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PRELIMINARY SUMMARY	
CLIENT	Philip Parry
SITE ADDRESS	Stanhope Yard, Arundel Road, Salvington, Worthing, West Sussex BN13 3UA
REPORT REFERENCE	GWPR4518
ENGINEER	Roger Foord, Ground and Water Limited

INVESTIGATION LOCATIONS AND SCOPE OF WORKS

Site works were undertaken on the 9th November 2021.

4No. Windowless Sampler Boreholes (WS1 – WS4) were drilled to depths of between 3.45 – 5.00m bgl with Standard Penetration Tests at 1.00m intervals. WS1 and WS2 were terminated at 3.40m bgl due to the stiffness of the soils. 3No. Trial Pits (TP1) was hand excavated to a depth of 0.60m bgl at the location of the proposed kargester to enable a pV infiltration test to be undertaken.

3No. combined groundwater and ground-gas monitoring standpipes were installed within WS1, WS2 and WS4. The installation and backfill information can be viewed below.

Combined Ground-gas and Groundwater Monitoring Well Construction

Trial Hole	Type of Installation	Depth of Installation (m bgl)	Thickness of slotted piping with gravel filter pack (m)	Thickness of plain piping with bentonite seal (m bgl)	Response Zone (m bgl)	Piping internal diameter (mm)
WS1	Standpipe	4.30	1.00	3.30	1.00 – 4.30	50
WS2	Standpipe	3.00	1.00	2.00	1.00 – 3.00	50
WS4	Standpipe	5.00	1.00	4.00	1.00 – 5.00	50

A selection of soil samples was taken for laboratory geotechnical and chemical testing. Upon completion of the site works all trial holes were backfilled and made good/reinstated in relation to the surrounding area. See trial hole location plan within Figure 1.

GROUND CONDITIONS ENCOUNTERED

The trial hole logs can be seen within Appendix B.

Summary of Strata Encountered (WS1 – WS4, TP1)

Strata	Depth Encountered (m bgl)	Base Depth (m bgl)	Thickness (m)
TOPSOIL (WS1 only): Dark brown gravelly CLAY. The gravel was fine to coarse, sub-angular flint and chalk.	GL	0.40	0.40
MADE GROUND (WS2 – WS4, TP1 only): Dark brown gravelly CLAY. The gravel was fine to coarse sub-angular of flint, brick, concrete and chalk. See trial holes logs in appendix A for proportions of constituents.	GL	0.50 – 0.80	0.50 – 0.80
HEAD DEPOSITS: Variable deposits ranging from a brown and orange gravelly CLAY to clayey GRAVEL. The gravel was fine to coarse, sub-angular flint and chalk.	0.40 – 0.80	2.60 – 2.70	1.80 – 2.30
SPETISBURY CHALK MEMBER: Off-white, cream clayey GRAVEL (putty chalk). The gravel was fine to coarse chalk and rare flint. (CIRIA 574: Grade Dm)	2.60 – 2.70	>3.45 - >5.00	>0.85 - >3.40

