



CC Ground Investigations Ltd

## FACTUAL REPORT

**SITE:** Southfield Brook Flood Alleviation Scheme

**CLIENT:** Cheltenham Borough Council

**ORDER No:** 12006885

**DATE:** 27 August 2015

**REPORT No:** C4710



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## 1. INTRODUCTION

This investigation was carried out by CC Ground Investigations Ltd (CCGI) on the instruction and on behalf of Cheltenham Borough Council (the Client) under the technical direction of CH2M HILL (the Engineer).

The purpose of the ground investigation was to provide information to assist in the design of flood alleviation measures.

The scope of the ground investigation was defined in the Engineer's specification, reference: Southfield Flood Alleviation Scheme Ground Investigation.

This report describes the work carried out by CC Ground Investigations Ltd and presents the findings.

All information, comments and opinions given in this report are based on the ground conditions encountered during the site work, and on the results of laboratory and field tests performed during the investigation. There may however be conditions at or adjacent to the site which have not been taken into account, such as unpredictable soil strata and water conditions between or below exploratory holes. A careful watch should be maintained during any future groundworks and the comments of this report reviewed as necessary.

This report has been prepared for Cheltenham Borough Council. This report shall not be relied upon or transferred to other parties without the written consent of CC Ground Investigations Ltd. Should any information contained within this

report be used by any unauthorised third party it is done so at their own risk and shall not be the responsibility of CC Ground Investigations Ltd.

## **2. SITE DESCRIPTION AND GEOLOGY**

### **2.1 Site Description**

The area of investigation comprises grass fields adjacent to Southfield Manor, Sandy Lane, Cheltenham, GL53 9DH. The site is centred on the approximate National Grid Reference SO 956 194.

### **2.2 Geology**

Geological Records (British Geological Survey (BGS), England and Wales sheet 235 Cirencester 1:50,000 scale) indicate the site is underlain by superficial deposits of Cheltenham Sand and Gravel. Underlying solid geology comprising the Charmouth Mudstone Formation is recorded. Superficial deposits are noted to be absent beyond the eastern and western boundaries of the area of interest.

### 3. GROUND INVESTIGATION

#### 3.1 Fieldwork

Four exploratory holes were carried out on the 13<sup>th</sup> and 14<sup>th</sup> July. All exploratory hole locations are shown on the site plan (Appendix A). The exploratory hole locations were set out by CCGI as directed by the Engineer on site.

The fieldwork was carried out in general accordance with BS5930, Amendment 2 (2010).

The windowless sample boreholes, referenced WS06 to WS09 (Exploratory Hole Data – Appendix B) were formed using a track mounted Terrier drilling rig. Following CAT scanning hand tools were used to excavate an inspection pit to a depth of 1.20m to check for buried services. The boreholes were then advanced using percussive sampling techniques to produce continuous disturbed samples ranging between 83mm and 61mm diameter.

Undisturbed samples of 70mm nominal diameter were taken in suitable cohesive material using an open drive sampler (U70). The samples were wax sealed on site to prevent moisture loss.

Boreholes were monitored for groundwater ingress as they were advanced. Upon encountering water, sampling was temporarily stopped to allow the level to stabilise. Water levels were also recorded at the completion of the borehole and are presented on the relevant log.

On completion, WS06 to WS09 were backfilled with arisings and bentonite pellets and the surface reinstated.

In situ hand shear vane tests were carried out in accordance with BS1377: Part 9:1990:4.4. The results are presented in on the exploratory hole logs in Appendix B.

Subsequent to fieldwork, all exploratory hole positions were surveyed and National Grid co-ordinates and levels are presented on the relevant log.

On completion of fieldwork all samples were brought to CCGI's office for storage.

### **3.2 In Situ Testing**

Standard penetration tests (SPT's) were carried out in general accordance with BS EN ISO 22476-3:2005. A split barrel was used and the split barrel samples retained as small disturbed samples. The SPT N value was taken as the number of blows to penetrate the 300mm test drive following a 150mm seating drive. Where low penetration was recorded the seating drive was terminated at 25 blows and the test drive completed after a further 50 blows. SPT results are summarised as uncorrected N values on the borehole logs. SPT hammer calibration data is presented in Appendix D.

