Appendix D

Aviron Ground Investigation Report

Report prepared at
4 Tavistock Place
London
WC1H 9RA

On behalf of
GFZ Investments Ltd

Report reference
15-192.01

Report date
May 2015

Prepared by
Aviron Associates Limited

Geotechnical and Land Contamination Specialists
www.aviron.co.uk

Report Quality Management

Project Name	4 Tavistock Place, London, WC1H 9RH		
Project Title	Factual Report of Ground Investigation		
Client	GFZ Investments Limited		
Project Number	15-192.01		
Version	ISSUE 1		**Date**
Prepared by	Orlando Blackwell BEng (Hons) MSc (Eng)	Principal Engineer	15/05/2015
Prepared & Checked by	James Burkitt BEng (Hons) CEnv MRICS	Managing Director	20/05/2015

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1.0 PROJECT AND SITE INFORMATION

1.1 APPOINTMENT

Aviron Associates Limited (Aviron) was retained by Form Structural Design Limited on behalf of GFZ Investments Limited (the "Client") to complete a Ground Investigation at the following premises:

4 Tavistock Place, London, WC1H 9RA (hereafter referred to as the "site").

The purpose of this assessment is to report on a ground investigation involving a single borehole in order to;

1. Complete a borehole to a depth of at least 3m below formation level to be logged by a qualified and competent geotechnical engineer.
2. Install a monitoring well standpipe to suitable depth, ideally within the water table.
3. Provide standing level groundwater monitoring one week after investigation works and a further week after this.

Proposed works to meet the requirement of the Local Authority's checking engineers in connection with the proposed lowering of the existing lower ground floor and extension of this level of accommodation out into the rear courtyard.

1.2 THE SITE

Table 1.2 provides a summary of site details and surrounding area.

Table 1.2 - Site Details

Site Location	The site is located on Tavistock Place in Camden. The site is approximately 1200m to the east of the most southern point of Regents Park and approximately 200mm north-north-east of Russell Square tube station.
National Grid Ref.	Centred at approximately 530034N, 182320E.
Current Land Use	The site exists as mid-terraced property which comprises six above ground storeys and a lower ground floor. To the front of the property (north) a small light well exists at lower ground floor level and to the rear a small courtyard garden at roughly ground floor (pavement) level. The site is boarded by the pavement of Tavistock Place to the north; numbers 6 and 8 Tavistock Place to the east; an ambulance station to the south and number 2 Tavistock Place to the west. **Figure 1** is presented as an Existing Section and Window Sample Location Plan.

Proposed Land Use	It is proposed to lower the current lower ground floor currently at 21.536m to 20.797m, thus a reduction of 0.739m. The proposed works shall also laterally extend beyond the rear elevation into the courtyard garden maintaining the floor level of 20.797m. Accounting for 400mm of new floor slab (250mm), blinding (50mm) and finishes (100mm) formation level is expected to be circa 20.3m. It is understood the neighbouring property of number 2 Tavistock Place has already completed a similar extension and therefore no underpinning will be required at this party wall. It is also understood that the property of number 6 Tavistock Place has a lower ground floor at the same level as that of the proposed development. Therefore, earth will be retained around the rear garden only. Garden perimeter walls will be underpinned to lower the garden level to the new depth in the rear. **Figure 2** is presented as a Proposed Section.

1.3 DESK BASED RESEARCH

As part of these works a formal desk study has not been completed. Information obtained has been taken from the *Screening and Scoping Study prepared by Card Geotechnics Limited (CGL), reference CG/18292, February 2015, Rev 1* in order to complete this section.

The following presents a brief summary of the information collected by CGL to assist understanding of ground conditions encountered and to avoid unnecessary repetition.

