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## **APPENDIX A**

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### **Selected Photographs**



Image A.1: Transition Zone, view from Fontmell East toward Concrete Plug



Image A.2: Transition Zone, view from Fontmell West toward Concrete Plug



Image A.3 Fontmell East



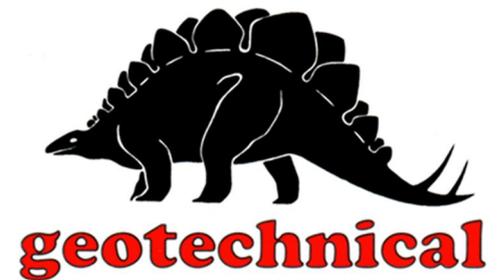
Image A.4 Fontmell West (Junction with Bridle Close)

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## **APPENDIX B**

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### **Factual Report (Geotechnical Engineering, 2016)**



# FONTMELL CLOSE SINKHOLE (ST ALBANS)

## FACTUAL REPORT ON GROUND INVESTIGATION

Prepared for HERTFORDSHIRE COUNTY COUNCIL

Report Ref: 31893

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# FONTMELL CLOSE SINKHOLE (ST ALBANS)

## FACTUAL REPORT ON GROUND INVESTIGATION

Prepared for HERTFORDSHIRE COUNTY COUNCIL

Report Ref: 31893

PROJECT: Ground Investigation

CONSULTANT: Opus International Consultants (UK) Ltd

VOLUME - VERSION	STATUS	ORIGINATOR	CHECKER	APPROVED	DATE
1 of 1 – A	INTERIM	ELe	CT	-	04/05/2016
1 of 1 – B	DRAFT	ELe	CT	-	13/05/2016
1 of 1 – C	FINAL	ELe	CT	CT	26/05/2016
<b>ORIGINATOR</b>			<b>APPROVER</b>		
					
E LEIVERS Senior Engineering Geologist			C THOMAS Geotechnical Consultant		

The report is not to be used for contractual or engineering purposes unless this sheet is signed and the report designated "Final".

The report has been prepared for the sole use and reliance by Hertfordshire County Council. GEL accepts no liability as a result of the use or reliance of this report by any other parties.



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APPENDIX B	CHEMICAL ANALYSES



## **1. INTRODUCTION**

It is proposed to reinstate road damage and associated infrastructure caused by a sinkhole at Fontmell Close, St Albans. Geotechnical Engineering Limited (GEL) was instructed by Opus International Consultants (UK) Ltd (the Consultant) acting on behalf of Hertfordshire County Council (the Client) to carry out an investigation to determine the ground conditions.

The scope of works and terms and conditions of appointment were specified by the Consultant and GEL correspondence reference T23552, dated 6<sup>th</sup> April 2016. The investigation was carried out under direction and supervision of the Consultant.

This report describes the investigation and presents the findings.

## **2. SITE LOCATION AND GEOLOGY**

The site is situated in the road at Fontmell Close, Bernard's Heath, approximately 1km northeast of St Albans city centre and may be located by its National Grid co-ordinates TL 154 084.

British Geological Survey (BGS) England and Wales (Sheet No. 239, Hertford (Drift), 1:50,000, dated 1978) and the BGS online geology (1:50,000) indicate the site is underlain by superficial deposits of sands and gravels of the Kesgrave Subgroup. The solid geology is shown to comprise the Reading Formation of the Lambeth Group over the Lewes Nodular Chalk Formation. Made Ground was anticipated to be present due to existing land use.



### **3. GROUND INVESTIGATION**

#### **3.1 Fieldwork**

The fieldwork was carried out in general accordance with BS5930:2015 during the period 18<sup>th</sup> April to 3<sup>rd</sup> May 2016 and comprised six boreholes and six dynamic probe holes.

The exploratory hole locations were selected and set out by the Consultant and are shown on Figure 1. The ground level and co-ordinates at each exploratory hole were provided by the Consultant.

#### **Pioneer boreholes**

The boreholes, referenced CH401 and CH402 (Appendix A), were formed using a track-mounted Geotechnical Pioneer Rig. The surface at borehole CH402 comprised hardstanding which was penetrated using rotary coring techniques. An inspection pit was then hand excavated at both borehole locations to a depth of 1.20m to check for buried services. Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars.

Borehole CH401 was advanced by rotary open-hole drilling techniques as detailed on the relevant borehole log utilising an air-mist flushing medium.

Borehole CH402 was advanced using heavy duty dynamic sampling techniques to produce a continuous disturbed sample of 112mm nominal diameter reducing to 97mm as the borehole was advanced. The samples were recovered in semi-rigid plastic liner. The dynamic samples were extracted horizontally from the sampler, the semi-rigid liner was cut to length and sealed at each end to retain moisture content. All samples and core were retained in sequence in labelled, wooden coreboxes. On refusal to dynamic sampling the



borehole was continued by rotary open-hole drilling techniques utilising an air-mist flushing medium.

The amount of flush and type of drill cuttings were continuously monitored in both boreholes by the lead driller as the probeholes were drilled.

On completion, boreholes CH401 and CH402 were backfilled with cementitious grout.

### **Terrier boreholes**

The boreholes, referenced WS401, WS402, WS403 and WS403A (Appendix A), were formed using a Terrier 2000 rig. Initially, an inspection pit was hand excavated at each borehole location to a depth of 1.20m to check for buried services. The inspection pit WS403 was terminated at 0.40m due to encountering a concrete obstruction and redrilled as WS403A. Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars. Dynamic sampling techniques were then employed in boreholes WS401, WS402 and WS403A to produce a continuous disturbed sample of 97mm diameter reducing to 83mm in WS401 and WS402 as the borehole was advanced. The samples were recovered in semi-rigid plastic liner.

The samples were extracted horizontally from the sampler, labelled and sealed at each end to retain moisture.

On completion, boreholes WS401, WS402, WS403 and WS403A were backfilled with bentonite pellets.

### **In-situ testing**

Standard penetration tests (SPT) were carried out in general accordance with BS EN ISO 22476-3:2005+A1:2011 in each borehole except CH401. A split barrel was used and the split barrel samples retained in airtight jars. 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. Detailed SPT results, together with the energy ratio ( $E_r$ ), are presented in Appendix A and summarised as uncorrected N values on the borehole logs.

Boreholes were monitored for groundwater ingress as dynamic sampling proceeded. Upon encountering water, sampling was temporarily stopped to allow the level to stabilise. Water levels were also recorded at the start and finish of each day's work and on completion of the borehole and are presented on the relevant log.

Dynamic probeholes, referenced DP401 to DP406 (Appendix A), were carried out using a Terrier 2000 rig. Initially, an inspection pit was hand excavated at each location to a depth of 1.20m to check for buried services. The holes were then advanced in general accordance with the DPSH(B) specification given in BS EN ISO 22476-2:2005+A1:2011. Sacrificial cones were used along with 32mm diameter x 1.00m long driving rods.

Probe depths were measured with respect to ground level and the number of blows,  $n_{100}$ , recorded for each 100mm penetration of the probe. Dynamic probeholes DP401 to DP404 and DP406 were undertaken by this Company and at the end of each 1m penetration the maximum torque acting on the rods was measured. Dynamic probehole DP405 was undertaken by others and torque measurements were not taken.

### **Sample delivery**

Samples for chemical analyses were dispatched directly to i2 Analytical Limited under a Chain of Custody. The remaining samples were brought to this Company's laboratory for storage.



### **3.2 Logging**

The logging of soils and rocks was carried out by an Engineering Geologist in general accordance with BS5930:2015. A key to the exploratory hole logs is presented in Appendix A.

Detailed descriptions of the samples are given in the borehole logs, Appendix A, along with details of sampling, in situ testing, groundwater ingress and relevant comments on drilling techniques. Where open-hole drilling techniques have been utilised, driller's descriptions have been provided based on flush returns and drilling parameters.

### **3.3 Chemical Analyses**

Selected samples were despatched to i2 Analytical Limited, where chemical analyses were carried out to in-house methods for a suite of contaminants. The results are presented in Appendix B.

**GEOTECHNICAL ENGINEERING LIMITED**



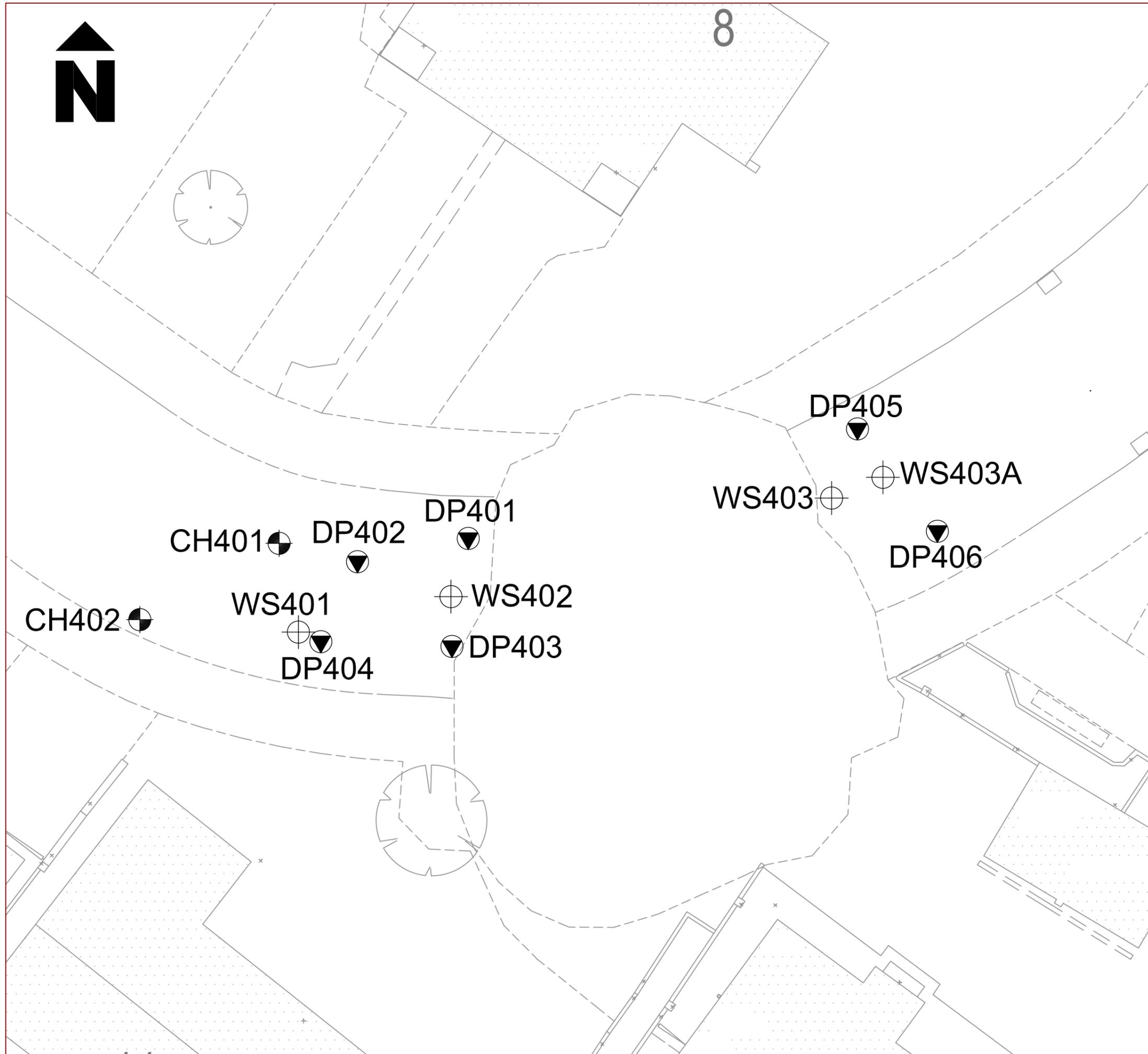
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#### 4. REFERENCES

British Standards Institution (2015): Code of practice for ground investigations. BS 5930:2015.

British Standards Institution (2012): Geotechnical investigation and testing. Field testing. Standard penetration test. BS EN ISO 22476-3:2005+A1:2011.

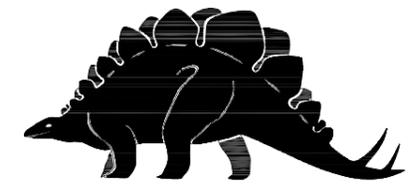
British Standards Institution (2012): Geotechnical investigation and testing. Field testing. Dynamic probing. BS EN ISO 22476-2:2005+A1:2011.



Key.

-  Dynamic Sampled Borehole Location.
-  Dynamic Probe Borehole Location
-  Rotary Borehole Location.

Notes:  
 Reproduced from the digital data supplied by the Consultant.



**geotechnical**

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Client:  
 HERTFORDSHIRE COUNTY COUNCIL

Site:  
 FONTMELL CLOSE SINKHOLE  
 (ST ALBANS)

Title:  
 EXPLORATORY HOLE LOCATION PLAN

Drawn By: DM	Checked By: ELE	Paper Size: A3
Scale: 1:100	Date: MAY 2016	
Contract: 31893	Figure: 1	



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# **APPENDIX A**

## **FIELDWORK DATA**



### Sample type

D Small disturbed	U Undisturbed	X/L Dynamic	D*/ES Environmental - soil	Cs Core subsample (prepared)
B Bulk disturbed	UT Undisturbed thin wall	C Core	EW Environmental - water	Xs/Ls Dynamic subsample (prepared)
LB Large bulk disturbed	P Piston	W Water		

### Test type

- S SPT - Split spoon sampler followed by uncorrected SPT 'N' Value
- C SPT - Solid cone followed by uncorrected SPT 'N' Value
- (\*250 - Where full test drive not completed, linearly extrapolated 'N' value reported, \*\* - Denotes no effective penetration)
- H Hand vane - direct reading in kPa - not corrected for BS1377 (1990). Re\* denotes refusal
- M Mackintosh probe - number of blows to achieve 100mm penetration
- PP Pocket penetrometer - direct reading in kg/sq.cm
- Vo Headspace vapour reading, uncorrected peak values in ppm, using a PID (calibrated with Isobutylene, using a 10.6eV bulb)

### Sample/core range/l<sub>r</sub>

| Dynamic sample

█ Undisturbed sample - open drive including thin wall. Symbol length reflects recovery

x x = Total Core Recovery (TCR) as percentage of core run

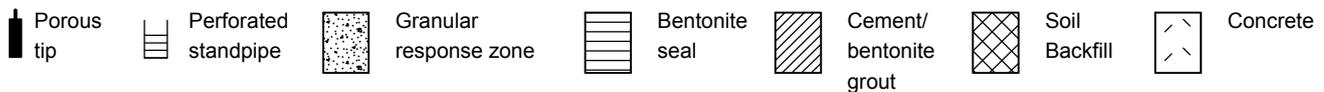
y y = Solid Core Recovery (SCR) as percentage of core run. Assessment of core is based on full diameter.

z z = Rock Quality Designation (RQD). The amount of solid core greater than 100mm expressed as percentage of core run.

Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment.

l<sub>r</sub> - fracture spacing - the modal fracture spacing (mm) over the indicated length of core. Where spacing varies significantly, the minimum, mode and maximum values are given. NI = non-intact core NA = not applicable

### Instrumentation



### Stratum boundaries



### Logging

The logging of soils and rocks has been carried out in general accordance with BS 5930:2015.

Chalk is logged in general accordance with Lord et al (2002) CIRIA C574. Where possible, dynamic samples in chalk have been logged in accordance with CIRIA C574; descriptions and gradings (if presented) should be treated with caution given the potential for sample disturbance.

For rocks the term fracture has been used to identify a mechanical break within the core. Where possible incipient and drilling induced fractures have been excluded from the assessment of fracture state. Where doubt exists, a note has been made in the descriptions. All fractures are considered to be continuous unless otherwise reported.

Made Ground is readily identifiable when, within the material make up, man made constituents are evident. Where Made Ground appears to be reworked natural material the differentiation between in situ natural deposits and Made Ground is much more difficult to ascertain. The interpretation of Made Ground within the logs should therefore be treated with caution.

The descriptors "topsoil" and "tarmacadam" are used as generic terms and do not imply conformation to any particular standard or composition.

Rootlets are defined as being less than 2mm in diameter, roots are defined as in excess of 2mm diameter.

### General Comments

The process of drilling and sampling will inevitably lead to disturbance, mixing or loss of material in some soil and rocks.

Indicated water levels are those recorded during the process of drilling or excavating exploratory holes and may not represent standing water levels.

