



REPORT
TO
FRASERS BROADWAY
ON
GEOTECHNICAL INVESTIGATION
FOR
BLOCKS 6 & 7 – COMMERCIAL & RETAIL ADAPTIVE
REUSE
AT
CENTRAL PARK

15 November 2012
Ref: JKG22905Srpt67



AS/NZS ISO 9001
Certified

Davis Langdon Certification Services

JK Geotechnics
GEOTECHNICAL & ENVIRONMENTAL ENGINEERS

PO Box 976, North Ryde BC NSW 1670
Tel: 02 9888 5000 Fax: 02 9888 5001
www.jkgeotechnics.com.au

Jeffery & Katauskas Pty Ltd, trading as
JK Geotechnics ABN 17 003 550 801

Date: 15 November 2012
Report No: 22905Srpt67
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Report prepared by:



Adam Mitchell
Senior Geotechnical Engineer

Report reviewed by:



Paul Stubbs
Principal

For and on behalf of
JK GEOTECHNICS
PO Box 976
NORTH RYDE BC NSW 1670

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TABLE OF CONTENTS

1	INTRODUCTION	1
2	INVESTIGATION PROCEDURE	1
3	RESULTS OF INVESTIGATION	2
3.1	Site Description	2
3.2	Subsurface Conditions	2
4	COMMENTS AND RECOMMENDATIONS	4
4.1	Geotechnical Issues	4
4.2	Site Preparation and Earthworks	4
4.3	Excavation	5
4.4	Vibration Management	6
4.5	Retention	6
4.6	Foundations	8
4.7	Slab on Grade Construction	9
5	GENERAL COMMENTS	10

J&K BOREHOLE LOGS B16, B21, P13, P14 AND P15

URS BOREHOLES LOGS 201 TO 208, MW101 and MW 102

FIGURE 1: BOREHOLE LOCATION PLAN

FIGURE 2: SITE ANALYSIS AND LOCATION PLAN

FIGURE 3: SITE (DEVELOPMENT) PLAN

JK GEOTECHNICS REPORT EXPLANATION NOTES



1 INTRODUCTION

This report presents the results of a compilation of geotechnical information obtained from geotechnical investigations undertaken within the Frasers Broadway site, for the proposed retail and commercial adaptive reuse for Blocks 6 and 7, Kensington Street Precinct, Frasers Broadway. This geotechnical assessment was commissioned by Anthony Green of Frasers Property Australia Pty Ltd, in an email dated 15 November 2012.

Based on the supplied plans which have been prepared by Tonkin Zulaikha Greer, we note that the proposed development has buildings no larger than 5 storeys, with no basement.

The purpose of this assessment was to provide a compilation of information on the sub-surface conditions beneath Blocks 6 and 7, and to present our comments and recommendations on geotechnical aspects of the proposed development.

The purpose of the investigation was to obtain geotechnical information on subsurface conditions as a basis for comments and recommendations

2 INVESTIGATION PROCEDURE

A number of previous investigations have been carried out on the site by ourselves and other contractors. The most relevant reports for this geotechnical assessment were carried out by Jeffery and Katauskas and covered the whole of Basement 2, 5 and 9 (Ref:22905rpt259, dated 28 November 2009) and a pavement investigation along Kensington Street and Kent Road (Ref:22905Sroadsrpt, dated 2 March 2010).

A geotechnical investigation was undertaken by URS (Ref: 43187193, dated 5 October 2006) which also contains boreholes drilled in the vicinity of Block 6 and 7.

We have shown the relevant approximate borehole locations on Figure 1 and have used the relevant information as part of this assessment. Copies of relevant borehole logs and explanatory notes which describe terms and symbols used as details of the exploratory techniques are attached with this report.



3 RESULTS OF INVESTIGATION

3.1 Site Description

The site is located at the Central Park development, Chippendale, NSW to the east of the main One Central complex. Blocks 6 and 7 lie to the east of Kensington Street (to be renamed Kensington Lane) and to the south of Dwyer Street.

Blocks 6 and 7 contain a number of separate properties fronting Kensington Street which are identified on the attached site analysis and location plan by Tonkin Zulaikha Greer Architects (Ref Project No 11022 Dwg No A-001) presented as Figure 2. The buildings comprise a mixture of small warehouse and terrace house type structures of masonry construction.

The key elements of the topography of the site are that it lies on the eastern side of an old creek which drained northwards in the river channel which originally occupied the area of Abercrombie Street and flowed northwards to Blackwattle Bay. Smaller tributary creeks, which flowed northwards towards Abercrombie Street, were culverted and infilled a long time ago and an old brick ovoid culvert lies a little to the south of Outram Street (to the south of Block 7). Ground slopes have been modified by the filling but fall gently to the south and south-west in the area of interest.

3.2 Subsurface Conditions

The geology of the site and subsurface conditions including groundwater have been discussed extensively in our previous report Ref: 22905Srpt259, dated 28 November 2009 as well as the URS report Ref: 43187193, dated 5 October 2006. In brief there is filling in the old creek channel which ran near the southern edge of the site, overlying a shallow sandy deposit which infills the creek and covers the surrounding area to shallow depth and probably represents the margin of the aeolian (wind-blown) deposits of the Botany Basin. Below the sands and elsewhere are silty clay soils, probably residual in origin overlying sandstone bedrock belonging to the Hawkesbury formation.

The nearest borehole information to the vicinity of Blocks 6 and 7 has been extracted from the previous reports and the logs are attached with this report; the borehole locations are shown on the attached Figure 1. Explanatory notes which refer to the Jeffery & Katauskas logs are also provided.



Fill

Within the areas of the proposed redevelopment fill was only encountered within Boreholes 206 and MW101 to depths of 0.8m. The fill typically comprised gravelly sand and building rubble. However fill depths varied between 0.5m (P13) and 1.5m (P15) beneath Kensington Road; the deeper fill could be associated with buried services. Further west B16 encountered fill to 2.4m depth which might be associated with an old drainage channel of unknown orientation, but equally may have no relevance to the site.

Natural Sand

Natural silty sand and sand was encountered within all of the boreholes from the surface (SB205) or beneath the fill to depths between 1.7m (SB204) and 4.9m (MW101). The sands were typically assessed to be medium grained, light brown to light grey with some boreholes revealing more coarse grained sands. The sands were assessed to be of loose relative density.

Silty Clay

Silty (sandy) clay, ranging from low to high plasticity, was encountered beneath the natural sand to depths between 3.5m (MW101) and 4.9m (201). The clay was assessed to be of soft to stiff strength.

Sandstone

Sandstone was encountered at a depth of 4.9m in SB201 (RL12.68m) and MW101 (RL12.65m), however penetration was limited to no more than 0.2m. With reference to B16 and B21 sandstone was encountered at depths of 3.8m (RL11.07m) and 5.7m (RL11.92m) respectively, and assessed to be extremely weathered and of extremely low strength on initial contact, becoming medium to high strength with depth.