1.3.1 Geology and Hydrogeology

Anticipated ground conditions are expected to comprise;

- Superficial Geology : Lynch Hill Gravel Member. Typically sandy GRAVEL. Listed as secondary (a) aquifer and thus expected to contain a mobile body of groundwater, typically perching upon the underlying London Clay Formation.
- Solid Geology : London Clay Formation. Typically brown, grey, blue fissured CLAY. Listed as unproductive strata and generally impermeable, typically retaining overlying groundwater bodies.
- Local British Geological Survey (BGS) borehole logs indicates the GRAVEL extends to thicknesses of between 3.2m and 4.6m. The nearest borehole log to the site reports (70m west) reports Made Ground to a depth of 0.2m, Lynch Hill Gravel Member to a depth of 3.2m and London Clay to a depth of 16.6m

The site is not located within an Environment Agency source protection zone (SPZ).

1.3.2 Hydrology

The Lost River Fleet is located approximately 200m north of the site with a further tributary 300m west/south-west of the site.

2.0 INVESTIGATION WORK

2.1 METHOD STATEMENT AND SITE INVESTIGATION APPROACH

A method statement detailing how the site investigation was to be conducted was produced in accordance with current statuary guidance, best practices and the Client's instructions.

A health and safety plan was completed before site work commenced. Site investigation staff were briefed on the potential risk and the appropriate personal protective equipment (PPE) to be adopted for this type of investigation.

The site investigation was conducted in accordance with British Standards; BS5930:1999 including amendment 2 'Code of Practice for site Investigation' and BS1377:1990 'Method of test for soils for Civil Engineering Purposes.

The investigation focused on the following objectives as set out in Section 1.1 and was completed on 8 May 2015 with return groundwater monitoring being completed on 15 May 2015.

2.2 SITE INVESTIGATION METHODS

Window sample drilling using a dismantleable modular rig and dynamic probing was employed in order to assess ground conditions beneath the site.

Figure 1 is enclosed as a Window Sample Location Plan.

Window Sampling : 8 May 2015

In order to complete ground investigation works a dismantleable 'modular' window sample drilling rig was constructed in the space available for drilling. Following site inspection insufficient internal access was available for drilling within the lower ground floor of the property. The rear garden is located some 3m higher than proposed formation level of the 'lowered' ground floor and therefore drilling at this elevation was unlikely to achieve the necessary depth of 3m below formation.

Drilling of location WS1 was completed within the front light well at an elevation of 22.050m. Considering the proposed finish floor level plus 0.4m of 'make-up', formation level is expected to be 20.3m, being 1.75m lower than the light well. Therefore, in order to complete a formation plus 3m deep borehole a 5m deep borehole would necessary. This was considered achievable using the proposed modular window sampling methods.

WS1 was completed within the front light well following the removal of a 470mm thick reinforced concrete slab at 150mm diameter. A 0.5m extension rod was placed on the first 1m window sampling tube to collect strata from 0.5m to 1.5m below the light well (blw). 'Sampling' (1m tubes) was completed to a depth of 2.5m below the light well. Standard Penetration Tests (SPTs) were undertaken at 1.5m and 2.5m within the borehole to in accordance with BS EN ISO 22476-2 "Standard Penetration Test".

'Sampling' continued from 2.5m to 3.5m however, due to the wet strata no recovery was possible. Therefore, the borehole was continued from the base of the 2.5m SPT at 2.95m to a depth of 6.05m using Dynamic Probing Super Heavy (DPSH). Thus a borehole of suitable depth has been completed.

Upon completion of drilling 1m of geosock wrapped slotted 63/50mm standpipe with push cover end cap was placed in the base of the borehole beneath 1m of un-perforated standpipe. The base of the installation was measured at 2.07m blw with the top of the pipe fixed with a gas valve 0.10m below slab level. 10mm pea shingle was introduced into the annulus to a depth of 1m blw and bentonite granules to 0.2m blw. The installation was fitted with a push over to standpipe and steel cover secure into the concrete light well slab.

2.3 GROUND CONDITIONS

Detailed strata descriptions are shown on the window sample log though in general ground conditions comprise;

- Reinforced CONCRETE to 0.47m blw.
- MADE GROUND; crushed brick to 0.70m blw.
- MADE GROUND; brown, re-worked sandy, gravelly Clay to 0.95m blw.
- Brown, very gravelly SAND to 1.50m blw
- Brown, very sandy GRAVEL to 2.35m blw.
- Brown, sandy CLAY to 2.5m blw.