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IN-SITU STRENGTH TESTING (SPTs)	The following is based upon the results of the SPTs within the Windowless Sampler Boreholes: **HEAD DEPOSITS (granular):** Medium Dense (SPT "N" Blow Count of 21). **HEAD DEPOSITS (cohesive):** Medium to high Undrained Shear Strength (SPT "N" Blow Count of 12 - 24; 60 - 120kPa); low/medium undrained shear strength to 1.45m bgl in WS3 (SPT "N" Blow Count of 8; 40kPa). **SPETISBURY CHALK MEMBER (chalk):** (SPT "N" Blow Count 12 – >56).
GROUNDWATER	Groundwater was not encountered. No groundwater was noted in the remaining trial holes. It should be noted that a groundwater strike may have been obstructed by the drilling process. The standpipes installed in WS1, WS2 and WS4 were all noted to be dry on the first round of winter groundwater monitoring on the 11th November 2021.
ROOTS	The depth of roots encountered in the trial holes can be seen tabulated below. **Summary of Root Penetration** **Trial Hole** / **Depth of Fresh Root Penetration (m bgl)** / **Depth of Dark Brown/Black Friable Rootlets (m bgl)** WS1 – 0.80m – - WS2 – - – - WS3 – - – - WS4 – - – - WP1 – - – - It should be noted that roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.
ANTICIPATED VOLUME CHANGE POTENTIAL	**HEAD DEPOSITS (cohesive):** Likely to have **medium to high** volume change potential in accordance with NHBC Standards Chapter 4.2 and BRE240. **HEAD DEPOSITS (granular):** Likely to have **no to low** volume change potential in accordance with NHBC Standards Chapter 4.2 and BRE240. Subject to confirmation of results of geotechnical classification testing.
FOUNDATION RECOMMENDATIONS	At the time of reporting, November 2021, the proposed development comprises the demolition of the existing buildings and the construction of a terrace of 4No. two storey residential properties with associated private garden areas and access road across the majority of the site. proposed development also included the erection of a timber clad barn and parking with separate access and division for a non-mechanised wood yard associated with woodland management in the southern portion. The following conclusions have been noted following the site works: • Topsoil and Made Ground was noted to a depth of between 0.40m – 0.80m bgl. • Roots were noted to a depth of 0.80m bgl in WS1. No roots were noted in the remaining trial holes. • Groundwater was not encountered during the intrusive investigation. The standpipes installed in WS1, WS2 and WS4 were all noted to be dry on the first round of winter groundwater monitoring on the 11th November 2021. • The geology generally comprised variable Head Deposits comprising medium to high undrained shear strength and medium dense granular soils. The underlying Spetisbury Chalk

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PRELIMINARY SUMMARY

Member strength was encountered in in the north-west corner of the site to at least 2.40m bgl in TP1 and 3.90m bgl in WS4.

Foundations must not be placed within cohesive root penetrated and/or desiccated soils and the influence of the trees surrounding the site must be taken into account, in case of soils with volume change potential. The base of foundation excavations must extend at least 300mm into non-root penetrated soils or soils of no volume change potential.

Assuming high volume change potential soils, foundations should be taken through any Topsoil or Made Ground, extend 300mm below the proven depth of root penetration and found on moisture stable, competent soils of the Head Deposits. Across the majority of the site, a minimum foundation depth of 1.00 – 1.10m bgl is applicable, subject to reference to NHBC tables; however, close to the north-east corner of the site, softer soils were encountered in WS3 and may result in locally deepened foundation depths to ~1.50m bgl.

Foundations should be taken through the Topsoil or Made Ground and into the underlying soils of the Head Deposits. Assuming a high volume change potential, foundations constructed on the Head Deposits at a depth of 1.00 – 1.10m bgl can be designed based on a presumed allowable bearing capacity of 125kN/m^2 over the majority of the site. This is based on trial hole records, the results of in-situ testing, inspection of samples recovered, and based on a 5m long by 1m wide foundation and a maximum settlement of 25mm. Settlements on loading are likely to be moderate to high.

Differential settlement between foundations cast into the cohesive and granular soils of the Head Deposits is anticipated and foundations must be reinforced to allow for such potential differential movement. Note should be made that differential settlement may also occur between strip and isolated pad foundations.

INFILTRATION TESTING

1No. Percolation Value (pV) was undertaken in TP1 at a depth 0.6m bgl in the Head Deposits. The results can be seen tabulated below.

pV Test Results						
Trial Pit/Depth of trial pit (m)	Test	Initial Water Level (m bgl)	Final Water Level (m bgl)	Time taken (mins)	Percolation Value (pV) (sec/mm)	Equivalent Infiltration Rate (m/s)
TP1/0.60m	1	0.30	0.60	9	2.33	2.14×10^{-4}
	2	0.30	0.60	15	2.97	1.69×10^{-4}
	3	0.30	0.60	20	4.33	1.15×10^{-4}

Based upon the results of the infiltration tests, it was considered likely that the soils of the Head Deposits would provide a suitable medium for soakaway installation. Consultation with the Environment Agency must be sought regarding any use that may have an impact on groundwater resources.