Groundwater

Groundwater was not encountered within many of the URS boreholes drilled within the area of Blocks 6 and 7. However, groundwater was encountered at depths between 3.7m and 3.8m (RL13.5m to 13.6m) in SB 207 and 208, at 2.7m (RL12.2m) in B16 and 3.9m (RL13.72) in B21, within the natural sands.



4 COMMENTS AND RECOMMENDATIONS

4.1 Geotechnical Issues

A summary of some of the main geotechnical issues is presented below. Further details are provided in the following sections of this report.

1. Demolition of non-heritage structures, in the locations of Blocks 6 and 7, while retaining the original building shells will require temporary propping with associated footings.
2. Deep fill profiles appear unlikely to be widespread within the blocks.
3. The natural sandy soils which appear to be the main soil type below the blocks are loose and at best suitable only for support of low rise structures; they are in places shown to be underlain by quite soft clay soils which would consolidate significantly if subject to significant load increases.
4. Vibrations from subgrade preparation which would be transmitted to the adjacent structures must be avoided.
5. The use of piled foundations for substantial structures at 14 and 42-44 Kensington Street will be necessary as near-surface soils will not be capable of providing stable support.

4.2 Site Preparation and Earthworks

If new ground floor slabs are to be suspended, the fill under the slabs to bring the level up would not have to be engineered fill, although it should be free from topsoil, root affected soils or other deleterious materials.

For any new pavement areas, or if ground floor slabs are not suspended, the comments and recommendation provided below should be followed. Earthworks recommendations in this report should be read in conjunction with AS3798-2007: *'Guidelines on Earthworks for Commercial and Residential Developments'*.

Drainage

Good drainage should be provided both during construction and for the long term maintenance of the site. The principle aim of the drainage should be to promote run off but avoid erosion.

Subgrade Preparation

The following subgrade preparation is recommended under any new pavement areas or floor slabs if not suspended and prior to the placement of engineered fill:



- Strip the subgrade of all hard surfacing and/or vegetation, demolition material, root affected soils, fill or other deleterious materials.
- Following stripping, proof roll the subgrade using a minimum of 8 passes of a smooth drum roller with a static weight of no less than 4 tonnes. All proof rolling should be completed in the presence of an experienced geotechnical engineer or geotechnician.
- The purpose of proof rolling is to improve the near surface density of the soils and identify any soft or unstable areas. Any soft or unstable areas identified should be excavated down to a sound base and reinstated with engineered fill as described below.

Engineered Fill

Materials preferred for use as engineered fill are well graded granular materials, such as ripped or crushed sandstone or processed concrete, free of any deleterious substances and having a maximum particle size of 75 millimetres (mm). Such fill should be compacted in layers not greater than 200mm loose thickness, to a minimum density of 98% Standard Maximum Dry Density (SMDD).

Compaction Control

Compaction control should consist of density tests completed at a minimum frequency of 1 test/layer/300m² or 3 test/layer, whichever is greater. Level 2 is the lowest category of compaction control that may be completed. For localised backfill areas such as service trenches, excavated soft spots etc, the frequency of testing should be 1 test/2 layers/50m². These recommendations should be read in conjunction with AS3798-2007.

4.3 Excavation

Exact levels of the proposed ground floors relative to existing surface levels have not been determined exactly; however we expect that excavations will be no greater than 1m deep. Such excavations will likely be undertaken for the removal of the existing building footings as part of the demolition process. The excavations will encounter a mixture of fill and natural sands, which should be readily achievable using conventional means such as the bucket of hydraulic excavators. Great care may be necessary to avoid undermining or disturbing the footings of adjacent structures. Test pits should be carried out under geotechnical supervision to assess such issues at the earliest practicable opportunity.



4.4 Vibration Management

Due to access constraints we anticipate that where tracked excavators are used they will be of relatively small size, and with no rock excavation anticipated the magnitude of transmitted vibrations from such sources will be small and will be unlikely to result in damage to nearby movement sensitive structures. However if slab on grade construction is proposed it is likely that substantial site preparation will be necessary which could involve the use of vibrating rollers.

It would be prudent to undertake dilapidation reports on buildings adjacent to the proposed excavations prior to commencement. The purpose of dilapidation reports is to provide a benchmark record of the condition of adjoining structures prior to the commencement of construction so that where allegations are raised of construction related damage a benchmark exists against which to compare the apparent change in condition of the structure. In this regard dilapidation reports are very useful in helping to prevent unfounded claims for construction related damage.

If vibrating rollers are to be used we recommend full time vibration monitoring on adjacent structures. It is unlikely that significant roller vibration can be used on such limited sites and static rolling will probably be necessary. As this is of limited effectiveness it may be easier to suspend floor slabs than rework significant thicknesses of fill, should this occur.

4.5 Retention

There are no basements proposed and so the following general advice regarding retention is directed towards relatively shallow depths of cut or fill associated with site levelling for ground floor slabs.

The use of temporary batters may be feasible, with permanent retaining walls constructed at the base of the batters and the walls subsequently backfilled. We recommend that batters only be considered where adjacent buildings or movement sensitive structures are located a horizontal distance from the crest of the batter of at least twice the height of the batter.

Where space permits, temporary batters within the fill and natural sands should be no steeper than 1 Vertical in 2 Horizontal (1V:2H). Such batters should remain stable in the short term provided all surcharge loads, including construction loads and adjoining structural loads etc. are kept well clear of the batters. Steeper batters may be feasible in the short term provided no surcharge loads are present.



If excavations or filling must extend to site boundaries then either temporary shoring or underpinning of adjacent structures would be necessary. Such issues should be addressed at the time of detailed site investigations.

Given the limited height that is likely to be retained, retaining walls may be designed as cantilevered walls. Where some adjacent ground movements are tolerable and adjacent structures are located beyond a horizontal distance from the walls of at least twice the retained height, the walls may be designed on the basis of an apparent triangular earth pressure distribution and an active earth pressure coefficient (K_a) of 0.35 and a bulk unit weight of 20kN/m^3 . Where structures are located within twice the retained height and movements are to be kept low, a higher earth pressure coefficient close to the 'at rest' earth pressure (K_0) of 0.55 should be used.

The above coefficients assume horizontal backfill surfaces and where inclined backfill is proposed the coefficients would need to be increased or the inclined backfill taken as a surcharge load. All surcharge loads, including adjacent structures, should be allowed for in the design. Full hydrostatic pressures should be considered unless measures are undertaken to provide complete and permanent drainage of the ground behind the wall.

Where batters are used, the space between the batters and the permanent retaining walls will need to be carefully backfilled to reduce further settlement of the backfill. Only light compaction equipment should be used for compaction behind retaining walls so that excessive lateral pressures are not placed on the walls. This will require the backfill to be placed in thin layers, say 100mm loose thickness, appropriate to the compaction equipment being used.

The compaction specification for the backfill will depend on whether paving or structures are to be supported on the fill. If the fill is supported paved areas in should be compacted to a density of at least 98% of Standard Maximum Dry Density (SMDD) for granular fill materials, but if it is only to support landscaped areas a lower compaction specification, say 95% of SMDD, may be appropriate, provided the risk of future settlement and maintenance can be expected. Alternatively a clean, hard, durable, single sized gravel may be used as backfill which would require much less compaction and would provide good drainage.



