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Memorandum

To	Lend Lease Building	Johanna Nolan	johanna.nolan@lendlease.com
From	Peter Oitmaa	**Date**	22 October 2013
Subject	Preliminary Geotechnical Information 4 Murray Rose Avenue, Sydney Olympic Park	**Project No.**	45153.03

This memorandum provides preliminary geotechnical information for the above project. The geotechnical report is currently being prepared and will expand upon the information contained herein.

- Five boreholes (BH1 to BH3, BH5 & BH6) were drilled to depths of 15.0 m to 15.2 m for geotechnical investigation purposes. The locations of the geotechnical boreholes are shown in red on the attached aerial photograph. BH4 was not drilled due to access constraints. The conditions encountered in the boreholes are shown on the logs and core photographs which are also attached.
- The boreholes indicate that the site is underlain by the following profile:
  - Filling: concrete, sandy/silty clay topsoil, shaly clay, shale and roadbase filling to depths of 0.2 m to 0.8 m.
  - Residual Soil: stiff to very stiff silty clay and clay with traces of ironstone gravel to depths of 0.6 m to 3.0 m.
  - Bedrock: initially extremely low strength shale (Class V), becoming low to medium strength (Class III) below depths of 1.5 m to 4.4 m, and medium, medium to high or high strength (Class II/I) below 3.5 m to 6.9 m depth.
- Free groundwater was not observed during augering and is likely to be well below the bedrock surface. Confirmation of groundwater levels will be made once the results of the groundwater sampling programme have been compiled.
- The rock profile on the site is similar to that encountered at 3 and 5 Murray Rose Avenue.
- Excavations in filling, soil and extremely low to very low strength shale should be readily achievable using conventional equipment such as a hydraulic excavator with bucket attachment. Excavations in low strength shale and stronger will require the use of ripping equipment and/or rock hammers.
- Excavations could be battered temporarily at 1(H):1(V) until such time as the basement walls have been constructed and the void backfilled. However, batters are unlikely to be practical for the proposed depth of excavation.
- Excavations that cannot be battered will need to be supported by shoring walls. Soldier pile walls with infill shotcrete panels would be suitable for the site. Walls could be designed on the basis of the parameters shown in Table 1 and should be constructed over the full excavation depth.

Table 1: Material and Strength Parameters for Excavation Support Structures

Material	Bulk Density (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure at Rest (K_o)	Ultimate Passive Earth Pressure (kPa)
Filling	20	0.35	0.6	-
Residual Soil	20	0.25	0.4	-
Class V Rock	22	0.15[1]	0.25[1]	750[2]
Class III Rock	23	0[1]	0[1]	3,000[2]
Class II/I Rock	23	0[1]	0[1]	6,000[2]

Notes: [1] Unless unfavourably jointed; [2] Only below bulk/detailed excavation level and where jointing is favourable

- Additional lateral loads from potential rock wedges should also be considered in the shoring wall design as was recommended for 3 and 5 Murray Rose Avenue.
- Temporary anchors will be required to support the soldier pile walls and could be designed using the parameters provided in Table 2.

Table 2: Allowable Bond Stresses for Anchor Design

Material Description	Allowable Bond Stress (kPa)
Class V Rock	100
Class III Rock	250
Class II/I Rock	500

- Groundwater is likely to be well below the top of the bedrock surface. Drainage provisions will be required in the basement to collect, store and remove seepage water.
- Spread footings (pads and strips) would be suitable for supporting the proposed structure. These could be proportioned on the basis of an allowable bearing pressure of 6000 kPa in the Class II/I shale, subject to spoon testing to check for the presence of seams below the footings.
- Bored piles used for shoring support could also be used to support structural loads providing they are founded below the bulk excavation level. Piles could also be used to support structural loads outside the basement area. Bored piles could be proportioned on the basis of the design parameters provided in Table 3.

Table 3: Design Parameters for Bored Piles

Material Description	Allowable End-Bearing Pressure (kPa)	Allowable Shaft Adhesion[1] (kPa)
Class V Rock	750	50
Class III Rock	3500	300
Class II/I Rock	6000	500

Notes: [1]Provided adequate socket roughness is achieved

We trust the above information meets your present requirements. These comments will be expanded upon in the geotechnical report which is currently being prepared.