### **3.3 Logging**

Soil samples from the exploratory holes were logged by an Engineering Geologist in general accordance with BS5930, Amendment 2 (2010). Bulk, small disturbed and environmental soil samples were taken retained at a range of depths:

Environmental soil samples were stored on site in temperature controlled conditions. Soil descriptions are presented in the borehole logs together with details of sampling, in situ testing and relevant comments on drilling techniques.

### 3.4 Laboratory Testing

The following laboratory tests were carried out by Professional Soils Laboratory (UKAS No. 4043) in accordance with BS1377:1990, Parts 1 to 8, unless otherwise stated. The results are presented in Appendix C.

Test Type	No. of Tests	Remarks
Natural Moisture Content	12	The results are shown on the summary of soil classification tests.
Liquid and Plastic Limits	12	The results are shown on the plasticity chart and summary of soil classification tests.
Particle Size Distribution (wet sieving method)	8	The fine fractions of 5 of these tests were further analysed using the hydrometer method.
One Dimensional Consolidation	2	
Linear Shrinkage Test	2	
Quick Undrained Triaxial Test	4	
Consolidated Undrained Triaxial Test of 3no 38mm diameter specimens with porewater pressure measurement	2	
Dispersive classification category determinations.	1	Using the pinhole method. A single sample was returned as unsuitable for the test.
Shear Strength by laboratory vane (set of 3)	3	
Shear strength of 3no 60mm specimens by direct shear	2	
BRE SD1 chemical testing suite for soil	5	Testing carried out by Chemical Testing Laboratories in accordance with BRE Special Digest 1.
Organic Matter Content	3	

A range of chemical tests were carried out on soil samples by i2 Analytical (UKAS No. 4041). Testing was carried out in accordance with ISO 17025. The results are tabulated and presented in Appendix C.

**CC GROUND INVESTIGATIONS LIMITED**



Richard Tucker BSc (Hons) FGS  
**Engineering Geologist**



Rob Clarke, BSc (Hons) MSc (Eng) FGS  
**Director**

#### 4. REFERENCES

British Geological Society, Solid and Drift Sheet 235, Cirencester, 1:50,000 scale

BRE Special Digest 1:2003: Concrete in aggressive ground. Part 1.

BS 5930+A2:1999 (2010), Code of Practice for Site Investigations

BS 1377: Parts 1 to 9 (1990), Methods of Tests of Soils for Civil Engineering Purposes

BS EN ISO 14688: Part 1: (2002), Identification and description of soil.

BS EN ISO 14688: Part 2: (2004), Principles for a classification of soil.

BS EN ISO 22475: Part 1: (2006), Technical principles for execution.

BS EN ISO 22476: Part 3: (2005), Standard penetration test.

**APPENDIX A**

Appendix A – Site Plan

**KEY:**



Window Sample Hole

**Notes:**

Locations indicative only.