4.6 Foundations

We understand that new construction is proposed at the areas indicated on the Site Plan prepared by Tonkin Zulaikha Greer Architects (Ref 11022 Dwg No A-002) presented as Figure 3 with this report. Due to the existence of a varied fill profile, loose natural sands, moderate structural loads and to limit differential settlement between the new buildings and the existing structures/facades, we recommend that any substantial structures be supported on piles founded within the sandstone bedrock. It may be possible to support light single story buildings on high level footings subject to a suitable program of subsurface investigations.

From the boreholes contained within our previous geotechnical report Ref: 22905Srpt259, dated 28 November 2009 and the URS report Ref: 43187193, dated 5 October 2006, sandstone was encountered at the following depths/RLs:

Block 6

Borehole Number	Surface RL (m)	Sandstone
SB201	17.58	4.9m / RL12.68m
MW101	17.55	4.9m / RL12.65m

Block 7

Borehole Number	Surface RL (m)	Sandstone
SB208	17.19	5.2m / RL11.99m
SB207	17.35	5.3m / RL12.05,
MW102	17.77	6.2m / RL11.57m

However, it should be noted that the above boreholes only penetrated a short distance into the underlying sandstone or the drill refused on the surface of the sandstone and hence the quality is really not known.

Due to the limited information on the strength and consistency of the underlying sandstone within the URS boreholes and the known poor quality sandstone observed within boreholes to the west of the site in Block 3, it should be assumed that the Allowable End Bearing Pressure (AEBP) on the upper sandstone should be limited to 700kPa. Higher bearing pressures of say 1,000kPa may be used for piles founded within Class IV sandstone, which might be encountered at depths (say)



1m to 3m below the rock surface. Cored boreholes will need to be completed to assess the depth and competency of the underlying sandstone bedrock, but good quality Class 1 to 2 sandstone was generally encountered within about 6m to 8m of the surface in the basement excavation to the west.

Due to the presence of poorly compacted fill, sandy soils and the potential for the water table to be present within the sandy soils, it will be necessary to use either CFA grout injected piles or perhaps steel screw piles for lightly loaded structures.

For light single storey structures it might be possible to adopt high level footings bearing on the loose sands. Stiffened raft slabs are generally best suited to these sort of conditions and allowable bearing pressures of 100kPa for footings with an embedment of at least 0.5m would probably be possible. The presence of soft clay layers at depth which might give rise to excessive settlement of the footings must be determined by detailed investigations.

Whatever preliminary foundation design is proposed, it should be noted that further site specific investigation should be carried out when site access permits.

We recommend that at least the initial stages of piling works and all shallow footings be inspected by a geotechnical engineer to confirm that a suitable founding stratum is being achieved.

4.7 Slab on Grade Construction

Slab-on-grade construction is considered feasible on condition that the subgrade is prepared in accordance with the recommendations given in Section 4.2 above.

Where concrete slabs are formed on-grade they should be separated from all other building elements. The purpose of this separation is to permit differential movements. Joints in the on-grade floor slabs should be provided with keyed or dowelled joints to accommodate shear forces but not bending moments.

A sub-base layer of minimum 100mm of DGB20, compacted to at least 98% of Modified Maximum Dry Density (MMDD) should be considered beneath any concrete on-ground floor slabs which will be subject to traffic.



5 GENERAL COMMENTS

The recommendations presented in this report include further investigations and assessments to be completed during the subsequent phases of the project. In the event that these recommendations are not implemented, the general advice may become inapplicable and Jeffery and Katauskas Pty Ltd accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

Occasionally, the subsurface conditions between the completed boreholes may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

If there is any change in the proposed development described in this report then all recommendations should be reviewed.

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Borehole No.
B16

1/4

BOREHOLE LOG

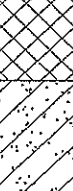
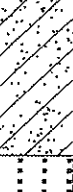
Client: FRASERS PROPERTY
Project: FRASERS BROADWAY, BLOCK 2, 5 AND 9
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905S
Date: 22-9-09

Method: SPIRAL AUGER
JK500

R.L. Surface: ≈ 14.87m
Datum: AHD

Logged/Checked by: T.M. 

Groundwater Record	SAMPLES				Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	US	DB	DS									
 ON 29-9-09						0			FILL: Sandy gravelly clay, low plasticity, brown, fine to coarse grained sand, fine to coarse grained angular ironstone, sandstone and igneous gravel, with sandstone cobbles, brick and concrete fragments.	MC≈PL			APPEARS POORLY COMPACTED
						1			FILL: Silty sandy gravel, fine to coarse grained igneous and ironstone gravel, brown, with fine to coarse grained sand, sandstone cobbles and boulders, brick, concrete, steel and wood fragments.	M			NO SPT DUE TO RUBBLE IN FILL
						2							NO SPT DUE TO RUBBLE IN FILL
						3		CL	SANDY CLAY: low to medium plasticity, light grey mottled orange brown and red brown, fine to coarse grained sand.	MC > PL	(VSt)	-	NO SPT DUE TO COLLAPSING OF FILL (SEVERAL ATTEMPTS)
						4		-	SANDSTONE: fine to coarse grained, light grey and red brown, with iron indurated bands.	XW	EL	-	VERY LOW 'TC' BIT RESISTANCE WITH LOW BANDS
						5			REFER TO CORED BOREHOLE LOG				
						6			SHALLOW STANDPIPE INSTALLED ADJACENT TO LOCATION B16. FOR DETAILS OF DEEP STANDPIPE PLEASE REFER TO CORED LOG PAGE 4/4 50mm CLASS 18 PVC STANDPIPE INSTALLED TO 4.1m, SLOTTED FROM 1.1m TO 4.1m, BACKFILLED WITH 2mm SAND FROM 1.1m TO 4.1m, WITH BENTONITE COLLAR FROM 0.3m TO 1.1m. A STEEL MONUMENT WITH CONCRETE CAP TO FINISH.				
						7							



Borehole No.
B16
2/4

CORED BOREHOLE LOG

Client:	FRASERS PROPERTY		
Project:	FRASERS BROADWAY, BLOCK 2, 5 AND 9		
Location:	20-102 BROADWAY, SYDNEY, NSW		
Job No. 22905S	Core Size: NMLC	R.L. Surface: ≈ 14.87m	
Date: 22-9-09	Inclination: VERTICAL	Datum: AHD	
Drill Type: JK500	Bearing: -	Logged/Checked by: T.M./	

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX I _s (50)	DEFECT DETAILS										
								DEFECT SPACING (mm)						DESCRIPTION Type, inclination, thickness, planarity, roughness, coating.				
								EL	VL	L	M	H	EH	500	300	100	50	30
		4		START CORING AT 4.29m														
FULL RET- URN				SANDSTONE: fine to medium grained, light grey, with red brown and orange brown stained bands, with grey and brown laminae, bedded at 0-25°.	DW	L												- XWS, 0°, 20mm.t - Be, 5-10°, P, S, HEALED - Be, 0°, P, S, IS - Be, 10°, P, S, IS
		5		SANDSTONE: fine to coarse grained, light grey, with grey and brown laminae, bedded at 0-25°.	FR	M	X											- Be, 15°, Un, S, IS - Be, 5°, P, S, IS
						H	X											
		6					X											
							X											
		7					X											- Be, 20°, Un, S
							X											
		8					X											
							X											
		9					X											
						X												
						X												
		10				X												
						M	X											

FULL
RET-
URN

Client: FRASERS PROPERTY
Project: FRASERS BROADWAY, BLOCK 2, 5 AND 9
Location: 20-102 BROADWAY, SYDNEY, NSW

R.L. Surface: $\approx 14.87\text{m}$

Datum: AHD

Logged/Checked by: T.M./

[illegible]

Borehole No.

