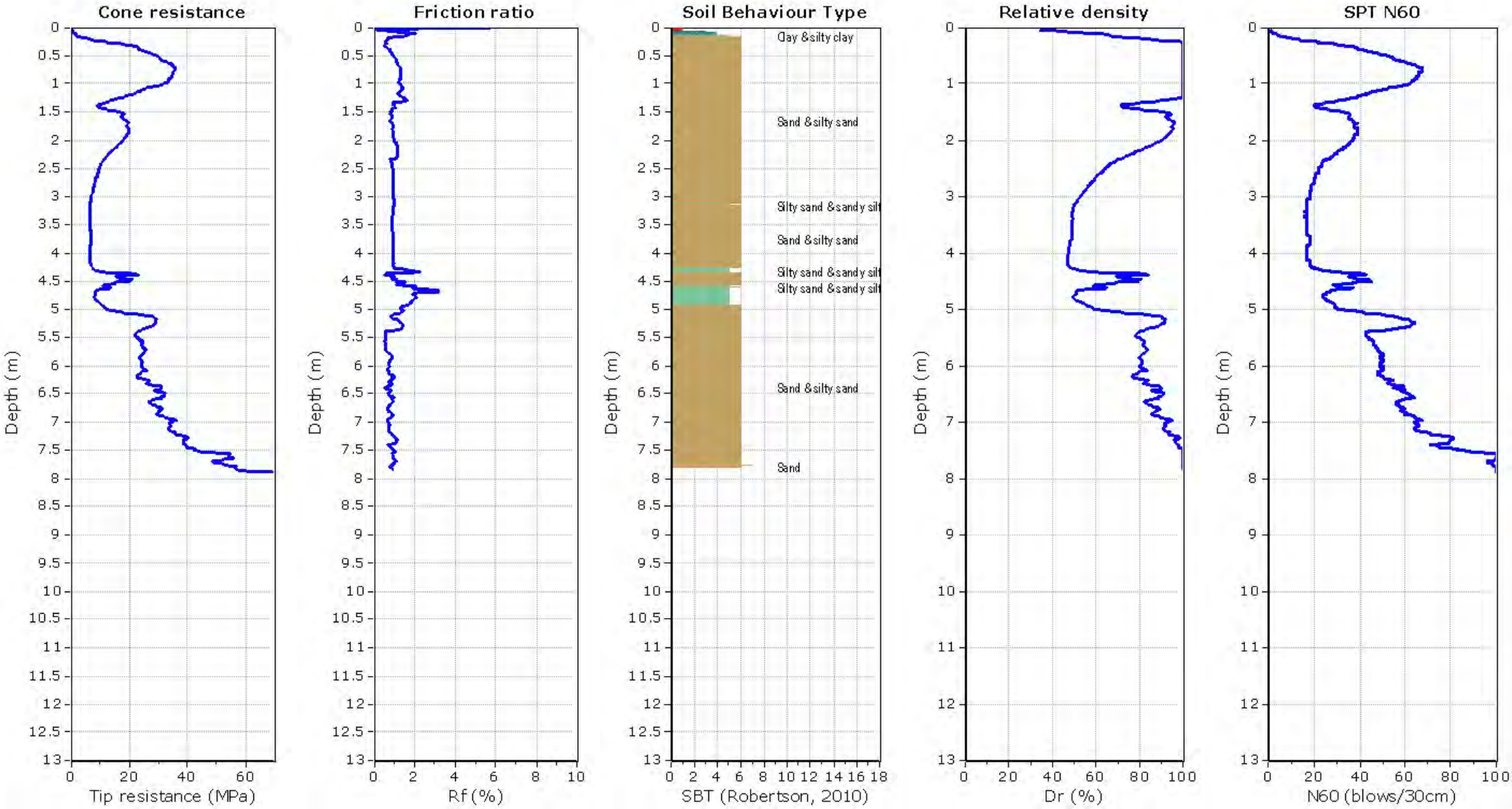


Water Table (m): - Refusal: 75MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPT 76
Total depth: 7.89 m, Date: 05/05/2017
Surface Elevation: 50.82 m
Coords: X:376484.47, Y:6499971.24
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:

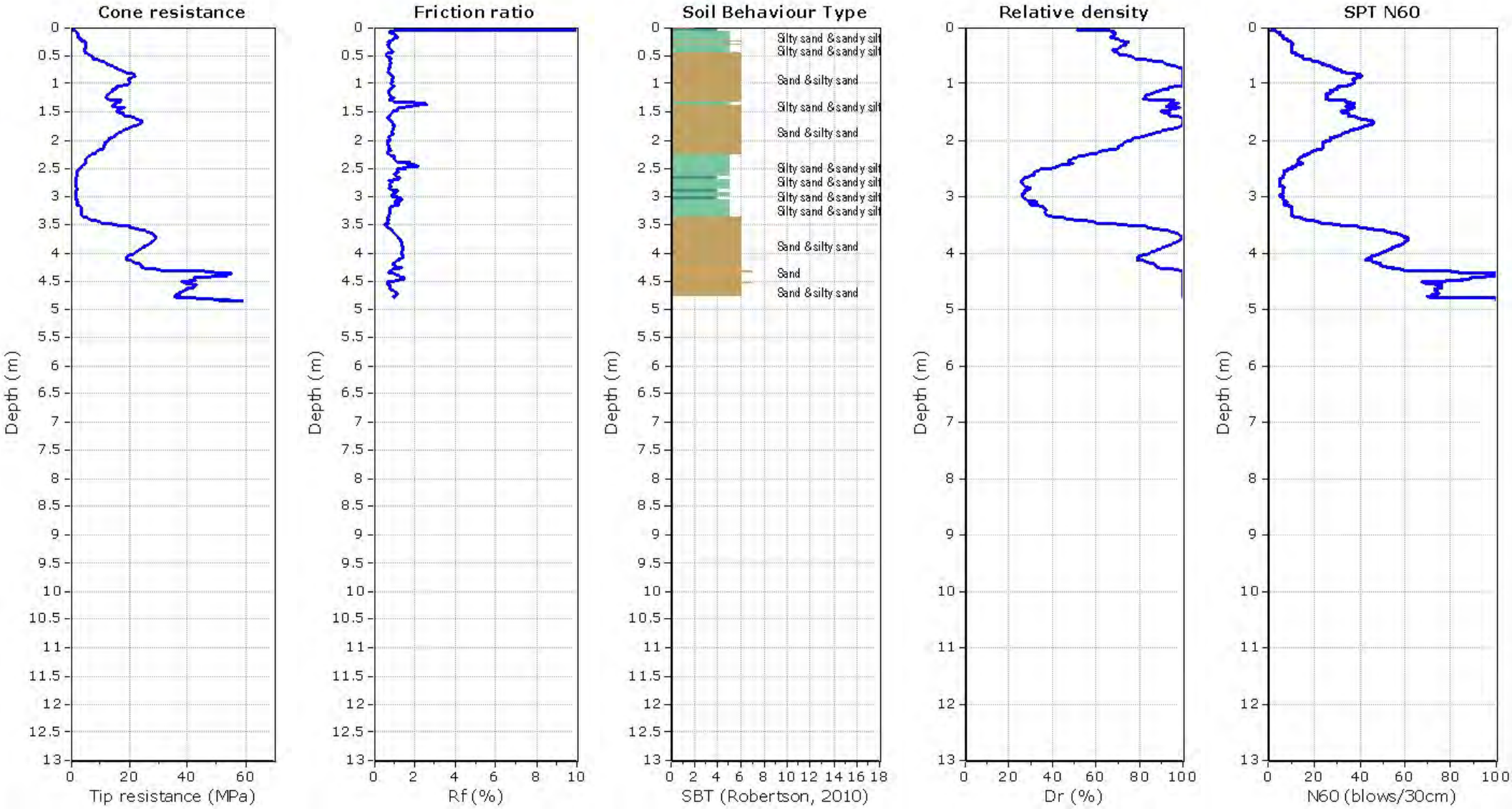


Water Table (m): - Refusal: 75MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPT 76-2
Total depth: 4.85 m, Date: 13/06/2017
Surface Elevation: 50.88 m
Coords: X:376464.74, Y:6500034.14
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:

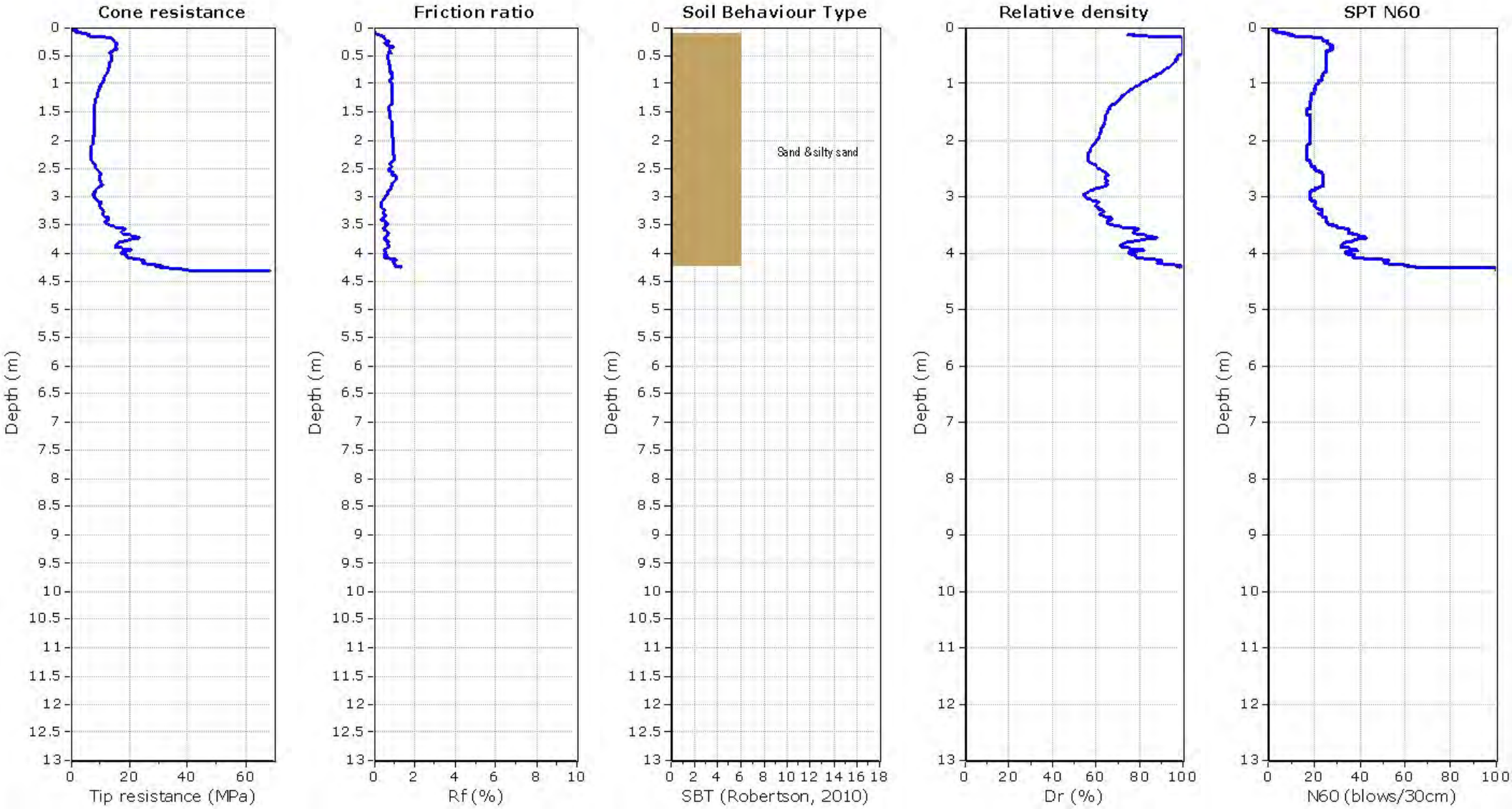


Water Table (m): - Refusal: 65MPa Cone ID: C15209 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPT 77
Total depth: 4.32 m, Date: 05/05/2017
Surface Elevation: 41.92 m
Coords: X:376519.24, Y:6499866.78
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:

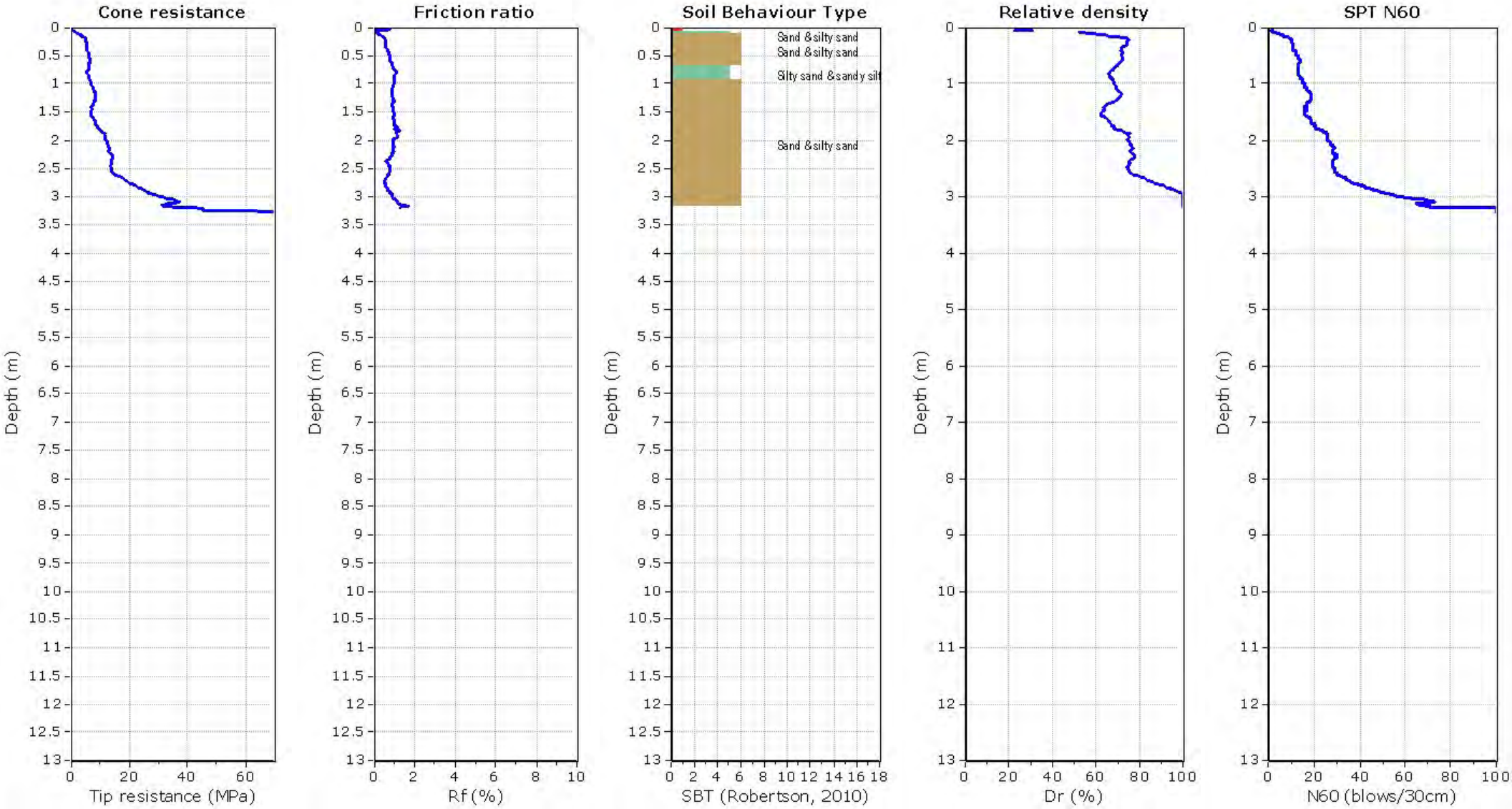


Water Table (m): - Refusal: 70MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPT 78
Total depth: 3.26 m, Date: 05/05/2017
Surface Elevation: 44.75 m
Coords: X:376555.55, Y:6499722.42
Cone Operator: Andrew

Project: **Butler to Yanchep Rail**
Location:



Water Table (m): - Refusal: 75MPa Cone ID: C15514 CPTWest File Name: 016178
CPT Rig: 22 tonne 6x6 truck Testing completed in accordance with AS1289.6.5.1-1999

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Appendix D Borehole Logs and Photographs

EXPLANATORY NOTES FOR SOIL DESCRIPTION AND CLASSIFICATION

Geotechnical logging is carried out in general accordance with Australian Standard AS 1726 - 1993 "Geotechnical site investigations". The description of soils is based on the Unified Soil Classification system and includes type, plasticity, particle characteristics, colour and minor components. Classification of soils is based on particle size distribution and plasticity, in accordance with Appendix A of AS 1726 - 1993. The terminology used by Advisian to describe the condition of soils for logging purposes is summarised below. Sheet 2 provides assistance for field description and soil classification.