Reproduced from base plan provided by CH2M Hill



CC Ground Investigations Ltd

Site Layout Plan

Southfield Brook Flood Alleviation Scheme

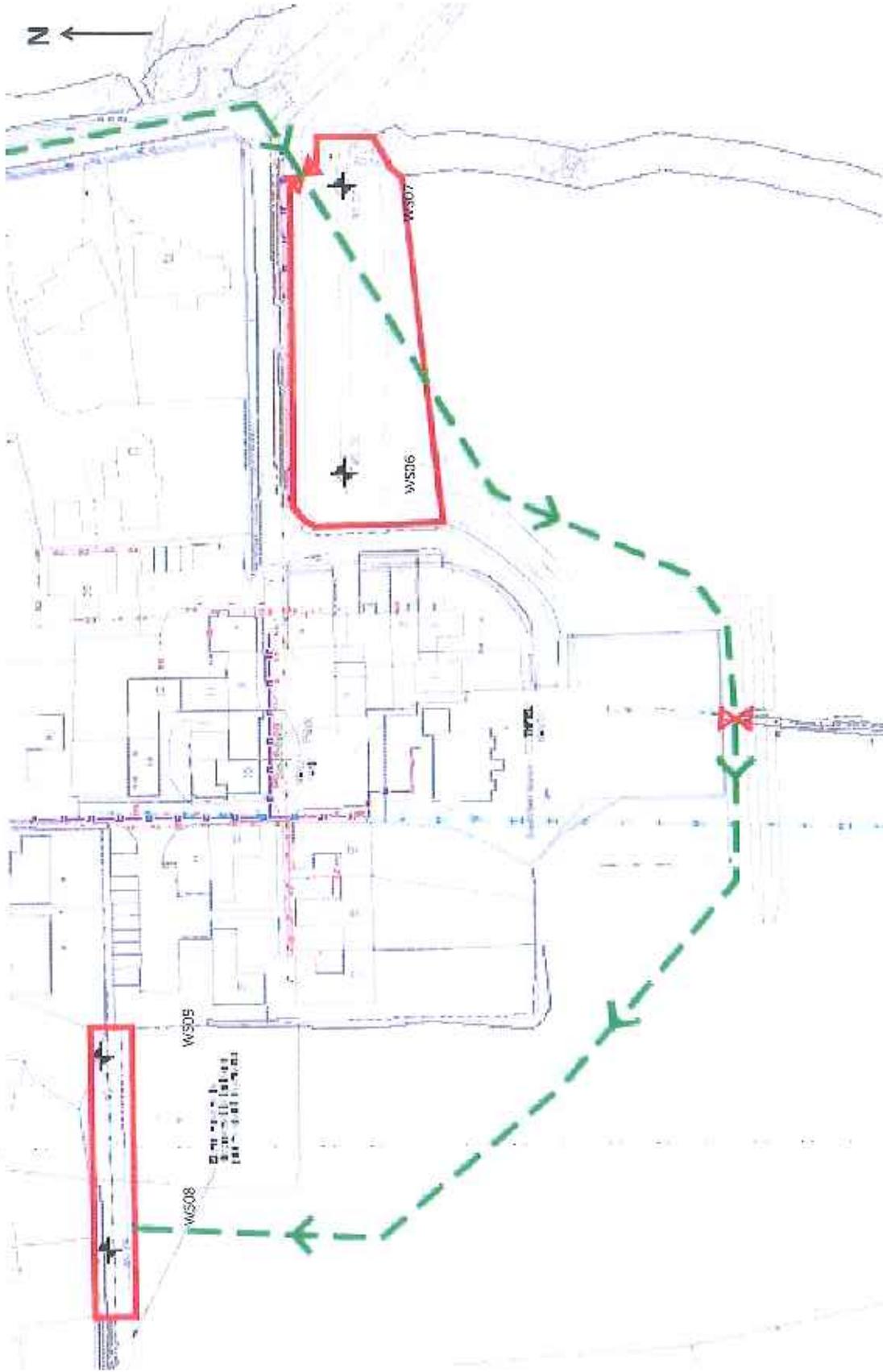
Cheltenham Borough Council

Appendix A

Contract No: C6750

Scale

NTS



**APPENDIX B**

Appendix B – Exploratory Hole Data

CC Ground Investigations Ltd  
**KEY TO EXPLORATORY HOLE LOGS**

**Logging**

The logging of soils and rocks has been carried out in general accordance with BS 5930: 1999 (Amendment No.2, 2010).

**Sample no/type**

- C Core run / sample
- X Dynamic sample
- D Small disturbed sample
- B Large disturbed sample
- U Undisturbed sample
- UT Thin walled undisturbed sample
- W Water sample
- ES Environmental
- SPT Standard Penetration Test carried out
- CPT Solid Cone Penetration Test carried out

**Water levels**



Initial Water Strike

Level after monitoring

3.00m Standing Level

**Insitu Tests**

- S 30 Split spoon sampler (SPT) followed by N Value (EN ISO 22476-3:2005)
- C 30 Solid cone (CPT) followed by N Value (EN ISO 22476-3:2005)
- \*240 Where full test drive not completed, linearly extrapolated N value reported.
- \*\* No effective penetration
- H 30 Hand Vane – direct reading in kPa. Re\* denotes refusal (i.e. >140 kPa)