No significant roots or rootlets were observed within the borehole. No visual or olfactory evidence of contamination was observed. Groundwater was noted in the sample liners at 1.8m blw and resting at 1.71m blw upon completion of work.

The ground conditions encountered are consisted with the closest recorded BGS borehole log noted 70m from the site.

The results of the DPSH indicates the strength of the underlying CLAY remains consitent to a depth of 5.05m blw at which point an increase in strength is noted to 5.25m blw where it is likely a unit of Claystone/Siltstone is present within the Formation. Beneath this the CLAY returns to a similar strength to a depth of 6.05m blw. No weakening of the Clay Formation is shown within the results of the DPSH.

Appendix I is presented as the window sample log, probe log and photographs.

2.4 GROUNDWATER

As previously mentioned groundwater was dipped as follows;

- 8 May 2015 : Completion of Work : 1.71m below light well (22.05 – 1.71 = 20.34m)
- 15 May 2015 : 1.75m below light well (22.05 – 1.75 = 20.3m)
- 20 May 2015 : 1.75m below light well (22.05 – 1.75 = 20.3m)

Formation level is expected to be approximately 20.3m.

3.0 PROJECT INSTRUCTION AND LIMITATIONS

3.1 SCOPE OF WORKS

The following scope of work was undertaken to the proposed methods within our proposal letter of 28 April 2015 and involves the following;

- Mobilise to site and undertake a site inspection to determine safe drilling access and working areas.
- Complete one window sample/dynamic probe to a depth of 3m below formation.
- Install the exploratory hole with standpipe to below the water table.
- Return on two occasions to complete groundwater standing level monitoring.
- Prepare a factual Ground Investigation Report.

Aviron has relied upon information received from the Client and their agents as accurate, unless contradicted by written documentation or site observations.

3.2 LIMITATIONS

Aviron's scope of work has been designed to meet the timeframe. The scope of work provided shall provide a view of site conditions and understanding of potential geo-environmental risks and possible mitigation procedures.

The information used in this report has been derived from the site investigation, which in turn were based on known current and historical land uses identified at the site and surrounding area, available to Aviron at the time of the investigation.

Intrusive points chosen relate to the data collected and the risk assessment will rely on these points only. It therefore follows that some areas of the site will not be examined. It is always possible that some areas not investigated may contain conditions which would be impossible to determine due to lack of evidence or time, access and budget restrictions.

Soil and groundwater sampling and testing was not undertaken as part of this instruction.

Should changes in legislation, statutory requirements or industry practices occurred following issue of this report, this report should be viewed in light of these changes.

4.0 REFERENCES AND OTHER SOURCES OF INFORMATION

Card Geotechnics Limited. Screening and Scoping Study. Reference CG/18292. Revision 1. February 2015.

BS5930:1999 +A2 2010. British Standards Institute. Code of Practice for Site Investigations.

BS EN ISO 22475-1 Geotechnical investigation and testing - sampling methods and groundwater measurements

Jardine, Maswose, Burland. 1985. Field and Laboratory Measurements of Soil Stiffness. Proceedings of the 11th International Conference on Soil Mechanics and Foundation Engineering, San Francisco.

Figures

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Legend

- Window Sample Borehole
- Areas/Structure to be demolished/excavated/ removed

Notes

Plan provided to Aviron by Client

Figure 1

Drawing Title	Existing Section and Window Sample Location Plan
Project Number	15-192.01
Project Title	4 Tavistock Place, London, WC1H 9RA
Drawn by	JB
Checked by	OB
Scale	NTS