MOISTURE CONDITION

Term	Symbol	Field Guide
Dry	D	Looks and feels dry. Cohesive soils usually hard, friable or powdery. Granular soils are cohesionless and free running
Moist	M	Feels cool and darkened in colour. Cohesive soils can be moulded by hand. Granular soils tend to cohere
Wet	W	Feels cool and darkened in colour. Cohesive soils usually weakened and free water forms on hands when remoulding. Granular soils tend to cohere

CONSISTENCY OF COHESIVE SOILS

Term	Symbol	Undrained Shear Strength (kPa)	Field Guide
Very Soft	VS	Less than 12	Exudes between fingers when squeezed in hand
Soft	S	12 to 25	Can be moulded by light finger pressure
Firm	F	25 to 50	Can be moulded by strong finger pressure
Stiff	St	50 to 100	Cannot be moulded by fingers, can be indented by thumb
Very Stiff	VSt	100 to 200	Can be indented by thumb nail
Hard	Hd	More than 200	Can be indented with difficulty by thumb nail

DENSITY OF GRANULAR SOILS

Term	Symbol	Density Index (%)
Very Loose	VL	Less than 15
Loose	L	15 to 35
Medium Dense	MD	35 to 65
Dense	D	65 to 85
Very Dense	VD	More than 85

PLASTICITY OF FINE GRAINED SOILS

Term	Range of Liquid Limit (%)
Low Plasticity	Less than 35
Medium Plasticity	35 to 50
High Plasticity	More than 50

MINOR COMPONENTS

Term	Field Guide	Material Proportion
Trace of	Presence just detectable	Coarse grained soils less than 5% Fine grained soils less than 15%
With some	Presence easily detectable	Coarse grained soils between 5 to 12% Fine grained soils between 15 to 30%

SAMPLE/TEST (FOR LOG SHEETS)

Details of field testing (and samples retrieved) including the following:

SPT	Standard Penetration Test (blows per 150mm and N value), HB - hammer bouncing, RW - rod weight
U	63mm diameter Thin Walled Tube Sample
HV	Hand Vane Test
PP	Pocket Penetrometer Test
Bs	Bulk Sample
PSP	Perth Sand Penetrometer (blows per 150mm)
DCP	Dynamic Cone Penetrometer (blows per 150mm)
	Disturbed Sample Interval (laboratory test result can be provided or alternatively type of test indicated "X")

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FIELD DESCRIPTION, IDENTIFICATION AND CLASSIFICATION OF SOILS

MAJOR DIVISIONS			PARTICLE SIZE (mm)	FIELD IDENTIFICATION PROCEDURES				GROUP SYMBOL
COARSE GRAINED SOILS (More than half of material less than 60mm is larger than 0.06mm)	The smallest particle visible to the naked eye is approximately 0.06mm	BOULDERS	200					BO
		COBBLES	60					CO
		GRAVELS (More than half of coarse fraction is larger than 2.0mm)	coarse / medium / fine — 20 / 6 / 2.0	Well graded gravels, gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength			GW
				Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels	Predominately one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength			GP
				Silty gravels, gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength			GM
				Clayey gravels, gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength			GC
		SANDS (More than half of coarse fraction is smaller than 2.0mm)	coarse / medium / fine — 0.6 / 0.2 / 0.06	Well graded sands, gravelly sands, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength			SW
				Poorly graded sands and gravelly sands, little or no fines, uniform sands	Predominately one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength			SP
				Silty sands, sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength			SM
				Clayey sands, sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength			SC
FINE GRAINED SOILS (More than half of material less than 60mm is smaller than 0.06mm)		SILTS and CLAYS (Liquid limit less than 50%)		Inorganic silts, clayey silts and sandy silts with low plastcity	Field assessment based on fraction smaller than 0.2mm			ML
					Dry strength	Dilatancy	Toughness	
					None to low	Quick to slow	None	
				Inorganic clays, gravelly clays, sandy clays and silty clays with low to medium plasticity	Medium to high	None to very slow	Medium	CL, CI
				Organic silts and silty clays of low plasticity	Low to medium	Slow	Low	OL
		SILTS and CLAYS (Liquid limit more than 50%)		Inorganic silts and micaceous or diatomaceous fine soils of high plasticity	Low to medium	Slow to none	Low to medium	MH
				Inorganic clays of high plasticity	High to very high	None	High	CH
				Organic clays and silts of medium to high plasticity	Medium to high	None to very slow	Low to medium	OH
		HIGHLY ORGANIC SOILS		Peat and other highly organic soils	Identified by colour, odour, spongy feel and generally by fibrous texture			Pt

SOURCE: Based on Table A1, AS 1726-1993

EXPLANATORY NOTES FOR ROCK DESCRIPTION AND CLASSIFICATION

Geotechnical logging is carried out in general accordance with Australian Standard AS 1726 - 1993 "Geotechnical site investigations". The terminology used by Advisian to describe the condition of rocks and associated materials for logging purposes is summarised below.

WEATHERING CLASSIFICATION

Term	Symbol	Definition
Residual Soil	RS	Soil derived from the weathering of rock, the mass structure and substance fabric are no longer evident, there is a large change in volume but the soil has not been significantly transported
Extremely Weathered Material	XW	Material is weathered to such an extent that it has "soil" properties i.e. it either disintegrates or can be remoulded in water. Original fabric still evident
Highly Weathered Rock	HW	Rock is weathered to such an extent that it shows considerable change in appearance and loss in strength. Material is still a rock but of relatively low strength
Moderately Weathered Rock	MW	Rock is weathered to such an extent that it shows a visible change in appearance with significant loss in strength
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock
Fresh Rock	FR	Rock shows no sign of decomposition or staining

Notes:

1. AS 1726 - 1993 suggests the term "distinctly weathered" to cover the range from extremely weathered to slightly weathered. For projects where it is judged that there is no advantage in differentiating between highly weathered and moderately weathered, "distinctly weathered" may be adopted using the definition given in AS 1726 - 1993.
2. Moderately weathered and highly weathered definitions above are taken from AS 1726 - 1981 "SAA Site Investigation Code".

ROCK MATERIAL STRENGTH

Term	Symbol	Point Load Index $I_{s(50)}$ (MPa)	Field Guide
Very Low	VL	Less than 0.1	Material crumbles under firm blows with sharp end of geological pick, can be peeled with a knife, pieces up to 30mm thick can be broken by finger pressure
Low	L	0.1 to 0.3	Easily scored with knife, indentations 1 to 3mm show with firm blows of a pick point, has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling
Medium	M	0.3 to 1	Readily scored with knife, a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty
High	H	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow, rock rings under hammer
Very High	VH	3 to 10	Hand specimen breaks after more than one blow of a pick, rock rings under hammer
Extremely High	EH	More than 10	Specimen requires many blows with pick to break, rock rings under hammer

Notes:

1. The term "extremely low" is not used as a rock material strength term. Although it is stated in AS 1726 - 1993 the accompanying field guide clearly states that materials in that strength range are soils in engineering terms.
2. Anisotropy of rock samples may affect field assessment of strength.
3. Uniaxial Compressive Strength (UCS) values are to be stated where tested for project specific correlation with Point Load Strength Index.

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CEMENTATION CLASSIFICATION

Term	Symbol	Definition
Uncemented	Uc	Clean grains exhibiting soil properties
Very weakly cemented	Vwk	Cement on some grains, collapsing feel under very light finger pressure
Weakly cemented	Wk	Cement on many grains, collapsing feel under finger pressure, breaks down to individual grains
Moderately weakly cemented	Mwk	Cement on most grains, breaks down to lumps under finger pressure, can crush to individual grains under knife blade
Moderately cemented	Mo	Cement on most grains, can break fragments off by hand and crush to small lumps under knife blade
Well cemented	We	Practically all grains cemented together, cannot break fragments off by hand, dull sound under hammer
Very well cemented	Vwe	Most primary pores filled with cement, requires firm blow with hammer to break off fragments, rings when struck

Note:

1. The above field classification system uses terms commonly adopted by geotechnical engineering practice in Western Australia.

DEFECT SPACING

Term	Symbol	Definition
Extremely Wide	Ew	More than 6m
Very Wide	Vw	2 to 6m
Wide	W	600mm to 2m
Moderate	M	200 to 600mm
Close	C	60 to 200mm
Very Close	Vc	20 to 60mm
Extremely Close	Ec	Less than 20mm

Note:

1. Above terms and definitions sourced from ISRM Suggested Methods - 1981 "Rock Characterisation, Testing and Monitoring".

ROCK MASS WEATHERING

Weathering of the rock mass in relation to the distribution of weathered materials and the effect of defects is described below.

Grade	Description
I	No visible sign of weathering except perhaps staining on defect surfaces
II	Almost all rock is discoloured by slight weathering
III	Less than half of the material is moderately to extremely weathered, some residual boulders/corestones may be present
IV	More than half of the material is moderately to extremely weathered, occasional corestones may be present
V	The material is extremely weathered with mass structure largely intact
VI	Refer to soil classification system

Note:

1. The above weathering grades apply to relatively large scale exposures. For boreholes, weathering terms discussed previously apply.
2. Defect persistence (areal extent) and aperture (openness) to be recorded where appropriate.

ROCK MASS BLOCK SHAPE

Blocky	Equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greater than cross section

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AN AID TO THE FIELD CLASSIFICATION OF ROCKS FOR ENGINEERING PURPOSES (CHART A)

GRAIN SIZE (mm)	BEDDED ROCKS (MOSTLY SEDIMENTARY)							OBVIOUSLY FOLATED ROCKS (MOSTLY METAMORPHIC)		ROCKS WITH MASSIVE STRUCTURE AND CRYSTALLINE TEXTURE (MOSTLY IGNEOUS)					
More than 20	GRAIN SIZE DESCRIPTION			AT LEAST 50% OF GRAINS ARE OF CARBONATE		AT LEAST 50% OF GRAINS ARE OF FINE GRAINED VOLCANIC ROCK		GRAIN SIZE DESCRIPTION		GRAIN SIZE DESCRIPTION		Pegmatite			Pyroxenite
20	RUDACEOUS		**CONGLOMERATE** Rounded boulders, cobbles and gravel cemented in a finer matrix Breccia Irregular rock fragments in a finer matrix	LIMESTONE AND DOLOMITE (undifferentiated)	Calcirudite	Fragments of volcanic ejecta in a finer matrix Rounded grains **AGGLOMERATE** Angular grains **VOLCANIC BRECCIA**	SALINE ROCKS Halite Anhydrite Gypsum	COARSE	**GNEISS** Well developed but often widely spaced foliation, sometimes with schistose bands Migmatite Irregularly foliated, mixed schists and gneisses	**MARBLE** **QUARTZITE** Granulite **HORNFELS** Amphibolite Serpentinite	COARSE	**GRANITE**[1]	Diorite[1,2]	**GABBRO**[3]	Peridotite
6												These rocks are sometimes porphyritic and are then described, for example, as as porphyritic granite			
2	ARENACEOUS Coarse / Medium / Fine		**SANDSTONE** Angular or rounded grains, commonly cemented by clay, calcitic or iron minerals Quartzite Quartz grains and siliceous cement Arkose Many feldspar grains Greywacke Many rock chips		Calcarenite	Cemented volcanic ash **TUFF**		MEDIUM	**SCHIST** Well developed undulose foliation, generally much mica		MEDIUM	Microgranite[1]	Microdiorite[1,2]	Dolerite[3,4]	
0.6												These rocks are sometimes porphyritic and are then described as porphyries			
0.2															
0.06															
0.002	ARGILLACEOUS	**MUDSTONE** / **SHALE** Fissile	**SILTSTONE** Mostly silt / **CLAYSTONE** Mostly clay	Calcareous mudstone	Calcisiltite / Calcilutite — **CHALK**	Fine grained **TUFF** Very fine grained **TUFF**		FINE	**PHYLLITE** Slightly undulose foliation, sometimes spotted **SLATE** Well developed plane cleavage (foliation)		FINE	**RHYOLITE**[4,5]	**ANDESITE**[4,5]	**BASALT**[4,5]	
Less than 0.002												These rocks are sometimes porphyritic and are then described as porphyries			
Amorphous or crypto-crystalline		Flint: occurs as bands of nodules in chalk Chert: occurs as nodules and beds in limestone and calcareous sandstone					COAL LIGNITE		Mylonite Found In fault zones, mainly In Igneous and metamorphic areas			Obsidian[5]	Volcanic glass		
		Granular cemented - except amorphous						CRYSTALLINE				colour: Pale ← – – – – – → Dark			
		SILICEOUS	CALCAREOUS		SILICEOUS	CARBON-ACEOUS		SILICEOUS	Mainly SILICEOUS			ACID Much quartz	INTERMEDIATE Some quartz	BASIC Little or no quartz	ULTRA BASIC

SEDIMENTARY ROCKS
Granular cemented rocks vary greatly in strength, some sandstones are stronger than igneous rocks. Bedding may not show in hand specimens and is best seen in outcrop. Only sedimentary rocks, and some metamorphic rocks derived from then, contain fossils.

Calcareous rocks contain calcite (calcium carbonate) which effervesces with dilute hydrochloric acid.

METAMORPHIC ROCKS
Most metamorphic rocks are distinguished by foliation which may impart fissility. Foliation in gneisses is best observed in outcrop. Non-foliated metamorphics are difficult to recognise except by association. Any rock baked by contact metamorphism is described as a 'hornfels' and is generally somewhat stronger than the parent rock. Most fresh metamorphic rocks are strong although perhaps fissile.

IGNEOUS ROCKS
Composed of closely interlocking mineral grains. Strong when fresh and non-porous.

Mode of occurrence: 1 Batholiths; 2 Laccoliths; 3 Sills; 4 Dykes; 5 Lava flows; 6 Veins.

SOURCE: Table 6, AS 1726-1993

Chart A gives guidance to the classification of rock types. The following chart has been adopted to suit local calcareous rocks based on modifications to the Clark and Walker (1977) and Gordon (2003) systems.