Yours faithfully,
Douglas Partners Pty Ltd

Peter Oitmaa
Senior Associate

Attachments: Aerial Photograph
Borehole Logs
Core Photographs


1
2
3
4
5
6
7
8
9
10
11
12
nearmap
current : clear : change

BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 11.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 45153.03
DATE: 27/9/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
11	0.15	CONCRETE							E			
		SILTY CLAY - very stiff, light grey brown silty clay with a trace of ironstone gravel, moist							S			9,16,14 N = 30
	0.6	SHALE - extremely low strength, grey brown shale with ironstone bands						Unless otherwise stated rock is fractured along rough planar bedding dipping 0°-10°	S			7,9,14 N = 23
10	1.5	SHALE - very low to low strength, grey shale										
	1.8	SHALE - low to medium strength, highly and highly to moderately weathered, fractured, grey brown shale, some very low strength bands						1.9m: B5°, fe 2.0 to 2.5m: B(x3) 0°-5°, cly 2.5 to 2.7m: B(x4) 0°, cly , fe 2.7m: J45° to 55°, cu, ro, cly 2.75 to 3.0m: B(x5) 0°, fe, cly 3m: J35°, un, ro, fe 3.12m: B5°, fe, cly 10mm 3.17 & 3.23m: B0°, fe 3.4 & 3.5m: J40°, pl, ro, fe 3.68m: B0°, fe, cly 10mm 3.85m: J80°, he 4.07 to 4.7m: B(x13) 0°, cly co 1-2mm	C	100	17	PL(A) = 0.3 PL(A) = 0.2 PL(A) = 0.3
9	4.7	SHALE - medium strength, fresh stained then fresh, slightly fractured and unbroken grey shale. Approximately 10% fine grained sandstone laminations. Some high strength siderite bands						4.7m: J75°, pl, ro, fe 4.9 to 5.13m: B(x3) 0°, fe 5.13 & 5.21m: J30°, pl, ro, cln 5.35m: B0°, cly 2mm 5.52m: J45°, pl, ro, cly 5.67m: J75°, pl, ro, fe 5.9m: J55°, un, ro, fe 6.04m: J80°, un, ro, fe 6.28m: J30°, pl, ro, cly 6.35m: J70°-90°, st, he, fe	C	100	92	PL(A) = 0.4 PL(A) = 1.3 PL(A) = 0.9
3								7.94m: J60°, pl, ro, cln 8.1 to 8.65m: J(x3) 20°-30°, pl, sm, cln	C	100	96	PL(A) = 0.6 PL(A) = 0.8

RIG: Scout 1 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.2m

TYPE OF BORING: Diatube to 0.15m; Solid flight auger to 1.0m; Rotary to 1.8m; NMLC coring to 15.05m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 15.05m (Screen 3.5m to 15.05m; Gravel 1.5m to 15.05m; Bentonite 1.0m to 1.5m; Backfill to Ground Level then Gatic cover)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 11.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 45153.03
DATE: 27/9/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
1	11	SHALE - medium strength, fresh stained then fresh, slightly fractured and unbroken grey shale. Approximately 10% fine grained sandstone laminations. Some high strength siderite bands *(continued)*							C	100	96	PL(A) = 0.5
0	12							11.13m: J35°, pl, ro, cln				PL(A) = 1.5
-1	13							12.15m: J85°, pl, ro, cln	C	100	100	PL(A) = 0.7
-2	14											PL(A) = 0.6
-3	15								C	100	100	PL(A) = 0.8
-4	15.05	Bore discontinued at 15.05m										
-5	16											
-6	17											
-7	18											
-8	19											