B16

4/4

CORED BOREHOLE LOG

Client: FRASERS PROPERTY
Project: FRASERS BROADWAY, BLOCK 2, 5 AND 9
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905S **Core Size:** NMLC **R.L. Surface:** ≈ 14.87m
Date: 22-9-09 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK500 **Bearing:** - **Logged/Checked by:** T.M./GA

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX I _s (50)	DEFECT DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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COREHOLE LOG

Client: FRASERS PROPERTY
Project: FRASERS BROADWAY, BLOCK 2, 5 AND 9
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905S

Method: SPIRAL AUGER
JK500

R.L. Surface: ≈ 17.62m

Date: 24-9-09

Datum: AHD

Logged/Checked by: T.M./*TM*

Groundwater Record	SAMPLES				Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Ref. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	US	DB	DS									
						0			ASPHALTIC CONCRETE: 60mm.t CONCRETE: 120mm.t CONCRETE: 170mm.t	-	-	-	NO OBSERVED REINFORCEMENT
					N = 7 4,3,4			SP	FILL: Silty sand, fine to medium grained, dark grey brown, with a trace of fine to medium grained angular ironstone and igneous gravel. SAND: fine to medium grained, grey.	M M	- L	- -	
					N = 14 4,6,8	1			SAND: fine to medium grained, light brown, with a trace of silt fines.		MD		
						2			SAND: fine to medium grained, light grey.				
					N = 27 12,12,15	3							
						4							
					N = 2 1,1,1	5		CH	SILTY CLAY: high plasticity, grey mottled orange brown, with a trace of fine to medium grained sub angular ironstone gravel.	MC > PL	F	70 70 70	
						6		-	SANDSTONE: fine to coarse grained, light grey, with orange and red brown bands and L strength bands.	XW	EL	-	VERY LOW 'TC' BIT RESISTANCE WITH LOW BANDS
					SPT 23/150mm REFUSAL				SANDSTONE: fine to coarse grained, orange brown, with XW seams.	DW	M		LOW TO MODERATE RESISTANCE WITH VERY LOW BANDS
						7							

ON
1-10-09

BOREHOLE LOG

Client: FRASERS PROPERTY
Project: FRASERS BROADWAY, BLOCK 2, 5 AND 9
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905S
Date: 24-9-09

Method: SPIRAL AUGER
JK500

R.L. Surface: ≈ 17.62m
Datum: AHD

Logged/Checked by: T.M./ (signature)

Groundwater Record	SAMPLES				Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	US	DB	DS									
									SANDSTONE: fine to coarse grained, orange brown, with XW seams. REFER TO CORED BOREHOLE LOG	DW	M		
						8			SHALLOW STANDPIPE INSTALLED ADJACENT TO LOCATION B21. FOR DETAILS OF DEEP STANDPIPE PLEASE REFER TO CORED LOG PAGE 5/5 50mm CLASS 18 PVC STANDPIPE INSTALLED TO 5.9m, SLOTTED FROM 2.9m TO 5.9m, BACKFILLED WITH 2mm SAND FROM 2.7m TO 5.9m, WITH BENTONITE COLLAR FROM 0.4m TO 2.7m. A STEEL MONUMENT WITH CONCRETE CAP TO FINISH.				
						9							
						10							
						11							
						12							
						13							
						14							

CORED BOREHOLE LOG

Client: FRASERS PROPERTY
Project: FRASERS BROADWAY, BLOCK 2, 5 AND 9
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905S **Core Size:** NMLC **R.L. Surface:** ≈ 17.62m
Date: 24-9-09 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK500 **Bearing:** - **Logged/Checked by:** T.M. *AS*

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$												DEFECT DETAILS	
							$I_s(50)$												DEFECT SPACING (mm)	DESCRIPTION Type, inclination, thickness, planarity, roughness, coating.
							EL	VL	L	M	H	VH	EH	500	300	100	50	30	10	
		7		START CORING AT 7.06m SANDSTONE: fine to coarse grained, light grey, with orange brown and red brown stained bands and grey and brown laminae, bedded at 0-20°.	DW	M				X										- Be, 0°, P, S - CS, 0°, 15mm.t - CS, 0°, 12mm.t - CS, 0°, 12mm.t - CS, 0°, 3mm.t
		8		SANDSTONE: fine to coarse grained, light grey, with grey and brown laminae, bedded at 0-25°.	FR	H				X										- Be, 0-5°, Un, S, IS, CLAY INFILL 2mm.t
		9								X										- Be, 10°, P, S, IS - XWS, 0°, 4mm.t - Be, 0°, P, S
		10								X										- XWS, 0°, 26mm.t
		11								X										
		12								X										
		13				M				X										- J, 75°, P, S

FULL
RET
URN

CORED BOREHOLE LOG

Client: FRASERS PROPERTY
Project: FRASERS BROADWAY, BLOCK 2, 5 AND 9
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905S **Core Size:** NMLC **R.L. Surface:** ≈ 17.62m
Date: 24-9-09 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK500 **Bearing:** - **Logged/Checked by:** T.M./*LM*

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX I _s (50)	DEFECT DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
								DEFECT SPACING (mm)										DESCRIPTION Type, inclination, thickness, planarity, roughness, coating.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
								EL	VL	L	M	H	VH	EH	500	300	100	50	30	10	Specific	General																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
FULL RET- URN		15		SANDSTONE: fine to coarse grained, orange brown, with XW seams.	FR	M																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

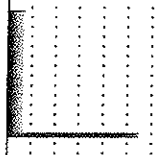


Borehole No.
B21
5/5

CORED BOREHOLE LOG

Client: FRASERS PROPERTY
Project: FRASERS BROADWAY, BLOCK 2, 5 AND 9
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905S **Core Size:** NMLC **R.L. Surface:** ≈ 17.62m
Date: 24-9-09 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK500 **Bearing:** - **Logged/Checked by:** T.M.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX I _s (50)	DEFECT DETAILS		
								DEFECT SPACING (mm)	DESCRIPTION	
									Type, inclination, thickness, planarity, roughness, coating.	
								Specific	General	
FULL RET URN		22		SANDSTONE: fine to coarse grained, light grey, with grey laminae, bedded at 0-25°.	FR	H	EL VL L M H VH EH		- XWS, 0-5°, 15mm.t	
										- Be, 0°, P, S - Be, 15°, P, S
		23								
		24								- CS, 15°, 4mm.t
										- CS, 0-5°, 23mm.t
		25		END OF BOREHOLE AT 24.87m					50mm CLASS 18 PVC STANDPIPE INSTALLED TO 10.7m, SLOTTED FROM 7.7m TO 10.7m, BACKFILLED WITH 2mm SAND FROM 7.8m TO 10.7m, WITH BENTONITE COLLAR FROM 0.3m TO 7.8m. A STEEL MONUMENT WITH CONCRETE CAP TO FINISH.	
		26								
		27								