CLASSIFICATION CHART ADOPTED FOR WESTERN AUSTRALIAN COASTAL ROCKS (CHART B)

MATERIAL TYPE	ADDITIONAL DESCRIPTIVE TERMS BASED ON ORIGIN OF CONSTITUENT PARTICLES				
	NOT DISCERNIBLE		BIOCLASTIC OOLITES	SHELL CORAL ALGAL PISOLITES/ CLASTS	
	GRAIN SIZE 0.002mm	0.060mm	2mm	60mm	
CALCRETE FACIES	CALCRETE CAPROCK (Duricrust) / GROUNDWATER CALCRETE (Fluid Deposition)		CALCRETED CALCARENITE	CALCRETED CALCIRUDITE	
EOLIANITES, BEACHROCK AND SHALLOW MARINE DEPOSITS	CALCILUTITE	CALCISILTITE	CALCARENITE	CALCIRUDITE	90
	Clayey CALCILUTITE	Siliceous CALCISILTITE	Siliceous CALCARENITE	Conglomeratic CALCIRUDITE	50
	Calcareous CLAYSTONE	Calcareous SILTSTONE	Calcareous SANDSTONE	Calcareous CONGLOMERATE	10

TOTAL CARBONATE CONTENT % (constituent particles plus matrix)

Notes:

1. Lithological terms based on grain size and field assessment (e.g. hand lens and dilute HCl) of carbonate composition
2. Degree of cementation to be assessed using terms provided in Explanatory Notes
3. Estimated rock strengths to be assessed using terms provided in Explanatory Notes
4. For other sedimentary rock classifications refer to Chart A

References:

Gordon, R. (2003) "Coastal Limestones", Australian Geomechanics, Vol 38, No. 4, December 2003, The Engineering Geology of Perth - Part 2, pp 7-23

Clark, A.R. and Walker, B.F. (1977) "A Proposed Scheme for the Classification and Nomenclature for Use in the Engineering Description of Middle Eastern Sedimentary Rocks", Geotechnique 27(1), pp 93-99

CORED BOREHOLE LOG

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BOREHOLE NO:

SHEET: OF

CLIENT:	DATE COMMENCED:
PROJECT:	DATE COMPLETED:
LOCATION:	LOGGED BY:
JOB NUMBER:	CHECKED BY:

Drill Contractor:	Bore Size:	Hole Angle:	Easting:	Surface RL:
Drill Model:	Drill Fluid:	Bearing:	Northing:	Datum:

Method	Casing	Drill Rate (min/m)	RL (m)	Depth (m)	Geological Unit	Graphic Log	Material Description	Cementation / Weathering	Estimated Strength	Defect Spacing (mm)	Lift & Core Recovery (%)	RQD %	Lab Tests: PLI (MPa)	Lab Tests: UCS (MPa)	Lab Tests: ITS (MPa)	Lab Tests: Other	Field Records / Comments and Defect Description	Water
1	2	3	4	4	5	6	7	8	9	10	11	12	13	13	13	13	14	16
PQ-3	Open Hole	6.7	-13.0	0.5	Marine Sands	CL	SAND (SP): fine to medium grained, subrounded quartz, pale grey, trace fine grained carbonate gravel (shells).	CL									Probe refusal between 0.4 to 0.7m. Material description based on grab sample.	
																	Core loss: 0 to 0.6m	
			-13.5	1.0	Coastal Limestone		CALCIRUDITE: fine to medium grained comprising shells/shell fragments and rounded lithic clasts to 15mm in calcarenite matrix, granular texture, grey, white, pale brown.	Mo-Mwk	L		1 / 60	27	0.42				a b c d e f 15 B, 30, Pl, R, Cl, Vn	
							0.9 to 1.1m: some borings		L-M									15:00 24/2/05
							...grading to calcarenite											

KEY TO CORED BOREHOLE LOG

The top section of the log is self explanatory giving details of the project including the client, location, drill contractor, job number, date, logger, drill information and survey data. The main part of the log is summarised below.

1 **METHOD:** Drill method; PQ-3 Core, HQ-3 Core, Washbore etc

2 **CASING:** Depth and size of casing or open hole

3 **DRILL RATE:** Time to drill/core interval (minutes per metre)

4 **RL/DEPTH:** Elevation relative to datum and distance in metres below ground level

5 **GEOLOGICAL UNIT:** Identification of the geological unit (if known) or symbol used for identification of geological unit on site plan

6 **GRAPHIC LOG:** Graphic pattern of material type

7 **MATERIAL DESCRIPTION:** Lithologic description in the order; rock type, grain size and shape, texture/fabric, colour, mineral composition or minor inclusions

8 **CEMENTATION/WEATHERING:** Cementation descriptor (e.g. sedimentary rocks) or weathering descriptor (e.g. igneous rocks)

9 **ESTIMATED STRENGTH:** Rock strength descriptor

10 **DEFECT SPACING:** Graphic record of spacing between natural pre-existing defects. Known mechanical breaks induced by drilling or handling core are discounted. If uncertain, the break is treated as a natural defect. Zones of core loss are left blank

11 **LIFT/%REC:** Each core run is defined as the lift. Core recovery represents the ratio of length of core recovered to the total length drilled for the corresponding core run and is expressed as a percentage. Core length is measured along the core centreline. Intervals of core loss are denoted "CL". Core loss is assigned to the end of the run unless there is evidence to suggest otherwise

12 **RQD:** Rock Quality Designation; is the ratio of the length of sound core recovered in pieces over 100mm to the length of core run drilled. Core length is measured along the core centreline. Mechanical breaks are discounted. If uncertain, the break is treated as a natural defect

13 **TESTS:** Field or laboratory test results e.g. point load index (diametral-D or axial-A), uniaxial compressive strength, indirect tensile strength (Brazil test)

14 **FIELD RECORD/COMMENTS:** Comments on drilling, fluid loss, core loss, sampling, highly fractured zones etc

15 **DEFECT DESCRIPTION:** Annotated description using terms described on the following page (Items a to f), including comment on uncertainty with regard to natural or mechanical breaks. Location of mechanical breaks to be provided where considered appropriate

16 **WATER:** Water level/depth; time (24 hr clock) and date to be provided

Notes on RQD:

1. Residual soil, extremely weathered material and highly weathered rock are judged not to be representative of sound core. Very weakly cemented, weakly cemented and moderately weakly cemented materials are judged not to be representative of sound core.
2. Engineering judgement is required when assessing RQD in variably cemented limestone containing cavities, and should therefore be used as indicative only.

KEY TO DEFECT DESCRIPTIVE TERMS USED ON CORED BOREHOLE LOGS

DEFECT DESCRIPTORS

a **Type:**

F - Fault
J - Joint
Fo - Foliation
V - Vein
B - Bedding
S - Shear

b Dip of fracture surface measured relative to a plane perpendicular to core axis (dip direction to be provided if core orientated)

c **Planarity:**

Un - Undulating, wavy surface
Pl - Planar, no variation in orientation
St - Stepped, well defined steps present
Ir - Irregular, many changes in orientation

d **Roughness:**

Slk - Slickensided, visual evidence of striations
S - Smooth, surface appears and feels smooth
SR - Slightly rough, asperities on the defect surface are distinguishable and can be felt
R - Rough, some ridges and angle steps are evident, asperities are clearly visible and surface feels abrasive
VR - Very rough, near right angle steps and ridges occur on the defect surface

e **Type of Infilling:**

Cl - Clay
Ca - Calcite
Ch - Chlorite
Fe - Iron oxide
Gy - Gypsum
H - Healed
Mn - Manganese oxide
Gr - Gravel
Py - Pyrite
Qz - Quartz
Sd - Sand
CA - Calcrete
Si - Silt
Uk - Unknown

f **Amount of Infilling:**

Cn - Clean, no visible coating or infilling
Su - Surface Stain, no visible coating or infilling but surfaces are discoloured
Vn - Veneer, a visible coating or infilling too thin to measure, may be patchy
Co - Coating, visible coating or infilling up to 1mm thick
Fi - Filled, coating or infilling greater than 1mm thick with amount in millimetres. Thick soil infilling to be described as seams if boundaries roughly parallel, or crushed seams if composed of rock fragments e.g. brecciated

Notes:

1. Cores with defect spacings in the range extremely close to close can be collectively denoted as "highly fractured" where considered appropriate

2. NR - not recorded NA - not applicable

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-03***
SHEET: 1 OF 2
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Romeo Road (CH42780)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	376067	**Surface R.L.:**	39.10m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501118	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm)	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE		39.0	0.0	Tamala Sand		Silica SAND: fine to medium grained, subrounded to rounded, quartz, dark brown	Uc	D		SPT		3,21,29 *N=50*					SPT: Recovery = 400mm
				0.5		CL	… mottled brown, pale brown	CL	CL									
			38.5															Core Loss: 0.45-0.75m
				1.0	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subrounded to rounded, quartz, pale brown, mottled pale orange-brown, trace calcrete development in patches and laminations	Wk-Mwk	L-M									Rockhead surface likely 'pinnacled', may extend up to or near 0.45m
		6	38.0								1/81	100			0.02			B, <5, Ir, R, Sd, Fi-2mm
				1.5														
			37.5															B, 10, Ir, R, Sd, Fi-2mm
				2.0														
			37.0		TS		Silica SAND: fine to medium grained, subrounded to rounded quartz, pale orange brown, with fine to coarse gravel of angular siliceous calcarenite and calcrete	Uc	MD-D									
				2.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subrounded to rounded, quartz, pale brown, mottled pale orange-brown,with solution features up to 25 x 80mm, infilled with sand	Mwk	L-M						0.11			B, 5, St, R, Sd, Fi-2mm
		5	36.5								2/100	63					1.50	
				3.0				Mwk-Mo	M									B, 0, St, R, Sd-Gr, Fi-3mm B, 15, St, R, Sd, Fi-1mm
			36.0															B, 30, Un, R, Sd, Fi-1mm
				3.5				Mo-We	M-H						0.66			B, 10, Un, R, Sd, Fi-1mm B, 5, St, R, Sd, Vn B, 5, St, R, Sd, Vn
			35.5															B, 15, Pl, SR, Sd, Vn
				4.0											0.25		5.20	
		5	35.0								3/100	100						
				4.5				Mwk-Mo	M									B, 40, Pl, R, Sd, Vn
			34.5															B, 5, Wv, R, Sd, Vn
				5.0										0.16	0.18			

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-03***
SHEET: 2 OF 2
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Romeo Road (CH42780)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	376067	**Surface R.L.:**	39.10m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501118	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	2	34.0	5.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subrounded to rounded, quartz, pale brown, mottled pale orange-brown,abundant solution features, voids and cavities infilled with sand, highly fractured in association with solution features	Mwk-Mo	M								1.60	
			33.5					Vwk-Mo	L-M									Highly fractured due to solution
				6.0			… 100mm band of sand, fine to medium grained, quartz, subrounded, with fine to coarse gravel of siliceous calcarenite				4/100	20		0.32	0.24			
			33.0					Mwk-Mo	M-H									B, 5, Ir, R, Sd, Fi-2mm
		NR		6.5										0.44	0.44			
			32.5															B, <5, Ir, R, Sd, Fi-2mm
				7.0							5/100	77						
			32.0															
				7.5														
			31.5															
				8.0										0.10				
		3	31.0															
				8.5														B, <5, Ir, R, Sd, Fi-1mm
			30.5								6/100	53						
				9.0				Mwk	M									
			30.0											0.04				
				9.5														B, <5, Ir, R, Sd, Fi-1mm
			29.5				End of BH-03 at 9.5m - Target Depth											
				10.0														

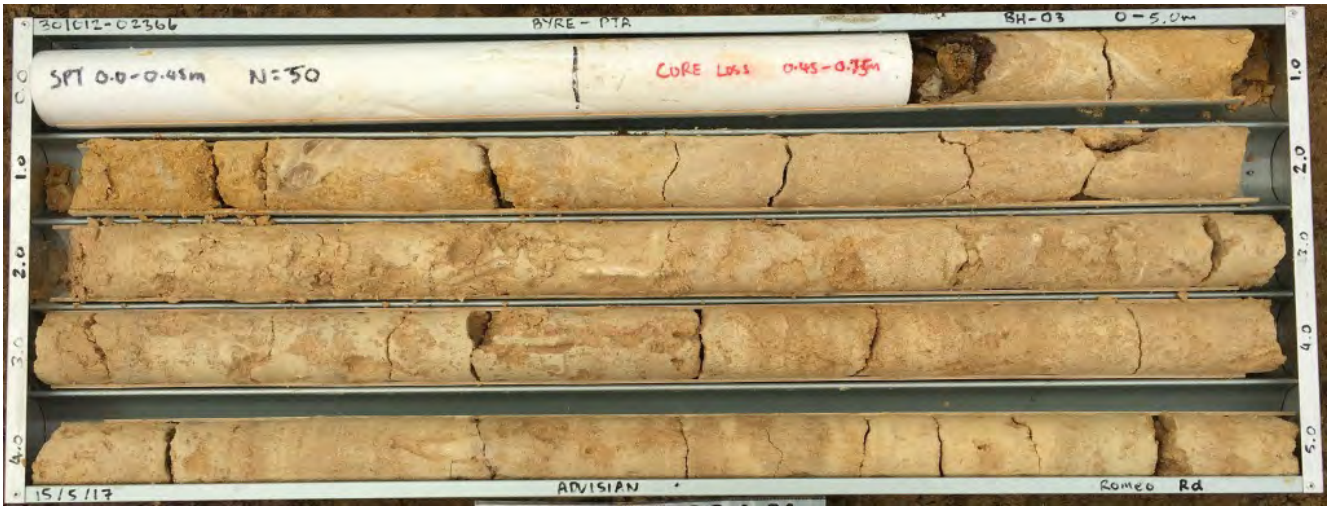
CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-03***
SHEET: 1 OF 2

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Romeo Road (CH42780)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	376067	**Surface R.L.:**	39.10m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501118	**Ref. System:**	AHD/GDA94



0.0 to 5.0m

5.0 to 9.95m

CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-03***

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Romeo Road (CH42780)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	376067	**Surface R.L.:**	39.10m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501118	**Ref. System:**	AHD/GDA94

Romeo Road Drill Site

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-09***
SHEET: 1 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Alkimos Station (CH43360)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375945	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501686	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm)	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE						Calcareous Silica SAND: fine to medium grained, subangular to rounded, quartz and carbonate (shell fragments), pale brown-grey, with organics (roots) top 100mm	Uc	VL	20 60 200 600 2000	SPT		1,1,2 *N=3*					SPT: Recovery = 450mm
			41.0	0.5	Safety Bay Sand	CL		CL	CL									
		NR	40.5	1.0			… trace organics (roots) up to 3mm diameter and 15mm long	Uc	L		1/52	NA						Core Loss: 0.45-1.20m
			40.0	1.5														
			39.5	2.0			Silica SAND: fine to medium grained, subangular to rounded, quartz, orange, trace shells, top 100mm fine to coarse grained, brown (palaeo-top soil)				SPT		2,2,2 *N=4*					SPT: Recovery = 360mm
			39.0	2.5	Tamala Sand	CL		CL	CL									
		NR	38.5	3.0							2/19	NA						Core Loss: 2.45-3.30m
			38.0	3.5				Uc	L									
			37.5	4.0							SPT		3,3,5 *N=8*					SPT: Recovery = 370mm
		NR	37.0	4.5		CL		CL	CL		3/0	NA						Core Loss: 3.95-5.00m
			36.5	5.0														