RIG: Scout 1 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.2m

TYPE OF BORING: Diatube to 0.15m; Solid flight auger to 1.0m; Rotary to 1.8m; NMLC coring to 15.05m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 15.05m (Screen 3.5m to 15.05m; Gravel 1.5m to 15.05m; Bentonite 1.0m to 1.5m; Backfill to Ground Level then Gatic cover)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 12.3 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 45153.03
DATE: 30/9/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
12	0.2	TOPSOIL - grey sandy clay topsoil with some grass rootlets, moist							E			
		CLAY - very stiff, mottled orange brown clay, moist							S			6,9,11 N = 20
11	0.8	CLAY - stiff to very stiff, light grey mottled brown clay, moist							S			3,6,9 N = 15
	1.8	SHALE - extremely low strength, light grey brown shale						Unless otherwise stated rock is fractured along rough planar bedding dipping 0°-10°				
10	2.3							2.3m: CORE LOSS: 100mm				
	2.4	SHALE - very low to low strength, highly weathered, fragmented to highly fractured, light grey brown shale. Some medium strength bands						2.4 to 3.0m: fg, fe, cly 3.0 to 3.6m: B5°, fe, cly	C	89	0	PL(A) = 0.9
9	4.0	SHALE - medium then low to medium strength, moderately weathered, fractured and slightly fractured, brown shale						3.75m: CORE LOSS: 250mm 4.0 to 4.4m: B(x4) 0°, fe 4.4 to 5.3m: B(x18) 0°, fe, he 4.6m: J35°, pl, ro, fe 4.85m: J55°, pl, ro, fe 5.3m: J45°-50°, he, fe 5.4 to 6.05m: J(x5) 60°-70°, pl, ro, fe	C	92	51	PL(A) = 0.4 PL(A) = 0.3
8	6.17	SHALE - medium strength, fresh, slightly fractured, grey shale. Approximately 10% fine grained sandstone laminations. Some high strength siderite bands						6.15m: B0°, fe, cly 10mm 6.2 to 6.3m: B(x3) 0°, fe 6.35m: J90°, pl, ro, cln 6.72m: J65° to 70°, cu, sm, cln 7.0 to 7.2m: J80°, un, ro, cln 7.75 to 7.9m: J45°, pl, sm, cln 8.65 to 9.3m: J(x3) 70°, pl, ro, cln	C	100	98	PL(A) = 2.7 PL(A) = 0.6 PL(A) = 0.6 PL(A) = 0.6
7												
6												
5												
4												
3												

RIG: Scout 1 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.2m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 2.3m; NMLC coring to 15.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 15.1m (Screen 3.1m to 15.1m; Gravel 2.0m to 15.1m; Bentonite 1.5m to 2.0m; Backfill to Ground Level then Gatic cover)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 12.3 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 45153.03
DATE: 30/9/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	11	SHALE - medium strength, fresh, slightly fractured, grey shale. Approximately 10% fine grained sandstone laminations. Some high strength siderite bands *(continued)*						10.1 to 10.6m: J(x4) 70°, pl, ro, cln 10.35m: J65°, he	C	100	93	PL(A) = 0.8
1	11.2	SHALE - medium to high strength, fresh, slightly fractured, grey shale with high strength siderite bands						10.97m: J90°, pl, sm, cln				PL(A) = 1.2
0	12 12.25	SHALE - medium strength, fresh, slightly fractured grey shale, with approximately 10% fine grained sandstone laminations						11.65 & 11.71m: J65°, pl, ro, cln 12.2m: J60°, Cz10mm	C	100	93	PL(A) = 1
-1	13							13.1 & 13.3m: J30°, un, ro, cln 13.6 & 13.85m; J70°, pl, sm, cln				PL(A) = 0.9
-2	14							13.9 & 14.33m: B0°-5°, cly 10-20mm	C	100	95	PL(A) = 0.6
-3	15 15.1	Bore discontinued at 15.1m										
-4	16											
-5	17											
-6	18											
-7	19											