All depths are measured along the axis of the borehole and are related to ground level at the point of entry. All inclinations are measured normal to the axis of the core.

# BOREHOLE LOG



**CH401**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 5

Start Date 22 April 2016 Easting 515446.0

Scale 1 : 50

End Date 25 April 2016 Northing 208426.0 Ground level 121.80mOD Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
22/04/16 0800hrs	1B	0.30 - 0.40	1.20				Dark grey mottled brown slightly sandy gravelly (ashy) SILT. Gravel is angular to rounded fine to coarse flint and rare brick fragments. (MADE GROUND)	0.45	121.35	
	1ES	0.30 - 0.40								
	2B	0.60 - 0.70					Firm orangish brown and grey slightly sandy gravelly CLAY. Gravel is angular to rounded fine to coarse flint, brick fragments and rare glass. (MADE GROUND)	0.85	120.95	
	2ES	0.60 - 0.70								
	3B	1.00 - 1.10					Dark grey slightly sandy gravelly (ashy) SILT. Gravel is angular to subrounded fine to coarse flint and rare brick and china fragments (50mm). (MADE GROUND)	1.20	120.60	
	3ES	1.00 - 1.10								
	CASE	1.20 - 8.50				MADE GROUND. Driller notes ash (Driller's description).				
Continued Next Page								{8.00}		

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Hand dug inspection pit 0.00-1.20m. Borehole advanced by reaming casing (200mm diam) 1.20-8.50m using an air-mist flush. Rotary open-hole drilled (146mm wireline) 8.50-30.00m using an air-mist flush. Rotary open-hole drilled (100mm conventional) 30.00-45.00m using an air-mist flush.  
 CASING: 200mm diam to 8.50m and 146mm diam to 30.00m.  
 BACKFILL: On completion, hole grouted to surface using a 3:1 cement:bentonite mix.  
 REMARKS: OH = open hole drilling. Coordinates supplied by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks



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# BOREHOLE LOG



CLIENT HERTFORDSHIRE COUNTY COUNCIL

**CH401**

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 5

Start Date 22 April 2016 Easting 515446.0

Scale 1 : 50

End Date 25 April 2016 Northing 208426.0 Ground level 121.80mOD Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
22/04/16 1600hrs Dry	OH	8.50 - 11.00	8.50				Brown CLAY (Driller's description). (MADE GROUND?)	8.50	113.30	
25/04/16 0850hrs Dry	OH	11.00 - 30.00	11.00				Yellow SAND and GRAVEL (Driller's description).	9.50	112.30	
							Yellow SAND (Driller's description).	13.70	108.10	
Continued Next Page								{18.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 31893.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 26/05/2016 13:53:05 SO EL/EC

water strike (m) casing (m) rose to (m) time to rise (m) remarks



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# BOREHOLE LOG



CLIENT HERTFORDSHIRE COUNTY COUNCIL

**CH401**

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 4 of 5

Start Date 22 April 2016 Easting 515446.0

Scale 1 : 50

End Date 25 April 2016 Northing 208426.0 Ground level 121.80mOD

Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	OH	30.00 - 45.00	30.00				White CHALK (Driller's description) continued.			
Continued Next Page								{38.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 31893.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 26/05/2016 13:53:05 SO EL/EC

water strike (m) casing (m) rose to (m) time to rise (m) remarks



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# BOREHOLE LOG



## CH401

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 5 of 5

Start Date 22 April 2016

Easting 515446.0

Scale 1 : 50

End Date 25 April 2016

Northing 208426.0 Ground level 121.80mOD

Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
							White CHALK (Driller's description) continued.			
25/04/16 1430hrs Dry							Borehole completed at 45.00m.	45.00	76.80	
								{48.00}		
water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks				CONTRACT	CHECKED	
42.00	30.00	41.90	20					<b>31893</b>	<b>CT</b>	

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# BOREHOLE LOG



CLIENT HERTFORDSHIRE COUNTY COUNCIL

**CH402**

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 5

Start Date 18 April 2016 Easting 515443.0

Scale 1 : 50

End Date 21 April 2016 Northing 208424.0 Ground level 121.90mOD Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend	
18/04/16 0900hrs	C	0.00 - 0.30			100		MADE GROUND comprising black screed (50mm) over dark grey CONCRETE composed of 70-80% angular to subrounded fine to coarse aggregate of flint with 5% voids (up to 5mm). (MADE GROUND)	0.30	121.60		
	1B	0.30 - 0.50						0.50	121.40		
	1ES	0.30 - 0.50									
	2B	0.50 - 0.70									
	2ES	0.50 - 0.70									
	3B	1.00 - 1.20									
	3ES	1.00 - 1.20									
	4D	1.20 - 1.65		Nil	S 2						
	5L	1.20 - 2.20									
		4ES	2.00								
		6D	2.20 - 2.65		Nil	S <1					
		7L	2.20 - 3.20								
		5ES	3.00								
		8D	3.20 - 3.65		Nil	S <1					
		9L	3.20 - 4.20								
	6ES	4.00									
	10D	4.20 - 4.65		Nil	S 2						
	11L	4.20 - 5.20					4.10 - 4.15m: Frequent fragments of angular coarse gravel sized glass.				
	7ES	5.00					4.60 - 4.65m: Frequent fragments of angular coarse gravel sized glass.				
	12D	5.20 - 5.65		Nil	S 27		4.70 - 5.20m: Dark orangish brown.				
	13L	5.20 - 6.70	5.20				5.20m: Medium dense.				
							5.50 - 5.70m: Clayey.	5.70	116.20		
	8ES	6.00					Soft off white slightly gravelly silty CLAY. Gravel is subangular and subrounded fine to coarse chalk. (MADE GROUND)	5.90	116.00		
	14D	6.70 - 7.15					Very loose black and reddish brown silty very sandy (ashy) angular and subangular clinker and coal GRAVEL. Frequent glass, wood and ceramic fragments (up to 60mm). (MADE GROUND)				
	15L	6.70 - 8.20	6.70	S 2							
18/04/16 1700hrs							Continued Next Page	8.00	113.90		
								{8.00}			

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Waterflush rotary core drilled (300mm) 0.00-0.30m. Hand dug inspection pit 0.30-1.20m. Dynamic sampled (128mm) 1.20-5.20m and (113mm) 5.20-9.70m. Rotary open-hole drilled (146mm wireline) 9.70-32.50m using an air mist flush. Rotary open-hole drilled (100mm conventional) 32.50-45.00m using an air-mist flush.  
 CASING: 200mm diam to 8.50m and 146mm diam to 32.50m.  
 BACKFILL: On completion, hole grouted to surface using a 3:1 cement:bentonite mix.  
 REMARKS: OH = open hole drilling. Coordinates supplied by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks



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# BOREHOLE LOG



CLIENT HERTFORDSHIRE COUNTY COUNCIL

**CH402**

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 5

Start Date 18 April 2016 Easting 515443.0

Scale 1 : 50

End Date 21 April 2016 Northing 208424.0 Ground level 121.90mOD Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
8.00m	16D	8.20 - 8.65	8.20	S 17			Orangish brown and light grey clayey sandy angular to rounded fine to coarse flint GRAVEL. Stiff orangish brown sandy CLAY.	8.20	113.70	
19/04/16 0800hrs 7.70m	17L	8.20 - 9.70				8.70		113.20		
	9ES	8.80					Stiff light grey mottled orangish brown slightly gravelly silty CLAY. Gravel is subangular to rounded fine to coarse flint.			
19/04/16 1730hrs 9.60m							9.70m: Very stiff.			
20/04/16 0730hrs Dry	18D OH	9.70 - 9.98 9.70 - 10.70	9.70	S*120				10.50	111.40	
	19D OH	10.70 - 11.05 10.70 - 12.20	10.70	S*75			Orangish brown gravelly very clayey fine and medium SAND. Gravel is subrounded and rounded fine to coarse flint. Description taken from SPT sample 10.70-11.05m. 10.70m: Very dense.			
							Orangish brown clayey very sandy subrounded and rounded fine to coarse flint GRAVEL. Description taken from SPT sample 12.20-12.40m.	11.50	110.40	
	20D OH	12.20 - 12.40 12.20 - 13.70	12.20	S*214			12.20m: Very dense.			
	OH	13.70 - 25.80	13.70				Coarse flint GRAVEL (Driller's description).	13.00	108.90	

Continued Next Page

{18.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 31893.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 26/05/2016 13:53:07 KE ELe/EC

water strike (m) casing (m) rose to (m) time to rise (m) remarks



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**CT**

# BOREHOLE LOG



**CH402**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 3 of 5

Start Date 18 April 2016

Easting 515443.0

Scale 1 : 50

End Date 21 April 2016

Northing 208424.0 Ground level 121.90mOD

Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
							Coarse flint GRAVEL (Driller's description) continued.			
20/04/16 1730hrs Dry										
21/04/16 0700hrs Dry	OH	25.80 - 32.50	25.80				White CHALK (Driller's description).	25.80	96.10	
							Continued Next Page	{28.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 31893.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 26/05/2016 13:53:07 KE ELe/EC

water strike (m) casing (m) rose to (m) time to rise (m) remarks

18.20 8.50 17.95 20



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# BOREHOLE LOG



CLIENT HERTFORDSHIRE COUNTY COUNCIL

**CH402**

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 4 of 5

Start Date 18 April 2016 Easting 515443.0

Scale 1 : 50

End Date 21 April 2016 Northing 208424.0 Ground level 121.90mOD

Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
	OH	32.50 - 45.00	32.50				White CHALK (Driller's description) continued.			
							Continued Next Page	{38.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 31893.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 26/05/2016 13:53:07 KE EL/EC

water strike (m) casing (m) rose to (m) time to rise (m) remarks



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**CT**

# BOREHOLE LOG



**CH402**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 5 of 5

Start Date 18 April 2016

Easting 515443.0

Scale 1 : 50

End Date 21 April 2016

Northing 208424.0 Ground level 121.90mOD

Depth 45.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
							White CHALK (Driller's description) continued.			
21/04/16 2100hrs Dry							Borehole completed at 45.00m.	45.00	76.90	
								{48.00}		

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water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks
39.30	32.50	38.90	20	



**CONTRACT**  
**31893**

**CHECKED**  
**CT**

# BOREHOLE LOG



**WS401**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 2

Start Date 22 April 2016 Easting 515447.0

Scale 1 : 25

End Date 22 April 2016 Northing 208424.0 Ground level 121.65mOD Depth 8.45 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend	
22/04/16 0900hrs	1B 1ES	0.50 - 0.60	1.20	Nil S 1			Dark grey and dark brown slightly sandy gravelly (ashy) SILT with a low angular flint cobble content. Gravel is angular to subrounded fine to coarse flint. (MADE GROUND)	0.25	121.40		
		0.50 - 0.60					Firm orangish brown and grey slightly sandy gravelly CLAY. Gravel is angular to rounded fine to coarse flint. Rare brick and glass fragments (up to 20mm). (MADE GROUND)	0.80	120.85		
	2B 2ES 3D 4L	1.00 - 1.10 1.00 - 1.10 1.20 - 1.65 1.20 - 2.00					1.20	1.20m: Very loose.	1.50		120.15
	3ES	1.80 - 2.00					2.00	Very loose dark grey and orangish brown slightly sandy gravelly (ashy) SILT. Gravel is angular to subrounded fine to coarse flint, clinker and slag. Rare brick, ceramic and glass fragments (up to 15mm). (MADE GROUND) 1.50 - 1.60m: Cream slightly sandy gravelly silt. Gravel is subangular and subrounded fine and medium chalk.	2.60		119.05
	5D 6L	2.00 - 2.45 2.00 - 3.00					S<1		2.70		118.95
	4ES	2.80 - 3.00					3.00	Soft grey and orangish brown slightly sandy slightly gravelly silty CLAY. Gravel is angular to rounded fine and medium flint and brick. (MADE GROUND)			
	7D 8L	3.00 - 3.45 3.00 - 4.00					S 1	Very loose dark grey and orangish brown slightly sandy gravelly (ashy) SILT. Gravel is angular to subrounded fine to coarse flint, brick, ceramic, clinker and slag. Rare glass fragments (up to 15mm). (MADE GROUND) 3.00 - 3.40m: Locally dark reddish brown.			
	5ES	3.70 - 3.90						Very soft dark reddish brown and dark grey slightly sandy clayey SILT. (MADE GROUND)	3.70		117.95
									3.90		117.75
											{4.00}

EQUIPMENT: Dando Terrier 2000 Rig.  
 METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-6.00m, (98mm) 6.00-7.00m and (84mm) 7.00-8.00m.  
 CASING: 140mm diam to 6.00m.  
 BACKFILL: On completion, hole backfilled with bentonite pellets.  
 REMARKS: Coordinates supplied by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		<b>CONTRACT</b> <b>31893</b>	<b>CHECKED</b> <b>CT</b>
				Groundwater not encountered.			

# BOREHOLE LOG



**WS401**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 2

Start Date 22 April 2016 Easting 515447.0

Scale 1 : 25

End Date 22 April 2016 Northing 208424.0 Ground level 121.65mOD Depth 8.45 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	9D 10L	4.00 - 4.45 4.00 - 5.00	4.00	S 1			Very loose dark grey and orangish brown slightly sandy gravelly (ashy) SILT. Gravel is angular to subrounded fine to coarse flint, brick, ceramic, clinker and slag. Rare glass fragments (up to 15mm). (MADE GROUND)			
	6ES	4.50 - 4.60								
	11D 12L 7ES	5.00 - 5.45 5.00 - 6.00 5.10 - 5.20	5.00	S 8			Grey and brownish grey slightly sandy clayey angular to subrounded fine to coarse flint GRAVEL. (MADE GROUND)	4.85 5.00	116.80 116.65	
	8ES	5.40 - 5.50					Firm brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint and rare clinker. (MADE GROUND)	5.30	116.35	
							Dark brown clayey sandy angular to subrounded fine to coarse flint, sandstone and clinker GRAVEL. (MADE GROUND)	5.60	116.05	
							Soft brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint, clinker and sandstone. (MADE GROUND)	5.80	115.85	
	13D 14L 9ES	6.00 - 6.45 6.00 - 7.00 6.10 - 6.20	6.00	S<1			Very loose cream slightly sandy gravelly SILT. Gravel is subangular and subrounded fine and medium chalk. (MADE GROUND)			
	10ES	6.50 - 6.60					Soft orangish brown slightly sandy slightly gravelly CLAY with frequent pockets (up to 15mm) of light grey fine sand. Gravel is subangular to well rounded fine to coarse flint, clinker and sandstone. (MADE GROUND)	6.40	115.25	
	15D 16L	7.00 - 7.45 7.00 - 8.00	6.00	S 5						
	11ES	7.50 - 7.60					7.65 - 7.80m: Greyish brown. Silty.			
	17D	8.00 - 8.45	6.00	S 10			7.90 - 8.00m: Cream slightly sandy gravelly silt. Gravel is subangular and subrounded fine and medium chalk. 8.10 - 8.45m: Firm light brownish grey silty clay.			
22/04/16 1115hrs Dry								8.45	113.20	
							Borehole completed at 8.45m.			
								{9.00}		

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water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>31893</b>	CHECKED <b>CT</b>
				Groundwater not encountered.			

# BOREHOLE LOG



**WS402**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 2

Start Date 26 April 2016 Easting 515451.0

Scale 1 : 25

End Date 26 April 2016 Northing 208424.0 Ground level 121.15mOD

Depth 7.45 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
26/04/16 0900hrs	1B 1ES	0.20 - 0.40 0.20 - 0.40					Stiff dark grey and orangish brown gravelly CLAY. Gravel is angular to subrounded fine to coarse brick, concrete and flint. (MADE GROUND)	0.40	120.75	
	2B 2ES	0.60 - 0.80 0.60 - 0.80				Very loose black and dark brown very sandy (ashy) angular to subrounded fine to coarse clinker and flint GRAVEL. Frequent glass and ceramic fragments (up to 50mm). (MADE GROUND) 0.70 - 0.80m: Orangish brown sandy angular to subrounded fine to coarse flint gravel.				
	3B 3ES	1.00 - 1.20 1.00 - 1.20								
	7D 8L	1.20 - 1.65 1.20 - 2.00	Nil 1.20	S <1						
	9D 10L	2.00 - 2.45 2.00 - 3.00	2.00	S 1			1.50 - 1.60m: Very soft light grey slightly gravelly silty clay.			
	4ES	2.70								
	11D 12L	3.00 - 3.45 3.00 - 4.00	3.00	S 1			3.45 - 3.65m: Dark orangish brown.			
	5ES	3.70								
							Continued Next Page	{4.00}		

EQUIPMENT: Dando Terrier 2000 Rig.  
 METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-6.00m and (98mm) 6.00-7.00m.  
 CASING: 140mm diam to 5.00m.  
 BACKFILL: On completion, hole backfilled with bentonite pellets.  
 REMARKS: Coordinates supplied by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks  
 Groundwater not encountered.