**Sample range**



Undisturbed sample



Core run

**Installation Details**



Porous Tip



Screened Standpipe



Bentonite seal



Plain standpipe



Granular response zone



Concrete



Grout



Arisings backfill

Soils	Rocks		
	Sedimentary	Metamorphic	Igneous
Made ground Boulders and cobbles Gravel Sand Silt Clay Peat <p>NOTE: Composite soil types will be signified by combined symbols, e.g.,</p> Silty sand	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Aplastic</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Acidic</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Basic</p> Chalk Limestone Conglomerate Breccia Sandstone Siltstone Mudstone Shale Coal Pyroclastic (volcanic ash) Gypsum, Rocksalt etc.	Coarse-grained Medium-grained Fine-grained	Coarse-grained Medium-grained Fine-grained



# WINDOW SAMPLE LOG

Telephone: 01452 739165 , Fax: 01452 739220 , Email: info@ccground.co.uk

Project Name: Southfield Brook Flood Alleviation Scheme		Project No: <b>C4710</b>	Co-ords: E 395717 N 219440	Hole Type WS
Location: Sandy Lane, Cheltenham		Level: 106.20m AOD		Scale 1 : 50.00
Client: Cheltenham Borough Council		Dates: Start: 13/07/2015 End: 13/07/2015		Logged By DP

(m)	Water Levels	Samples & In Situ Testing			Sample	Install	Description	Depth (m)	Level (m AOD)	Legend
		No/Type	Depth (m)	Result						
		B ES	0.20			MADE GROUND: Grass over friable greyish brown slightly sandy slightly gravelly CLAY with frequent rootlets (<2mm). Gravel is rounded fine to medium of limestone.	0.10	106.10	XXXX	
		B ES	0.50				Soft friable orangish brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to rounded fine to medium of limestone.	(0.90)		
1		B ES SPT	1.00 1.20 - 1.65	S 9		Firm greyish brown, brown and orangish brown slightly sandy slightly gravelly CLAY. Gravel is sub-rounded fine of limestone.	1.00 (0.70)	105.20	1	
		D	1.55			Very loose to loose orangish brown sandy very clayey GRAVEL. Gravel is sub-angular to sub-rounded fine to coarse of limestone. (CHELTENHAM SAND & GRAVEL)	1.70	104.50	2	
2		B SPT	1.75 - 2.00 2.00 - 2.45	S 4			2.35-2.55m: Firm light brown and grey slightly gravelly clay.	(0.85)		
		D	2.50			Firm indistinctly thinly laminated grey and bluish grey locally mottled orangish brown slightly sandy CLAY, (CHARMOUTH MUDSTONE FORMATION)	2.55	103.65	3	
3		H D U70	2.70 2.90 3.00 - 3.40	H 48 H 76			3.00-3.80m: Estimated	(1.25)		
		D	3.80			Stiff indistinctly thinly laminated grey locally slightly sandy silty CLAY with occasional fossils and shell fragments (<2mm). (CHARMOUTH MUDSTONE FORMATION)	3.80	102.40	4	
4		SPT	4.00 - 4.45	S 24			5.00m: High strength.	(2.20)		
		D H D U70	4.60 4.00 5.00 - 5.40	H 76		Borehole completed at 6.00m	6.00	100.20	6	
5		D U70	4.00 5.40 - 5.80							
		D SPT	5.00 6.00 - 6.36	S*71						
6										
7										
8										

**REMARKS:**

EQUIPMENT: Hand digging tools, Terrier 2002 track mounted rig.  
 METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous disturbed sampling using 101mm and 86mm diam sample barrels: 1.20-6.00m.  
 CASING: None used.  
 GROUNDWATER: Struck at 5.19m. Rose to 5.10m after 20 minutes.  
 BACKFILL: Upon completion hole backfilled with bentonite pellets 0.50-6.00m, and arisings 0.00-0.50m and the ground surface reinstated.  
 REMARKS: Window sample refused at 6.00m.