RIG: Scout 1 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.2m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 2.3m; NMLC coring to 15.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 15.1m (Screen 3.1m to 15.1m; Gravel 2.0m to 15.1m; Bentonite 1.5m to 2.0m; Backfill to Ground Level then Gatic cover)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 12.1 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 45153.03
DATE: 30/9/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
12	0.16	CONCRETE							E			
	0.3	FILLING - shaly clay filling, damp										
		CLAY - very stiff, grey brown clay with a trace of irosntone gravel, moist							S			4,9,6 N = 15
11	1								S			4,8,20 N = 28
	1.5	SHALE - extremely low strength, light grey brown shale with ironstone bands						Unless otherwise stated rock is fractured along rough planar bedding dipping 0°-10°				
	1.8	SHALE- low strength, highly weathered, fragmented and fractured, light grey brown shale						1.8 to 2.08m: fg, fe 2.08 to 3.0m: B0°, fe, cly	C	100	0	PL(A) = 0.2
10	2											
	3.0	SHALE - very low and very low to low strength, highly weathered, light grey and grey shale						3.0 to 3.4m: Ds				
9	3							3.4m: CORE LOSS: 450mm				
	3.85											
8	4							4.2 to 4.7m: fg, cly				
	4.7	SHALE - low strength, highly then slightly weathered, slightly fractured, grey brown shale							C	85	45	PL(A) = 0.2
7	5							5.0 to 5.06m: fg 5.06m: J35°, pl, ro, fe				PL(A) = 0.2
								5.4m: J90°, pl, ro, cln				
								5.75m: J70°, un, ro, fe, cly				
6	6.0	SHALE - medium and medium to high strength, slightly weathered then fresh, slightly fractured and unbroken, grey shale. Approximately 5% fine grained sandstone laminations						5.85m: B0°, fe and J80°, un, ro, fe 6.1 to 6.4m: B(x6) 0°, fe				PL(A) = 0.6
								6.55m: J90°, pl, ro, fe 6.75m: B0°, cly				
5	7							7.45 to 7.9m: J(x5) 25°-30°, pl, ro, cln				PL(A) = 0.7
4	8								C	100	94	
												PL(A) = 0.6
3	9							9.15m: J60°, pl, ro, cln 9.2m: J85°, un, ro, cln				
								9.67m: J45°, pl, ro, cln	C	100	100	PL(A) = 0.7

RIG: Scout 4 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.8m

TYPE OF BORING: Diatube to 0.16m; Solid flight auger to 1.0m; Rotary to 1.8m; NMLC coring to 15.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 12.1 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 45153.03
DATE: 30/9/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	11	SHALE - medium and medium to high strength, slightly weathered then fresh, slightly fractured and unbroken, grey shale. Approximately 5% fine grained sandstone laminations *(continued)*						10.6m: J30°, pl, ro, cln				PL(A) = 1.5
1	12							11.35m: J45°, pl, ro, cln	C	100	100	PL(A) = 0.6
0	13							12.52m: J30°, sl, sm, cln 12.9m: J30°, sl, sm, cln				PL(A) = 0.6
-1	14							13.53m: J45°, pl, sm, cln 13.73 to 13.78m: Cz, cly 13.78 to 14.03m: J(x6) 20°-30°, pl, sm	C	100	98	PL(A) = 0.5
-2	15 15.0							14.7m: J50°, pl, sm, cln				PL(A) = 0.5
-3		Bore discontinued at 15.0m										
-4	16											
-5	17											
-6	18											
-7	19											

RIG: Scout 4 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.8m

TYPE OF BORING: Diatube to 0.16m; Solid flight auger to 1.0m; Rotary to 1.8m; NMLC coring to 15.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 11.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 45153.03
DATE: 1/10/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
11	0.2	TOPSOIL - grey brown silty clay topsoil with a trace of grass rootlets, moist							E			
		CLAY - very stiff, red brown clay with ironstone bands, moist						Unless otherwise stated rock is fractured along rough planar bedding dipping at 0°-10°	S			5,7,9 N = 16
1	1.0	SHALE - extremely low to very low strength, light grey brown shale							S			7,9,25 N = 34
10	1.45	SHALE - low to medium strength, highly to moderately weathered, fractured then slightly fractured, light grey brown shale						1.45 to 1.62m: fg, fe 1.8m: J85°, un, ro, fe 2.4 to 2.81m: J(x3) 55°-70°, pl, ro, cln	C	100	95	PL(A) = 0.6 PL(A) = 0.3 PL(A) = 0.4
2	3.5	SHALE - medium strength, slightly weathered, fractured and slightly fractured, grey brown shale						3.3m: J55° & 75°, st, ro, cln 3.8m: J85°, pl, ro, cln 4m: J80°, pl, ro, fe 4.17m: B0°, cly 5mm 4.43m: B0°, fe 4.75m: J30°, pl, ro, fe 5.5 to 5.9m: J(x5) 50°-70°, pl, ro, fe 6.07m: J75°, un, ro, cln	C	100	96	PL(A) = 6.5 PL(A) = 0.5 PL(A) = 0.5
9		- high strength siderite band										
3	6.1	SHALE - medium and medium to high strength, fresh, slightly fractured and unbroken, grey shale. Approximately 5% fine grained sandstone laminations - 6.7m and 10.65m: high strength siderite bands						>> 9.7 to 9.85m: J75°, pl, ro, cln	C	100	100	PL(A) = 0.7 PL(A) = 0.6
8									C	100	100	PL(A) = 0.7
2												