CONTRACT  
**31893**

CHECKED  
**CT**

# BOREHOLE LOG



**WS402**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 2

Start Date 26 April 2016 Easting 515451.0

Scale 1 : 25

End Date 26 April 2016 Northing 208424.0 Ground level 121.15mOD

Depth 7.45 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
26/04/16 1100hrs Dry	13D 14L	4.00 - 4.45 4.00 - 5.00	4.00	S 5				4.20	116.95	
							Soft orangish brown and grey slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse brick, coal and flint. (MADE GROUND)			
	6ES	4.70						4.80	116.35	
							Cream slightly sandy gravelly SILT. Gravel is angular and subangular fine to coarse chalk. (MADE GROUND)	4.95	116.20	
	15D 16L	5.00 - 5.45 5.00 - 6.00	5.00	S 4				5.35	115.80	
							Soft grey and orangish brown slightly gravelly silty CLAY. Gravel is angular to subrounded fine to coarse chalk, brick and coal. (MADE GROUND)			
							Firm light orangish brown and light grey slightly gravelly silty CLAY. Gravel is angular to subrounded fine to coarse brick, flint and clinker. (MADE GROUND) 5.55 - 5.65m: Soft grey slightly gravelly clay. Gravel is angular and subangular fine to coarse chalk.	5.65	115.50	
	17D 18L	6.00 - 6.45 6.00 - 7.00	5.00	S 9						
							Soft light bluish grey mottled orangish brown slightly gravelly silty CLAY. Gravel is angular to subrounded coarse flint.			
							6.45 - 6.55m: Firm orangish brown slightly sandy clay. 6.70 - 6.80m: Firm orangish brown slightly sandy slightly gravelly clay. Gravel is angular and subangular fine to coarse flint.			
	19D	7.00 - 7.45	5.00	S 7				7.45	113.70	
							Borehole completed at 7.45m.			
								{9.00}		

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water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>31893</b>	CHECKED <b>CT</b>
				Groundwater not encountered.			

# BOREHOLE LOG



**WS403**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 1

Start Date 19 April 2016

Easting 515461.0

Scale 1 : 25

End Date 19 April 2016

Northing 208427.0 Ground level 121.45mOD

Depth 0.40 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
19/04/16 1000hrs 19/04/16 1030hrs Dry							Grey and brown sandy angular and subangular fine to coarse crystalline, concrete and brick GRAVEL with a medium angular brick cobble content. (MADE GROUND)	0.40	121.05	
							0.40m: Concrete across pit. Borehole completed at 0.40m.			
								{4.00}		

EQUIPMENT: Terrier 2000 rig.  
 METHOD: Hand dug inspection pit 0.00-0.40m.  
 CASING: None used.  
 BACKFILL: On completion, hole backfilled with arisings.  
 REMARKS: Hole terminated at 0.40m due to concrete obstruction and redrilled as WS403A. Coordinates supplied by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks  
 Groundwater not encountered.



CONTRACT  
**31893**

CHECKED  
**CT**

# BOREHOLE LOG



**WS403A**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 2

Start Date 19 April 2016 Easting 515463.0

Scale 1 : 25

End Date 22 April 2016 Northing 208428.0 Ground level 121.65mOD

Depth 6.45 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend																																																																																																																								
19/04/16 1230hrs	1B	0.20 - 0.40					Grey and dark grey silty sandy angular to subrounded fine to coarse flint GRAVEL. (MADE GROUND)	0.50	121.15																																																																																																																									
	1ES	0.20 - 0.40									19/04/16 1310hrs Dry	2B	0.60 - 0.80					Soft dark grey and brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. (MADE GROUND)				2ES	0.60 - 0.80					3B	1.00 - 1.20					3ES	1.00 - 1.20									22/04/16 1200hrs Dry	4L	1.20 - 2.00	1.20	Nil S<1			Very soft orangish brown slightly gravelly sandy CLAY. Gravel is subangular to well rounded fine to coarse flint, chalk and clinker. (MADE GROUND)	1.20	120.45		4ES	1.60 - 1.70						5D	2.00 - 2.45	2.00	S 3			Soft brown slightly sandy slightly gravelly CLAY. Gravel is subangular to well rounded fine to coarse flint. (MADE GROUND)	2.35	119.30		6L	2.00 - 3.00					5ES	2.60 - 2.70					7D	3.00 - 3.45	3.00	S 6			8L	3.00 - 4.00											3.20 - 3.30m: Dark brown. Silty.						6ES	3.50 - 3.60					Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular and subrounded fine to coarse clinker, flint, chalk and rare brick. (MADE GROUND)	3.40	118.25			9D	4.00 - 4.45	4.00	S 5			Continued Next Page					
19/04/16 1310hrs Dry	2B	0.60 - 0.80					Soft dark grey and brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. (MADE GROUND)																																																																																																																											
	2ES	0.60 - 0.80										3B	1.00 - 1.20									3ES	1.00 - 1.20									22/04/16 1200hrs Dry	4L	1.20 - 2.00	1.20	Nil S<1			Very soft orangish brown slightly gravelly sandy CLAY. Gravel is subangular to well rounded fine to coarse flint, chalk and clinker. (MADE GROUND)	1.20	120.45		4ES	1.60 - 1.70						5D	2.00 - 2.45	2.00	S 3			Soft brown slightly sandy slightly gravelly CLAY. Gravel is subangular to well rounded fine to coarse flint. (MADE GROUND)	2.35	119.30		6L		2.00 - 3.00					5ES					2.60 - 2.70					7D	3.00 - 3.45	3.00	S 6			8L	3.00 - 4.00											3.20 - 3.30m: Dark brown. Silty.						6ES	3.50 - 3.60					Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular and subrounded fine to coarse clinker, flint, chalk and rare brick. (MADE GROUND)	3.40	118.25			9D	4.00 - 4.45	4.00	S 5			Continued Next Page								{4.00}				
	3B	1.00 - 1.20																																																																																																																																
3ES	1.00 - 1.20																																																																																																																																	
22/04/16 1200hrs Dry	4L	1.20 - 2.00	1.20	Nil S<1			Very soft orangish brown slightly gravelly sandy CLAY. Gravel is subangular to well rounded fine to coarse flint, chalk and clinker. (MADE GROUND)	1.20	120.45																																																																																																																									
	4ES	1.60 - 1.70										5D	2.00 - 2.45	2.00	S 3			Soft brown slightly sandy slightly gravelly CLAY. Gravel is subangular to well rounded fine to coarse flint. (MADE GROUND)	2.35	119.30		6L	2.00 - 3.00					5ES	2.60 - 2.70					7D	3.00 - 3.45	3.00	S 6			8L	3.00 - 4.00												3.20 - 3.30m: Dark brown. Silty.										6ES	3.50 - 3.60					Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular and subrounded fine to coarse clinker, flint, chalk and rare brick. (MADE GROUND)	3.40	118.25			9D	4.00 - 4.45	4.00	S 5			Continued Next Page								{4.00}																																										
	5D	2.00 - 2.45	2.00	S 3			Soft brown slightly sandy slightly gravelly CLAY. Gravel is subangular to well rounded fine to coarse flint. (MADE GROUND)	2.35	119.30																																																																																																																									
	6L	2.00 - 3.00										5ES	2.60 - 2.70									7D	3.00 - 3.45	3.00	S 6			8L	3.00 - 4.00											3.20 - 3.30m: Dark brown. Silty.						6ES	3.50 - 3.60					Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular and subrounded fine to coarse clinker, flint, chalk and rare brick. (MADE GROUND)	3.40	118.25			9D	4.00 - 4.45	4.00	S 5			Continued Next Page								{4.00}																																																											
	5ES	2.60 - 2.70										7D	3.00 - 3.45	3.00	S 6							8L	3.00 - 4.00											3.20 - 3.30m: Dark brown. Silty.						6ES	3.50 - 3.60					Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular and subrounded fine to coarse clinker, flint, chalk and rare brick. (MADE GROUND)	3.40	118.25			9D					4.00 - 4.45	4.00	S 5			Continued Next Page								{4.00}																																																													
	7D	3.00 - 3.45	3.00	S 6								8L	3.00 - 4.00															3.20 - 3.30m: Dark brown. Silty.						6ES	3.50 - 3.60					Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular and subrounded fine to coarse clinker, flint, chalk and rare brick. (MADE GROUND)	3.40	118.25			9D					4.00 - 4.45	4.00	S 5			Continued Next Page								{4.00}																																																																			
	8L	3.00 - 4.00																																																																																																																																
						3.20 - 3.30m: Dark brown. Silty.																																																																																																																												
	6ES	3.50 - 3.60					Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular and subrounded fine to coarse clinker, flint, chalk and rare brick. (MADE GROUND)	3.40	118.25																																																																																																																									
	9D	4.00 - 4.45	4.00	S 5																																																																																																																														
Continued Next Page								{4.00}																																																																																																																										

EQUIPMENT: Dando Terrier 2000 Rig.  
 METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-6.00m.  
 CASING: 140mm diam to 5.00m.  
 BACKFILL: On completion, hole backfilled with bentonite pellets.  
 REMARKS: Coordinates supplied by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.



CONTRACT  
**31893**

CHECKED  
**CT**

# BOREHOLE LOG



**WS403A**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 2

Start Date 19 April 2016 Easting 515463.0

Scale 1 : 25

End Date 22 April 2016 Northing 208428.0 Ground level 121.65mOD Depth 6.45 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
22/04/16 1400hrs Dry	10L	4.00 - 5.00						4.20	117.45	
							Firm orangish brown slightly gravelly sandy silty CLAY. Gravel is subrounded to well rounded fine and medium flint. 4.20 - 4.30m: Brown. 4.30 - 4.50m: Mottled light grey.			
	7ES	4.80 - 4.90						4.90	116.75	
	11D 12L	5.00 - 5.45 5.00 - 6.00	5.00	S 24			Medium dense orangish brown slightly gravelly very clayey fine and medium SAND. Gravel is subrounded to well rounded fine and medium flint.			
	8ES 13D	5.70 - 5.80 6.00 - 6.45	5.00	S 22				6.45	115.20	
							Borehole completed at 6.45m.	{9.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 31893.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 26/05/2016 13:53:24 ELe CT

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT	CHECKED
				Groundwater not encountered.		<b>31893</b>	<b>CT</b>

# STANDARD PENETRATION TEST



CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

borehole no.	borehole depth (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)						
					blows	pen (mm)	blows		pen (mm)										
CH402	1.20	1.65	Nil	1.10	1	0	75	75	1	0	1	0	75	75	75	75	S	2	70
CH402	2.20	2.65	Nil	2.10	1	0	75	75	0	0	0	0	75	75	75	75	S	<1	70
CH402	3.20	3.65	Nil	2.10	1	0	75	75	0	1	0	0	75	75	75	75	S	<1	70
CH402	4.20	4.65	Nil	Dry	1	0	75	75	0	1	0	1	75	75	75	75	S	2	70
CH402	5.20	5.65	Nil	Dry	1	1	75	75	2	5	10	10	75	75	75	75	S	27	70
CH402	6.70	7.15	6.70	Dry	2	0	75	75	1	0	1	0	75	75	75	75	S	2	70
CH402	8.20	8.65	8.20	8.00	1	2	75	75	3	3	5	6	75	75	75	75	S	17	70
CH402	9.70	9.98	9.70	9.50	5	15	75	75	32	18			75	50			S	120	70
CH402	10.70	11.05	10.70	Dry	5	11	75	75	16	21	13		75	75	50		S	75	70
CH402	12.20	12.40	12.20	Dry	10	15	75	50	50				70				S	214	70
WS401	1.20	1.65	Nil	Dry	1	0	75	75	0	1	0	0	75	75	75	75	S	1	74
WS401	2.00	2.45	2.00	Dry	0	0	75	75	0	0	0	0	75	75	75	75	S	<1	74
WS401	3.00	3.45	3.00	Dry	1	0	75	75	0	1	0	0	75	75	75	75	S	1	74
WS401	4.00	4.45	4.00	Dry	1	0	75	75	0	0	1	0	75	75	75	75	S	1	74
WS401	5.00	5.45	5.00	Dry	0	1	75	75	1	2	3	2	75	75	75	75	S	8	74
WS401	6.00	6.45	6.00	Dry	0	0	75	75	0	0	0	0	75	75	75	75	S	<1	74
WS401	7.00	7.45	6.00	Dry	0	0	75	75	0	2	2	1	75	75	75	75	S	5	74
WS401	8.00	8.45	6.00	Dry	0	0	75	75	2	3	3	2	75	75	75	75	S	10	74
WS402	1.20	1.65	Nil	Dry	0	0	75	75	0	0	0	0	75	75	75	75	S	<1	74
WS402	2.00	2.45	2.00	Dry	0	1	75	75	0	0	1	0	75	75	75	75	S	1	74
WS402	3.00	3.45	3.00	Dry	0	0	75	75	0	0	1	0	75	75	75	75	S	1	74
WS402	4.00	4.45	4.00	Dry	1	0	75	75	2	2	0	1	75	75	75	75	S	5	74
WS402	5.00	5.45	5.00	Dry	0	0	75	75	0	0	2	2	75	75	75	75	S	4	74
WS402	6.00	6.45	5.00	Dry	1	1	75	75	2	2	2	3	75	75	75	75	S	9	74

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, solid cone C.
4. Where full test drive not completed, linearly extrapolated N value reported.
5. <1 Denotes hammer self weight penetration (sank under own weight).
6. \*\* Denotes no effective penetration.

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Geotechnical Engineering Limited  
**STANDARD PENETRATION TEST**



CLIENT HERTFORDSHIRE COUNTY COUNCIL  
 SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

borehole no.	borehole depth (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
					blows	pen (mm)	blows	pen (mm)					
WS402	7.00	7.45	5.00	Dry	1 1	75 75	1 2 2 2	75 75 75 75	S	7	74		
WS403A	1.20	1.65	Nil	Dry	1 0	75 75	0 0 0 0	75 75 75 75	S	<1	74		
WS403A	2.00	2.45	2.00	Dry	1 0	75 75	1 0 1 1	75 75 75 75	S	3	74		
WS403A	3.00	3.45	3.00	Dry	1 1	75 75	1 1 2 2	75 75 75 75	S	6	74		
WS403A	4.00	4.45	4.00	Dry	1 0	75 75	1 0 2 2	75 75 75 75	S	5	74		
WS403A	5.00	5.45	5.00	Dry	2 3	75 75	6 6 6 6	75 75 75 75	S	24	74		
WS403A	6.00	6.45	5.00	Dry	2 4	75 75	5 5 6 6	75 75 75 75	S	22	74		

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, solid cone C.
4. Where full test drive not completed, linearly extrapolated N value reported.
5. <1 Denotes hammer self weight penetration (sank under own weight).
6. \*\* Denotes no effective penetration.