Borehole No.
P13

1/1

BOREHOLE LOG

Client: FRASERS PROPERTY
Project: PROPOSED STAGE 1 & 2 INFRASTRUCTURE
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905Sroads **Method:** SPIRAL AUGER JK350 **R.L. Surface:** N/A
Date: 20-1-10 **Datum:**

Logged/Checked by: T.M./ *LM*

Groundwater Record	SAMPLES				Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	US	DB	DS									
L 1/1 ON COMPLETION						0			ASPHALTIC CONCRETE: 50mm.t CONCRETE: 190mm.t	-	-	-	NO OBSERVED REINFORCEMENT
						0.5			FILL: Sand, fine to medium grained, brown and grey, with fine to medium grained igneous and sandstone gravel.	M	-	-	APPEARS POORLY TO MODERATELY COMPACTED
					N = 7 5,4,3			SP	SAND: fine to medium grained, brown and grey.	M	L		
						1							
						1.5			END OF BOREHOLE AT 1.5m				
						2							
						2.5							
						3							
						3.5							



Borehole No.
P14

1/1

BOREHOLE LOG

Client: FRASERS PROPERTY
Project: PROPOSED STAGE 1 & 2 INFRASTRUCTURE
Location: 20-102 BROADWAY, SYDNEY, NSW

Job No. 22905Roads
Date: 20-1-10

Method: SPIRAL AUGER
JK350

R.L. Surface: N/A
Datum:

Logged/Checked by: L.Y./

Groundwater Record	SAMPLES			Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	USO	DB									
COMPLETION					0			ASPHALTIC CONCRETE: 95mm.t				
								CONCRETE: 200mm.t	-	-	-	NO OBSERVED REINFORCEMENT
				N = 9 5,4,5	0.5		-	FILL: Sand, fine to medium grained, brown and grey, with a trace of fine to medium grained sandstone gravel and cobbles	M	-	-	APPEARS MODERATELY COMPACTED
					1							
					1.5			END OF BOREHOLE AT 1.5m				
					2							
					2.5							
					3							
					3.5							



Borehole No.
P15

1/1

BOREHOLE LOG

Client: FRASERS PROPERTY Project: PROPOSED STAGE 1 & 2 INFRASTRUCTURE Location: 20-102 BROADWAY, SYDNEY, NSW													
Job No. 22905Roads Date: 20-1-10			Method: SPIRAL AUGER JK350			R.L. Surface: N/A Datum:							
Logged/Checked by: L.Y./ <i>QZ</i>													
Groundwater Record	SAMPLES				Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	USO	DB	DS									
Dry ON COMPLETION						0			ASPHALTIC CONCRETE AND CONCRETE: 255mm.t				CORE LEFT IN THE BOREHOLE
						0.5		-	VOID: 200mm.t				
						0.5		-	FILL: Sand, fine to medium grained, brown and grey, with fine to medium grained sandstone and igneous gravel.	M			APPEARS POORLY COMPACTED
					N = 0 SUNK	1							
						1.5			END OF BOREHOLE AT 1.5m				
						2							
						2.5							
						3							
						3.5							

URS

Sheet 1 of 1

SOIL BOREHOLE SB201

URS Australia Pty Ltd		Phone	Project Reference: GUST	Client: GUST
Drilling Contractor: Terratest, Engineering Exploration		Fax	Project No.: 31503-016	Location: Chippendale, NSW
Logged By: DD	Bore Size: 150 mm	Relative Level: 17.58 mRL	Drill Type: Solid stem auger	
Checked By: JS	Total Depth: 5.10 m	Coordinates: 6249188.14 mN	Drill Model: Explorer	
Date Started: 22-07-03	Casing Size: mm	333695.16 mE	Drill Fluid: NA	
Date Finished: 22-07-03	Permit No:			

Method	Casing	Penetration				Ground Water Data and Comments	Depth (m)	Graphic Log	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency	Relative Density	Sample Interval	Sample ID
		S	M	H	R										
							0		SW	CONCRETE SAND, coarse grain, brown orange, dry, loose	D	L		0.2	SB201_0.2-0.3
							1							0.7	SB201_0.9-1.1
							2		CL	CLAY, low plasticity, grey mottled red, dry, firm, friable	D	F		0.9	SB201_1.9-2.1
							3							0.1	SB201_2.9-3.1
							4							0	SB201_3.9-4.1
							5			SANDSTONE, white, dry EOH@5.1m.	D	H		0.1	SB201_4.9-5.1
							6								
							7								
							8								

URS

SOIL BOREHOLE SB202

Sheet 1 of 1

URS Australia Pty Ltd	Phone Fax	Project Reference: GUST	Client: GUST
Drilling Contractor: Terratest, Engineering Exploration		Project No.: 31503-016	Location: Chippendale, NSW
Logged By: LMR	Bore Size: 110 mm	Relative Level: 17.87 mRL	Drill Type: Solid stem auger
Checked By: JS	Total Depth: 4.00 m	Coordinates: 6249163.05 mN	Drill Model: XP60
Date Started: 28-07-03	Casing Size: mm	333702.67 mE	Drill Fluid: NA
Date Finished: 28-07-03		Permit No:	

Method	Casing	Penetration S M H R	Ground Water Data and Comments	Depth (m)	Graphic Log	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency	Relative Density	Sample Interval	PID (ppm)	Sample ID
				0			CONCRETE						
						FILL	FILL, gravelly sand, fine grained, dark brown, dry to moist	D/M			G	0	SB202_0.2-0.3 QC312, QC313
						SW	SAND, fine to medium grained, pale grey with black layers, dry, loose	D		L	II	0	SB202_0.5-0.6
				1			Grading to medium grained, yellow - brown, dry to moist	D/M			III	0	SB202_0.9-1
				2							III	0	SB202_1.9-2.0
				3		CH	CLAY, high plasticity, mottled brown, orange and red, moist, firm	M		F	III	0	SB202_2.9-3.0
							Grading to grey mottled red				III	0	SB202_3.9-4.0
				4			EOH@4.0m. Limit of investigation.				III	0	
				5									
				6									
				7									
				8									