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PRELIMINARY SUMMARY

The principles of sustainable urban drainage system (SUDS) should be applied to reduce the risk of flooding from surface water ponding and collection associated with the construction of the foundations.

Any soakaways should be placed at sufficient distance away from buildings, in order to avoid undermining of foundations. The relevant guidance should be followed, especially for chalk.

Figure 1 **Trial Hole Location Plan**

Appendix A **Conditions and Limitations**
Appendix B **Trial Hole Logs**

This preliminary information may be subject to amendment in the final report and no liability can be accepted for any actions based on this preliminary information.

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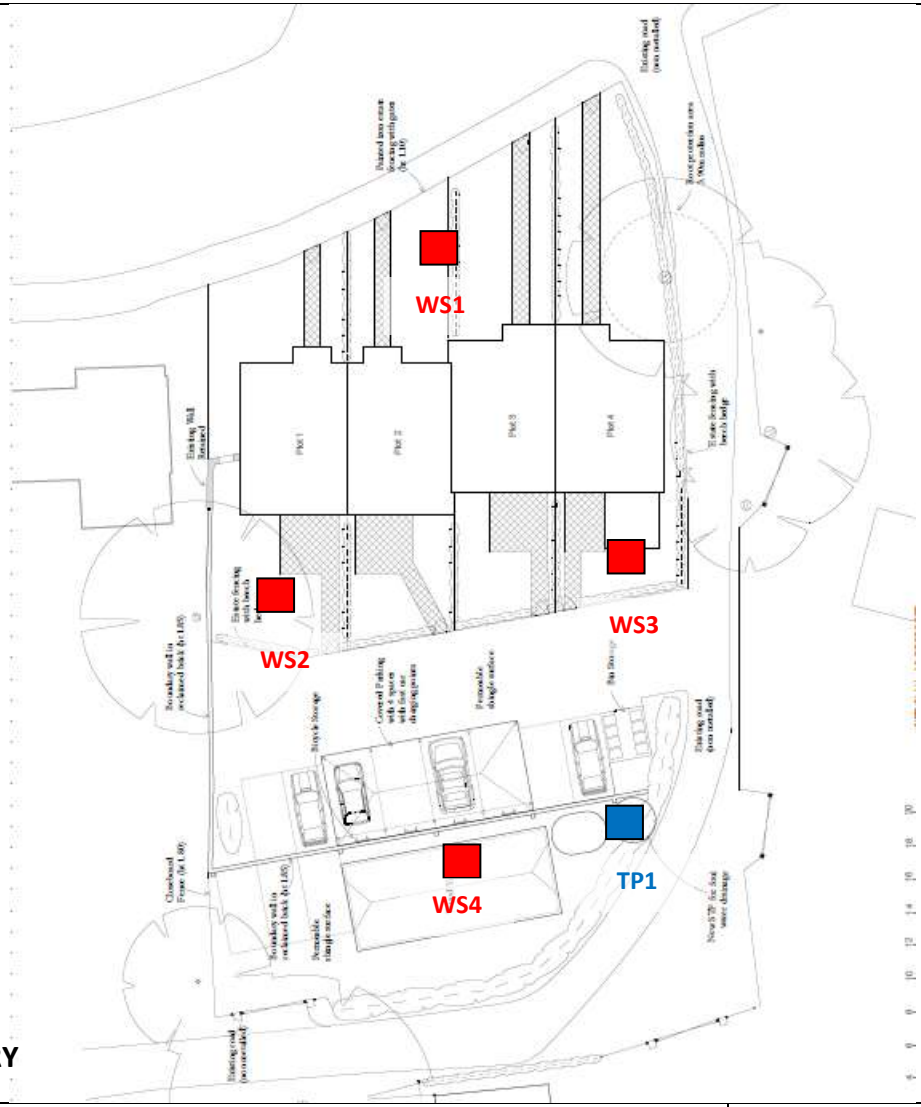
FIGURES