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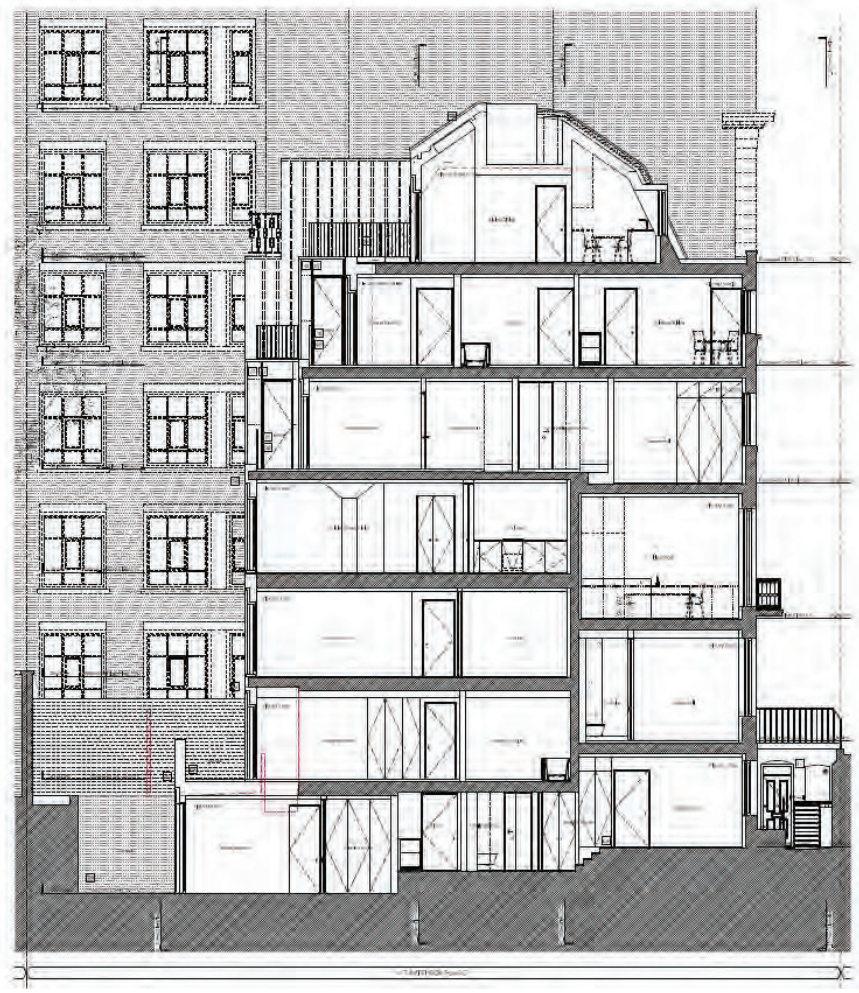

Legend

Notes

Plan provided to Aviron by Client

Figure 2

Drawing Title	Proposed Section
Project Number	15-192.01
Project Title	4 Tavistock Place, London, WC1H 9RA
Drawn by	JB
Checked by	OB
Scale	NTS

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Appendices

I Window Sample Log, Probe Log and Photographs

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WINDOW SAMPLE LOG

Project:		Project No.	Borehole:
4 Tavistock Place, London, WC1H 9RA		15-192.01	WS1
Client:	Start:	End:	Sheet:
GFZ Investments Limited	08.05.15	08.05.15	1 of 1
Method/Plant Used:	Co-ordinates:	Ground Level:	
Modular Window Sample	NT	22.05m (light well)	

Description of Strata	Legend	Depth (m bgl) (thickness)	Standing Water Level	Samples/Tests			SPT Results						Laboratory Test Details
				Depth	No	Type	75mm	75mm	75mm	75mm	75mm	N' Value	
MADE GROUND; Reinforced CONCRETE		(0.47) 0.47											
MADE GROUND; Crush red brick comprising red, sub-angular to angular, fine to coarse, sandy Gravel		(0.23) 0.70											
MADE GROUND; Brown, grey, sandy, gravelly re-worked Clay. Gravel is sub-rounded to angular, fine to coarse, brick, flint and concrete		(0.25) 0.95											
Brown, yellow, very gravelly, angular, coarse SAND. Gravel is sub-angular to angular, fine to coarse flint (LYNCH HILL GRAVEL MEMBER)		1.50		1.5		SPT	3	3	4	4	4	16	
Medium dense, brown, very sandy, rounded to sub-angular, fine to coarse, flint GRAVEL. Sand is angular and coarse. (LYNCH HILL GRAVEL MEMBER)		(0.85) 2.35	▼										
Stiff, brown, slightly sandy (sand stained) CLAY. Sand is angular and medium. (LONDON CLAY FORMATION)		(0.15) 2.50		2.5		SPT	4	5	6	5	5	21	