URS

SOIL BOREHOLE SB203

Sheet 1 of 1

URS Australia Pty Ltd	Phone Fax	Project Reference: GUST	Client: GUST
Drilling Contractor: NA		Project No.: 31503-016	Location: Chippendale, NSW
Logged By: DD	Bore Size: 60 mm	Relative Level: 18.06 mRL	Drill Type: Hand Auger
Checked By: JS	Total Depth: 2.10 m	Coordinates: 6249157.10 mN	Drill Model: Hand Auger
Date Started: 05-08-03	Casing Size: mm	333713.90 mE	Drill Fluid: NA
Date Finished: 05-08-03		Permit No:	

Method	Casing	Penetration	Ground Water Data and Comments	Depth (m)	Graphic Log	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency	Relative Density	Sample Interval PID (ppm)	Sample ID
		S M H R		0		SW	Paver SAND, medium grain, light brown, dry, loose	D	L	G	0.1	SB203_0.1-0.2
				1		SW	As above, darker brown, trace clay, moist	M	L	G	0.1	SB203_0.9-1.1
				2						G	0.1	SB203_1.9-2.1
							EOH @ 2.1m. Limit of hand auger					
				3								
				4								
				5								
				6								
				7								
				8								

URS

SOIL BOREHOLE SB204

Sheet 1 of 1

URS Australia Pty Ltd	Phone Fax	Project Reference: GUST	Client: GUST
Drilling Contractor: NA		Project No.: 31503-016	Location: Chippendale, NSW
Logged By: DD	Bore Size: 60 mm	Relative Level: 18.29 mRL	Drill Type: Hand Auger
Checked By: JS	Total Depth: 1.70 m	Coordinates: 6249143.90 mN	Drill Model: Hand Auger
Date Started: 05-08-03	Casing Size: mm	333716.40 mE	Drill Fluid: NA
Date Finished: 05-08-03		Permit No:	

Method	Casing	Penetration				Ground Water Data and Comments	Depth (m)	Graphic Log	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency	Relative Density	Sample Interval PID (ppm)	Sample ID
		S	M	H	R										
							0			Grass and topsoil					
									SW	SAND, medium grain, light brown, loose, moist	M	L		G 0.1	SB204_0.1-0.2 QC135, QC136
							1							G 0.1	SB204_0.9-1
														G 0.1	SB204_1.5-1.7
							2			EOH, too stiff for hand auger					
							3								
							4								
							5								
							6								
							7								
							8								

URS

SOIL BOREHOLE SB205

Sheet 1 of 1

URS Australia Pty Ltd

Phone
FaxProject
Reference: GUST

Client: GUST

Drilling Contractor: NA

Project No.: 31503-016

Location: Chippendale, NSW

Logged By: DD

Bore Size: 80 mm

Relative Level: 17.85 mRL

Drill Type: Hand Auger

Checked By: JS

Total Depth: 2.10 m

Coordinates: 6249128.50 mN

Drill Model: Hand Auger

Date Started: 05-08-03

Casing Size: mm

333719.20 mE

Drill Fluid: NA

Date Finished: 05-08-03

Permit No:

Method	Casing	Penetration			Ground Water Data and Comments	Depth (m)	Graphic Log	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
		S	M	HR									
						0		SW	SAND, medium grain, grey, dry, loose	D	L	G 0.1	SB205_0.0-0.1
						1		SW	As above, light brown, moist	M	L	G 0.1	SB205_0.9-1.1
						2			EOH, limit of hand auger			G 0.1	SB205_1.9-2.1
						3							
						4							
						5							
						6							
						7							
						8							

URS

SOIL BOREHOLE SB206

Sheet 1 of 1

URS Australia Pty Ltd	Phone Fax	Project Reference: GUST	Client: GUST
Drilling Contractor: NA		Project No.: 31503-016	Location: Chippendale, NSW
Logged By: DD	Bore Size: 60 mm	Relative Level: 17.85 mRL	Drill Type: Hand Auger
Checked By: JS	Total Depth: 2.10 m	Coordinates: 6249108.40 mN	Drill Model: Hand Auger
Date Started: 05-08-03	Casing Size: mm	333725.70 mE	Drill Fluid: NA
Date Finished: 05-08-03		Permit No:	

Method	Casing	Penetration				Ground Water Data and Comments	Depth (m)	Graphic Log	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency	Relative Density	Sample Interval	PID (ppm)	Sample ID
		S	M	H	R											
							0		FILL	Paver FILL, brick, rubble, sand, dry, loose	D	L	(5)	0		SB206_0.1-0.2
									SW	SAND, medium grain, light brown to orange, dry, loose	D	L	(5)	0		SB206_0.4-0.5 QC137, QC138
							1		SW	SAND, medium grain, light brown to orange, dry, loose	D	L	(5)	0		SB206_0.9-1
							2		SW	As above, moist	M	L	(5)	0		SB206_1.9-2.1
										EOH, limit of hand auger						
							3									
							4									
							5									
							6									
							7									
							8									

URS

Sheet 1 of 1

SOIL BOREHOLE SB207

URS Australia Pty Ltd		Phone	Project Reference: GUST	Client: GUST
Drilling Contractor: Terratest, Engineering Exploration		Fax	Project No.: 31503-016	Location: Chippendale, NSW
Logged By: DD	Bore Size: 150 mm	Relative Level: 17.35 mRL	Drill Type: Solid stem auger	
Checked By: JS	Total Depth: 5.40 m	Coordinates: 6249073.94 mN	Drill Model: Explorer	
Date Started: 23-07-03	Casing Size: mm	333722.02 mE	Drill Fluid: NA	
Date Finished: 23-07-03	Permit No:			

Method	Casing	Penetration				Ground Water Data and Comments	Depth (m)	Graphic Log	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency	Relative Density	Sample Interval	PID (ppm)	Sample ID
		S	M	H	R											
							0		SW	CONCRETE	D	L		1.3		SB207_0.2-0.3
							1			SAND, coarse grained, brown - light orange, dry, loose				1.1		SB207_0.9-1.1 QC107, QC108
							2							0.9		SB207_1.9-2.1
							3							1.1		SB207_2.9-3.1
							4			As above, moist As above, wet	M W	L L		0.9		SB207_3.9-4.1
							5		CLS	Sandy CLAY, moderate plasticity, orange mottled red, soft, wet, with coarse sand	W	S		0.9		SB207_4.9-5.1
										SANDSTONE, coarse, hard EOH@5.4m.						
							6									
							7									
							8									

URS

SOIL BOREHOLE SB208

Sheet 1 of 1

URS Australia Pty Ltd	Phone	Project Reference: GUST	Client: GUST
	Fax		
Drilling Contractor: Terratest, Engineering Exploration		Project No.: 31503-016	Location: Chippendale, NSW
Logged By: DD	Bore Size: 150 mm	Relative Level: 17.19 mRL	Drill Type: Solid stem auger
Checked By: JS	Total Depth: 5.40 m	Coordinates: 6249067.05 mN	Drill Model: Explorer
Date Started: 23-07-03	Casing Size: mm	333722.47 mE	Drill Fluid: NA
Date Finished: 23-07-03		Permit No:	