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-09***
SHEET: 2 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Alkimos Station (CH43360)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375945	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501686	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm)	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE		36.0	5.5	Tamala Sand		Silica SAND: fine to medium grained, subangular to rounded, quartz, orange, trace shells, top 100mm fine to coarse grained, brown (palaeo-top soil)	Uc	L		SPT		3,3,5 *N=8*					SPT: Recovery = 360mm
						CL		CL	CL									
		NR	35.5	6.0				Uc	L		4/57	87						Core Loss: 5.45-5.90m
					Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to subrounded quartz and shells, pale brown-white, carbonate-cemented, trace coarse sand, with some solution features infilled with sand up to 30mm by 100mm	Mwk-Mo	M-H									B, 20, Ir-Pl, R, Cn
															0.05			B, 5, Pl-Ir, R, Sd, Fi-2mm Bedding' defects commonly associated with solution features
		7	35.0	6.5														B, 10, Pl-Ir, R, Sd, Fi-4mm B, 30, Ir, R, Sd, Fi-20mm
			34.5	7.0														B, 20, Ir, R, Sd, Fi-2mm
											5/100	93						B, 20, Ir, R, Sd, Fi-5mm
			34.0	7.5											0.05			
																	7.10	
		NR	33.5	8.0														
								Wk-Mwk	L-M									B, 0, Ir, R, Sd, Fi-1mm
			33.0	8.5				Mwk-Mo	M-H		6/100	93			0.26			B, 10, Ir, R, Sd, Fi-1mm
																		Highly fractured on solution, B, 5-10, Ir, R, Sd, Fi-1-5mm
			32.5	9.0											0.23			B, 5, Ir, R, Sd, Fi-1mm
								Wk-Mwk	L-M									
		NR	32.0	9.5											0.75			
											7/100	100					1.30	
			31.5	10.0				Wk	L									B, 0, Ir, R, Sd, Fi-1mm

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-09***
SHEET: 3 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Alkimos Station (CH43360)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375945	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501686	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm)	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	NR	31.0	10.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to subrounded quartz and shells, pale brown-white, carbonate-cemented, trace coarse sand, with some solution features infilled with sand up to 30mm by 100mm	Wk	L	20 60 200 600 2000	7/100	100		0.30	0.34		2.90	B, 0, Ir, R, Sd, Fi-2mm
								Mwk	M									
			30.5	11.0														B, 0, Ir, R, Sd, Fi-2mm
		NR					… abundant solution features infilled with sand, fine to medium grained quartz and shells, pale yellow-white, highly fractured along solution features	Wk-Mwk	L-M									B, <5, Ir, R, Sd, Fi-1mm
			30.0	11.5			… 50mm band of sand											Highly fractured due to solution
							Calcareous Silica SAND: fine to medium grained, quartz, shells, pale yellow-white	Uc			8/100							
							Siliceous CALCARENITE: fine to medium grained, subangular to subrounded quartz and shells, pale brown-white, carbonate-cemented	Wk-Mwk						0.58	0.31			
			29.5	12.0			Calcareous Silica SAND: fine to medium grained, quartz, shells, pale yellow-white	Uc										
							Siliceous CALCARENITE: fine to medium grained, subangular to subrounded quartz and shells, pale brown-white, carbonate-cemented	Mwk	M									
			29.0	12.5														B, <5, Ir, R, Sd, Fi-1mm
		NR			Tamala Sand	CL	Silica SAND: fine to coarse grained, subrounded to rounded, quartz, orange to dark orange	CL	CL		9/83	NA						Core Loss: 12.50-12.75m
								Uc										
			28.5	13.0														
			28.0	13.5														
			27.5	14.0	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to subrounded quartz and shells, pale brown-white, carbonate-cemented, trace coarse sand with some solution features	Wk-Mwk	L-M		SPT		28/140mm HB N=R					
			27.0	14.5			End of BH-09 at 14.45m - Target Depth											
			26.5	15.0														

CORE PHOTOGRAPHS

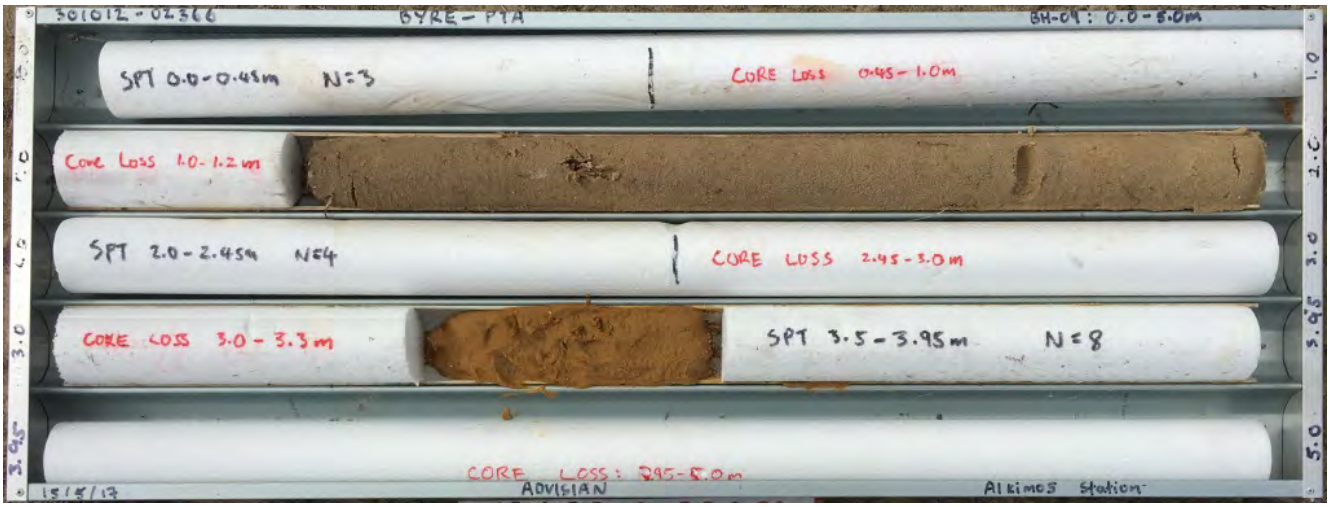
Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-09***

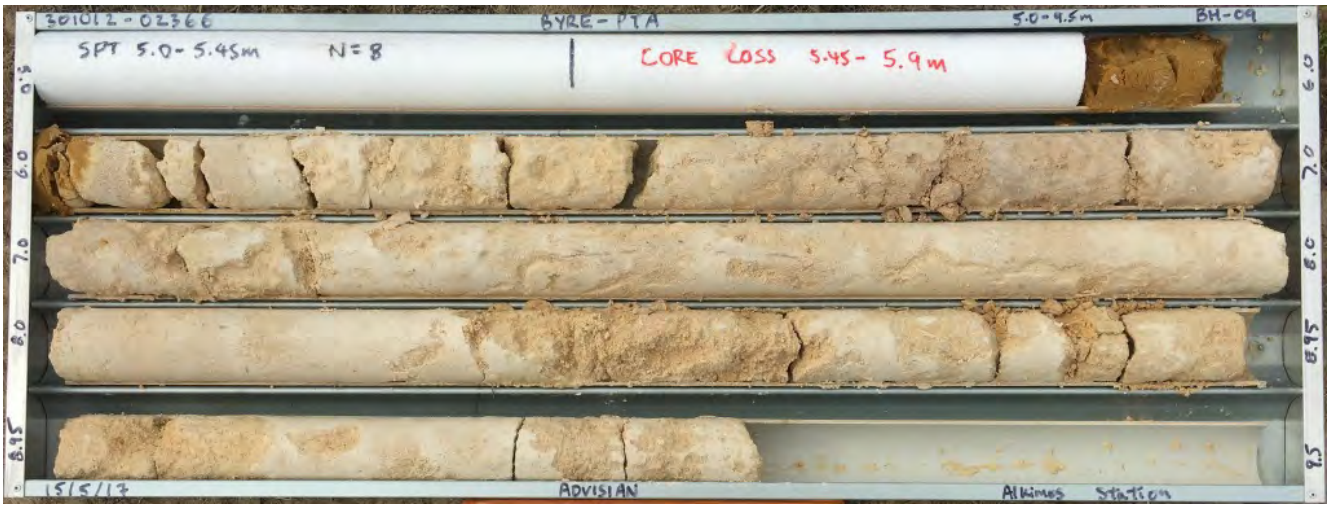
SHEET: 1 OF 2

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Alkimos Station (CH43360)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375945	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501686	**Ref. System:**	AHD/GDA94



0.0 to 5.0m



5.0 to 9.50m

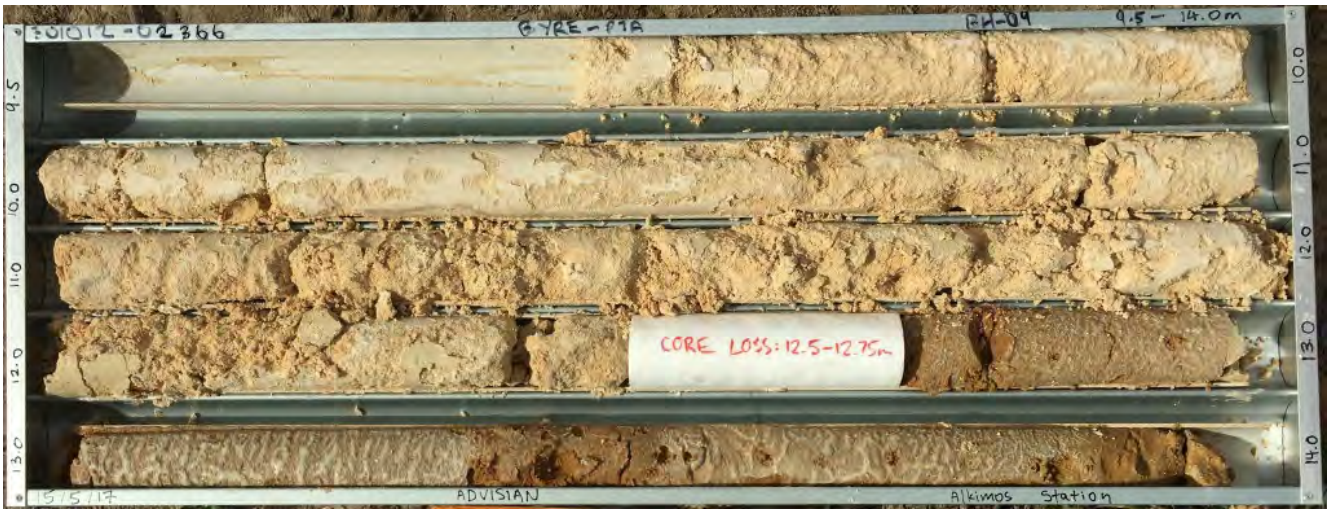
CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

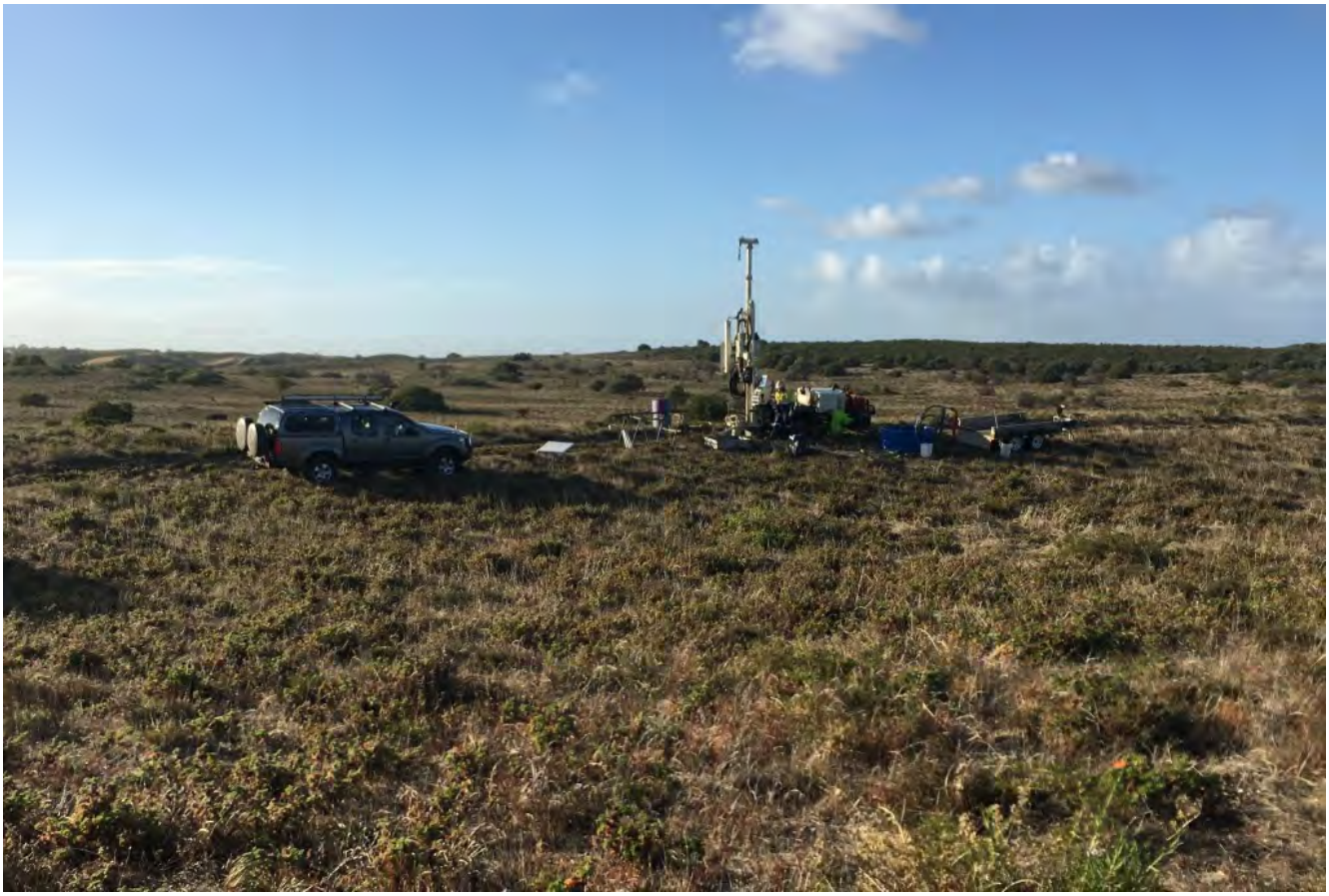
BOREHOLE: ***BH-09***
SHEET: 2 OF 2

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***15.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***15.5.2017***
LOCATION:	***Alkimos Station (CH43360)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375945	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6501686	**Ref. System:**	AHD/GDA94



9.50 to 14.0m



Alkimos Station Drill Site

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-12***
SHEET: 1 OF 2
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH44140 (Landcorp 3 Crossing)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor: National Geotech **Bore Size:** 96mm **Hole Angle:** -90° **Easting:** 375788 **Surface R.L.:** 31.70m (est.)