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# SPT Calibration Report



## Hammer Energy Measurement Report

Type of Hammer: SPT HAMMER  
 Client: GEOTECHNICAL ENGINEERING  
 Test No: EQU1369  
 Test Depth (m): 12.19  
 Date of Test: 22 December 2015  
 Valid until: 21 December 2016  
 Hammer ID: EQU010

Mass of the hammer:  $m = 63.5\text{kg}$   
 Falling height:  $h = 0.76\text{m}$   
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

### Characteristics of the instrumented rod

Diameter:  $d_r = 0.052\text{ m}$   
 Length of the instrumented rod:  $0.558\text{ m}$   
 Area:  $A = 11.61\text{ cm}^2$   
 Modulus:  $E_a = 206843\text{ MPa}$

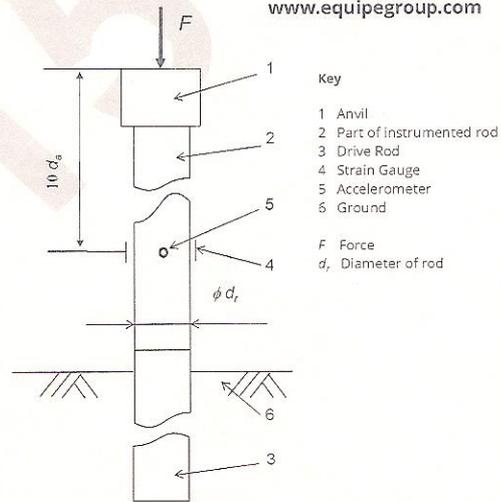
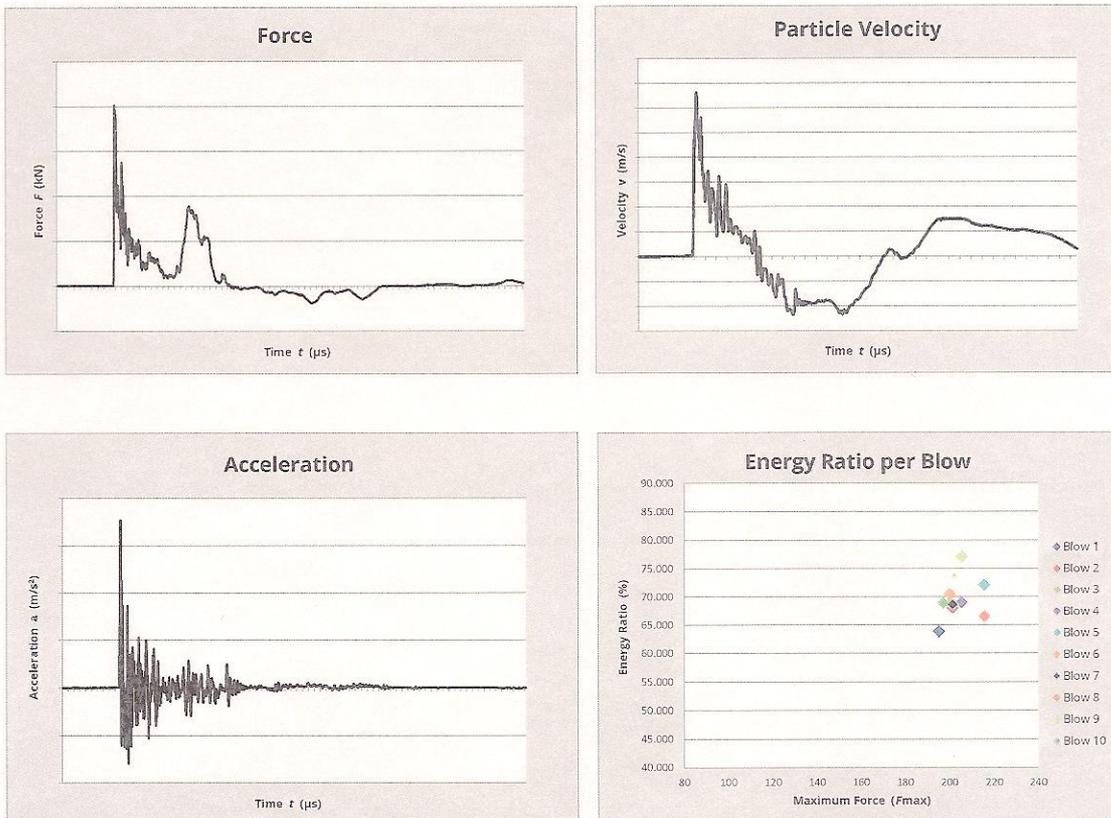


Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011



Observations:  
 1.

$E_{\text{meas}} = 0.329\text{ kN-m}$   
 $E_{\text{theor}} = 0.473\text{ kN-m}$

Energy Ratio  $(E_r) = \frac{E_{\text{meas}}}{E_{\text{theor}}} = 69.56\%$

Equipe SPT Analyzer Operators: MH  
 Prepared by: *[Signature]* Checked by: *[Signature]* Date: 22/12/2015

**Southern Testing Laboratories**  
Keeble House  
Stuart Way  
East Grinstead  
West Sussex  
RH19 4QA

SPT Hammer Ref: SW68  
Test Date: 03/03/2016  
Report Date: 07/03/2016  
File Name: SW68.spt  
Test Operator: NPB

**Instrumented Rod Data**

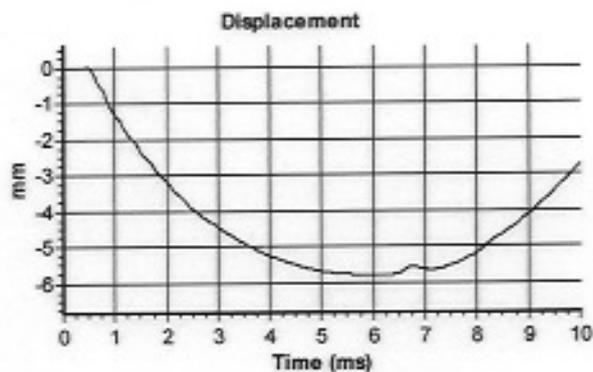
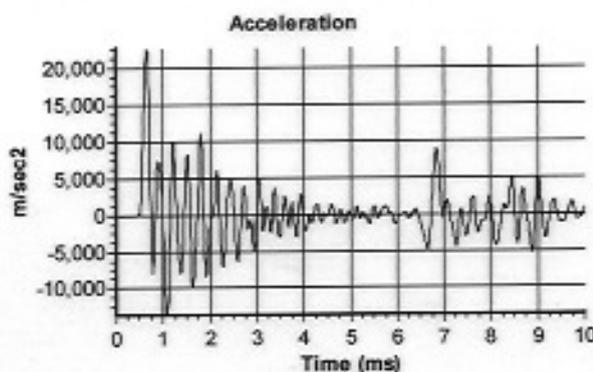
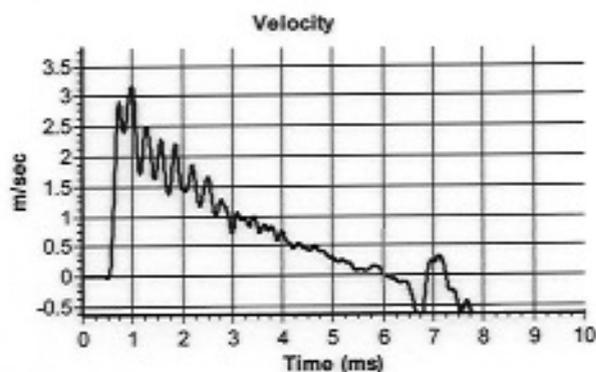
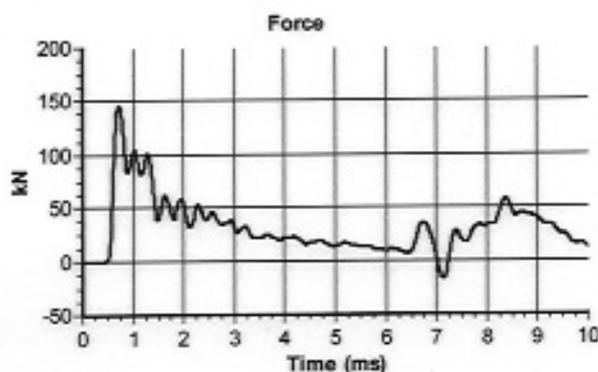
Diameter  $d_r$  (mm): 54  
Wall Thickness  $t_r$  (mm): 6.0  
Assumed Modulus  $E_a$  (GPa): 200  
Accelerometer No.1: 6458  
Accelerometer No.2: 9607

**SPT Hammer Information**

Hammer Mass  $m$  (kg): 64.5  
Falling Height  $h$  (mm): 750  
SPT String Length  $L$  (m): 14.0

**Comments / Location**

Charwoods



**Calculations**

Area of Rod A ( $\text{mm}^2$ ): 905  
Theoretical Energy  $E_{\text{theor}}$  (J): 473  
Measured Energy  $E_{\text{meas}}$  (J): 352

**Energy Ratio  $E_r$  (%)**

**74**

*NPB Burrows*

Signed: N P Burrows  
Title: Field Operations Manager

The recommended calibration interval is 12 months

# DYNAMIC PROBE RESULTS



CLIENT HERTFORDSHIRE COUNTY COUNCIL

**DP401**

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 5

Date 22 April 2016 Easting 515452.0

Scale 1 : 25

Ground level 121.15mOD Northing 208426.0

Depth 21.00 m

depth (m)	blowcount / penetration (mm)	blowcount (n <sub>100</sub> ) v depth plot					torque (Nm)	remarks
		10	20	30	40	50		
0.00								Dark grey and dark brown slightly sandy gravelly (ashy) SILT with low angular flint cobble content. Gravel is angular to subrounded fine to coarse flint. (MADE GROUND)
1.00	0 / 100							Firm orangish brown and grey slightly sandy gravelly CLAY. Gravel is angular to rounded fine to coarse flint, brick fragments and rare glass. (MADE GROUND)
2.00	0 / 100						0	Dark grey slightly sandy gravelly (ashy) SILT. Gravel is angular to subrounded fine to coarse flint and rare brick and china fragments (50mm). (MADE GROUND)
3.00	0 / 100						0	
4.00	0 / 100						0	
5.00	0 / 100							

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REMARKS

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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# DYNAMIC PROBE RESULTS



**DP401**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 5

Date 22 April 2016 Easting 515452.0

Scale 1 : 25

Ground level 121.15mOD Northing 208426.0

Depth 21.00 m

depth (m)	blowcount / penetration (mm)	blowcount ( $n_{100}$ ) v depth plot					torque (Nm)	remarks
		10	20	30	40	50		
6.00	1 / 100						0	
	0 / 100							
	1 / 100							
	2 / 100							
	2 / 100							
	3 / 100							
	3 / 100							
	3 / 100							
	3 / 100							
	4 / 100							
	1 / 100						0	
	3 / 100							
	3 / 100							
	3 / 100							
	4 / 100							
	3 / 100							
	4 / 100							
	4 / 100							
	4 / 100							
	4 / 100							
7.00	2 / 100						14	
	2 / 100							
	4 / 100							
	4 / 100							
	5 / 100							
	5 / 100							
	6 / 100							
	7 / 100							
	6 / 100							
8.00	6 / 100						27	
	6 / 100							
	6 / 100							
	6 / 100							
	6 / 100							
	6 / 100							
	7 / 100							
	8 / 100							
	8 / 100							
	8 / 100							
	9 / 100							
9.00	9 / 100						54	
	9 / 100							
	9 / 100							
	9 / 100							
	10 / 100							
	11 / 100							
	11 / 100							
	11 / 100							
	9 / 100							
	7 / 100							
	8 / 100							
10.00	8 / 100							

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**REMARKS**

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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# DYNAMIC PROBE RESULTS



**DP401**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 3 of 5

Date 22 April 2016 Easting 515452.0

Scale 1 : 25

Ground level 121.15mOD Northing 208426.0

Depth 21.00 m

depth (m)	blowcount / penetration (mm)	blowcount (n <sub>100</sub> ) v depth plot					torque (Nm)	remarks
		10	20	30	40	50		
11.00	7 / 100						68	
	7 / 100							
	7 / 100							
	6 / 100							
	7 / 100							
	8 / 100							
	11 / 100							
	11 / 100							
	10 / 100							
	10 / 100							
12.00	7 / 100						47	
	9 / 100							
	10 / 100							
	11 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	13 / 100							
	14 / 100							
13.00	13 / 100						81	
	14 / 100							
	13 / 100							
	16 / 100							
	16 / 100							
	15 / 100							
	15 / 100							
	17 / 100							
	17 / 100							
	18 / 100							
14.00	11 / 100						95	
	13 / 100							
	14 / 100							
	15 / 100							
	15 / 100							
	14 / 100							
	17 / 100							
	19 / 100							
	17 / 100							
	18 / 100							
15.00	15 / 100						176	
	17 / 100							
	18 / 100							
	19 / 100							
	16 / 100							
	15 / 100							
	15 / 100							
	16 / 100							
	15 / 100							
	16 / 100							

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**REMARKS**

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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# DYNAMIC PROBE RESULTS



**DP401**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 4 of 5

Date 22 April 2016 Easting 515452.0

Scale 1 : 25

Ground level 121.15mOD Northing 208426.0

Depth 21.00 m

depth (m)	blowcount / penetration (mm)	blowcount ( $n_{100}$ ) v depth plot	torque (Nm)	remarks
	12 / 100		176	
	15 / 100			
	14 / 100			
	15 / 100			
	15 / 100			
	16 / 100			
	15 / 100			
	16 / 100			
	16 / 100			
16.00	16 / 100			
	15 / 100		176	
	16 / 100			
	17 / 100			
	17 / 100			
	15 / 100			
	15 / 100			
	16 / 100			
	15 / 100			
	16 / 100			
17.00	17 / 100			
	17 / 100		176	
	16 / 100			
	14 / 100			
	14 / 100			
	14 / 100			
	16 / 100			
	14 / 100			
	15 / 100			
	16 / 100			
18.00	15 / 100			
	10 / 100		149	
	10 / 100			
	11 / 100			
	11 / 100			
	10 / 100			
	12 / 100			
	11 / 100			
	12 / 100			
19.00	12 / 100			
	7 / 100		122	
	10 / 100			
	10 / 100			
	11 / 100			
	13 / 100			
	15 / 100			
	14 / 100			
	12 / 100			
	12 / 100			
20.00	14 / 100			

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REMARKS

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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# DYNAMIC PROBE RESULTS



## DP401

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 5 of 5

Date 22 April 2016 Easting 515452.0

Scale 1 : 25

Ground level 121.15mOD Northing 208426.0

Depth 21.00 m

depth (m)	blowcount / penetration (mm)	blowcount ( $n_{100}$ ) v depth plot					torque (Nm)	remarks	
		10	20	30	40	50			
	10 / 100						81	Completed at 21.00m.	
	11 / 100								
	11 / 100								
	10 / 100								
	11 / 100								
	10 / 100								
	10 / 100								
	10 / 100								
	11 / 100								
21.00	11 / 100						122		
22.00									
23.00									
24.00									
25.00									
REMARKS								CONTRACT <b>31893</b>	CHECKED <b>CT</b>
DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.									



# DYNAMIC PROBE RESULTS



**DP402**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 3

Date 22 April 2016 Easting 515449.0

Scale 1 : 25

Ground level 121.70mOD Northing 208425.0

Depth 12.00 m

depth (m)	blowcount / penetration (mm)	blowcount ( $n_{100}$ ) v depth plot					torque (Nm)	remarks
		10	20	30	40	50		
6.00	1 / 100						0	
	1 / 100							
	1 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	1 / 100						0	
	1 / 100							
	1 / 100							
	1 / 100							
	0 / 100							
	1 / 100							
	0 / 100							
	1 / 100							
	1 / 100							
	0 / 100						14	
	0 / 100							
	0 / 100							
	1 / 100							
	0 / 100							
	1 / 100							
	1 / 100							
	2 / 100							
	2 / 100							
	2 / 100							
	1 / 100							
	1 / 100							
	2 / 100							
	2 / 100							
	2 / 100							
	1 / 100						27	
	1 / 100							
	2 / 100							
	5 / 100							
	5 / 100							
	4 / 100							
	6 / 100							
	6 / 100							
	5 / 100							
	5 / 100							
	5 / 100							
	7 / 100						54	
	5 / 100							
	6 / 100							
	6 / 100							
	6 / 100							
	6 / 100							
	6 / 100							
	7 / 100							
	7 / 100							
	8 / 100							

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**REMARKS**

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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# DYNAMIC PROBE RESULTS



## DP402

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 3 of 3

Date 22 April 2016 Easting 515449.0

Scale 1 : 25

Ground level 121.70mOD Northing 208425.0

Depth 12.00 m

depth (m)	blowcount / penetration (mm)	blowcount ( $n_{100}$ ) v depth plot					torque (Nm)	remarks																	
		10	20	30	40	50																			
	5 / 100						68	Completed at 12.00m.																	
	6 / 100						68																		
	7 / 100								68																
	7 / 100									68															
	7 / 100										68														
	7 / 100											68													
	8 / 100												68												
11.00	10 / 100													68											
	10 / 100														68										
	9 / 100															68									
	8 / 100																68								
	8 / 100																	68							
	9 / 100																		68						
	10 / 100																			68					
	10 / 100																				68				
	9 / 100																					68			
	9 / 100																						68		
	9 / 100																							68	
	9 / 100																								68
12.00	9 / 100																								
13.00																									
14.00																									
15.00																									
REMARKS							AGS	CONTRACT <b>31893</b>	CHECKED <b>CT</b>																
DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.																									