Groundwater:				Hole Progress:			
Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)	Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
13/07/15	5.19	Nil	5.10	13/07/2015	6.00	Nil	6.18

## Window Sample Photograph



Hole ID: WS06 0.00-1.20m



Hole ID: WS06 0.00-1.20m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS06

## Window Sample Photograph



Hole ID: WS06 0.00-1.20m



Hole ID: WS06 0.00-1.20m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS06

## Window Sample Photograph



Hole ID: WS06 1.20-4.00m



Hole ID: WS06 4.00-6.00m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS06



# WINDOW SAMPLE LOG

Telephone: 01452 739165 ; Fax: 01452 739220 , Email: info@ccground.co.uk

Project Name: Southfield Brook Flood Alleviation Scheme		Project No: <b>C4710</b>	Co-ords: E 395773 N 219449	Hole Type WS
Location: Sandy Lane, Cheltenham		Level: 105.99m AOD		Scale 1 : 50.00
Client: Cheltenham Borough Council		Dates: Start: 13/07/2015 End: 13/07/2015		Logged By DP

(m)	Water Levels	Samples & In Situ Testing			Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		No/Type	Depth (m)	Result						
1		B ES	0.20			MADE GROUND: Grass over soft friable slightly sandy slightly gravelly CLAY with frequent roots and rootlets (<10mm). Gravel is rounded fine of limestone.	0.10	105.89	1	
		B ES	0.50				MADE GROUND: Soft orangish brown slightly sandy slightly gravelly CLAY with rare roots and rootlets (<20mm). Gravel is sub-rounded fine to coarse of limestone, siltstone and 1 no. brick fragment.	(0.90)		
2		B ES	1.00			0.50-1.00m: Locally mottled dark brown. Soft greyish brown and brown locally mottled bluish grey and orange slightly sandy CLAY.	1.00	104.99	2	
		SPT	1.20 - 1.85	S 7			(0.65)			
3		H	1.75			Firm greyish brown locally mottled bluish grey slightly sandy CLAY. (CHARMOUTH MUDSTONE FORMATION) 2.00m: High strength.	1.65	104.34	3	
		D	1.90	H 70			(1.15)			
		H	1.95	H 80						
		U70	2.00 - 2.40							
4		U70	2.40 - 2.80			2.00-2.80m: Estimated. Stiff grey thinly laminated slightly sandy silty CLAY with occasional fossil and shell fragments (<5mm). (CHARMOUTH MUDSTONE FORMATION) 2.80-3.00m: Rare orangish brown discoloration.	2.80	103.19	4	
		D SPT	3.00 - 3.45	S 28						
5		D	3.50			5.00m: Very Stiff. 5.45-6.00m: Locally tending to extremely weak mudstone.			5	
		U70	4.00 - 4.40				(3.20)			
6	Dry	U70	4.40 - 4.80			Borehole completed at 6.00m			6	
		D SPT	5.00 - 5.45	S 49			6.00	99.99		
7		D	5.80						7	
		D SPT	6.00 - 6.43	S 54						
8									8	

**REMARKS:**

EQUIPMENT: Hand digging tools. Terrier 2002 track mounted rig.  
 METHOD: Hand dug inspection pit 0.00-1.20m. Continuous disturbed sampling using 101mm, 86mm and 76mm diam sample barrels: 1.20-6.00m.  
 CASING: None used.  
 GROUNDWATER: Not encountered.  
 BACKFILL: Upon completion hole backfilled with bentonite pellets 0.50-6.00m, and arisings 0.00-0.50m and the ground surface reinstated.  
 REMARKS: Window sample refused at 6.00m.

Groundwater: Dry				Hole Progress:			
Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)	Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
				13/07/2015	6.00	Nil	Dry

CC WS LOG - CAT10 - GENI 813 ASS 3 - 13/07/2015

## Window Sample Photograph



Hole ID: WS07 0.00-1.20m



Hole ID: WS07 0.00-1.20m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS07

## Window Sample Photograph



Hole ID: WS07 0.00-1.20m



Hole ID: WS07 0.00-1.20m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS07

## Window Sample Photograph



Hole ID: WS07 1.20-4.00m



Hole ID: WS07 4.00-6.00m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS07



# WINDOW SAMPLE LOG

Telephone: 01452 739165 , Fax: 01452 739220 , Email: info@ccground.co.uk

Project Name: Southfield Brook Flood Alleviation Scheme		Project No: <b>C4710</b>	Co-ords: E 395561 N 219486	Hole Type WS
Location: Sandy Lane, Cheltenham		Level: 104.69mAOD		Scale 1 : 50.00
Client: Cheltenham Borough Council		Dates: Start: 14/07/2015 End: 14/07/2015		Logged By DP