Drill Model: Geoprobe 7822DT **Drill Fluid:** Biovis + Liqui-Pol **Bearing:** NA **Northing:** 6502441 **Ref. System:** AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
Washbore (HQ)	OPEN HOLE		31.5	0.5	Tamala Sand		Silica SAND: fine to coarse grained, subangular to rounded, quartz, orange, top 100mm dark grey-brown, with organic silt and rootlets	Uc	VL		SPT		1,0,1 *N=1*					SPT: Recovery = 500mm
			31.0	1.0														
			30.5	1.5					L									
			30.0	2.0			… trace black organics (decomposed wood/roots)				SPT		1,2,2 *N=4*					SPT: Recovery = 380mm
			29.5	2.5														
			29.0	3.0														
			28.5	3.5														
			28.0	4.0	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to rounded, quartz, shell fragments, carbonate-cemented, pale brown, with some coarse grained	Wk-Mwk	L		SPT		3,10,18 *N=28*					SPT: Recovery = 450mm
HQ-3		7	27.5	4.5				Wk-Mo	L-M		1/100	15			1.34			Highly fractured, medium strength rock separated by bands of weakly cemented rock to uncemented sand up to 30mm
			27.0	5.0										0.22				

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-12***
SHEET: 2 OF 2
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH44140 (Landcorp 3 Crossing)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375788	**Surface R.L.:**	31.70m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6502441	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm)	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	2	26.5	5.5	TL		Siliceous CALCARENITE: see previuos	Mo-We	M-H	20 60 200 600 2000	2/100	23			2.52	0.03		Highly fractured, medium to high strength rock, becoming low to medium strength rock, interbedded with bands of sand and very weakly to weakly cemented rock, includes solution features, voids/cavities infilled with sand
					TS		Calcareous Silica SAND: fine to coarse grained, subangular to rounded, quartz, shell, pale brown	Uc	MD-D									
					TL		Siliceous CALCARENITE: fine to medium grained, subangular to rounded, quartz, shell fragments, carbonate-cemented, pale brown, with some coarse grained	Mo-We	M-H									
					TS			Uc										
			26.0	6.0	Tamala Limestone		Calcareous Silica SAND: fine to coarse grained, subangular to rounded, quartz, shell, pale brown	Mo-We	M-H									
							Siliceous CALCARENITE: fine to medium grained, subangular to rounded, quartz, shell fragments, carbonate-cemented, pale brown, with some coarse grained, remnant low angle, planar beddings … 20mm sand band (5.55m) … 30mm sand band (5.75m) … trace calcrete bands (5.80 to 6.15m) … 5-15mm sand band (5.85m) ... remnant, low angle, planar cross-bedding from (6.0m) … 30-40mm band of sand and gravel (6.15m) … 30mm sand band (6.3m)									
		3	25.5	6.5				Wk-Mo	L-M		3/100	21		0.12		0.07		
			25.0	7.0														
			24.5	7.5			… 30mm band of sand and gravel … pockets of sand up to 25mm											
			24.0	8.0			… 40-50mm band of gravel and sand											
			23.5	8.5			End of BH-12 at 8m - Target Depth											
			23.0	9.0														
			22.5	9.5														
			22.0	10.0														

CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-12***
SHEET: 1 OF 2

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH44140 (Landcorp 3 Crossing)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375788	**Surface R.L.:**	31.70m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6502441	**Ref. System:**	AHD/GDA94

3.95 to 8.0m

CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-12***
SHEET: 2 OF 2

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH44140 (Landcorp 3 Crossing)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375788	**Surface R.L.:**	31.70m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6502441	**Ref. System:**	AHD/GDA94

Drill Site

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-21***
SHEET: 1 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH45820***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375064	**Surface R.L.:**	45.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6503892	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	NR	45.0	0.5	Tamala Sand		Silica SAND: fine to medium grained, subrounded to rounded, quartz, dark brown, with organics (roots, plant matter) … becoming orange, trace organics from 0.2m	Uc	VL		SPT		1,0,1 *N=1*					SPT: Recovery = 650mm
			44.5	1.0														
			44.0	1.5		CL		CL	CL		1/52	NA						Core Loss: 1.00-2.00m
			43.5	2.0														Core recovered from 2.0 - 3.5m; SPT likely deflected down side of pinnacled rock surface
		4			Tamala Limestone		Calcreted CALCARENITE: fine to medium grained, subrounded to rounded, quartz, carbonate-cemented, laminar calcrete concretions on upper surface, with subvertical solution features infilled with sand	We-Vwe	H		SPT		7,32,43 *N=75*	0.86				SPT: Recovery = 450mm B, 30, Pl-Un, SR, Cn
			43.0	2.5			Siliceous CALCARENITE: fine to coarse grained, subangular to rounded, quartz, shell fragments, carbonate-cemented	Mo	M		2/100	100						B, 25, Pl, R, Sd, Vn
			42.5	3.0														B, 10, Wv, R, Sd, Fi - 1mm
							… with come calcrete in part	Mo-We	M-H					0.47			2.50	B, 10, Pl, SR, Sd, Vn
								Mwk-Mo	M									
			42.0	3.5														B, <5, Pl, R, Sd, Fi - 2mm
		3	41.5	4.0				Mo-We	H		3/100	100		0.07			0.46	B, <5, Pl-Wv, R, Sd, Fi-4mm
																		B, 10, Pl-Wv, R, Sd, Fi-2mm
			41.0	4.5														B, 10, Pl, R, Sd, Fi-2mm
														0.19				B, 30, Pl-St, R, Sd, Fi-3mm
																	0.80	B, 45, Pl, R, Sd, Fi-1mm
			40.5	5.0														B, 20, Pl, R, Sd, Vn

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-21***
SHEET: 2 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH45820***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375064	**Surface R.L.:**	45.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6503892	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	7	40.0	5.5	Tamala Limestone		Siliceous CALCARENITE: fine to coarse grained, subangular to rounded, quartz, shell fragments, carbonate-cemented … highly fractured	Mo-We	H									
						CL		CL	CL		4/17	0						Core loss interval potentially either sand or low strength rock disaggregated by drilling and washed away Core Loss: 5.25-6.50m
			39.5	6.0														
			39.0	6.5			Calcareous SANDSTONE: fine to coarse grained, subangular to rounded, quartz, shell fragments	Wk-Mwk	L-M		SPT		23,29,45 *N=74*					SPT: Recovery = 430mm
		3	38.5	7.0							5/100	100						B, 30, Pl, R, Sd, Vn
			38.0	7.5											0.07			B, 15, Un, R, Sd, Vn B, 10, Pl-Wv, R, Sd, Vn
			37.5	8.0														B, 10, Pl-Un, R, Sd, Vn
		8				CL		CL	CL									Core Loss: 8.00-8.35m
			37.0	8.5			… interbedded with sand	Uc-Wk	D-L									Some sand recovered, unclear if ground disaggregated by drilling
								We	H									
					TS		Silica SAND: fine to medium grained, subangular to rounded, quartz, trace carbonate, orange, trace coarse sand	Uc	L-MD									
					Tamala Limestone		Calcreted CALCARENITE: fine to medium grained, subangular to rounded, quartz, shell fragments, pale brown-white pervasively calcreted in part, with some patches of moderately cemented where calcrete absent	We-Vwe	H		6/77	50						Upper 200mm, highly fractured during drilling, likely irregular karstic weathering surface
			36.5	9.0													2.90	
															1.12			
			36.0	9.5			… becoming calcreted in part											
		3					… solution cavity infilled with white silty sand (carbonate silt/mud), 50-100mm wide	Mo-We			7/100	83						B, 30, Pl-Un, SR, Sd/Si, Fi-3mm B/Solution, Sd/Si, 50-100mm, B, 10, Pl-st, Sd/Si, Fi-20mm
			35.5	10.0														

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-21***
SHEET: 3 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH45820***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor: National Geotech **Bore Size:** 96mm **Hole Angle:** -90° **Easting:** 375064 **Surface R.L.:** 45.50m (est.)

Drill Model: Geoprobe 7822DT **Drill Fluid:** Biovis + Liqui-Pol **Bearing:** NA **Northing:** 6503892 **Ref. System:** AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	3	35.0	10.5	Tamala Limestone		Calcreted CALCARENITE: see previous	Mo-We	H		7/100	83						B/Solution, 45, St, R, Sd, Fi-1mm
							Siliceous CALCARENITE: fine to medium grained, angular to subrounded, quartz, shell fragments, carbonate-cemented, trace calcrete in mottles and patches, white to pale yellow-white	Mwk-Mo	M									B, 40, Pl, R, Sd/Si, Vn
																		B, 10, St, R, Sd, Vn
																		B, 10, St-Wv, R, Sd/Si, Vn
			34.5	11.0			… becoming pale brown-white, fine to coarse grained, tending to calcareous sandstone in part											10.95 - 11.1, highly fractured due to solution, infilled with sand
		9	34.0	11.5	TS		Calcareous Silica SAND: fine to coarse grained, subrounded to rounded, quartz, with carbonate (shell fragments), dark pink-brown, trace carbonate silt	Uc	D								0.94	
					Tamala Limestone		Siliceous CALCARENITE: fine to coarse grained, subangular to rounded, quartz, shell fragments, pale brown-white	Mo-We	H		8/100	92		0.87	1.06		5.10	
			33.5	12.0														B, 10, Pl, R, Cn
							… tending to calcareous sandstone											B, 5, Pl-Un, R, Sd, Vn
			33.0	12.5														B, 20, Pl, R, Sd, Fi- 1mm
							End of BH-21 at 12.5m - Target Depth											
			32.5	13.0														
			32.0	13.5														
			31.5	14.0														
			31.0	14.5														
			30.5	15.0														

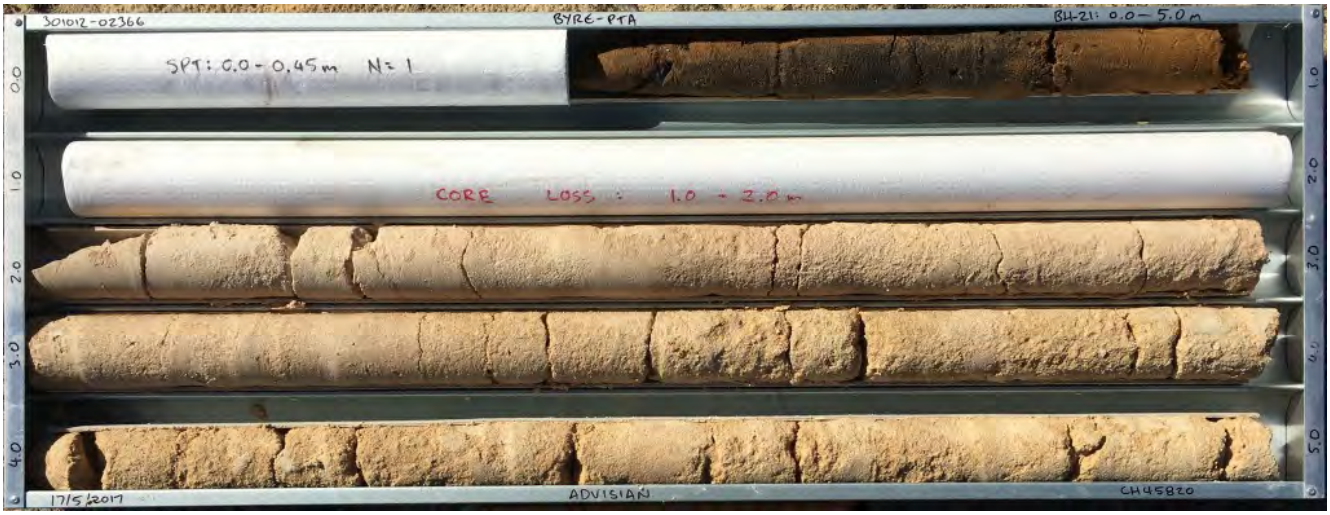
CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

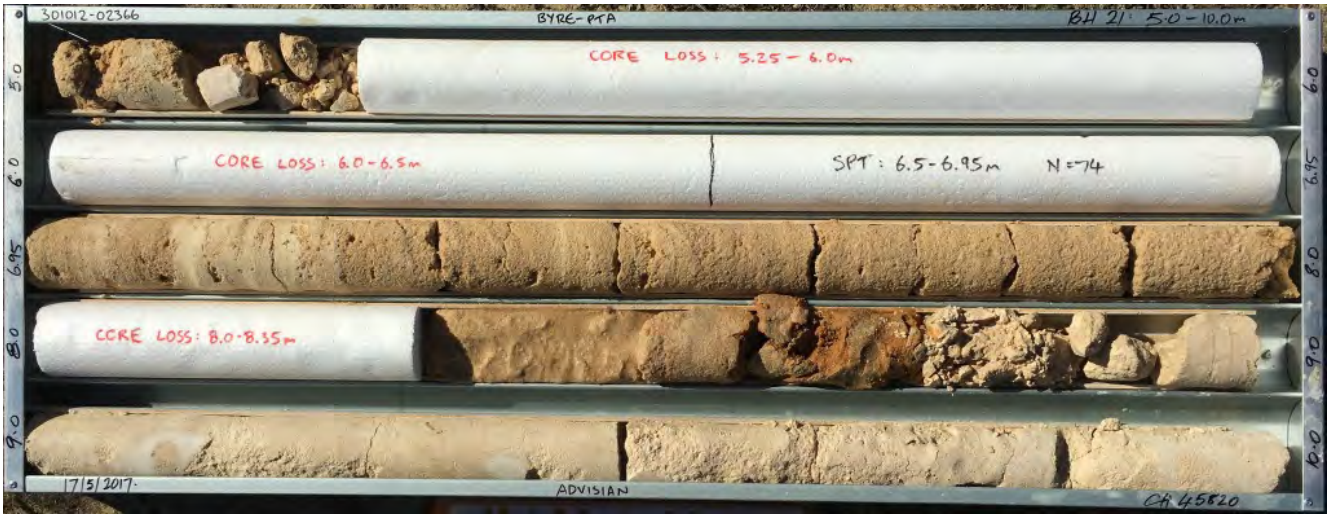
BOREHOLE: ***BH-21***

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH45820***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375064	**Surface R.L.:**	45.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6503892	**Ref. System:**	AHD/GDA94



0.0 to 5.0m



5.0 to 10.0m

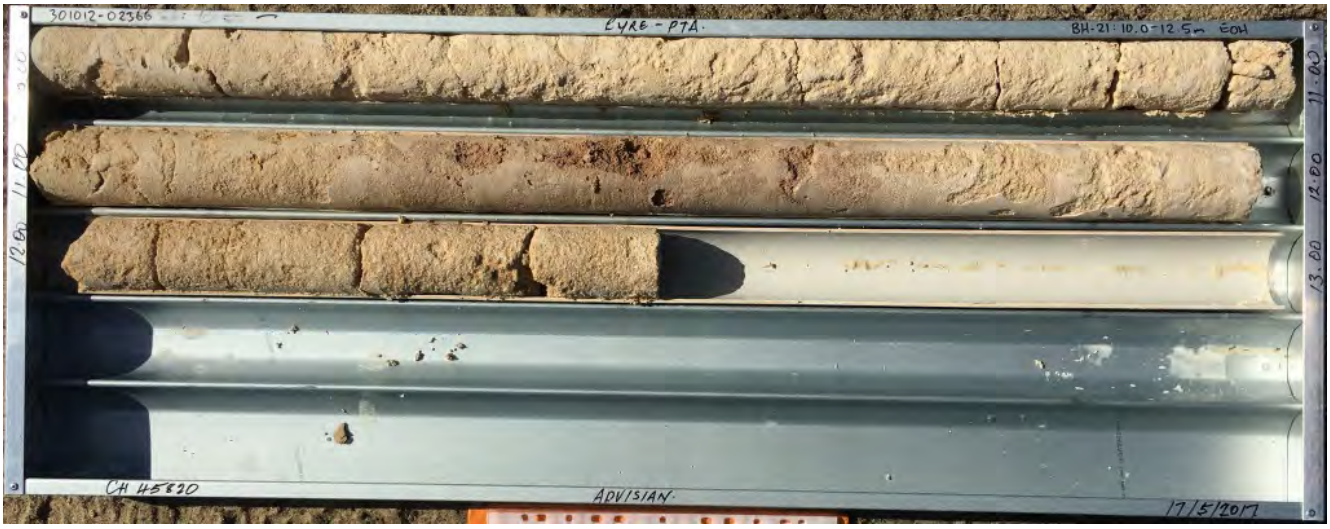
CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-21***