# DYNAMIC PROBE RESULTS



## DP403

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 3

Date 25 April 2016 Easting 515451.0

Scale 1 : 25

Ground level 121.15mOD Northing 208423.0

Depth 13.00 m

depth (m)	blowcount / penetration (mm)	blowcount (n <sub>100</sub> ) v depth plot					torque (Nm)	remarks
		10	20	30	40	50		
6.00	0 / 100						20	
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	2 / 100							
	2 / 100							
	2 / 100						54	
	3 / 100							
	3 / 100							
	3 / 100							
	4 / 100							
	4 / 100							
	4 / 100							
	4 / 100							
	3 / 100							
	3 / 100							
	3 / 100							
	3 / 100							
7.00	2 / 100						95	
	3 / 100							
	3 / 100							
	3 / 100							
	2 / 100							
	3 / 100							
	5 / 100							
	6 / 100							
	6 / 100							
	7 / 100							
	6 / 100							
	9 / 100							
	10 / 100							
	10 / 100							
	12 / 100							
	12 / 100							
	10 / 100							
	12 / 100							
	13 / 100							
8.00	11 / 100						95	
	14 / 100							
	14 / 100							
	13 / 100							
	13 / 100							
	14 / 100							
	13 / 100							
	14 / 100							
	13 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
9.00	14 / 100						95	
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
10.00	14 / 100						95	
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
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	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							
	14 / 100							

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REMARKS

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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# DYNAMIC PROBE RESULTS



**DP403**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 3 of 3

Date 25 April 2016 Easting 515451.0

Scale 1 : 25

Ground level 121.15mOD Northing 208423.0

Depth 13.00 m

depth (m)	blowcount / penetration (mm)	blowcount ( $n_{100}$ ) v depth plot					torque (Nm)	remarks	
		10	20	30	40	50			
	12 / 100								
	16 / 100								
	17 / 100								
	20 / 100								
	19 / 100								
	19 / 100								
	16 / 100								
	17 / 100								
11.00	16 / 100						102		
	18 / 100								
	16 / 100								
	17 / 100								
	19 / 100								
	21 / 100								
	19 / 100								
	24 / 100								
	24 / 100								
	23 / 100								
12.00	19 / 100						81		
	19 / 100								
	19 / 100								
	26 / 100								
	28 / 100								
	29 / 100								
	26 / 100								
	27 / 100								
	28 / 100								
	29 / 100								
	31 / 100								
13.00	30 / 100						95	Completed at 13.00m.	
14.00									
15.00									
REMARKS							AGS	CONTRACT <b>31893</b>	CHECKED <b>CT</b>
DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.									



# DYNAMIC PROBE RESULTS

CLIENT HERTFORDSHIRE COUNTY COUNCIL

**DP404**

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 3

Date 3 May 2016 Easting 515448.0

Scale 1 : 25

Ground level 121.70mOD Northing 208423.0

Depth 12.58 m

depth (m)	blowcount / penetration (mm)	blowcount (n <sub>100</sub> ) v depth plot					torque (Nm)	remarks
		10	20	30	40	50		
0.00								Dark brown slightly clayey slightly sandy angular to subrounded fine to coarse concrete, clinker, brick and sandstone GRAVEL. (MADE GROUND)
0.50								
1.00								
1.50	0 / 100							Dark brown slightly sandy gravelly SILT. Gravel is subangular and subrounded fine to coarse brick and coal. Rare wood fragments (up to 10mm). (MADE GROUND)
2.00	0 / 100						0	
2.50	0 / 100							
3.00	0 / 100							7
3.50	0 / 100							
4.00	0 / 100							
4.50	1 / 100							14
5.00	1 / 100							
5.50	0 / 100							
6.00	3 / 100							20
6.50	2 / 100							
7.00	0 / 100							
7.50	0 / 100							
8.00	0 / 100							
8.50	0 / 100							
9.00	0 / 100							
9.50	0 / 100							
10.00	0 / 100							
10.50	0 / 100							
11.00	0 / 100							
11.50	0 / 100							
12.00	0 / 100							
12.58	0 / 100							

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Geotechnical Engineering Ltd, Tel. 01452 527743 31893.GPJ TRIAL\JH.GPJ GEOTECH2.GLB 26/05/2016 13:53:59 JB

**REMARKS**

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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# DYNAMIC PROBE RESULTS



**DP404**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 2 of 3

Date 3 May 2016 Easting 515448.0

Scale 1 : 25

Ground level 121.70mOD Northing 208423.0

Depth 12.58 m

depth (m)	blowcount / penetration (mm)	blowcount (n <sub>100</sub> ) v depth plot					torque (Nm)	remarks
		10	20	30	40	50		
5.00	5 / 100							
	1 / 100							
	3 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
6.00	0 / 100						20	
	1 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	0 / 100							
	1 / 100							
	2 / 100							
	0 / 100							
7.00	0 / 100						41	
	0 / 100							
	3 / 100							
	2 / 100							
	2 / 100							
	2 / 100							
	3 / 100							
	4 / 100							
	2 / 100							
	3 / 100							
8.00	2 / 100						68	
	3 / 100							
	2 / 100							
	3 / 100							
	3 / 100							
	2 / 100							
	4 / 100							
	6 / 100							
	5 / 100							
	4 / 100							
9.00	5 / 100						68	
	5 / 100							
	11 / 100							
	13 / 100							
	13 / 100							
	13 / 100							
	13 / 100							
	15 / 100							
	13 / 100							
	13 / 100							
10.00	13 / 100						102	

Continued Next Page

**REMARKS**

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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Geotechnical Engineering Ltd., Tel. 01452 527743 31893.GPJ TRIAL\JH.GPJ GEOTECH2.GLB 26/05/2016 13:53:59 JB

# DYNAMIC PROBE RESULTS



**DP404**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 3 of 3

Date 3 May 2016 Easting 515448.0

Scale 1 : 25

Ground level 121.70mOD Northing 208423.0

Depth 12.58 m

depth (m)	blowcount / penetration (mm)	blowcount (n <sub>100</sub> ) v depth plot	torque (Nm)	remarks	
	10 / 100				
	16 / 100				
	15 / 100				
	15 / 100				
	13 / 100				
	9 / 100				
	12 / 100				
	11 / 100				
	12 / 100				
11.00	16 / 100		68		
	17 / 100				
	16 / 100				
	14 / 100				
	14 / 100				
	14 / 100				
	14 / 100				
	16 / 100				
	17 / 100				
12.00	21 / 100		129		
	19 / 100				
	22 / 100				
	23 / 100				
	28 / 100				
	33 / 100				
	48 / 100				
	50 / 80		149	Completed at 12.58m.	
13.00					
14.00					
15.00					
REMARKS				CONTRACT <b>31893</b>	CHECKED <b>CT</b>
DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.					

Geotechnical Engineering Ltd, Tel. 01452 527743 31893.GPJ TRIAL\JH.GPJ GEOTECH\2.GLB 26/05/2016 13:53:59 JB

# DYNAMIC PROBE RESULTS



CLIENT HERTFORDSHIRE COUNTY COUNCIL

**DP405**

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

Sheet 1 of 2

Date 22 April 2016 Easting 515462.0

Scale 1 : 25

Ground level 121.60mOD Northing 208429.0

Depth 10.00 m

depth (m)	blowcount / penetration (mm)	blowcount ( $n_{100}$ ) v depth plot					torque (Nm)	remarks
		10	20	30	40	50		
0.00								Grey and dark grey silty sandy angular to subrounded fine to coarse flint GRAVEL. (MADE GROUND)  Firm grey slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint, concrete, clinker and brick. (MADE GROUND)  Firm grey and orangish brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint, concrete, clinker and brick. Rare decomposed wood fragments (up to 50mm). (MADE GROUND)
0.10	1 / 100							
0.20	0 / 100							
0.30	0 / 100							
0.40	1 / 100							
0.50	0 / 100							
0.60	1 / 100							
0.70	1 / 100							
0.80	1 / 100							
0.90	1 / 100							
1.00	1 / 100							
1.10	1 / 100							
1.20	1 / 100							
1.30	1 / 100							
1.40	1 / 100							
1.50	0 / 100							
1.60	0 / 100							
1.70	0 / 100							
1.80	0 / 100							
1.90	0 / 100							
2.00	2 / 100							
2.10	2 / 100							
2.20	2 / 100							
2.30	1 / 100							
2.40	1 / 100							
2.50	1 / 100							
2.60	2 / 100							
2.70	2 / 100							
2.80	2 / 100							
2.90	2 / 100							
3.00	2 / 100							
3.10	2 / 100							
3.20	2 / 100							
3.30	2 / 100							
3.40	2 / 100							
3.50	2 / 100							
3.60	2 / 100							
3.70	2 / 100							
3.80	2 / 100							
3.90	2 / 100							
4.00	1 / 100							
4.10	1 / 100							
4.20	2 / 100							
4.30	2 / 100							
4.40	3 / 100							
4.50	3 / 100							
4.60	3 / 100							
4.70	5 / 100							
4.80	7 / 100							
4.90	11 / 100							

Continued Next Page

REMARKS

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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# DYNAMIC PROBE RESULTS



**DP405**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

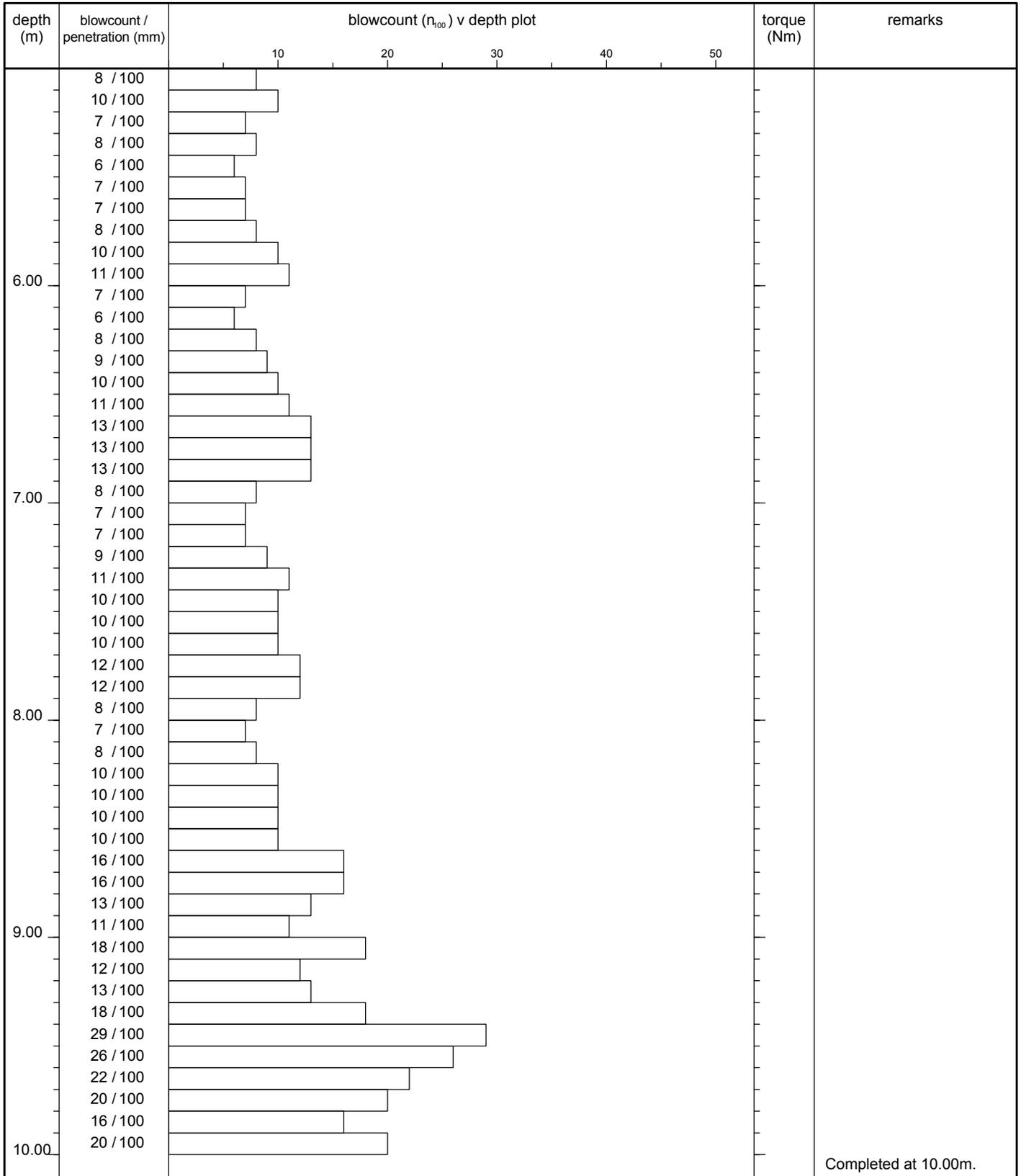
Sheet 2 of 2

Date 22 April 2016 Easting 515462.0

Scale 1 : 25

Ground level 121.60mOD Northing 208429.0

Depth 10.00 m



Completed at 10.00m.

**REMARKS**

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



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**31893**

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**CT**



# DYNAMIC PROBE RESULTS



**DP406**

CLIENT HERTFORDSHIRE COUNTY COUNCIL

SITE FONTMELL CLOSE SINKHOLE (ST ALBANS)

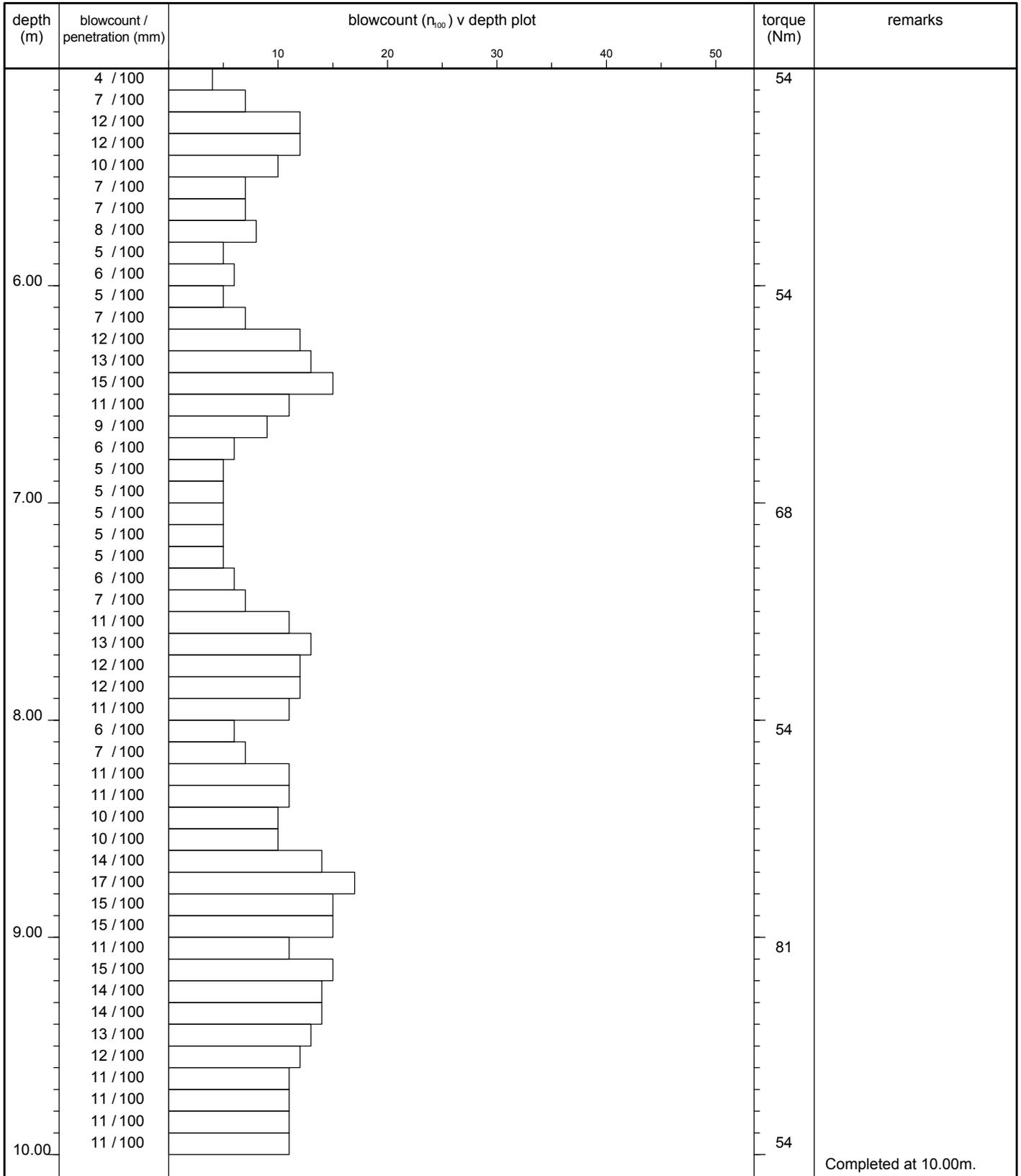
Sheet 2 of 2

Date 22 April 2016 Easting 515464.0

Scale 1 : 25

Ground level 121.75mOD Northing 208426.0

Depth 10.00 m



Geotechnical Engineering Ltd, Tel. 01452 527743 31893.GPJ TRIAL\JH.GPJ GEOTECH2.GLB 26/05/2016 13:54:02 SO

**REMARKS**

DPSH(B) test carried out in general accordance with BS EN ISO 22476-2:2005 + A1:2011, sacrificial cone used. Coordinates supplied by the Consultant.