(m)	Water Levels	Samples & In Situ Testing		Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		No/Type	Depth (m)						
1		B ES	0.20		[Cross-hatched pattern]	MADE GROUND: Grass over soft friable greyish brown slightly gravelly sandy CLAY with frequent roots and rootlets (<20mm). Gravel is sub-angular fine to medium limestone and brick.	0.15	104.54	[Cross-hatched pattern]
		H ES	0.50			MADE GROUND: Brown and greyish brown slightly sandy clayey GRAVEL with occasional roots and rootlets (<20mm). Gravel is sub-angular to sub-rounded fine to coarse limestone, siltstone and brick.	0.40	104.29	
2		R ES	1.00		[Horizontal lines]	Loose light brown and orangish brown sandy clayey GRAVEL with rare roots and rootlets (<10mm). Gravel is sub-angular to sub-rounded fine to coarse limestone and siltstone, (CHELTENHAM SAND AND GRAVEL) 1.00-1.35m: Orangish brown.	0.95	103.34	[Horizontal lines]
		SPT	1.20 - 1.85	S 9					
3	1	D H	1.70	H 78	[Vertical bar]	Firm indistinctly thinly laminated greyish brown locally mottled bluish grey slightly sandy silty CLAY with rare shell and fossil fragments (<20mm). (CHARMOUTH MUDSTONE FORMATION)	1.15	102.19	[Vertical bar]
		D H	1.90	H 76					
		D H	2.00 - 2.40						
		U70 D	2.40						
4	1	U70 D	2.40 - 2.80		[Vertical bar]	1.40-1.50m: Locally mottled orangish brown. 2.00m: High strength. 2.20-2.40m: Locally orangish brown. Frequent shell fragments (<10mm). 2.00-2.80m: Estimated	2.50	102.19	[Vertical bar]
		U70 D	2.70						
		SPT	3.00 - 3.45	S 23					
5	1	D H	3.60	H 90	[Vertical bar]	3.80m: Stiff	2.50	99.69	[Vertical bar]
		D H	3.70						
6	1	D H	3.00		[Vertical bar]				[Vertical bar]
		U70	4.00 - 4.40						
7	1	U70	4.40 - 4.80		[Vertical bar]				[Vertical bar]
		D SPT	5.00	S 41					
8			5.00 - 5.45			Borehole completed at 5.00m	5.00	99.69	

**REMARKS:**

EQUIPMENT: Hand digging tools, Terrier 2002 track mounted rig.  
 METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous disturbed sampling using 101mm and 86mm diam sample barrels: 1.20-5.00m.  
 CASING: None Used.  
 GROUNDWATER: Water struck at 3.75m, rose to 2.75m after 20mins.  
 BACKFILL: Upon completion hole backfilled with bentonite pellets 0.50-5.00m, and arisings 0.00-0.50m and the ground surface reinstated.

Groundwater:				Hole Progress:			
Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)	Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
14/07/15	3.75	Nil	2.75	14/07/2015	5.00	Nil	2.00

CC WS LOG C4710.GP1 SINT STD AGS 3 1.GDT 27/06/15

## Window Sample Photograph



Hole ID: WS08 0.00-1.20m



Hole ID: WS08 0.00-1.20m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS08

## Window Sample Photograph



Hole ID: WS08 0.00-1.20m



Hole ID: WS08 0.00-1.20m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS08

## Window Sample Photograph



Hole ID: WS08 1.20-5.00m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS08



# WINDOW SAMPLE LOG

Telephone: 01452 739165, Fax: 01452 739220, Email: info@ccground.co.uk

Project Name: Southfield Brook Flood Alleviation Scheme		Project No: <b>C4710</b>	Co-ords: E 395598 N 219487	Hole Type WS
Location: Sandy Lane, Cheltenham		Level: 104.67mAOD		Scale 1 : 50.00
Client: Cheltenham Borough Council		Dates: Start: 14/07/2015 End: 14/07/2015		Logged By DP