RIG: Scout 1 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.2m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 1.45m; NMLC coring to 15.15m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 15.15m (Screen 3.15m to 15.15m; Gravel 1.5m to 15.15m; Bentonite 1.0m to 1.5m; Backfill to Ground Level then Gatic cover)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 11.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 45153.03
DATE: 1/10/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
11	11	SHALE - medium and medium to high strength, fresh, slightly fractured and unbroken, grey shale. Approximately 5% fine grained sandstone laminations *(continued)*						10.35m: J65°, pl, ro, cln				PL(A) = 0.7
									C	100	100	PL(A) = 2.5
12	12							>>				
												PL(A) = 1.2
13	13											
								13.6m: J20°, un, ro, cln	C	100	100	PL(A) = 0.6
14	14							14.3m: J80°, pl, ro, cln				PL(A) = 0.6
15	15											PL(A) = 0.5
	15.15	Bore discontinued at 15.15m										
16	16											
17	17											
18	18											
19	19											

RIG: Scout 1 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.2m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 1.45m; NMLC coring to 15.15m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 15.15m (Screen 3.15m to 15.15m; Gravel 1.5m to 15.15m; Bentonite 1.0m to 1.5m; Backfill to Ground Level then Gatic cover)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 10.2 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 45153.03
DATE: 2/10/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
10	0.14	CONCRETE										
		FILLING - grey clay and crushed shale filling with some road base gravel and a trace of ash, moist							A			
	0.8	CLAY - stiff then very stiff, brown clay with a trace of ironstone gravel, moist							S			4,7,7 N = 14
9	1								S			3,6,8 N = 14
8	2											
7	3							Unless otherwise stated rock is fractured along rough planar bedding dipping at 0°-10°	S			4,7,18 N = 25
	3.0	SHALE - extremely low strength, light grey brown shale										
6	4							3.8m: CORE LOSS: 580mm				
	4.38	SHALE - medium and low to medium strength, highly then slightly weathered, highly fractured to fractured, grey brown to grey shale, some very low strength bands						4.38 to 4.8m: B0°*10°, fe 4.8 to 5.3m: fg 5.4 to 5.7m: Ds	C	60	0	PL(A) = 0.4
5	5							5.7m: CORE LOSS: 530mm				
4	6							6.23 to 6.37m: fg, fe 6.42 nto 6.57m: J(x3) 30°-35°, pl, ro, fe 6.73 to 6.83m: fg, fe 6.83m: J45°, pl, ro, fe 7.03 & 7.16m: J(x2) 30°, pl, sm, cln 7.3 to 7.35m: Cz	C	94	57	PL(A) = 0.6 PL(A) = 0.6 PL(A) = 1
	6.23											
3	7											
	7.35	SHALE - medium strength, fresh, slightly fractured and unbroken, grey shale. Approximately 5% fine grained sandstone laminations										
2	8											
1	9							9.0 & 10.38m: B0°, cly, vn	C	100	100	PL(A) = 0.7

RIG: Scout 1 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 2.7m

TYPE OF BORING: Diatube to 0.17m; Solid flight auger to 2.5m; Rotary to 3.8m; NMLC coring to 15.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 14.9m (Screen 3.5m to 14.9m; Gravel 3.0m to 14.9m; Bentonite 2.5m to 3.0m; Backfill 2.5m to Ground Level then Gatic cover)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Lend Lease Building Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 4 Murray Rose Avenue, Sydney Olympic Park

SURFACE LEVEL: 10.2 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 45153.03
DATE: 2/10/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
0		SHALE - medium strength, fresh, slightly fractured and unbroken, grey shale. Approximately 5% fine grained sandstone laminations *(continued)*										PL(A) = 0.8
-1	11								C	100	100	
												PL(A) = 0.6
-2	12 12.0	LAMINITE - high strength, fresh, unbroken light grey and grey laminite with approximately 25% fine grained sandstone laminations						>>				PL(A) = 1.2
-3	13											PL(A) = 1.8
									C	96	96	
-4	14											PL(A) = 2
	14.88	- 14.88m to 15.0m: core left down the hole						14.88m: CORE LOSS: 120mm				
-5	15 15.0	Bore discontinued at 15.0m										
-6	16											
-7	17											
-8	18											
-9	19											