Casing record			Chiselling records			Water level observations (depths in metres below gl)					
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
08.05.15	101	1.00				08.05.15	1.80	1.60	NT	1.71	Water recovered in bailer on 15.05.15 dark brown in colour
						15.05.15	-	-	-	1.75	

Remarks		By	Date
No unusual stains or odours No roots Liners taken from site to Aviron stores.	Logged	OB	08.05.15
	Checked	JB	15.05.15

Scale 01:25

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DPSH LOG

Project:		Project No.	Borehole:
4 Tavistock Place, London, WC1H 9RA		15-192.01	WS1-DP
Client:	**Start:**	**End:**	**Sheet:**
GFZ Investments Limited	08.05.15	08.05.15	1 of 1
Method/Plant Used:	**Ground Level:**	**Ground Level:**	
Modular Window Sample	NT	22.05m (light well)	

Strata Description (Assumed)	Legend	Depth (m) bgl	Blow Counts (per 100mm penetration)
Brown to grey CLAY (LONDON CLAY FORMATION		2.95-3.05	5
		3.05-3.15	5
		3.15-3.25	6
		3.25-3.35	6
		3.35-3.45	6
		3.45-3.55	5
		3.55-3.65	5
		3.65-3.75	5
		3.75-3.85	5
		3.85-3.95	4
		3.95-4.05	4
		4.05-4.15	5
		4.15-4.25	5
		4.25-4.35	6
		4.35-4.45	6
		4.45-4.55	6
		4.55-4.65	7
		4.65-4.75	7
		4.75-4.85	7
		4.85-4.95	5
		4.95-5.05	9
- Unit of Claystone/Siltone		5.05-5.15	15
		5.15-5.25	12
		5.25-5.35	7
		5.35-5.45	7
		5.54-5.55	7
		5.55-5.56	6
		5.65-5.75	8
		5.75-5.85	8
		5.85-5.95	7
		5.95-6.05	7

Remarks:
Commenced in base of SPT

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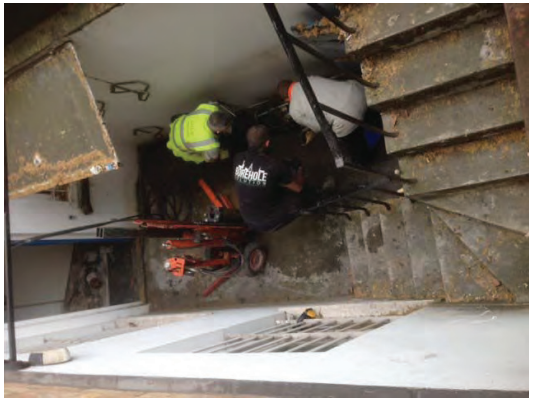
PHOTOGRAPHIC LOG

SITE 4 Tavistock **DATE** 08.05.15

PROJECT 15-192.01 **TAKEN BY** JD + OB

Coring of WS1



Drilling of WS1

WS1

Top : Clay at 2.35m to 2.5m.

Bottom : Sample liners. 0.5m rod placed on first 1m sampler to account for 0.47m concrete slab.

AVIRON ASSOCIATES LIMITED

is a dynamic company of Chartered Environmental Surveyors and Geotechnical Engineers.

We continuously work hard to ensure our services are the most technically competent, efficient and viable in our market place. Our years of experience of vastly varied sites and projects compliment our ability to deliver assured and effective Ground Investigations and Risk Assessments of both Brownfield, Greenfield and Currently Developed Land.

Our clients choose Aviron to plan, design and manage their Ground Investigations and Land Remediation Schemes assisting in land procurement to deliver engineering requirements, discharge planning and ensure their sites are suitable, developable and sustainable.

Our tenaciously committed team ensure regardless of project value we will always deliver quickly, effectively and exceed expectations.

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