Project: Stanhope Yard, Arundel Road, Salvington, Worthing, West Sussex BN13 3UA	**Figure 1**
Client: Philip Parry	**Date:** November 2021
Proposed Trial Hole Location Plan	**Ref:** GWPR4518

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APPENDIX A: Conditions and Limitations

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The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to Stanhope Yard, Arundel Road, Salvington, Worthing, West Sussex BN13 3UA.

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Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets, remain with Ground and Water Limited. Licence is for the sole use of the client and may not be assigned, transferred or given to a third party.

Only our client may rely on this report and should this report or any information contained in it be provided to any third party we accept no responsibility to the third party for the contents of this report save to the extent expressly outlined by us in writing in a reliance letter addressed from us to the third party.

Recipients are not permitted to publish this report outside of their organisation without our express written consent.

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APPENDIX B: Trial Hole Logs

Percussion Drilling Log

Project Name: Stanhope Yard, Arundel Road, Salvington	Client: Philip Parry	Date: 08/11/2021
Location: Worthing, West Sussex BN13 3UA	Contractor: MCD	
Project No. : GWPR4518	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS1	WS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D		0.40			TOPSOIL: Dark brown gravelly CLAY. The gravel was fine to coarse sub-angular of flint and chalk.
		0.50	D		0.60			Dark brown, white gravelly CLAY. The gravel was fine to coarse sub-angular of flint and chalk. (HEAD DEPOSITS).
		0.80	D					Mid brown, orange, gravelly CLAY becoming very gravelly at 0.80m bgl. The gravel was fine to coarse sub-angular of flint and chalk. (HEAD DEPOSITS).
		1.00	D					
		1.00	SPT	N=24 (8,9/8,6,5,5)				
		1.50	D					
		2.00	D					
		2.00	SPT	N=19 (5,5/5,5,4,5)				
		2.50	D		2.40			Mid brown, orange, clayey GRAVEL. The gravel was fine to coarse sub-angular of flint and chalk. (HEAD DEPOSITS).
		3.00	D		2.70			Off white, cream, clayey GRAVEL (Putty Chalk). The gravel was fine to coarse of chalk and rare flint. Structureless chalk grade Dm. (SPETISBURY CHALK MEMBER).
		3.00	SPT	N=12 (3,2/3,3,3,3)				
		3.50	D					
		4.00	D					
		4.00	SPT	N=56 (3,2/56 for 251mm)				
					4.45			End of Borehole at 4.450m

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

No Groundwater recorded.
Roots recorded to 0.80m bgl.

Percussion Drilling Log

Project Name: Stanhope Yard, Arundel Road, Salvington	Client: Philip Parry	Date: 08/11/2021
Location: Worthing, West Sussex BN13 3UA	Contractor: MCD	
Project No. : GWPR4518	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS2	WS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					Dark brown gravelly CLAY. The gravel was fine to coarse sub-angular of flint (60%), brick(15%), concrete (15%) and chalk (10%) (MADE GROUND).
		0.50	D					
		0.80	D		0.80			Orange, grey, brown, sandy GRAVEL. The sand was fine to coarse. and the gravel iwas fine to coarse sub-angular of flint and chalk. (HEAD DEPOSITS).
		1.00	D					
		1.00	SPT	N=21 (5,6/6,4,5,6)				
		1.50	D		1.30			Mid brown, orange, gravelly CLAY. The gravel was fine to coarse sub-angular of flint and chalk. (HEAD DEPOSITS).
		2.00	D					
		2.00	SPT	N=24 (7,6/6,7,5,6)				
		2.50	D		2.60			Off white, cream, clayey GRAVEL (Putty Chalk). The gravel was fine to coarse of chalk and rare flint. Structureless chalk grade Dm. (SPETISBURY CHALK MEMBER).
		3.00	D					
		3.00	SPT	N=50 (8,9/11,11,13,15)				
					3.45			End of Borehole at 3.450m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

No Groundwater recorded.
No roots recorded.