RIG: Scout 1 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 2.7m

TYPE OF BORING: Diatube to 0.17m; Solid flight auger to 2.5m; Rotary to 3.8m; NMLC coring to 15.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 14.9m (Screen 3.5m to 14.9m; Gravel 3.0m to 14.9m; Bentonite 2.5m to 3.0m; Backfill 2.5m to Ground Level then Gatic cover)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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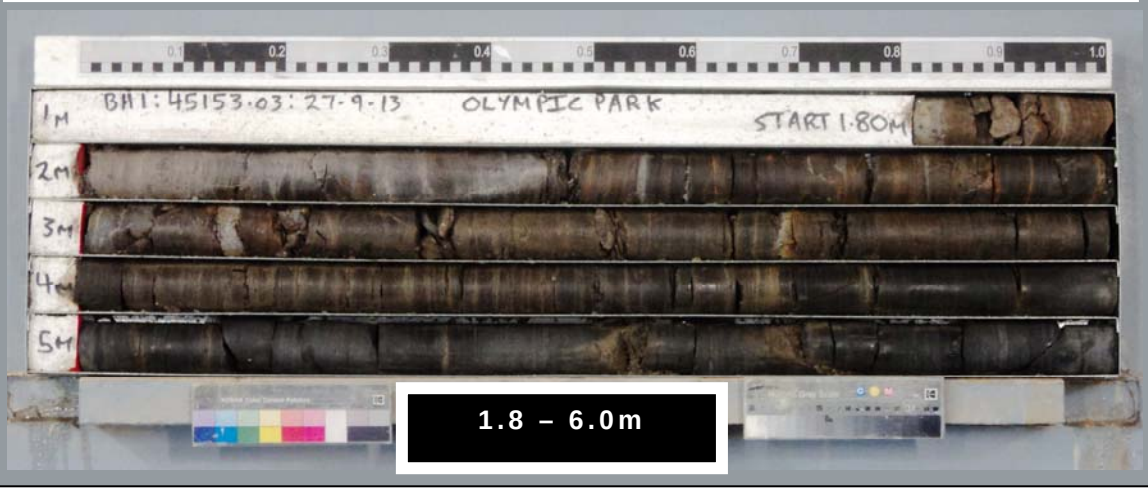
Geotechnics / Environment / Groundwater

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 1 PROJECT 45153.03 SEP 2013

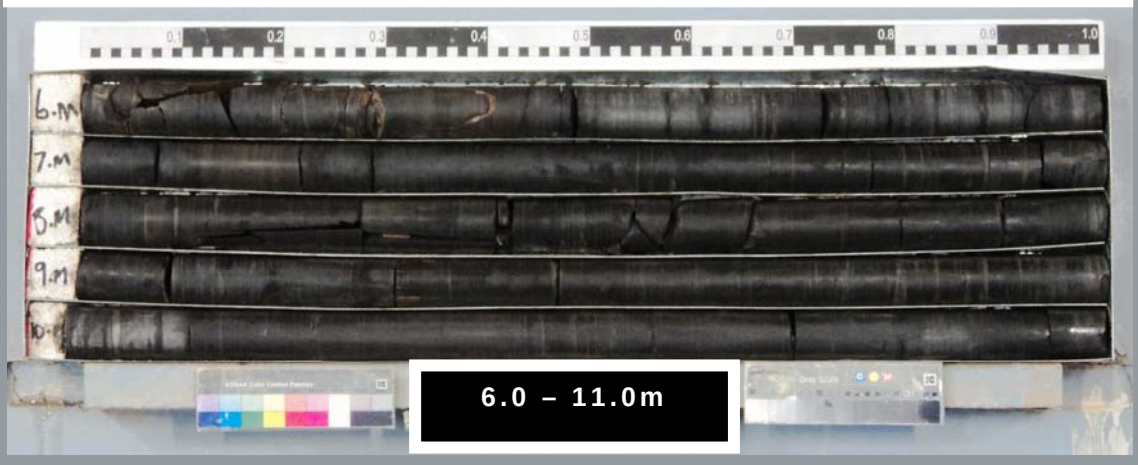


1.8 – 6.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 1 PROJECT 45153.03 SEP 2013