Method	Casing	Penetration				Ground Water Data and Comments	Depth (m)	Graphic Log	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency	Relative Density	Sample Interval PID (ppm)	Sample ID
		S	M	H	R										
							0		SW	CONCRETE	D	L		0.7	SB208_0.2-0.3
							1			SAND, coarse grained, light brown, loose, dry					
										As above, dark brown				0.6	SB208_0.9-1
										As above, light brown	D	L			
							2			As above, off white	D	L		0.7	SB208_1.9-2.1 QC109, QC110
							3			As above, wet				0.5	SB208_2.9-3.1
							4		CL	CLAY, orange, some trace of shale, moist, soft, becoming weathered sandstone	W	L		0.6	SB208_3.9-4.1
							5			SANDSTONE, white, hard	M	S		0.6	SB208_4.9-5.1
										EOH@5.4m.	D	H			
							6								
							7								
							8								

URS**MONITORING WELL MW101**URS Australia Pty. Ltd.
Level 3, 116 Miller Street, North SydneyPhone
FaxProject
Reference:

GUST

Client: GUST

Location: Chippendale, NSW

Drilling Contractor: Terratest, Engineering Exploration

Project No.: 31503-016

Logged By: DD

Bore Size: 150 mm

Relative Level: 17.55 mRL

Drill Type: Solid stem auger

Checked By: JS

Total Depth: 5.00 m

Coordinates: 6249178.64 mN

Drill Model: Explorer

Date Started: 22-07-03

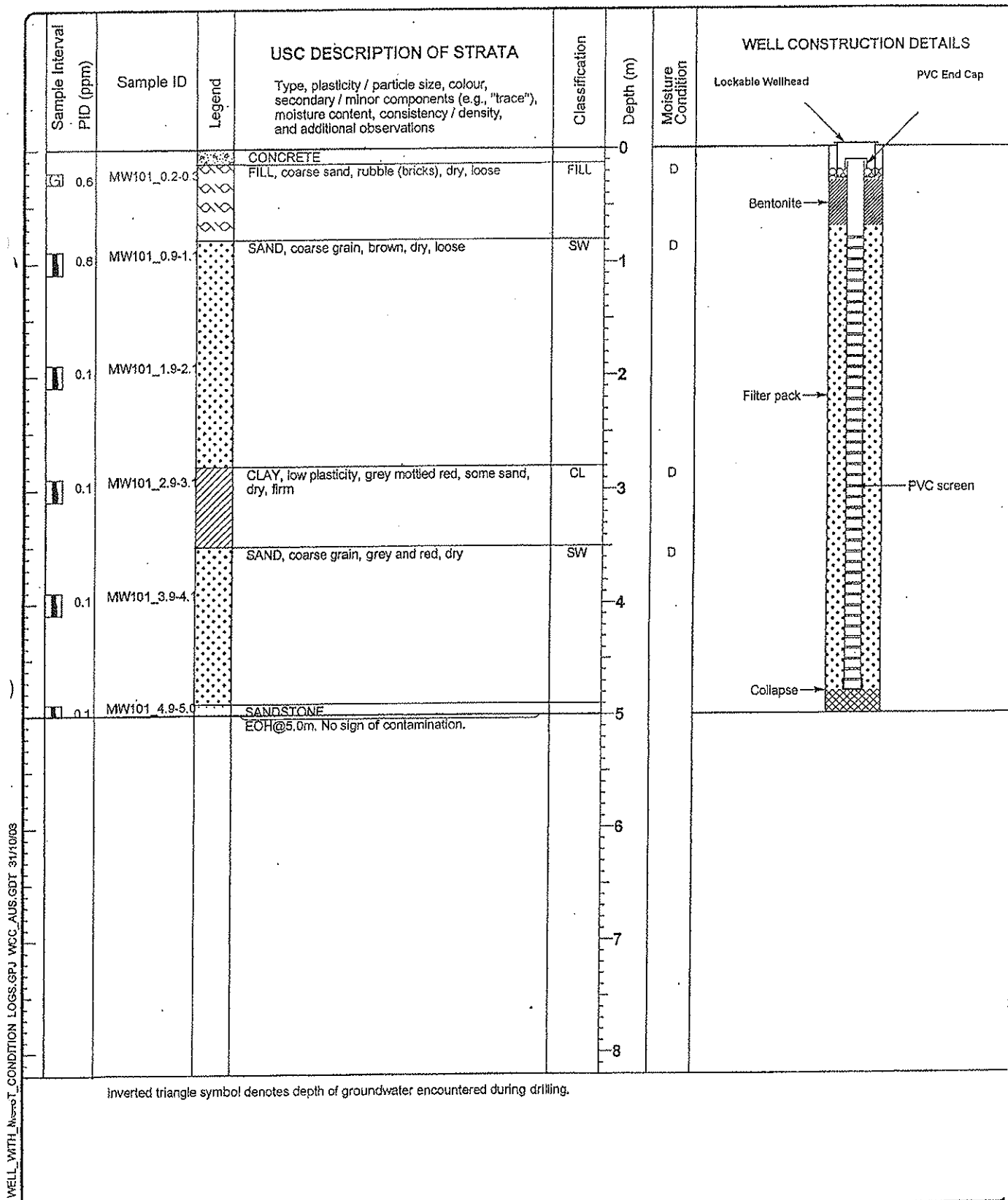
Casing Size: 50 mm

333704.74 mE

Drill Fluid: NA

Date Finished: 22-07-03

Permit No:



URS

MONITORING WELL MW102

Sheet 1 of 1

URS Australia Pty. Ltd.
Level 3, 116 Miller Street, North SydneyPhone
FaxProject
Reference: GUST