Percussion Drilling Log

Project Name: Stanhope Yard, Arundel Road, Salvington	Client: Philip Parry	Date: 08/11/2021
Location: Worthing, West Sussex BN13 3UA	Contractor: MCD	
Project No. : GWPR4518	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS3	WS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					Dark brown gravelly CLAY. The gravel was fine to coarse sub-angular of flint (60%), brick(15%), concrete (15%) and chalk (10%) (MADE GROUND).
		0.50	D		0.50			
		0.80	D					Orange, brown, gravelly CLAY. Gravel is fine to coarse sub-angular of flint and chalk. (HEAD DEPOSITS).
		1.00	D					
		1.00	SPT	N=8 (2,2/2,2,2,2)				
		1.50	D					
		2.00	D					
		2.00	SPT	N=28 (7,8/6,7,8,7)				
		2.50	D		2.60			Off white, cream, clayey GRAVEL (Putty Chalk). Gravel is fine to coarse of chalk and rare flint. Structureless chalk grade Dm. (SPETISBURY CHALK MEMBER).
		3.00	D					
		3.00	SPT	50 (13,15/50 for 180mm)				
					3.45			End of Borehole at 3.450m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

No Groundwater recorded.
No roots recorded.

Percussion Drilling Log

Project Name: Stanhope Yard, Arundel Road, Salvington	Client: Philip Parry	Date: 08/11/2021
Location: Worthing, West Sussex BN13 3UA	Contractor: MCD	
Project No. : GWPR4518	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS4	WS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					Dark brown gravelly CLAY. The gravel was fine to coarse sub-angular of flint (70%), brick(15%) and concrete (15%) (MADE GROUND).
		0.50	D		0.50			
		0.80	D					Mid brown, orange, gravelly CLAY. Gravel is fine-coarse sub-angular of flint and chalk. (HEAD DEPOSITS).
		1.00	D					
		1.00	SPT	N=12 (2,2/3,3,3,3)	1.20			
		1.50	D					Mid brown, orange, cream, white, gravelly CLAY. The gravel was fine to medium sub-angular of chalk and some flint. (HEAD DEPOSITS).
		2.00	D					
		2.00	SPT	N=23 (7,8/6,7,5,5)				
		2.50	D		2.60			
		3.00	D					Off white, cream, clayey GRAVEL (Putty Chalk). The gravel was fine to coarse of chalk and rare flint. Structureless chalk grade Dm. (SPETISBURY CHALK MEMBER).
		3.00	SPT	N=16 (5,5/5,5,1,5)				
		3.50	D					
		4.00	D					
		4.00	SPT	N=51 (8,11/51 for 255mm)				
		4.50	D					
		5.00	D		5.00			End of Borehole at 5.000m

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

No Groundwater recorded.
No roots recorded.

Trial Pit Log

Project Name: Stanhope Yard, Arundel Road, Salvington	Client: Philip Parry	Date: 08/11/2021
Location: Worthing, West Sussex BN13 3UA	Contractor: MCD	
Project No. : GWPR4518	Crew Name:	Equipment: Hand

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP1	TP			1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					Dark brown gravelly CLAY. The gravel was fine to coarse sub-angular of flint (70%), brick(15%) and concrete (15%) (MADE GROUND).
		0.50	D		0.50			Mid brown, orange, gravelly CLAY. Gravel is fine-coarse sub-angular of flint and chalk. (HEAD DEPOSITS).
					0.60			End of Borehole at 0.600m

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
0.30	0.30						

Remarks

No groundwater recorded. No roots recorded