**CONTRACT**  
**31893**

**CHECKED**  
**CT**



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# **APPENDIX B**

## **CHEMICAL ANALYSES**



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# **APPENDIX B**

## **CHEMICAL ANALYSES**



**4041**  
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## **Analytical Report Number : 16-15943**

Replaces Analytical Report Number : 16-15943, issue no. 1

<b>Project / Site name:</b>	Fontmell Close, St Albans	<b>Samples received on:</b>	19/04/2016
<b>Your job number:</b>	31893	<b>Samples instructed on:</b>	22/04/2016
<b>Your order number:</b>		<b>Analysis completed by:</b>	23/05/2016
<b>Report Issue Number:</b>	2	<b>Report issued on:</b>	25/05/2016
<b>Samples Analysed:</b>	3 soil samples		

**Signed:** CC Stone

Dr Claire Stone  
 Quality Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:** EM

Emma Winter  
 Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Environmental Science

Analytical Report Number: 16-15943

Project / Site name: Fontmell Close, St Albans

Lab Sample Number				564222	564223	564224		
Sample Reference				CH402	CH402	CH402		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.30-0.50	1.00-1.20	2.00		
Date Sampled				18/04/2016	18/04/2016	18/04/2016		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	-		
Moisture Content	%	N/A	NONE	12	14	-		
Total mass of sample received	kg	0.001	NONE	2.0	2.0	-		

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected		
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**General Inorganics**

pH	pH Units	N/A	MCERTS	10.1	8.2	-		
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	-		
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.36	0.023	-		
Sulphide	mg/kg	1	MCERTS	15	< 1.0	-		
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.3	0.3	-		

**Total Phenols**

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-		
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**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-		
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-		
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-		

**Total PAH**

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	< 1.60	< 1.60	-		
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.0	10	-		
Boron (water soluble)	mg/kg	0.2	MCERTS	5.1	0.4	-		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-		
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	-		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	22	30	-		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	17	14	-		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	220	11	-		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	23	16	-		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	29	28	-		



**Analytical Report Number : 16-15943**

**Project / Site name: Fontmell Close, St Albans**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
564222	CH402	None Supplied	0.30-0.50	Brown sandy gravel.**
564223	CH402	None Supplied	1.00-1.20	Light brown sandy clay.
564224	CH402	None Supplied	2.00	-

\*\*Non MCerts matrix



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Environmental Science

Analytical Report Number : 16-15943

Project / Site name: Fontmell Close, St Albans

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 300c.



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## **Analytical Report Number : 16-16055**

Replaces Analytical Report Number : 16-16055, issue no. 1

<b>Project / Site name:</b>	Fontmell Close, St Albans	<b>Samples received on:</b>	20/04/2016
<b>Your job number:</b>	31893	<b>Samples instructed on:</b>	22/04/2016
<b>Your order number:</b>		<b>Analysis completed by:</b>	11/05/2016
<b>Report Issue Number:</b>	2	<b>Report issued on:</b>	11/05/2016
<b>Samples Analysed:</b>	1 soil sample		

**Signed:** \_\_\_\_\_

Rexona Rahman  
 Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:** \_\_\_\_\_

Emma Winter  
 Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Environmental Science

Analytical Report Number: 16-16055

Project / Site name: Fontmell Close, St Albans

<b>Lab Sample Number</b>				564839				
<b>Sample Reference</b>				WS403A				
<b>Sample Number</b>				None Supplied				
<b>Depth (m)</b>				0.20-0.40				
<b>Date Sampled</b>				19/04/2016				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	8.2				
Total mass of sample received	kg	0.001	NONE	1.8				

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile- Loose fibres				
Asbestos in Soil	Type	N/A	ISO 17025	Detected				

**General Inorganics**

pH	pH Units	N/A	MCERTS	8.9				
Total Cyanide	mg/kg	1	MCERTS	< 1				
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.22				
Sulphide	mg/kg	1	MCERTS	7.1				
Organic Matter	%	0.1	MCERTS	2.2				

**Total Phenols**

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0				
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**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	0.37				
Acenaphthylene	mg/kg	0.1	MCERTS	0.52				
Acenaphthene	mg/kg	0.1	MCERTS	0.43				
Fluorene	mg/kg	0.1	MCERTS	0.45				
Phenanthrene	mg/kg	0.1	MCERTS	4.6				
Anthracene	mg/kg	0.1	MCERTS	1.4				
Fluoranthene	mg/kg	0.1	MCERTS	10				
Pyrene	mg/kg	0.1	MCERTS	11				
Benzo(a)anthracene	mg/kg	0.1	MCERTS	4.6				
Chrysene	mg/kg	0.05	MCERTS	4.6				
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	6.0				
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	2.0				
Benzo(a)pyrene	mg/kg	0.1	MCERTS	4.7				
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	2.3				
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.57				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.5				

**Total PAH**

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	56.4				
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.9				
Boron (water soluble)	mg/kg	0.2	MCERTS	2.7				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	33				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	76				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	100				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	27				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110				



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Environmental Science

**Analytical Report Number : 16-16055**

**Project / Site name: Fontmell Close, St Albans**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
564839	WS403A	None Supplied	0.20-0.40	Brown loam and clay with gravel.



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Environmental Science

Analytical Report Number : 16-16055

Project / Site name: Fontmell Close, St Albans

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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## **Analytical Report Number : 16-16370**

<b>Project / Site name:</b>	Fontmell Close, St Albans	<b>Samples received on:</b>	22/04/2016
<b>Your job number:</b>	31893	<b>Samples instructed on:</b>	27/04/2016
<b>Your order number:</b>		<b>Analysis completed by:</b>	03/05/2016
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	03/05/2016
<b>Samples Analysed:</b>	1 soil sample		

**Signed:**

Rexona Rahman  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:**

Emma Winter  
Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 16-16370

Project / Site name: Fontmell Close, St Albans

<b>Lab Sample Number</b>				566442				
<b>Sample Reference</b>				WS401				
<b>Sample Number</b>				None Supplied				
<b>Depth (m)</b>				0.50-0.60				
<b>Date Sampled</b>				22/04/2016				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>				<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>		
Asbestos in Soil				Type	N/A	ISO 17025	Not-detected	



**Analytical Report Number : 16-16370**

**Project / Site name: Fontmell Close, St Albans**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**

**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**

**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**



**Emma Leivers**

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## **Analytical Report Number : 16-16371**

<b>Project / Site name:</b>	Fontmell Close, St Albans	<b>Samples received on:</b>	22/04/2016
<b>Your job number:</b>	31893	<b>Samples instructed on:</b>	27/04/2016
<b>Your order number:</b>		<b>Analysis completed by:</b>	09/05/2016
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	09/05/2016
<b>Samples Analysed:</b>	1 wac multi sample		

**Signed:**

Rexona Rahman  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:**

Emma Winter  
Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

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soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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### Waste Acceptance Criteria Analytical Results

<b>Report No:</b>	16-16371						
<b>Client:</b>	GEOENG						
<b>Location</b>	Fontmell Close, St Albans						
<b>Lab Reference (Sample Number)</b>	566443						
<b>Sampling Date</b>	22/04/2016						
<b>Sample ID</b>	WS401						
<b>Depth (m)</b>	0.50-0.60						
					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
<b>Solid Waste Analysis</b>							
TOC (%)**	0.1				3%	5%	6%
Loss on Ignition (%) **	2.6				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.30				1	--	--
Mineral Oil (mg/kg)	26				500	--	--
Total PAH (WAC-17) (mg/kg)	< 1.6				100	--	--
pH (units)**	7.4				--	>6	--
Acid Neutralisation Capacity (mol / kg)	2.5				--	To be evaluated	To be evaluated
<b>Eluate Analysis</b>	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test		
(BS EN 12457 - 3 preparation utilising end over end leaching procedure)	mg/l	mg/l		mg/kg	using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.010	< 0.010		< 0.050	0.5	2	25
Barium *	0.013	0.0075		0.083	20	100	300
Cadmium *	< 0.0005	< 0.0005		< 0.0020	0.04	1	5
Chromium *	< 0.0010	0.0016		0.014	0.5	10	70
Copper *	0.0036	0.0035		0.035	2	50	100
Mercury *	< 0.0015	< 0.0015		< 0.010	0.01	0.2	2
Molybdenum *	< 0.0030	< 0.0030		< 0.020	0.5	10	30
Nickel *	< 0.0010	0.0014		0.011	0.4	10	40
Lead *	< 0.0050	< 0.0050		< 0.020	0.5	10	50
Antimony *	< 0.0050	< 0.0050		< 0.020	0.06	0.7	5
Selenium *	< 0.010	< 0.010		< 0.040	0.1	0.5	7
Zinc *	< 0.0010	< 0.0010		< 0.020	4	50	200
Chloride *	< 4.0	< 4.0		19	800	4000	25000
Fluoride	0.45	0.44		4.5	10	150	500
Sulphate *	18	4.9		67	1000	20000	50000
TDS	80	40		450	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.13	< 0.13		< 0.50	1	-	-
DOC	7.2	4.5		48	500	800	1000
<b>Leach Test Information</b>							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.8						
Dry Matter (%)	93						
Moisture (%)	6.7						
<b>Stage 1</b>							
Volume Eluate L2 (litres)	0.34						
Filtered Eluate VE1 (litres)	0.24						

Results are expressed on a dry weight basis, after correction for moisture content where applicable  
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

\* = UKAS accredited (liquid eluate analysis only)

\*\* = MCERTS accredited

**Analytical Report Number : 16-16371**

**Project / Site name: Fontmell Close, St Albans**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
566443	WS401	None Supplied	0.50-0.60	Brown clay and loam with gravel.

**Analytical Report Number : 16-16371**

**Project / Site name: Fontmell Close, St Albans**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance	L046-PL	W	NONE
BTEX (Sum of BTEX compounds) in soil	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Chloride in WAC leachate (BS EN 12457-3 Prep)	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
DOC in WAC leachate (BS EN 12457-3 Prep)	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR analyser.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L037-PL	W	NONE
Fluoride in WAC leachate (BS EN 12457-3 Prep)	Determination of fluoride in leachate by 1:1 ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L033-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L047-PL	D	MCERTS
Metals in WAC leachate (BS EN 12457-3 Prep)	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L039-PL	W	ISO 17025
Mineral Oil in Soil	Determination of dichloromethane/hexane extractable hydrocarbons in soil by GC-MS.	In-house method based on USEPA 8270	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
PCB's by GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Phenol Index in WAC leachate (BS EN 12457-3 Prep)	Determination of monohydric phenols in leachate by continuous flow analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Sociated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in WAC leachate (BS EN 12457-3 Prep)	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L039-PL	W	ISO 17025
TDS in WAC leachate (BS EN 12457-3 Prep)	Determination of total dissolved solids in leachate by electrometric measurement.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L031-PL	W	NONE
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS



**Analytical Report Number : 16-16371**

**Project / Site name: Fontmell Close, St Albans**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



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## **Analytical Report Number : 16-16373**

Replaces Analytical Report Number : 16-16373, issue no. 1

<b>Project / Site name:</b>	Fontmell Close, St Albans	<b>Samples received on:</b>	22/04/2016
<b>Your job number:</b>	31893	<b>Samples instructed on:</b>	27/04/2016
<b>Your order number:</b>		<b>Analysis completed by:</b>	11/05/2016
<b>Report Issue Number:</b>	2	<b>Report issued on:</b>	11/05/2016
<b>Samples Analysed:</b>	1 soil sample		

**Signed:**

Rexona Rahman  
 Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:**

Emma Winter  
 Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Environmental Science

Analytical Report Number: 16-16373

Project / Site name: Fontmell Close, St Albans

<b>Lab Sample Number</b>				566453				
<b>Sample Reference</b>				CH401				
<b>Sample Number</b>				None Supplied				
<b>Depth (m)</b>				0.30-0.40				
<b>Date Sampled</b>				22/04/2016				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	7.9				
Total mass of sample received	kg	0.001	NONE	1.8				

<b>Asbestos in Soil</b>	<b>Type</b>	N/A	ISO 17025	Not-detected				
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**General Inorganics**

pH	pH Units	N/A	MCERTS	9.9				
Total Cyanide	mg/kg	1	MCERTS	< 1				
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.68				
Sulphide	mg/kg	1	MCERTS	73				
Organic Matter	%	0.1	MCERTS	3.0				

**Total Phenols**

<b>Total Phenols (monohydric)</b>	mg/kg	1	MCERTS	< 1.0				
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**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	11				
Acenaphthylene	mg/kg	0.1	MCERTS	5.2				
Acenaphthene	mg/kg	0.1	MCERTS	16				
Fluorene	mg/kg	0.1	MCERTS	23				
Phenanthrene	mg/kg	0.1	MCERTS	140				
Anthracene	mg/kg	0.1	MCERTS	35				
Fluoranthene	mg/kg	0.1	MCERTS	190				
Pyrene	mg/kg	0.1	MCERTS	150				
Benzo(a)anthracene	mg/kg	0.1	MCERTS	62				
Chrysene	mg/kg	0.05	MCERTS	64				
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	63				
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	34				
Benzo(a)pyrene	mg/kg	0.1	MCERTS	60				
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	29				
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	5.6				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	33				

**Total PAH**

<b>Speciated Total EPA-16 PAHs</b>	mg/kg	1.6	MCERTS	924				
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16				
Boron (water soluble)	mg/kg	0.2	MCERTS	2.7				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	27				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	34				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	92				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	18				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	80				



4041



Environmental Science

**Analytical Report Number : 16-16373**

**Project / Site name: Fontmell Close, St Albans**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
566453	CH401	None Supplied	0.30-0.40	Brown loam and clay with gravel and rubble.



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Environmental Science

Analytical Report Number : 16-16373

Project / Site name: Fontmell Close, St Albans

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



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## **Analytical Report Number : 16-16392**

Replaces Analytical Report Number : 16-16392, issue no. 1

<b>Project / Site name:</b>	Fontmell Close, St Albans	<b>Samples received on:</b>	26/04/2016
<b>Your job number:</b>	31893	<b>Samples instructed on:</b>	27/04/2016
<b>Your order number:</b>		<b>Analysis completed by:</b>	11/05/2016
<b>Report Issue Number:</b>	2	<b>Report issued on:</b>	11/05/2016
<b>Samples Analysed:</b>	2 soil samples		

**Signed:**

Rexona Rahman  
 Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:**

Emma Winter  
 Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Environmental Science

Analytical Report Number: 16-16392

Project / Site name: Fontmell Close, St Albans

<b>Lab Sample Number</b>				566527	566528			
<b>Sample Reference</b>				WS402	WS402			
<b>Sample Number</b>				None Supplied	None Supplied			
<b>Depth (m)</b>				0.20-0.40	0.60-0.80			
<b>Date Sampled</b>				25/04/2016	25/04/2016			
<b>Time Taken</b>				None Supplied	None Supplied			
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	9.5	18			
Total mass of sample received	kg	0.001	NONE	2.0	1.6			

<b>Asbestos in Soil</b>	<b>Type</b>	N/A	ISO 17025	Not-detected	Not-detected			
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**General Inorganics**

pH	pH Units	N/A	MCERTS	7.9	7.6			
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1			
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.082	0.32			
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0			
Organic Matter	%	0.1	MCERTS	2.8	-			

**Total Phenols**

<b>Total Phenols (monohydric)</b>	mg/kg	1	MCERTS	< 1.0	< 1.0			
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**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	0.39	< 0.05			
Acenaphthylene	mg/kg	0.1	MCERTS	0.44	< 0.10			
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Phenanthrene	mg/kg	0.1	MCERTS	0.89	0.75			
Anthracene	mg/kg	0.1	MCERTS	0.24	0.17			
Fluoranthene	mg/kg	0.1	MCERTS	4.9	1.7			
Pyrene	mg/kg	0.1	MCERTS	4.6	1.5			
Benzo(a)anthracene	mg/kg	0.1	MCERTS	3.2	1.1			
Chrysene	mg/kg	0.05	MCERTS	3.6	1.1			
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	5.6	1.4			
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	2.5	0.68			
Benzo(a)pyrene	mg/kg	0.1	MCERTS	4.6	1.2			
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	2.6	0.52			
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.56	< 0.10			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.3	0.85			

**Total PAH**

<b>Speciated Total EPA-16 PAHs</b>	mg/kg	1.6	MCERTS	37.5	10.9			
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	15	58			
Boron (water soluble)	mg/kg	0.2	MCERTS	1.8	8.8			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	31			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	62	500			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	210	930			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.8	1.1			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	85			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	290			



**Analytical Report Number : 16-16392**

**Project / Site name: Fontmell Close, St Albans**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
566527	WS402	None Supplied	0.20-0.40	Brown clay and loam with gravel.
566528	WS402	None Supplied	0.60-0.80	Brown loam and sand with gravel.