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH45820***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375064	**Surface R.L.:**	45.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6503892	**Ref. System:**	AHD/GDA94



10.0 to 12.50m

Drill Site - View North

CORE PHOTOGRAPHS

Advisian
WorleyParsons Group

Public Transport Authority

BOREHOLE: ***BH-21***
SHEET: 3 OF 3

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***17.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***17.5.2017***
LOCATION:	***CH45820***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	375064	**Surface R.L.:**	45.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6503892	**Ref. System:**	AHD/GDA94

Drill Site - View South

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-26***
SHEET: 1 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***12.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***12.5.2017***
LOCATION:	***Pipidinny Road (CH47520)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	374002	**Surface R.L.:**	45.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6505122	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE																	
			44.5	0.5	Tamala Sand	CL	Silica SAND: fine to coarse grained, subrounded to rounded, quartz, pale orange- brown, trace carbonate, top 100mm grey-brown, with organics … trace fine gravel of carbonate-cemented sand and calcrete	Uc CL	L-MD CL		SPT		1,1,8 *N=9*					SPT: Recovery = 400mm Core Loss: 0.45-0.70m
		5	44.0	1.0	Tamala Limestone		Calcareous SANDSTONE: fine to coarse grained, subrounded to rounded, pale yellow to pale orange-brown, carbonate-cemented, with some laminar and patches of calcrete to 1.6m … 50mm interval, highly fractured due to solution, partly infilled with brown sand and organics (0.83-0.88m)	Mwk-We	M-H		1/84	71			0.20		3.40	Solution induced break
			43.5	1.5				Mwk	M									
			43.0	2.0														
		2	42.5	2.5			… trace calcrete in lenses up to 50mm long and 15mm wide								1.04			B, 15, Pl, R, Sd
			42.0	3.0			… trace calcrete patches	Mwk-We			2/83	80						
			41.5	3.5	Tamala Sand	CL	Silica SAND: fine to medium grained, subrounded to rounded, quartz, pale orange, trace carbonate	Uc CL Uc	D CL D									Core Loss: 3.25-3.50m
			41.0	4.0							SPT		8,21,27 *N=48*					
			40.5	4.5	TL		Calcareous SANDSTONE: firm to medium grained, subrounded to rounded, quartz, carbonate-cemented, pale yellow-orange	Wk-Mwk	L-M									
		4			Tamala Sand		Silica SAND: fine to coarse grained, subrounded to rounded, quartz, pale brown to pale yellow-brown				3/86	18						
			40.0	5.0		CL		CL	CL									Core Loss: 4.85-5.00m

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-26***
SHEET: 2 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***12.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***12.5.2017***
LOCATION:	***Pipidinny Road (CH47520)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	374002	**Surface R.L.:**	45.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6505122	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	3	39.5	5.5	Tamala Sand		Silica SAND: fine to medium grained, subrounded to rounded, quartz, pale yellow, trace coarse sand, silt and carbonate … with some fine to coarse, subangular to subrounded gravel of calcareous sandstone (possible cemented bands/lenses)	Uc	D		SPT		15,15,23 *N=38*					SPT: Recovery = 400mm
			39.0	6.0		CL		CL	CL		4/43	NA						Core Loss: 5.90-6.50m
			38.5	6.5			… fine to coarse grained, mottled pale brown and orange	Uc	D		SPT		10,21,14 *N=35*					SPT: Recovery = 380mm
		NR	38.0	7.0		CL		CL	CL		5/0	NA						Core Loss: 6.95-8.00m
			37.5	7.5														
			37.0	8.0			… fine to coarse grained, subangular to rounded, quartz, orange	Uc	MD		SPT		6,7,9 *N=16*					SPT: Recovery = 320mm
			36.5	8.5		CL		CL	CL									Core Loss: 8.45-8.75m
		5	36.0	9.0	Tamala Limestone		Calcareous SANDSTONE: fine to coarse grained, subrounded to rounded, quartz, carbonate-cemented, orange-brown, trace shell fragments, trace laminar calcrete, subvertical solution cavities (pipes) > 40mm diameter, infilled with silica sand from 9.05m	We-Vwe	H		6/73							
			35.5	9.5	TS		Silica SAND: fine to medium grained, subrounded to rounded, quartz, orange, trace coarse sand and carbonate	We	D-VD									SPT in sand-filled solution cavity
					TL		Calcareous SANDSTONE: fine to medium grained, subrounded to rounded, quartz, carbonate-cemented, pale brown to pale orange-brown, patchy calcrete, subvertical solution cavities infilled with sand	Uc	H		SPT		6,16,32 *N=48*					SPT: Recovery = 300mm SPT in sand-filled solution
			35.0	10.0														

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-26***
SHEET: 3 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***12.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***12.5.2017***
LOCATION:	***Pipidinny Road (CH47520)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	374002	**Surface R.L.:**	45.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6505122	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	13	34.5	10.5	Tamala Limestone		Calcareous SANDSTONE: fine to medium grained, subrounded to rounded, quartz, carbonate-cemented, pale brown to pale orange-brown, trace coarse grained sand and shell fragments, patchy calcrete in part, subvertical solution cavity (pipe) from 6.9 to 10.25m, infilled with orange silica sand	We	H H		7/100	100					6.20	J (solution), 50, Pl, R, Sd
			34.0	11.0			… calcrete absent							0.81	2.52			
		9	33.5	11.5			… 50mm band of sand … solution voids up to 10mm diameter, infilled with sand	Uc Mwk-We	D M-H		8/100	50		1.08	3.96			B, <5, Pl-lr, R, Sd
			33.0	12.0			Silica SAND: fine to coarse grained, subrounded to rounded, quartz, pale orange-brown	Uc Mwk-We	D M-H									B, <5, Pl-lr, R, Sd
			32.5	12.5			Calcareous SANDSTONE: fine to medium grained, subrounded to rounded, quartz, pale brown to pale orange-brown, prevalent dissolution features, voids up to 15mm diameter and subvertical cavities to 70mm, solution features infilled with sand											Highly fractured rockmass due to solution
						CL	Silica SAND: fine to coarse grained, subrounded to rounded, quartz, pale orange-brown	CL Uc	CL D									Core Loss: 12.50-12.60m B, <5, Pl-lr, R, Sd
		8	32.0	13.0			Calcareous SANDSTONE: fine to medium grained, subrounded to rounded, quartz, pale brown to pale orange-brown … highly fractured due to solution, sand infill on fractures … 40mm band of sand	We	M-H									Highly fractured, solution B, 5, Pl, R, Sd (solution)
			31.5	13.5			Siliceous CALCARENITE: fine to medium grained, subrounded to rounded, quartz, shell and carbonate silt, pale brown to pale brown-white, upper 100mm calcreted with laminar to massive calcrete … 50mm band of sand (13.4m) … solution features evident, voids, subvertical cavities, sand along fractures	Vwe Uc Mwk-We	H D M-H		9/93	63			3.02		2.60	B, <5, Pl, R, Sd (solution) B, 45, Pl, R, Sd (solution) B, 5-30, Ir, R, Sd (solution)
			31.0	14.0														
							End of BH-26 at 14m - Target Depth											
			30.5	14.5														
			30.0	15.0														

CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

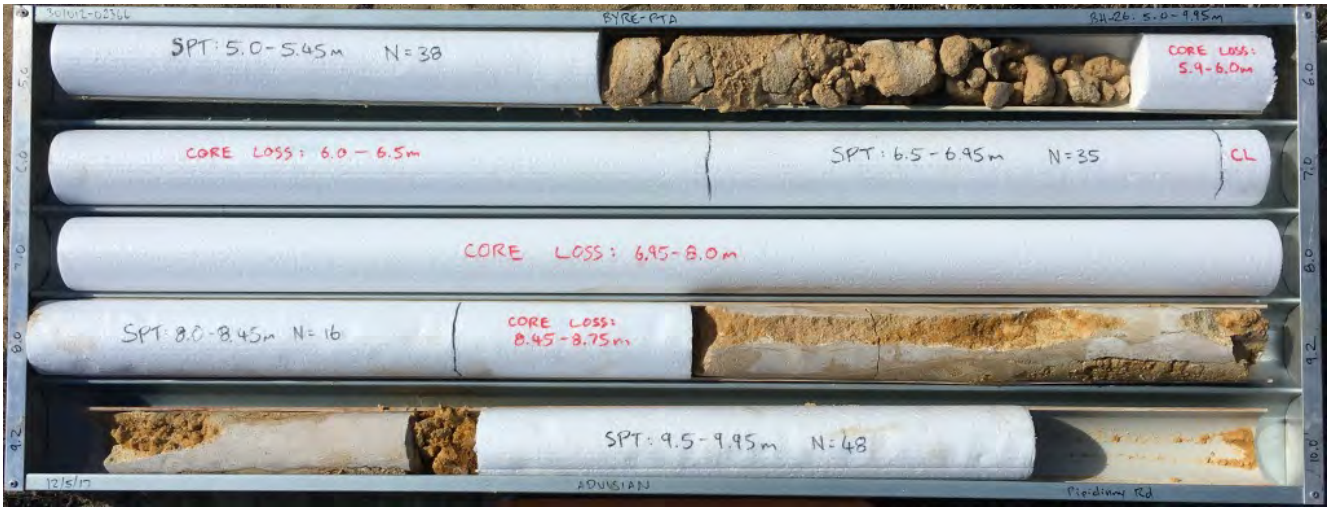
BOREHOLE: ***BH-26***

SHEET: 1 OF 3

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***12.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***12.5.2017***
LOCATION:	***Pipidinny Road (CH47520)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	374002	**Surface R.L.:**	45.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6505122	**Ref. System:**	AHD/GDA94

0.0 to 5.0m



5.0 to 9.95m

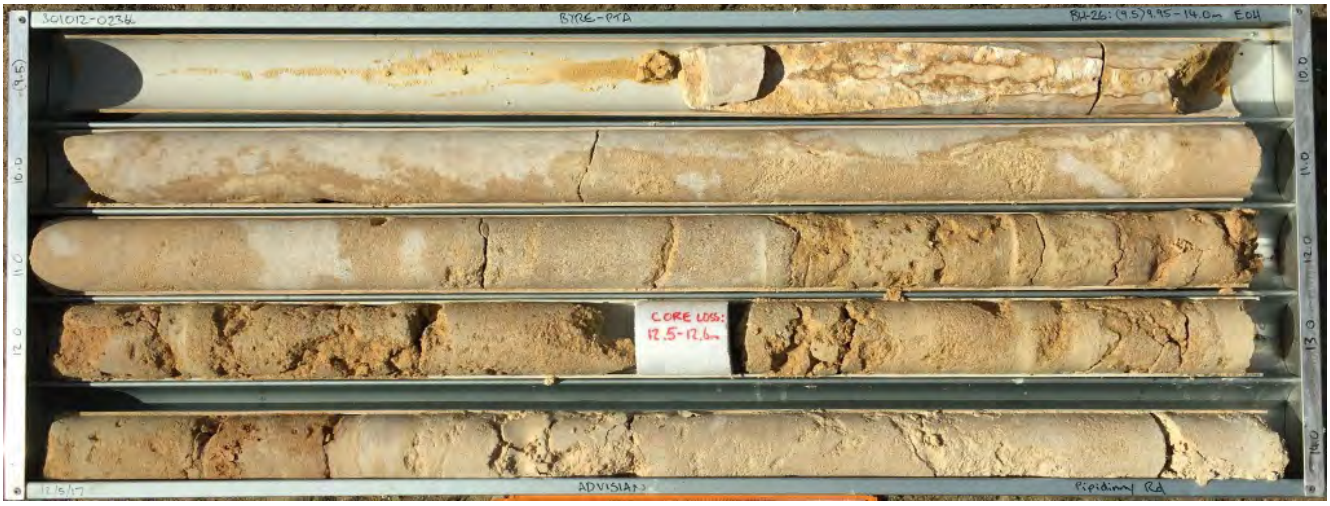
CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-26***

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***12.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***12.5.2017***
LOCATION:	***Pipidinny Road (CH47520)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	374002	**Surface R.L.:**	45.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6505122	**Ref. System:**	AHD/GDA94



9.95 to 14.0m

Drill Site - View East

CORE PHOTOGRAPHS

Advisian WorleyParsons Group

Public Transport Authority

BOREHOLE: ***BH-26***

SHEET: 3 OF 3

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***12.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***12.5.2017***
LOCATION:	***Pipidinny Road (CH47520)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	374002	**Surface R.L.:**	45.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6505122	**Ref. System:**	AHD/GDA94

Drill Site - View West

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-47***
SHEET: 1 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***11.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***11.5.2017***
LOCATION:	***Yanchep Beach Rd (CH52600)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371461	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6508917	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm)	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	NR	37.5	0.5	Safety Bay Sand	CL	Calcareous Silica SAND: fine to medium grained, subangular to rounded, quartz, carbonate (shell fragments), white to pale brown-white, trace coarse grained sand and silt	Uc	L MD	20 60 200 600 2000	SPT		4,9,20 *N=29*					SPT: Recovery = 450mm Drilling on track, near transition from cut to fill on top of dune, surface disturbed but natural material
			37.0	1.0				CL	CL		1/29	NA						Core Loss: 0.45-1.50m
			36.5	1.5	Tamala Sand		Calcareous Silica SAND: fine to medium grained, subrounded to rounded, quartz, carbonate (shell debris), brown to orange-brown, with roots to 10mm diameter and > 500mm long and organic fibers, trace coarse grained sand and silt	Uc	D VD VD		SPT		30,31,33 *N=64*					SPT: Recovery = 450mm
		NR	35.5	2.5					MD		2/100	NA						
		NR	35.0	3.0														
			34.5	3.5							SPT		1,9,5 *N=14*					SPT: Recovery = 300mm
			34.0	4.0	Tamala Limestone		… patchy cementation from 3.9m Calcreted CALCARENITE: fine to medium grained, subrounded to rounded, quartz, carbonate (shell debris), pale brown, patchy calcretisation	Vwe	H		3/100	80			2.45		23.00	
		7	33.5	4.5			Siliceous CALCARENITE: fine to medium grained, subrounded to rounded, quartz, carbonate (shell debris), pale brown-white, trace weakly to very weakly cemented sand bands up to 30mm wide spaced 100 to 150mm apart	Mo-We	M						0.69			
			33.0	5.0														

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-47***
SHEET: 2 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***11.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***11.5.2017***
LOCATION:	***Yanchep Beach Rd (CH52600)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor: National Geotech **Bore Size:** 96mm **Hole Angle:** -90° **Easting:** 371461 **Surface R.L.:** 38.0m (est.)