Client: GUST

Drilling Contractor: Terratest, Engineering Exploration

Project No.: 31503-016

Location: Chippendale, NSW

Logged By: DD

Bore Size: 200 mm

Relative Level: 17.77 mRL

Drill Type: Continuous flight hollow stem auger

Checked By: JS

Total Depth: 6.20 m

Coordinates: 6249077.46 mN

Drill Model: Explorer

Date Started: 23-07-03

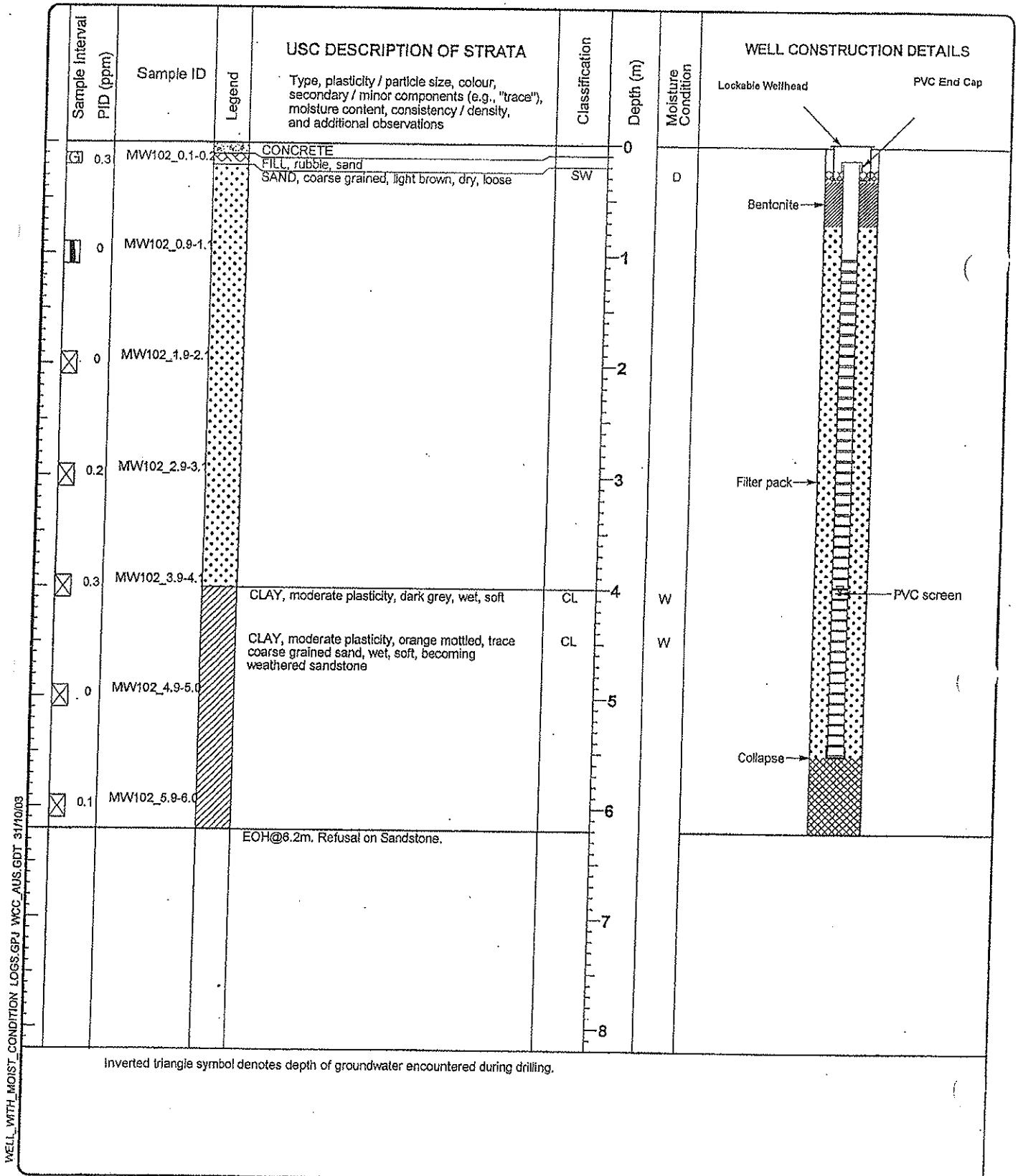
Casing Size: 50 mm

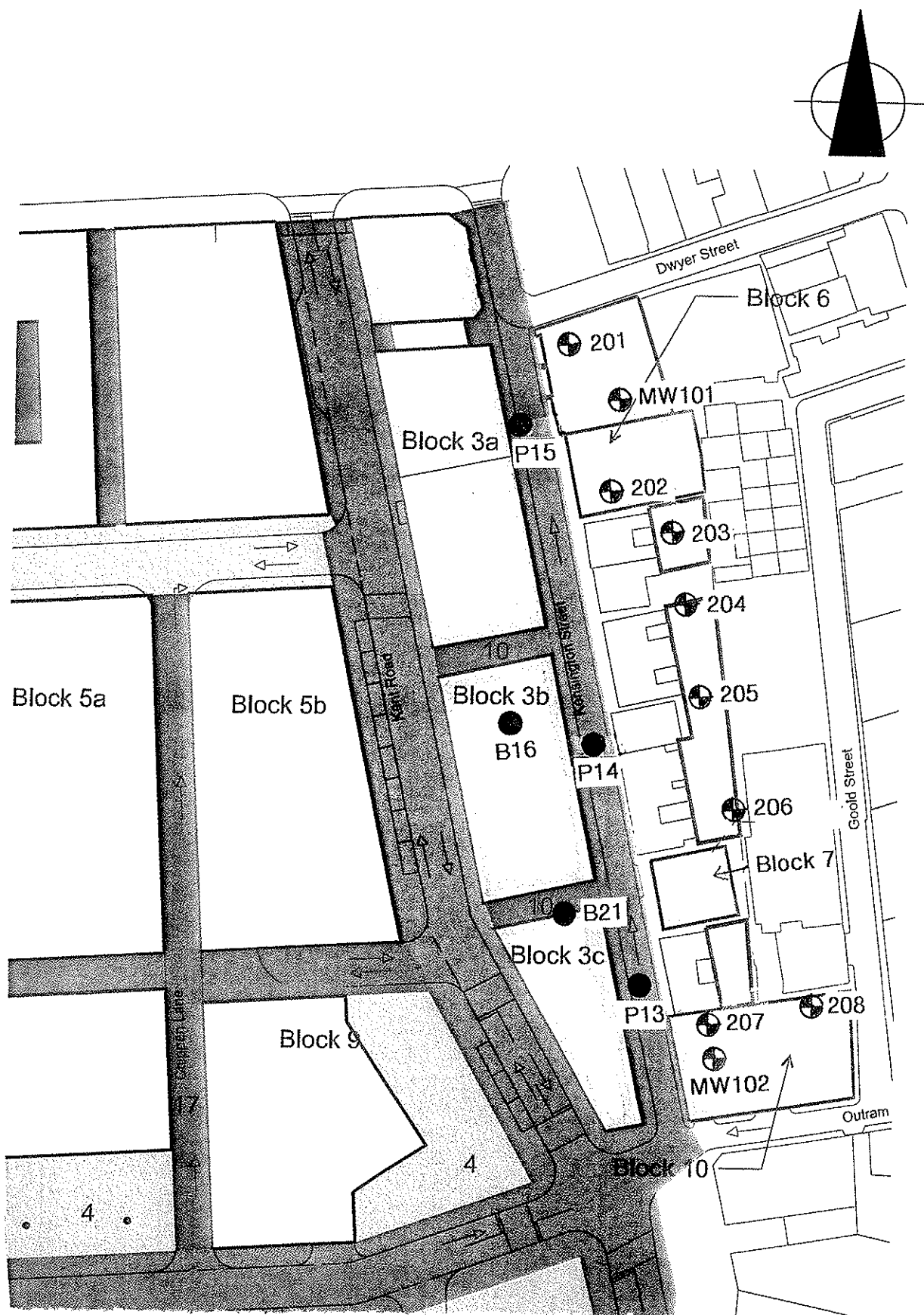
333739.86 mE

Drill Fluid: NA

Date Finished: 23-07-03

Permit No:





BOREHOLE LOCATION PLAN

Jeffery and Katauskas Pty Ltd
CONSULTING GEOTECHNICAL & ENVIRONMENTAL ENGINEERS



Report No. 22509S

Figure No. 1

SCALE (m)



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