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Environmental Science

Analytical Report Number : 16-16392

Project / Site name: Fontmell Close, St Albans

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



**Emma Leivers**

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**Analytical Report Number : 16-17821**

<b>Project / Site name:</b>	Fontmell Close, St Albans	<b>Samples received on:</b>	20/04/2016
<b>Your job number:</b>	31893	<b>Samples instructed on:</b>	16/05/2016
<b>Your order number:</b>	31893	<b>Analysis completed by:</b>	20/05/2016
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	20/05/2016
<b>Samples Analysed:</b>	1 soil sample		

**Signed:** 

Dr Irma Doyle  
Senior Account Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:** 

Emma Winter  
Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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**Analytical Report Number: 16-17821**

**Project / Site name: Fontmell Close, St Albans**

**Your Order No: 31893**

<b>Lab Sample Number</b>				574789				
<b>Sample Reference</b>				WS403A				
<b>Sample Number</b>				None Supplied				
<b>Depth (m)</b>				0.60-0.80				
<b>Date Sampled</b>				19/04/2016				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>				<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>		
Asbestos in Soil				Type	N/A	ISO 17025	Not-detected	



**Analytical Report Number : 16-17821**

**Project / Site name: Fontmell Close, St Albans**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**

**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**

**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**

# APPENDIX C

## Composite Plot of DCP N100 v Depth

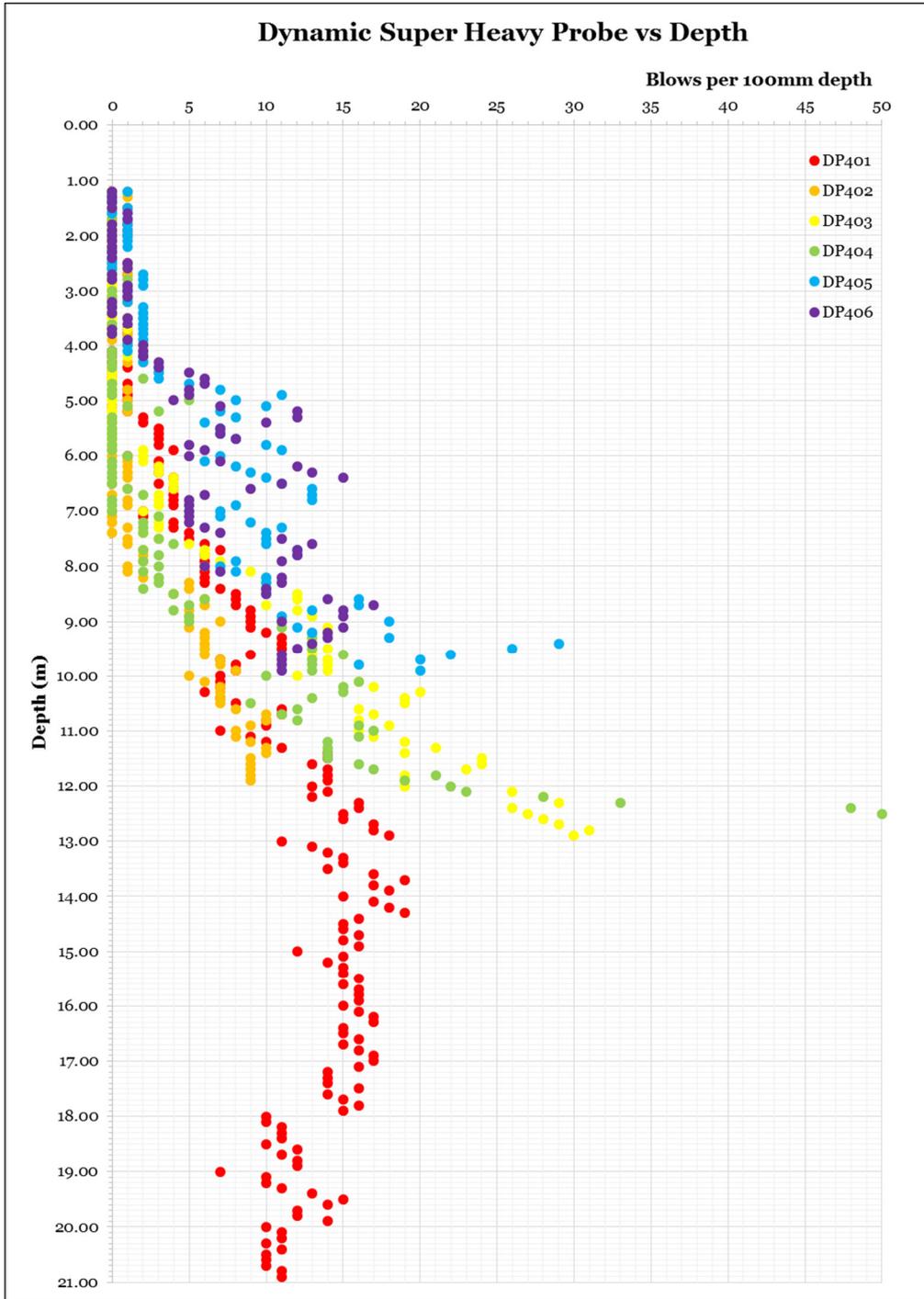


Figure C.1. Plot of DCP N100 v Depth bgl. Note the extremely poor characteristics from the start of probing (at 1.2m depth bgl) to 7m depth

## APPENDIX D

### Composite Plot of SPT N v Depth

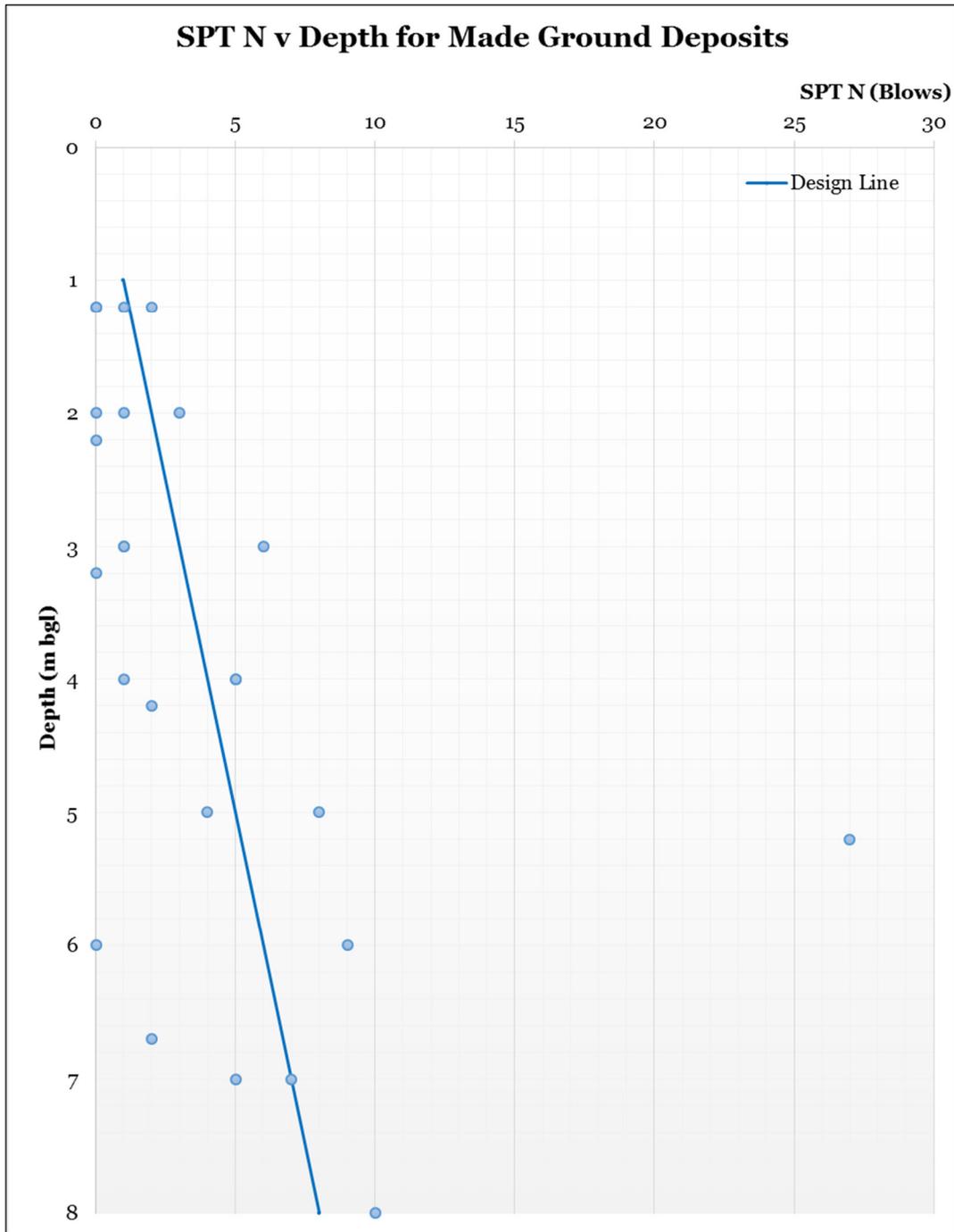


Figure D.1: Composite plot of SPT N v Depth for N values recorded in the Made Ground deposits within the Dynamic Sampling Borehole and Window Sample Holes. This shows broad equivalence with the  $N_{100}$  plot (Figure C.1) indicating very poor strength characteristics at depths of up to 7m below ground level.

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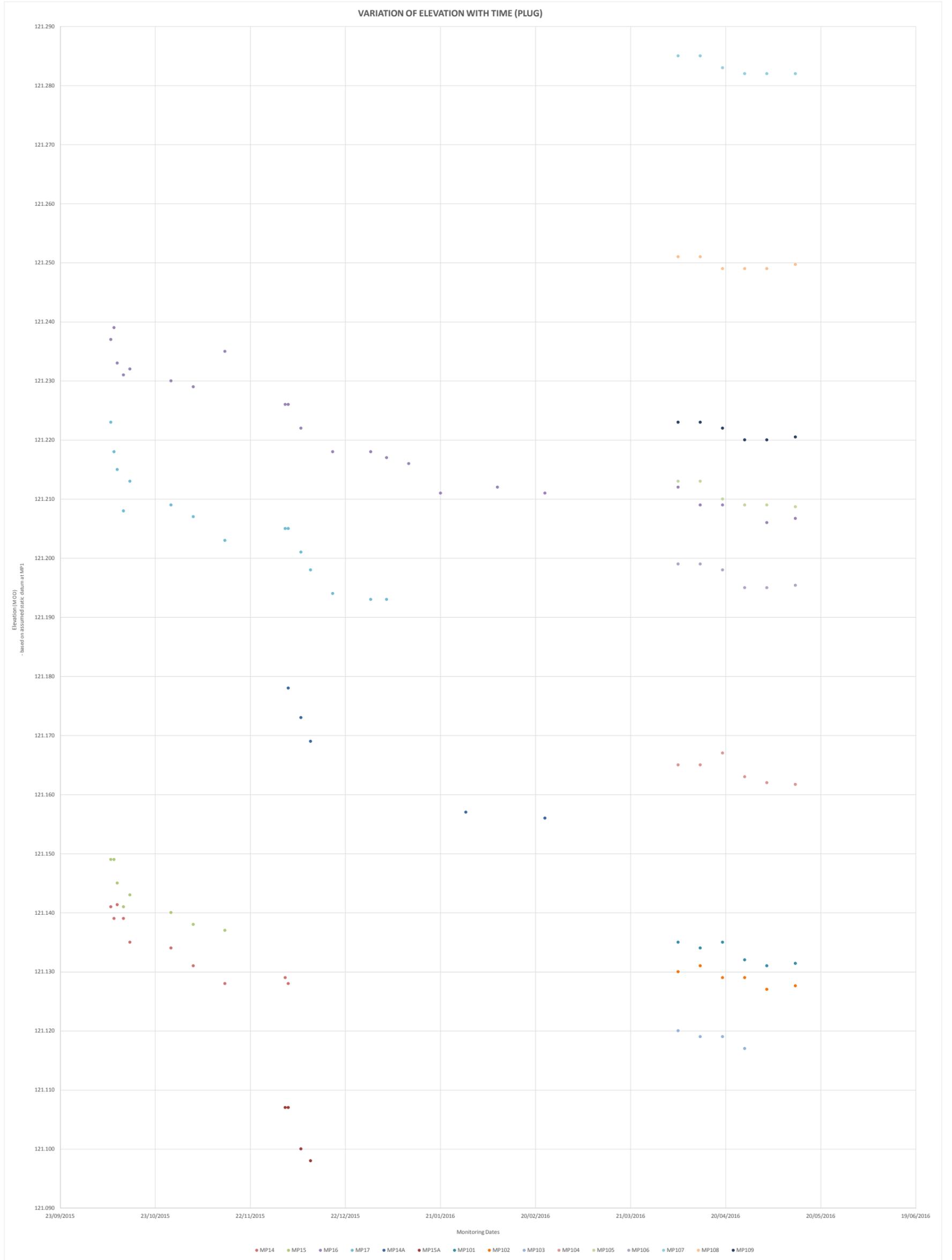
## **APPENDIX E**

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### **Level Monitoring Data and Graphs**