Drill Model: Geoprobe 7822DT **Drill Fluid:** Biovis + Liqui-Pol **Bearing:** NA **Northing:** 6508917 **Ref. System:** AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	3	32.5	5.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subrounded to rounded, quartz, carbonate (shell debris), pale brown-white	Mo-We	M		4/100	53					3.50	Mechanical breaks only
			32.0	6.0				Wk-Mwk	L					0.39	0.52			
		4	31.5	6.5					L-M		5/100	83			0.85			Partially mechanical breaks on remnant bedding, B, 5-30,Un-lr, R
			31.0	7.0														
			30.5	7.5														
			30.0	8.0														
		3	29.5	8.5							6/100	60		0.39	0.35			Partially mechanical breaks on remnant bedding, B, 5-30,Un-lr, R
			29.0	9.0				Wk	L									Partially mechanical breaks on remnant bedding, B, 5-30,Un-lr, R
			28.5	9.5			… pale brown to grey-brown, with sand bands up to 40mm wide	Vwk	VL									
		5	28.0	10.0				Vwk-Wk	VL-L		7/100	28		0.04	0.11			

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-47***
SHEET: 3 OF 3
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***11.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***11.5.2017***
LOCATION:	***Yanchep Beach Rd (CH52600)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor: National Geotech **Bore Size:** 96mm **Hole Angle:** -90° **Easting:** 371461 **Surface R.L.:** 38.0m (est.)

Drill Model: Geoprobe 7822DT **Drill Fluid:** Biovis + Liqui-Pol **Bearing:** NA **Northing:** 6508917 **Ref. System:** AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	5	27.5	10.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium, subrounded to rounded, quartz, carbonate, pale brown to pale yellow-white, trace of remnant low-angle planar cross-bedding (aeolianite)	Wk-Mwk	L-M		7/100	28		0.88	0.47			B, <5, Pl, R, Sd
								Wk	L									
								Wk-Mwk	L-M									
								Vwk-Wk	VL-L									
			27.0	11.0														
		4						Wk	L-M		8/100	80		0.07	0.36		1.10	B, 50, Pl, R, Sd
			26.5	11.5														
			26.0	12.0			… solution voids and cavities, highly fractured for ~250mm											Highly fractured
			25.5	12.5				Wk-Mwk	M									
		NR					… 30mm sand lens				9/100	95						B, <5, Pl, SR, Sd
			25.0	13.0			… 15mm sand lens											B, <5, Pl, SR, Sd
							… 10mm sand lens											B, <5, Pl, SR, Sd
			24.5	13.5			… 50mm sand lens	Uc	MD									Sand lens
								Wk-Mwk	M								1.10	
							… 20mm sand lens							0.53	0.20			B, 5< Pl, SR, Sd
			24.0	14.0														
							End of BH-47 at 14m - Target Depth											
			23.5	14.5														
			23.0	15.0														

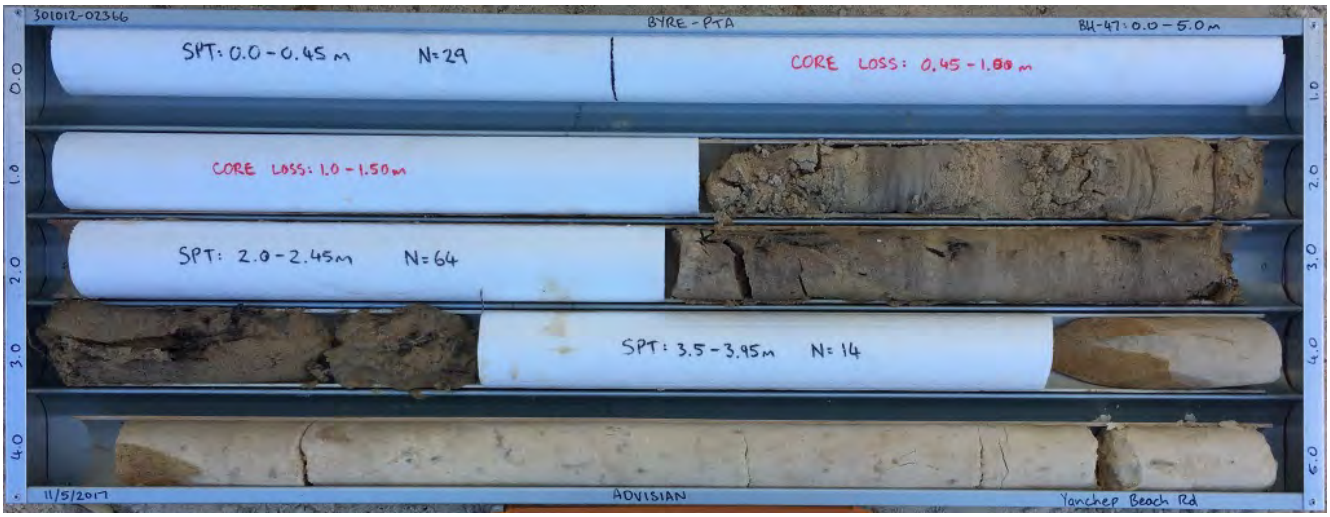
CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-47***
SHEET: 1 OF 2

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***11.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***11.5.2017***
LOCATION:	***Yanchep Beach Rd (CH52600)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371461	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6508917	**Ref. System:**	AHD/GDA94



0.0 to 5.0m

5.0 to 10.0m

CORE PHOTOGRAPHS

Advisian
WorleyParsons Group

Public Transport Authority

BOREHOLE: ***BH-47***
SHEET: 2 OF 2

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***11.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***11.5.2017***
LOCATION:	***Yanchep Beach Rd (CH52600)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371461	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6508917	**Ref. System:**	AHD/GDA94

10.0 to 14.0m

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-59***
SHEET: 1 OF 4
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***CH53800 (Tokyu 1)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371258	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510079	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
Washbore (HQ)	OPEN HOLE		41.0	0.5	Tamala Sand		Calcareous Silica SAND: fine to medium grained, subangular to subrounded, quartz and shells, trace organics, dark grey, top 100mm brown	Uc	L		SPT		1,2,2 *N=4*					SPT: Recovery = 350mm
			40.5	1.0														
			40.0	1.5														
			39.5	2.0							SPT		3,3,4 *N=7*					SPT: Recovery = 450mm
			39.0	2.5														
			38.5	3.0														
			38.0	3.5			… trace fine grained sand of black, heavy minerals		MD		SPT		3,5,6 *N=11*					SPT: Recovery = 500mm
			37.5	4.0														
			37.0	4.5														
		4	36.5	5.0	TL	CL		CL	CL			100						Core Loss: 4.90-5.00m

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-59***
SHEET: 2 OF 4
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***CH53800 (Tokyu 1)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor: National Geotech **Bore Size:** 96mm **Hole Angle:** -90° **Easting:** 371258 **Surface R.L.:** 41.50m (est.)

Drill Model: Geoprobe 7822DT **Drill Fluid:** Biovis + Liqui-Pol **Bearing:** NA **Northing:** 6510079 **Ref. System:** AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	4	36.0	5.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to subrounded, quartz, and shells, trace black grains (heavy minerals), partly calcreted, pale brown to white	Mo-We	M-H		1/88	100			0.46			B, <5, lr, R, Sd, Vn
			35.5	6.0				Wk-Mwk	L-M									B, <5, lr, R, Sd, Vn
			35.0	6.5														B, 20, lr, R, Sd, Fi-2mm
		7	34.5	7.0							2/100	95			0.31			B, <5, lr, R, Sd, Vn
																		B, 30, lr, R, Sd, Vn
																		B, 10, lr, R, Sd, Vn
			34.0	7.5			… very weakly cemented sand band up to 40mm wide											B, 10, lr, R, Sd, Fi-2mm
							Calcreted CALCARENITE: fine to medium grained, quartz and shells with carbonate cement, pervasively calcreted, white	We	M-H									B, 10, lr, R, Sd, Vn
															0.35		2.60	B, 30, lr, R, Sd, Vn
			33.5	8.0														
		8	33.0	8.5			… with solution features, voids up to 40mm, infilled with white silty sand (carbonate)				3/100	100						B, 10, lr, R, Sd, Fi-1mm
			32.5	9.0														B, 10, lr, R, Sd, Fi-5mm
			32.0	9.5														
		3					Siliceous CALCARENITE: fine to medium grained, subangular to subrounded, quartz and shells, white to pale yellow-white				4/100	60						Highly fractured due to solution
			31.5	10.0											0.70			B, 10, lr, R, Sd, Fi-40mm

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-59***
SHEET: 3 OF 4
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***CH53800 (Tokyu 1)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor: National Geotech **Bore Size:** 96mm **Hole Angle:** -90° **Easting:** 371258 **Surface R.L.:** 41.50m (est.)

Drill Model: Geoprobe 7822DT **Drill Fluid:** Biovis + Liqui-Pol **Bearing:** NA **Northing:** 6510079 **Ref. System:** AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	3	31.0	10.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to subrounded, quartz and shells, white to pale yellow-white	We	M-H									
							… sand band, 50mm wide											
								Wk-Mwk	L-M		4/100	60						Highly fractured, abundant solution
			30.5	11.0													2.70	
		5													0.82			
			30.0	11.5			… sand band, 50mm wide											Highly fractured, abundant solution
											5/100	77						
			29.5	12.0				Mwk-Mo	M-H									
							… pocket of sand up to 40mm wide and 120mm long,(infilled solution cavity)											B, <5, Ir, R, Sd, Fi-5mm
			29.0	12.5														Highly fractured, abundant solution
		7	28.5	13.0										0.32	0.55			
											6/100	90						B, <5, Ir, R, Sd, Fi-2mm
			28.0	13.5														Driller reported losing circulation (reduced)
			27.5	14.0														B, 20, Ir, R, Sd, Fi-2mm
		NR																Lost circulation completely
			27.0	14.5							7/100	81		0.22	0.20			
			26.5	15.0													0.50	

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-59***
SHEET: 4 OF 4
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***CH53800 (Tokyu 1)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor: National Geotech **Bore Size:** 96mm **Hole Angle:** -90° **Easting:** 371258 **Surface R.L.:** 41.50m (est.)

Drill Model: Geoprobe 7822DT **Drill Fluid:** Biovis + Liqui-Pol **Bearing:** NA **Northing:** 6510079 **Ref. System:** AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	NR	26.0	15.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to subrounded, quartz and shells, white to pale yellow-white	Mwk-Mo	M		7/100	81						B, 20, lr, Sd, Fi-1mm B, 20, lr, Sd, Fi-1mm
							… pocket of sand, 40mm wide											B, <5, lr, Sd, Fi-40mm
							End of BH-59 at 15.6m - Target Depth											
			25.5	16.0														
			25.0	16.5														
			24.5	17.0														
			24.0	17.5														
			23.5	18.0														
			23.0	18.5														
			22.5	19.0														
			22.0	19.5														
			21.5	20.0														

CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-59***

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***CH53800 (Tokyu 1)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371258	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510079	**Ref. System:**	AHD/GDA94

5.0 to 10.0m

10.0 to 15.0m

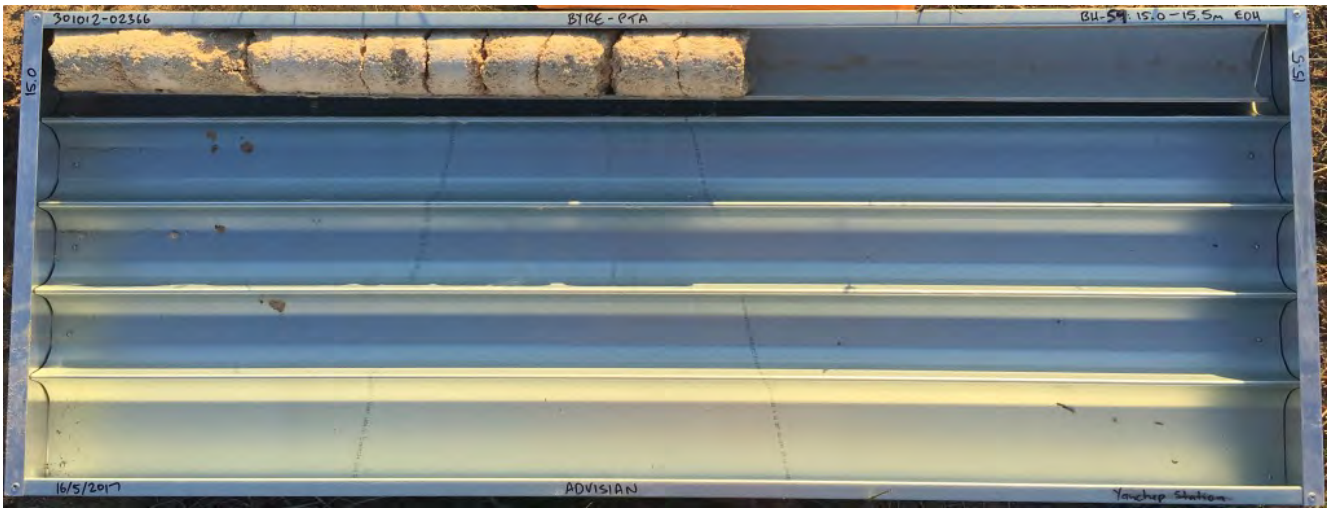
CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-59***

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***CH53800 (Tokyu 1)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371258	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510079	**Ref. System:**	AHD/GDA94



15.0 to 15.50m

CORE PHOTOGRAPHS

BOREHOLE: ***BH-59***
SHEET: 3 OF 3

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***CH53800 (Tokyu 1)***	LOGGED BY:	***WJ/MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371258	**Surface R.L.:**	41.50m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510079	**Ref. System:**	AHD/GDA94

Drill Site

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-65***
SHEET: 1 OF 4
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***Yanchep Station (CH54430)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371256	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510708	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	1	37.5	0.5	Tamala Sand		Silica SAND: fine to medium grained, subrounded to rounded, quartz, orange, top 150mm dark brown-orange, trace organics (roots, plant matter)	Uc	L		SPT		1,2,3 *N=5*					SPT: Recovery = 480mm
						CL		CL	CL			NA						Rock outcropping ~10m to south on flank/crest of dune, as well as ~15m north
			37.0	1.0														
			36.5	1.5														Core Loss: 0.45-2.00m
			36.0	2.0														
							… trace fine grained sand of black, heavy minerals	Uc	L		SPT		2,2,2 *N=4*					SPT: Recovery = 400mm
			35.5	2.5		CL		CL	CL			NA						Core Loss: 2.45-3.50m
		1	35.0	3.0														
			34.5	3.5														
							… becoming pale brown, trace carbonate silt and fine gravel of cemented sand/calcarenite	Uc	L		SPT		1,3,5 *N=8*					SPT: Recovery = 350mm
			34.0	4.0	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to rounded, quartz, carbonate-cemented, pale brown to white, with some laminar calcrete development, with subvertical solution features up to 40mm wide and 200mm long, infilled with brown sand, trace organics	Wk-Mwk	L-M		3/100	100			0.08	1.30		Mechanical breaks
		4	33.5	4.5														
			33.0	5.0														

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-65***
SHEET: 2 OF 4
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***Yanchep Station (CH54430)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor: National Geotech **Bore Size:** 96mm **Hole Angle:** -90° **Easting:** 371256 **Surface R.L.:** 38.0m (est.)