6.0 – 11.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 1 PROJECT 45153.03 SEP 2013

11.0 – 15.05m

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PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 2 PROJECT 45153.03 SEP 2013

2.3 – 6.0m

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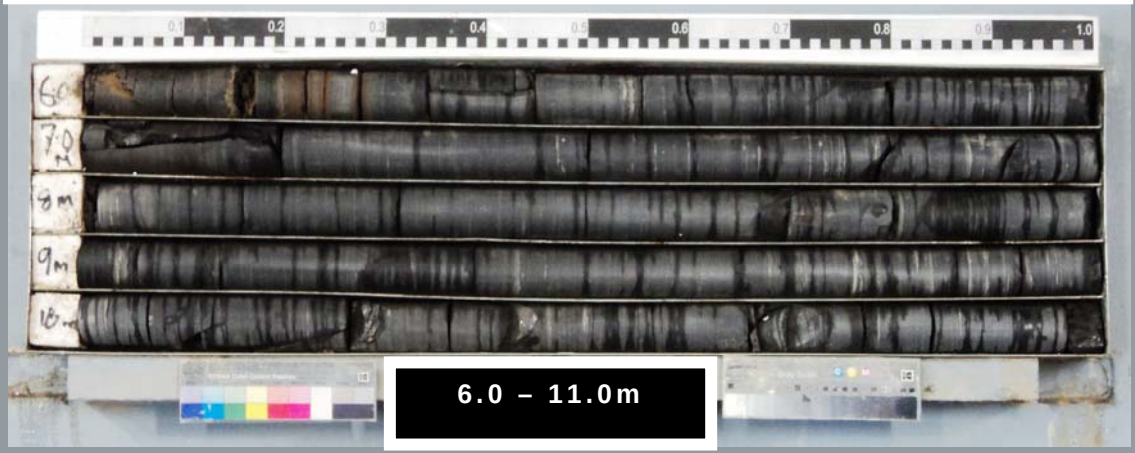
PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 2 PROJECT 45153.03 SEP 2013



6.0 – 11.0m

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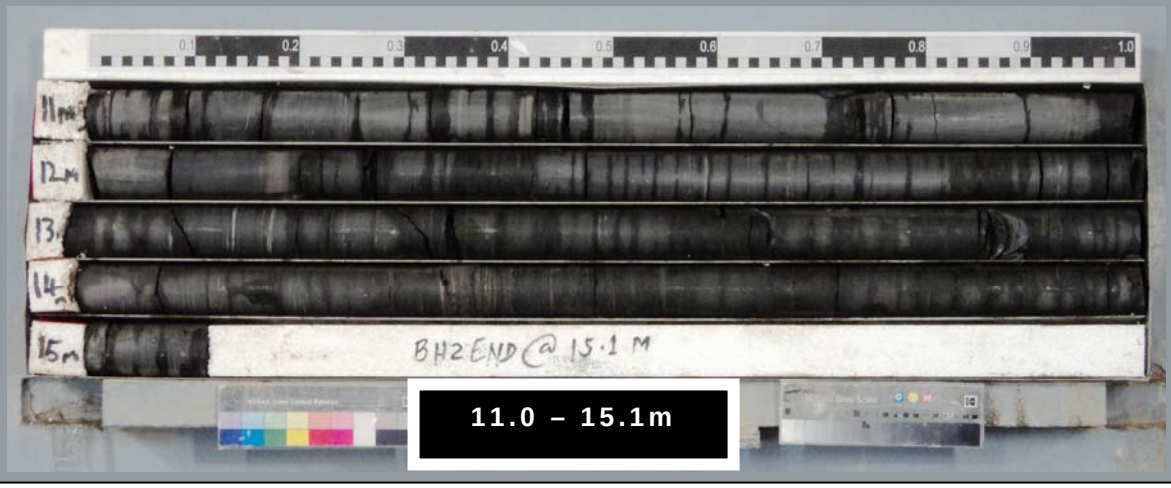
PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 2 PROJECT 45153.03 SEP 2013



11.0 – 15.1m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 3 PROJECT 45153.03 SEP 2013

1.8 – 6.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 3 PROJECT 45153.03 SEP 2013