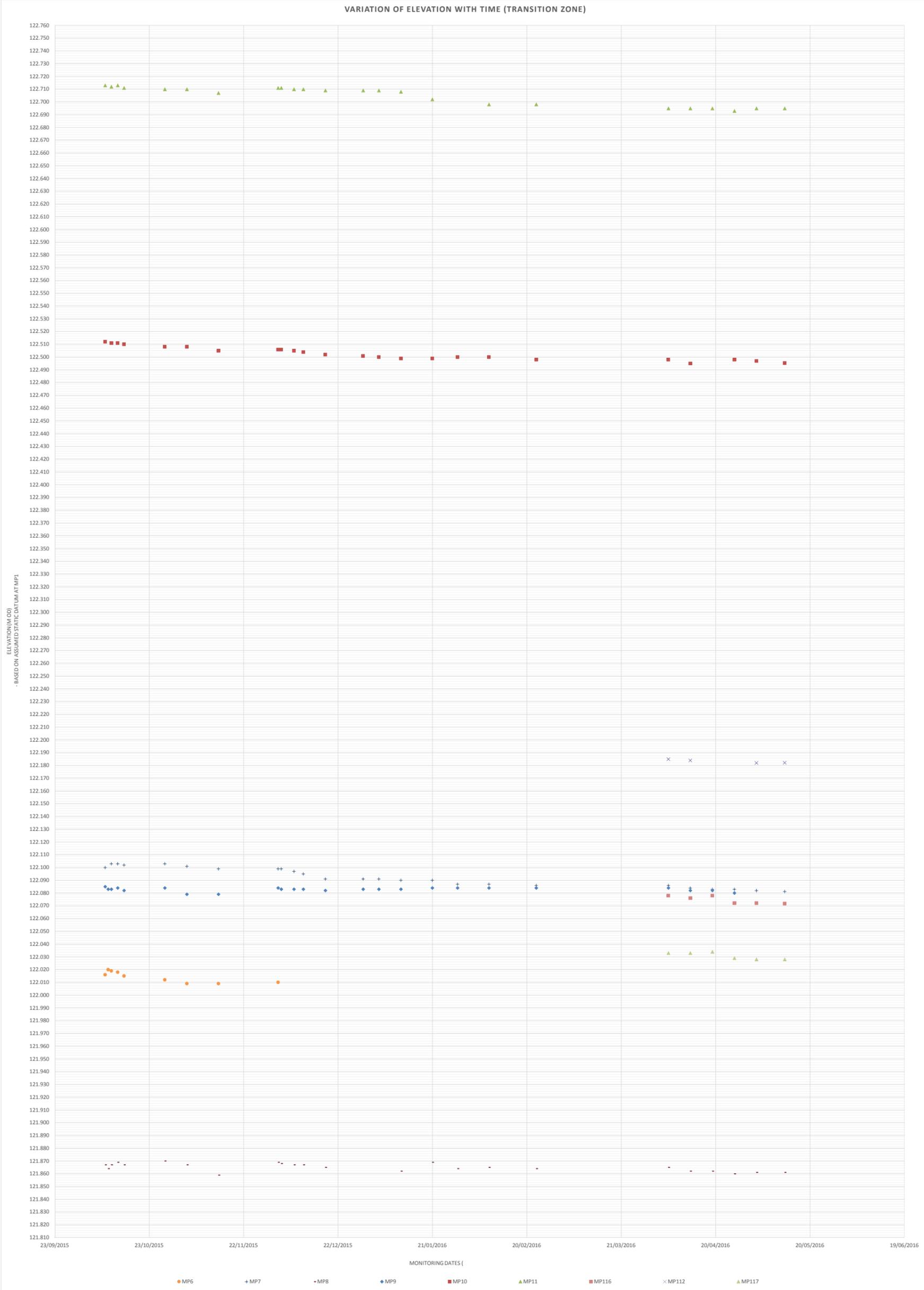


Pin ID	MP 14, 15, 16 and 17 on concrete in collapse												MP1 near Bridle outside all visible cracks					Gryphon Site Visits					Tower Site Visits				
	09/10/2015	10/10/2015	11/10/2015	13/10/2015	15/10/2015	28/10/2015	04/11/2015	14/11/2015	03/12/2015	04/12/2015	08/12/2015	11/12/2015	18/12/2015	30/12/2015	04/01/2016	11/01/2016	21/01/2016	29/01/2016	08/02/2016	23/02/2016	05/04/2016	12/04/2016	19/04/2016	26/04/2016	03/05/2016	12/05/2016	
MP14	121.141	121.139	121.141	121.139	121.135	121.134	121.131	121.128	121.129	121.128																	
MP15	121.149	121.149	121.145	121.141	121.143	121.140	121.138	121.137																			
MP16	121.237	121.239	121.233	121.231	121.232	121.23	121.229	121.235	121.226	121.226	121.222																
MP17	121.223	121.218	121.215	121.208	121.213	121.209	121.207	121.203	121.205	121.205	121.201	121.198	121.194	121.193	121.193												
MP14A																											
MP15A																											
MP101																											
MP102																											
MP103																											
MP104																											
MP105																											
MP106																											
MP107																											
MP108																											
MP109																											



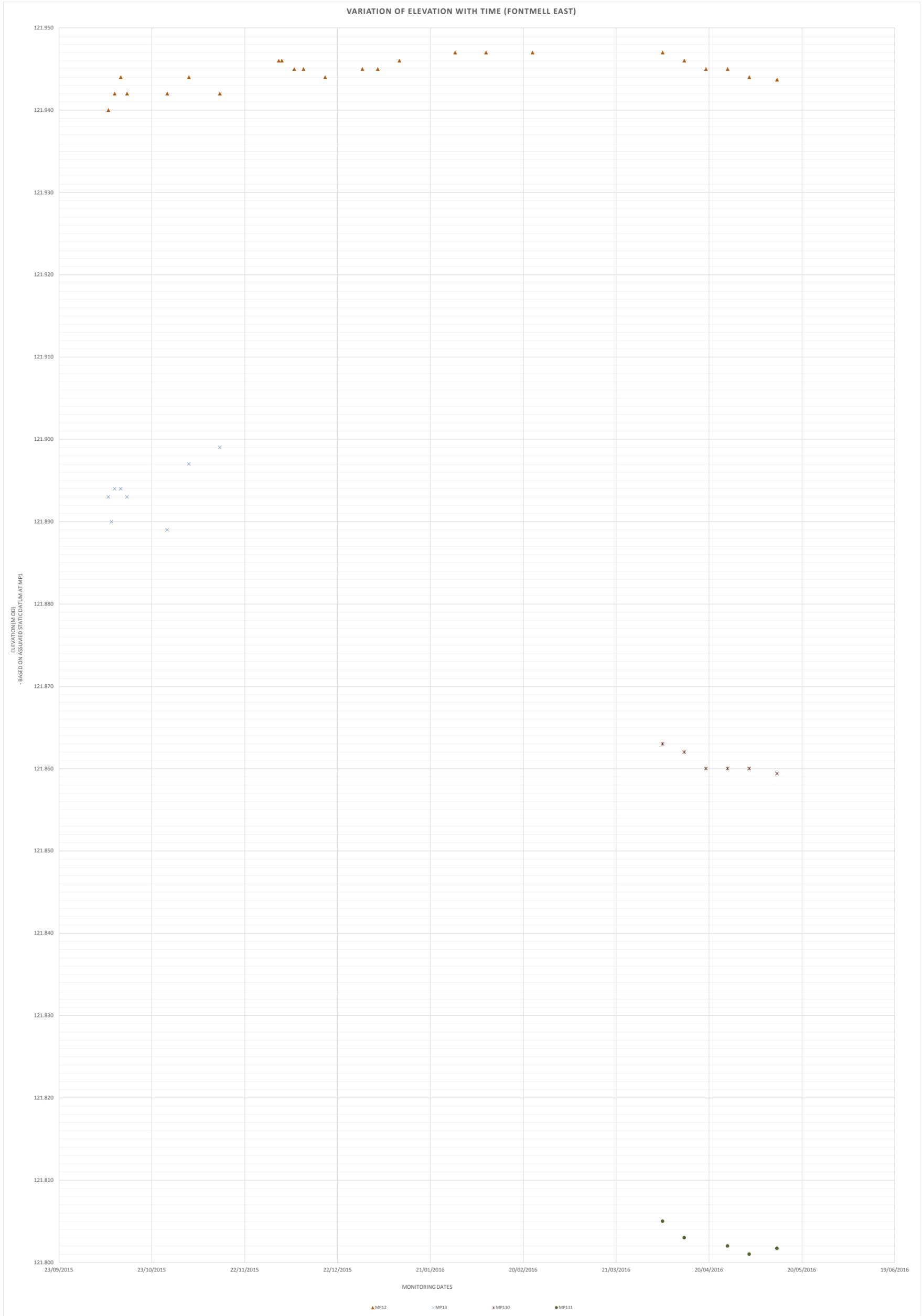
Fontmell Close Sinkhole Monitoring - Transition Zone

Pin Elevations Relative to MP1	MP 14, 15, 16 and 17 on concrete in collapse												MP1 near Bridle outside all visible cracks					Gryphon Site Visits					Tower Site Visits				
	HCC VISITS																										
Pin ID	09/10/2015	10/10/2015	11/10/2015	13/10/2015	15/10/2015	28/10/2015	04/11/2015	14/11/2015	03/12/2015	04/12/2015	08/12/2015	11/12/2015	15/12/2015	30/12/2015	04/01/2016	11/01/2016	21/01/2016	29/01/2016	08/02/2016	23/02/2016	05/04/2016	12/04/2016	19/04/2016	26/04/2016	03/05/2016	12/05/2016	
MP6	122.016	122.020	122.019	122.018	122.015	122.012	122.009	122.009	122.010	122.009	122.009	122.009	122.009	122.009	122.091	122.091	122.09	122.09	122.087	122.087	122.086	122.086	122.084	122.083	122.083	122.081	122.081
MP7	122.100		122.103	122.103	122.102	122.103	122.101	122.099	122.099	122.099	122.099	122.099	122.099	122.099			122.09	122.09	122.087	122.087	122.086	122.086	122.085	122.085	122.082	122.082	122.081
MP8	121.867	121.864	121.867	121.869	121.867	121.87	121.867	121.859	121.869	121.868	121.867	121.867	121.867	121.865			121.862	121.869	121.864	121.865	121.864	121.865	121.865	121.862	121.862	121.860	121.861
MP9	122.085	122.083	122.083	122.084	122.082	122.084	122.079	122.079	122.084	122.083	122.083	122.083	122.083	122.082	122.083	122.083	122.083	122.084	122.084	122.084	122.084	122.084	122.082	122.082	122.080		122.081
MP10	122.512		122.511	122.511	122.510	122.508	122.508	122.505	122.506	122.506	122.505	122.504	122.502	122.501	122.500	122.499	122.499	122.499	122.500	122.500	122.498	122.498	122.495	122.495	122.493	122.493	122.495
MP11	122.713		122.712	122.713	122.711	122.71	122.71	122.707	122.711	122.711	122.71	122.71	122.71	122.709	122.709	122.708	122.702		122.698	122.698	122.698	122.695	122.695	122.695	122.693	122.693	122.695
MP12																						122.185	122.184			122.182	122.182
MP116																						122.078	122.076	122.078	122.072	122.072	122.072
MP117																						122.033	122.033	122.034	122.029	122.028	122.028



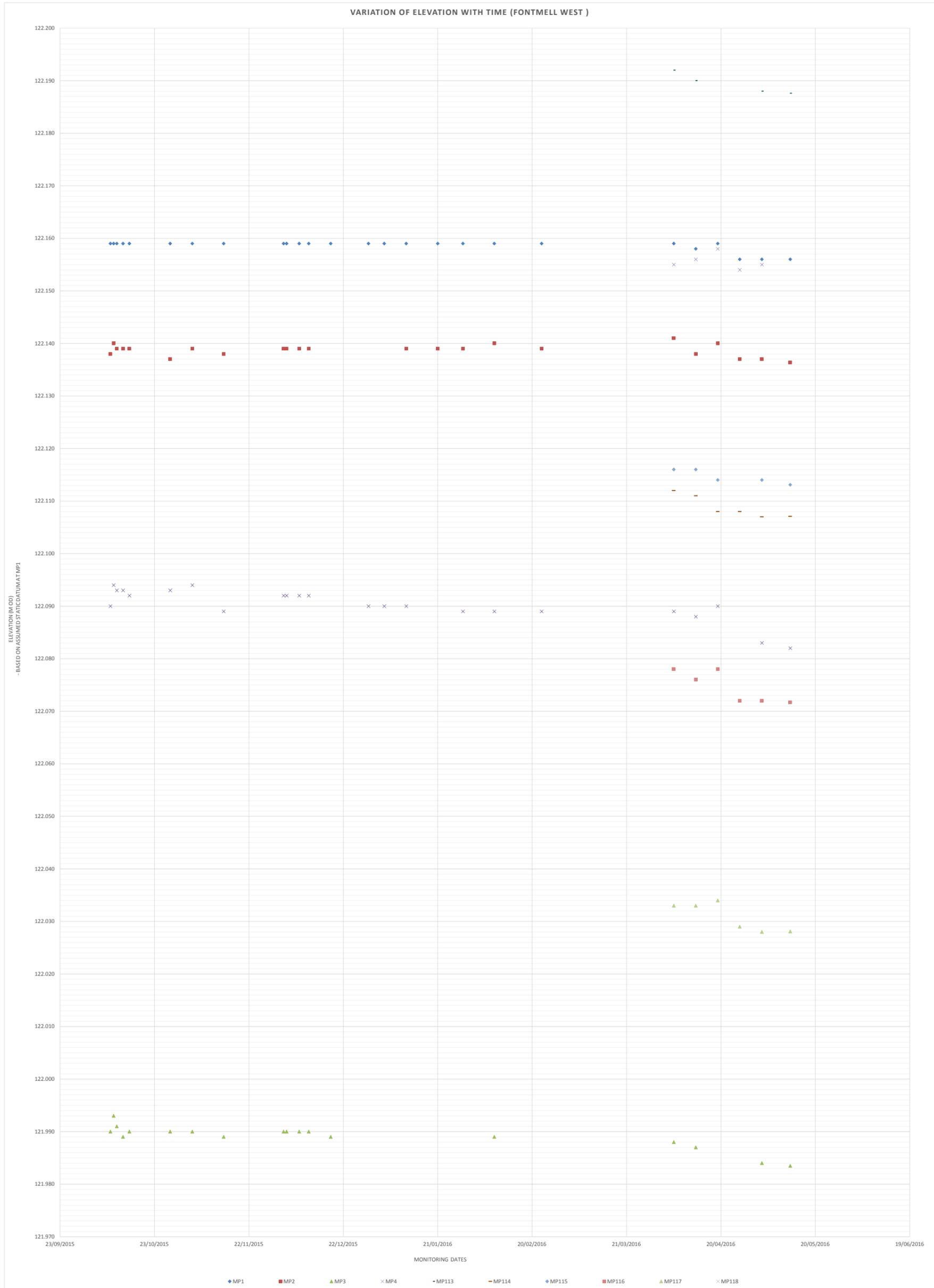
Fontmell Close Sinkhole Monitoring - Fontmell East

Pin Elevations Relative to MP1	MP 14, 15, 16 and 17 on concrete in collapse														Gryphon Site Visits					Tower Site Visits										
	HCC VISITS														1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
Pin ID	09/10/2015	10/10/2015	11/10/2015	13/10/2015	15/10/2015	28/10/2015	04/11/2015	14/11/2015	03/12/2015	04/12/2015	08/12/2015	11/12/2015	18/12/2015	30/12/2015	04/01/2016	11/01/2016	21/01/2016	29/01/2016	08/02/2016	23/02/2016	05/04/2016	12/04/2016	19/04/2016	26/04/2016	03/05/2016	12/05/2016				
MP12	121.940			121.942	121.944	121.942	121.942	121.944	121.942	121.946	121.946	121.945	121.945	121.944	121.945	121.945	121.946													
MP13	121.893	121.890	121.894	121.894	121.894	121.893	121.889	121.897	121.899																					
MP110																														
MP111																														



Fontmell Close Sinkhole Monitoring - Fontmell West

Pin Elevations Relative to MP1	MP 14, 15, 16 and 17 on concrete in collapse												MP1 near Bridle outside all visible cracks					Gryphon Site Visits					Tower Site Visits				
	09/10/2015	10/10/2015	11/10/2015	13/10/2015	15/10/2015	28/10/2015	04/11/2015	14/11/2015	03/12/2015	04/12/2015	08/12/2015	11/12/2015	18/12/2015	30/12/2015	04/01/2016	11/01/2016	21/01/2016	29/01/2016	08/02/2016	23/02/2016	05/04/2016	12/04/2016	19/04/2016	26/04/2016	03/05/2016	12/05/2016	
MP1	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1590	122.1580	122.1590	122.1560	122.1560	122.1560	
MP2	122.1380	122.1400	122.1390	122.1390	122.1390	122.1370	122.1390	122.1380	122.1390	122.1390	122.1390	122.1390	122.1390	122.1390	122.1390	122.1390	122.1390	122.1390	122.1400	122.1390	122.1410	122.1380	122.1400	122.1370	122.1370	122.1364	
MP3	121.9900	121.9930	121.9910	121.9890	121.9900	121.9900	121.9900	121.9890	121.9900	121.9900	121.9900	121.9900	121.9900	121.9890	121.9900	121.9900	121.9900	121.9890	121.9890	121.9880	121.9880	121.9870	121.9870	121.9840	121.9840	121.9835	
MP4	122.0900	122.0940	122.0930	122.0930	122.0920	122.0930	122.0940	122.0890	122.0920	122.0920	122.0920	122.0920	122.0920	121.9890	122.0900	122.0900	122.0900	122.0890	122.0890	122.0890	122.0890	122.0880	122.0900	122.0830	122.0830	122.0820	
MP113																					122.1920	122.1900	122.1080	122.1080	122.1876	122.1876	
MP114																					122.1120	122.1110	122.1140	122.1140	122.1071	122.1071	
MP115																					122.1160	122.1160	122.1140	122.1140	122.1140	122.1131	
MP116																					122.0780	122.0760	122.0780	122.0720	122.0720	122.0717	
MP117																					122.0330	122.0330	122.0340	122.0290	122.0290	122.0281	
MP118																					122.1550	122.1560	122.1580	122.1540	122.1550	122.1550	





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