Drill Model: Geoprobe 7822DT **Drill Fluid:** Biovis + Liqui-Pol **Bearing:** NA **Northing:** 6510708 **Ref. System:** AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	3	32.5	5.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to rounded, quartz, carbonate-cemented, pale brown	Wk-Mwk	L-M								2.90	B, 40, Pl, R, Cn
							… becoming moderately cemented, with solution voids up to 10mm diameter with weakly to moderately weakly cemented infill	Mwk-Mo	M						0.45			B, 40, Pl-Un, R, Cn
			32.0	6.0							4/100	100						B, 30, Pl-Wv, R, Sd, Vn
			31.5	6.5														
		3					… remnant bedding evident, low-angle, planar cross-bedding, (aeolianite), some solution on bedding planes and voids/cavities up to 10-30mm	Mwk-We	M-H									B, 30, Pl-Ir, R, Sd, Fi-3mm
			31.0	7.0														B, 30, Pl-Un, R, Sd, Fi-10mm
																		B, 30, Pl-Wv, R, Sd, Fi-2mm
																		B, 40, Pl, R, Sd, Fi-2mm
											5/100	83						B, 40, Pl, R, Sd, Fi-5mm
																		B, 30, Pl-Ir, R, Sd, Fi-2mm
			30.5	7.5											0.45			
																	0.92	B, 45, Pl-Ir, R, Sd-Gr, Fi-10mm
																		B, 40, Pl-Un, R, Sd, Fi-5mm
			30.0	8.0														
								Mwk-Mo	M									B, 45, Pl-Ir, R, Sd, Fi-3mm
			29.5	8.5														B, 30, Pl-St, R, Sd, Fi-2mm
		4					… 20-30mm band of sand on remnant bedding				6/100	92						B, 45, Pl-St, R, Sd, Fi-20mm
																		B, 40, Pl-St, R, Sd, Fi-1mm
			29.0	9.0										0.24	0.16			
																		B, 45, Pl, R, Sd, Fi-2mm
			28.5	9.5	Tamala Sand		Silica SAND: fine to medium grained, subangular to rounded, quartz, trace carbonate, dark orange-brown, trace fine gravel of cemented sand/calcarenite	Uc	MD		SPT		8,12,15 *N=27*					SPT: Recovery = 450mm
			28.0	10.0														

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-65***
SHEET: 3 OF 4
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***Yanchep Station (CH54430)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371256	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510708	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm)	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	4					Silica SAND: see previous	Uc	MD									
		4	27.5	10.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to rounded, quartz, carbonate-cemented, pale orange-brown, with remnant bedding … abundant solution cavities and pockets infilled with sand	Mo-We	M-H		7/81	19						Breaks on remnant bedding and solution
								Wk	L									B, 5, Pl, R, Sd, Fi-1mm
								Mwk	M									B, 10, Pl, R, Sd, Fi-3mm
								We	M-H									B, 15, Pl-St, R, Sd, Fi-3mm
			27.0	11.0	Tamala Sand	CL	Silica SAND: fine to medium grained, subangular to subrounded, quartz, orange to dark orange, trace coarse sand	CL	CL									Core Loss: 10.80-11.00m
								Uc	MD		SPT		6,10,11 *N=21*					SPT: Recovery = 230mm
		2	26.5	11.5														
			26.0	12.0		CL		CL	CL		8/14	NA						Core Loss: 11.60-12.50m
			25.5	12.5			… becoming fine grained, with medium grained sand, orange	Uc	MD		SPT		7,10,11 *N=21*					
			25.0	13.0														
		5	24.5	13.5		CL		CL	CL			14						Core Loss: 12.95-13.70m
							…fine to medium grained	Uc	MD		9/29			0.58	1.98			
			24.0	14.0	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to subrounded, quartz, carbonate-cemented, trace shell fragments, pale brown to pale pink-white, calcreted in part … with lenses and patches of laminar and concentric calcrete (infilled solution features)	Vwe	H								2.20	
		7	23.5	14.5			… abundant solution features infilled with sand and very weakly cemented sand, up to 70mm long, rockmass partly calcreted	Mo-We	M-H		10/100	60						B, <5, Un-Pl, R, Sd, Vn
			23.0	15.0										0.15	0.50			B, 0, Ir-Pl, R, Sd, Fi-10mm

CORED BOREHOLE LOG

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-65***
SHEET: 4 OF 4
REV:

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Butler to Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***Yanchep Station (CH54430)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***	CHECKED BY:	

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371256	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510708	**Ref. System:**	AHD/GDA94

Method	Casing	Drill Rate (min/m)	RL (mAHD)	Depth (m)	Geological Unit	Graphic Log	Material Description	Weathering / Cementation	Estimated Strength	Defect Spacing (mm) 20 60 200 600 2000	Lift & Core Recovery (%)	RQD (%)	SPT	Lab Results: PLI - axial (MPa)	Lab Results: PLI - diametral (MPa)	Lab Results: PLI - lump (MPa)	Lab Results: UCS (MPa)	Field Records / Comments and Defect Description
HQ-3	OPEN HOLE	7	22.5	15.5	Tamala Limestone		Siliceous CALCARENITE: fine to medium grained, subangular to subrounded, quartz, carbonate-cemented, trace shell fragments, pale brown to pale pink-white, calcreted in part … with very weakly to weakly cemented bands up to 40mm wide, pale pink-brown, well cemented (calcreted) rock mass with abundant solution features	Mo-We	M-H		10/100	60						Highly fractured in association with solution and remnant bedding, Ir-St, VR, Sd
							End of BH-65 at 15.5m - Target Depth											
			22.0	16.0														
			21.5	16.5														
			21.0	17.0														
			20.5	17.5														
			20.0	18.0														
			19.5	18.5														
			19.0	19.0														
			18.5	19.5														
			18.0	20.0														

CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-65***
SHEET: 1 OF 4

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***Yanchep Station (CH54430)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371256	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510708	**Ref. System:**	AHD/GDA94

0.0 to 5.0m

5.0 to 9.95m

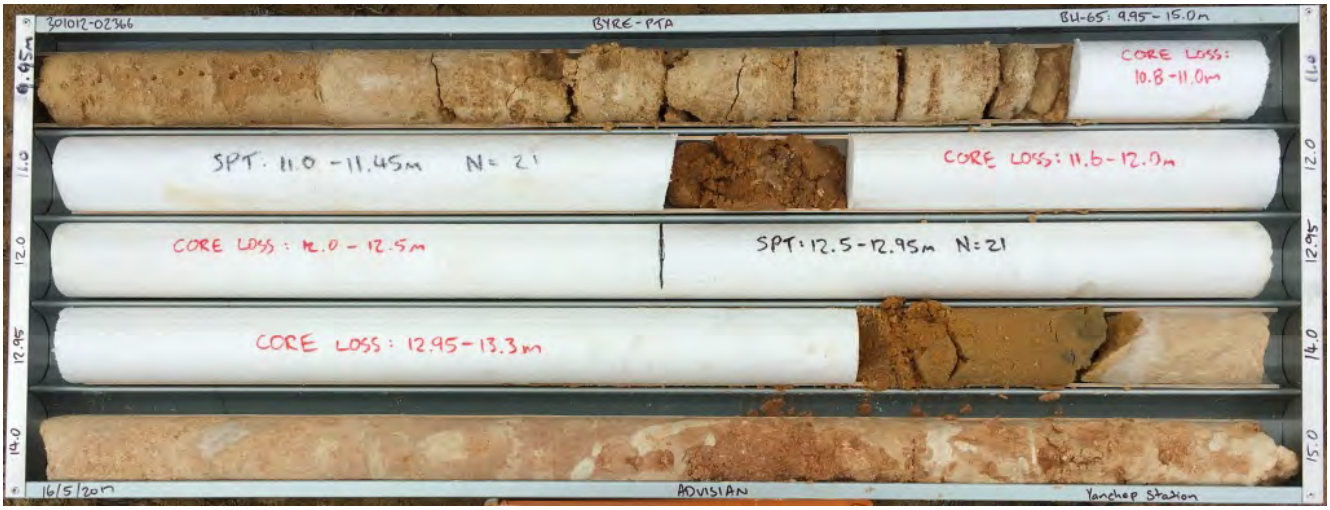
CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-65***
SHEET: 2 OF 4

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***Yanchep Station (CH54430)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371256	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510708	**Ref. System:**	AHD/GDA94



9.95 to 15.0m

15.0 to 15.50m

CORE PHOTOGRAPHS

Advisian WorleyParsons Group | Public Transport Authority

BOREHOLE: ***BH-65***

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***Yanchep Station (CH54430)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371256	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510708	**Ref. System:**	AHD/GDA94

Drill Site - View South

CORE PHOTOGRAPHS

Advisian WorleyParsons Group

Public Transport Authority

BOREHOLE: ***BH-65***

SHEET: 4 OF 4

CLIENT:	***Public Transport Authority***	DATE COMMENCED:	***16.5.2017***
PROJECT:	***Yanchep Rail Extension***	DATE COMPLETED:	***16.5.2017***
LOCATION:	***Yanchep Station (CH54430)***	LOGGED BY:	***MP***
JOB NUMBER:	***301012-02366***		

Drill Contractor:	National Geotech	**Bore Size:**	96mm	**Hole Angle:**	-90°	**Easting:**	371256	**Surface R.L.:**	38.0m (est.)
Drill Model:	Geoprobe 7822DT	**Drill Fluid:**	Biovis + Liqui-Pol	**Bearing:**	NA	**Northing:**	6510708	**Ref. System:**	AHD/GDA94

Drill Site - View North

Advisian
WorleyParsons Group

Appendix E Laboratory Test Certificates

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/223
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-03 2.5 to 2.75m	**Sample No.**	G17/223
Sample Description	Not Available		
Failure Mode*	Vertical splitting		

SAMPLE DETAILS

Length (L)	170	mm	**Bulk Density**	1.988	t/m³
Diameter (D)	59.8	mm	**Dry Density**	1.669	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.8	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	1.5	MPa

Test Duration	03:56 minutes : seconds
Moisture Content @ time of test	19.1 %

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample outside of the 5 to 15 minute testing range.

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory : _____

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/225
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-03 3.68 to 3.89m	**Sample No.**	G17/225
Sample Description	Not Available		
Failure Mode*	Vertical splitting		

SAMPLE DETAILS

Length (L)	170	mm	**Bulk Density**	2.073	t/m³
Diameter (D)	60.4	mm	**Dry Density**	1.771	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.8	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance	
UCS	5.2	MPa

Test Duration	05:36	minutes : seconds
Moisture Content @ time of test	17.1	%

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory :_____

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/228
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-03 5 to 5.2m	**Sample No.**	G17/228
Sample Description	Not Available		
Failure Mode*	Vertical splitting		

SAMPLE DETAILS

Length (L)	180	mm	**Bulk Density**	2.058	t/m³
Diameter (D)	60.0	mm	**Dry Density**	1.725	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	3.0	

Before Test After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	1.6	MPa

Test Duration	02:02 minutes : seconds
Moisture Content @ time of test	19.3 %

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample outside of the 5 to 15 minute testing range.

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory :_____

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/235
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-09 7.45 to 7.65m	**Sample No.**	G17/235
Sample Description	Not Available		
Failure Mode*	Vertical splitting		

SAMPLE DETAILS

Length (L)	150	mm	**Bulk Density**	1.989	t/m³
Diameter (D)	60.3	mm	**Dry Density**	1.681	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.5	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	7.1	MPa

Test Duration	05:18	minutes : seconds
Moisture Content @ time of test	18.3	%

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory : _____

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/239
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-09 9.6 to 9.8m	**Sample No.**	G17/239
Sample Description	Not Available		
Failure Mode*	Vertical splitting		

SAMPLE DETAILS

Length (L)	165	mm	**Bulk Density**	1.772	t/m³
Diameter (D)	57.9	mm	**Dry Density**	1.387	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.9	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	1.3	MPa

Test Duration	02:56 minutes : seconds
Moisture Content @ time of test	27.7 %

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Sample outside of the 5 to 15 minute testing range.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory : _____

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/240
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-09 10.2 to 10.4m	**Sample No.**	G17/240
Sample Description	Not Available		
Failure Mode*	Simple shear		

SAMPLE DETAILS

Length (L)	168	mm	**Bulk Density**	1.904	t/m³
Diameter (D)	60.2	mm	**Dry Density**	1.527	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.8	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	2.9	MPa

Test Duration	04:52 minutes : seconds
Moisture Content @ time of test	24.7 %

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Sample outside of the 5 to 15 minute testing range.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory :_____

\\Gbtesting\rock testing projects\Advisian\BYRE Rail Extension\UCS\UCS G17 240

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/251
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-21 3.12 to 3.32m	**Sample No.**	G17/251
Sample Description	Not Available		
Failure Mode*	Vertical splitting		

SAMPLE DETAILS

Length (L)	166	mm	**Bulk Density**	2.036	t/m³
Diameter (D)	60.2	mm	**Dry Density**	1.702	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.8	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	2.5	MPa

Test Duration	02:40 minutes : seconds
Moisture Content @ time of test	19.6 %

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Sample outside of the 5 to 15 minute testing range.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory :_____

\\Gbtesting\rock testing projects\Advisian\BYRE Rail Extension\UCS\UCS G17 251

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/253
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-21 3.7 to 3.9m	**Sample No.**	G17/253
Sample Description	Not Available		
Failure Mode*	End crushing		

SAMPLE DETAILS

Length (L)	136	mm	**Bulk Density**	1.984	t/m³
Diameter (D)	59.3	mm	**Dry Density**	1.659	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.3	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	0.46	MPa

Test Duration	02:59 minutes : seconds
Moisture Content @ time of test	19.6 %

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Sample outside of the 5 to 15 minute testing range.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory :_____

\\Gbtesting\rock testing projects\Advisian\BYRE Rail Extension\UCS\UCS G17 253

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/255
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-21 4.63 to 4.85m	**Sample No.**	G17/255
Sample Description	Not Available		
Failure Mode*	Vertical splitting		

SAMPLE DETAILS

Length (L)	151	mm	**Bulk Density**	2.056	t/m³
Diameter (D)	59.9	mm	**Dry Density**	1.741	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.5	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	0.80	MPa

Test Duration	01:58 minutes : seconds
Moisture Content @ time of test	18.1 %

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Sample outside of the 5 to 15 minute testing range.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory :_____

\\Gbtesting\rock testing projects\Advisian\BYRE Rail Extension\UCS\UCS G17 255

UNIAXIAL COMPRESSIVE STRENGTH

AS 4133.4.2.2
AS 4133.1.1.1

GBTesting
9 Lerista Court, Bibra Lake WA 6163
Ph (08) 9434 9999

Report no	C03-G17/257
Client No.	C03
Date	12/6/17

Client	Advisian	**Date Tested**	9/6/17
Client Address	Level 4, 600 Murray Street, West Perth 6005	**Tested by**	G Bilton
Project	BYRE Rail Extension	**Checked by**	G Bilton
Location	Butler to Yanchep		

Sample Identification	BH-21 9.0 to 9.2m	**Sample No.**	G17/257
Sample Description	Not Available		
Failure Mode*	Vertical splitting		

SAMPLE DETAILS

Length (L)	154	mm	**Bulk Density**	2.063	t/m³
Diameter (D)	60.2	mm	**Dry Density**	1.764	t/m³
Strain Rate	0.1	mm/min	**L /D Ratio**	2.6	

Before Test / After Test

TEST RESULTS

Testing Machine	Wykeham Farrance

UCS	2.9	MPa

Test Duration	02:36 minutes : seconds
Moisture Content @ time of test	16.9 %

STORAGE HISTORY AND ENVIRONMENT

	Yes	No
Plastic wrapped		
Bagged		
Plastic sleeve wrapped	X	
Evidence of moisture loss		X

COMMENTS / OBSERVATIONS

Sample sides are not smooth and free of irregularities and straight to within over the full length of the sample as per standard - due to naturally occurring voids, exposed grains or drilling irregularities.

Sample outside of the 5 to 15 minute testing range.

Advisian Project Number - 301012-02366

Legend : * - after Szwedzicki & Shamu 1999

Approved Signatory :_____

\\Gbtesting\rock testing projects\Advisian\BYRE Rail Extension\UCS\UCS G17 257