6.0 – 11.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

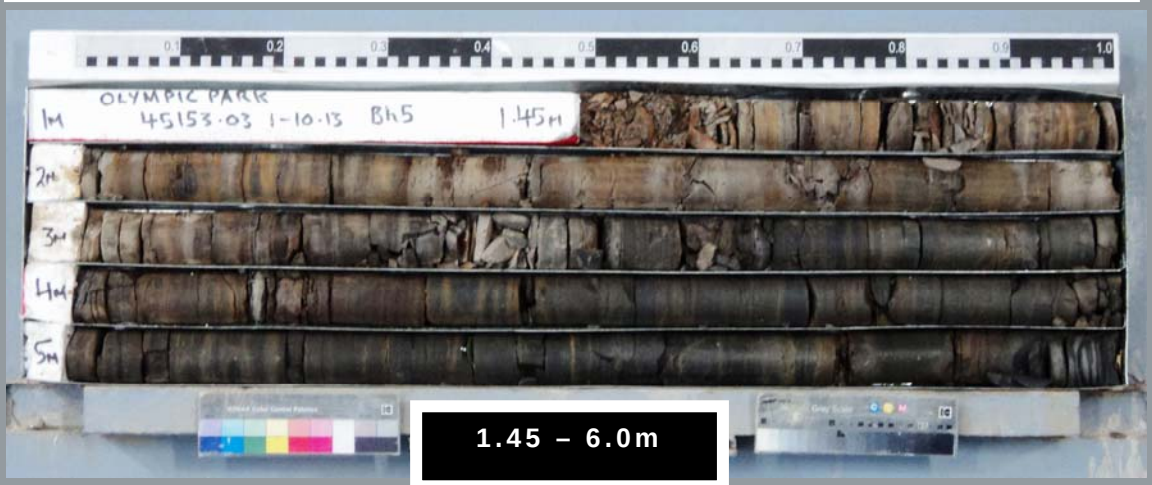
BORE 3 PROJECT 45153.03 SEP 2013

11.0 – 15.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 5 PROJECT 45153.03 SEP 2013

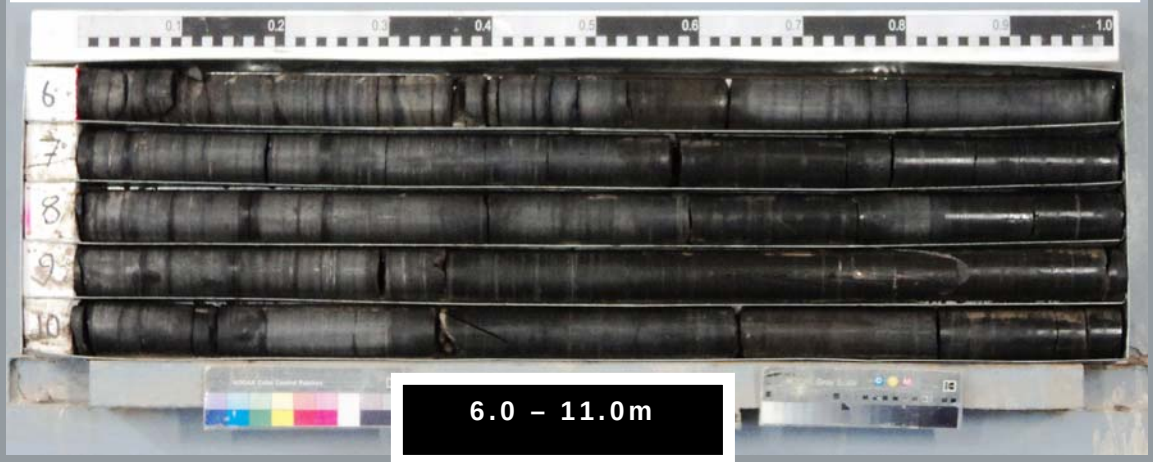


1.45 – 6.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 5 PROJECT 45153.03 SEP 2013



6.0 – 11.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 5 PROJECT 45153.03 SEP 2013

11.0 – 15.15m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 6 PROJECT 45153.03 SEP 2013

3.8 – 8.0m

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PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 6 PROJECT 45153.03 SEP 2013

8.0 – 13.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED COMMERCIAL DEVELOPMENT – SYDNEY OLYMPIC PARK

BORE 6 PROJECT 45153.03 SEP 2013