(m)	Water Levels	Samples & In Situ Testing		Sample	Install	Description	Depth (m)	Level (mAOD)	Legend
		No/Type	Depth (m)						
1		B ES	0.20			MADE GROUND; Grass over soft friable greyish brown slightly gravelly sandy CLAY with frequent roots and rootlets (<10mm). Gravel is sub-angular to sub-rounded fine to coarse brick, limestone, shells and siltstone.	0.20	104.47	
		B ES	0.50				0.30	104.37	
2		B ES SPT	1.20 - 1.65	S 12		MADE GROUND: Dark grey locally light grey and black clayey sandy ashy GRAVEL with occasional pockets of stiff clay (<30mm) and low cobble content. Gravel is angular to sub-angular fine to coarse brick, clinker, limestone and siltstone. Cobbles are sub-angular of limestone. Soft friable brown and orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to medium limestone and siltstone.	0.70	103.97	
		D SPT	1.65 1.75 - 2.00				1.05	102.92	
3		B SPT	2.00 - 2.70 2.00 - 2.37	S'68		Firm brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium limestone. 1.25-1.55m: Locally mottled orange. 1.60-1.75m: Orangish brown. Sandy. Greyish brown and light brown clayey sandy GRAVEL. Gravel is sub-angular fine to coarse limestone. (CHELTENHAM SAND & GRAVEL)	2.00	102.67	
		B	2.70 - 2.95				(0.70)	101.97	
4		U70	3.00 - 3.40			Very dense light brown slightly clayey very sandy GRAVEL. Gravel is sub-angular to sub-rounded fine to medium limestone. (CHELTENHAM SAND & GRAVEL) Very dense greyish brown and light brown slightly clayey very sandy GRAVEL. Gravel is sub-angular to sub-rounded fine to coarse siltstone and limestone. (CHELTENHAM SAND AND GRAVEL)	2.70	101.72	
		D H D H D SPT B	3.60 3.65 3.75 3.90 4.00 4.00 - 4.45 4.30 - 4.70	H 48 H 40 S 26			(0.90)	100.82	
5		H D SPT	4.00 5.00 5.00 - 5.45	H 120 S 30		Firm indistinctly thinly laminated grey and brownish grey slightly sandy CLAY. (CHARMOUTH MUDSTONE FORMATION) 3.00m: High strength. 3.65-3.70m: Slightly gravelly. Gravel is sub-angular fine to medium of limestone. 3.70-3.85m: Sand. 3.00m-3.40m: Estimated. Soft thinly laminated grey and bluish grey slightly sandy CLAY with occasional shell and fossil fragments (<5mm). (CHARMOUTH MUDSTONE FORMATION) 4.85m: 1 no. fossil fragment (<60mm). Borehole completed at 5.00m	3.85	99.67	
							(1.15)		

**REMARKS:**

EQUIPMENT: Hand digging tools. Terrier 2002 track mounted rig.  
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous disturbed sampling using 101mm and 86mm diam sample barrels: 1.20-5.00m.  
CASING: 113mm to 2.00m.  
GROUNDWATER: Water struck at 4.10m, rose to 4.00m after 20mins.  
BACKFILL: Upon completion hole backfilled with bentonite pellets 0.50-5.00m, and arisings 0.00-0.50m and the ground surface reinstated.  
REMARKS: U70 attempted 3.40-3.80m - no recovery.

Groundwater:				Hole Progress:			
Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)	Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
14/07/15	4.10	2.00	4.00	14/07/2015	5.00	2.00	3.80

## Window Sample Photograph



Hole ID: WS09 0.00-1.20m



Hole ID: WS09 0.00-1.20m



CC Ground Investigations Ltd

**Contract Name:**

Southfield Brook  
Flood Alleviation Scheme

**Contract ID:**

C4710

**Client:**

Cheltenham Borough Council

**Hole ID:**

WS09

## Window Sample Photograph



Hole ID: WS09 0.00-1.20m



Hole ID: WS09 0.00-1.20m



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**Hole ID:**

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## Window Sample Photograph



Hole ID: WS09 1.20-5.00m



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**Client:**

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**Hole ID:**

WS09