



Ref: 1CO102284/180229/L1

Date: 29th February 2018

Chris Hendry
Arch Associates
On behalf of Renaissance Retirement Ltd
The Town House
St George's Square
Bishop Waltham
SO32 1AF

By email only to: chris.h@archassociates.co.uk

Dear Chris,

**Provision of Soil Infiltration Testing –
Greenhurst & 14 Fitzalan Road, Arundel, West Sussex, BN18 9JS.**

1. Introduction

Resource and Environmental Consultants Ltd (REC) has been commissioned by Renaissance Retirement Ltd to undertake soil infiltration testing in order to support a detailed drainage design for a proposed development on the site.

REC has previously undertaken a Phase I and II Site Investigation (Report Ref: 1CO102284P2R0 dated October 2016) within the Blastreat Ltd area only. During the initial investigation, non-standard permeability test could not be undertaken within installed monitoring wells due to high groundwater table recorded across the site.

It is noted that for the purposes of this infiltration investigation, the area of the adjacent property (Greenhurst) has been included.

A site location plan (Drawing ref. 1CO102284-001) is included in Attachment 2.

A selection of site photographs are included within Attachment 5.

2. Scope of work

In accordance with REC's fee proposal Ref. 1CO102284/180130/P2, the scope of works comprised the following:

- A single day of trial pitting (3no. locations) to the base of the Made Ground and or at reasonable depth into the natural strata;



- ❖ Soil infiltration testing broadly in accordance with BRE 365 standard;
- ❖ Provision of a 10,000 litre water tanker to be used for infiltration testing; and,
- ❖ Site attendance by an REC Engineer to undertake sample logging and soil infiltration testing.

REC attended site on 12th February 2018, and advanced 3no. trial pits, with soil infiltration testing undertaken within 2no. of these. The trial pits were excavated using an 8ton rubber tracked machine and 10,000ltr water tanker was provided for delivery of bulk water for use in soil infiltration tests. All trial pits were backfilled with arising in reverse order following completion and made safe via compaction.

Soil infiltration testing could not be undertaken within SA101-A and SA101-B due to shallow ground water being identified. Given the nature of the encountered ground conditions, only a single test was undertaken within SA102 and SA103. Details of infiltration data and test certificates are presented within Attachment 4

An exploratory hole location plan (Drawing ref. 1CO102284.002-002) is presented within Attachment 2.

3. Limitations

The limitations to this letter report are presented in Attachment I.

4. Ground Conditions

4.1. Summary of Ground Conditions

The ground investigation confirmed the published geology, and geology identified within the previous site investigation. A summary of ground conditions is presented in Table 4.1 below:

Table 4.1 **Summary of Strata**

Stratum	Min Depth to Top of Strata (m)	Max Depth to Top of Strata (m)	Max Thickness (m)
Made Ground	Ground Level	Ground Level	0.70
Raised Marine Deposits (Alluvium)	0.25 (SA102)	0.70 (SA103)	1.20 (SA101-B) <i>NP</i>

NP: Not Proven

4.1.1 Made Ground

Made Ground was encountered within all trial pits, and comprised asphalt, concrete or grass overlying heterogeneous material comprising GRAVEL, SAND and CLAY. Gravel and cobbles comprised a mixture of anthropogenic material such as brick, concrete, slate and relic white chalk. A total thickness of 1.20m was encountered within SA101-B.

No visual or olfactory evidence of potential contamination was identified within this stratum.

4.1.2 Raised Marine Deposits (Alluvium)

Alluvium was encountered within all the trial pits beneath the Made Ground to a thickness of 1.20m, and generally comprised soft to firm light brown to light greyish-brown sandy CLAY. Sand is generally fine to coarse grained.

No visual or olfactory evidence of potential contamination was identified within this stratum.

4.2 Soil Infiltration Results

The results of the soil infiltration testing, summarised within Table 4.2 below, indicated soil infiltration rates of 3.06×10^{-6} m/s for SA102 and 9.76×10^{-6} m/s for SA103, indicating moderate permeability.

Table 4.2 Summary of soil infiltration testing

Location	Depth (m bgl)	Receiving Strata	Test No.	Soil Infiltration Rate (m/s)
SA102	0.55	ALLUVIUM (Fine to coarse sandy CLAY)	1	3.06×10^{-6}
SA103	0.90		1	9.74×10^{-6}

Soil infiltration test certificates are included within Attachment 4.

5.0 Conclusions

Given the results obtained during the infiltration testing, it is considered likely that shallow soakaways could be implemented for the scheme with consideration given to the shallow groundwater conditions identified. A detailed drainage design will need to undertaken by a qualified drainage specialist.

We trust this letter and its enclosures are clear. Should you have any queries, please contact the undersigned.

Yours sincerely,

For and on behalf of REC Ltd

Michael Nworah
Geo-Environmental Consultant

Ross Lawton
Senior Consultant

Enclosed:

Attachment 1 – Limitations

Attachment 2 – Drawings

Drawing No 1CO102284.002 - 001 – Site Location Plan

Drawing No 1CO102284.002 - 002 – Trial Pit/Soil Infiltration Test Location Plan

Attachment 3 – Exploratory Hole Log

Attachment 4 – Soil Infiltration Test Certificate

Attachment 5 – Site Photographs

Attachment 1
Limitations

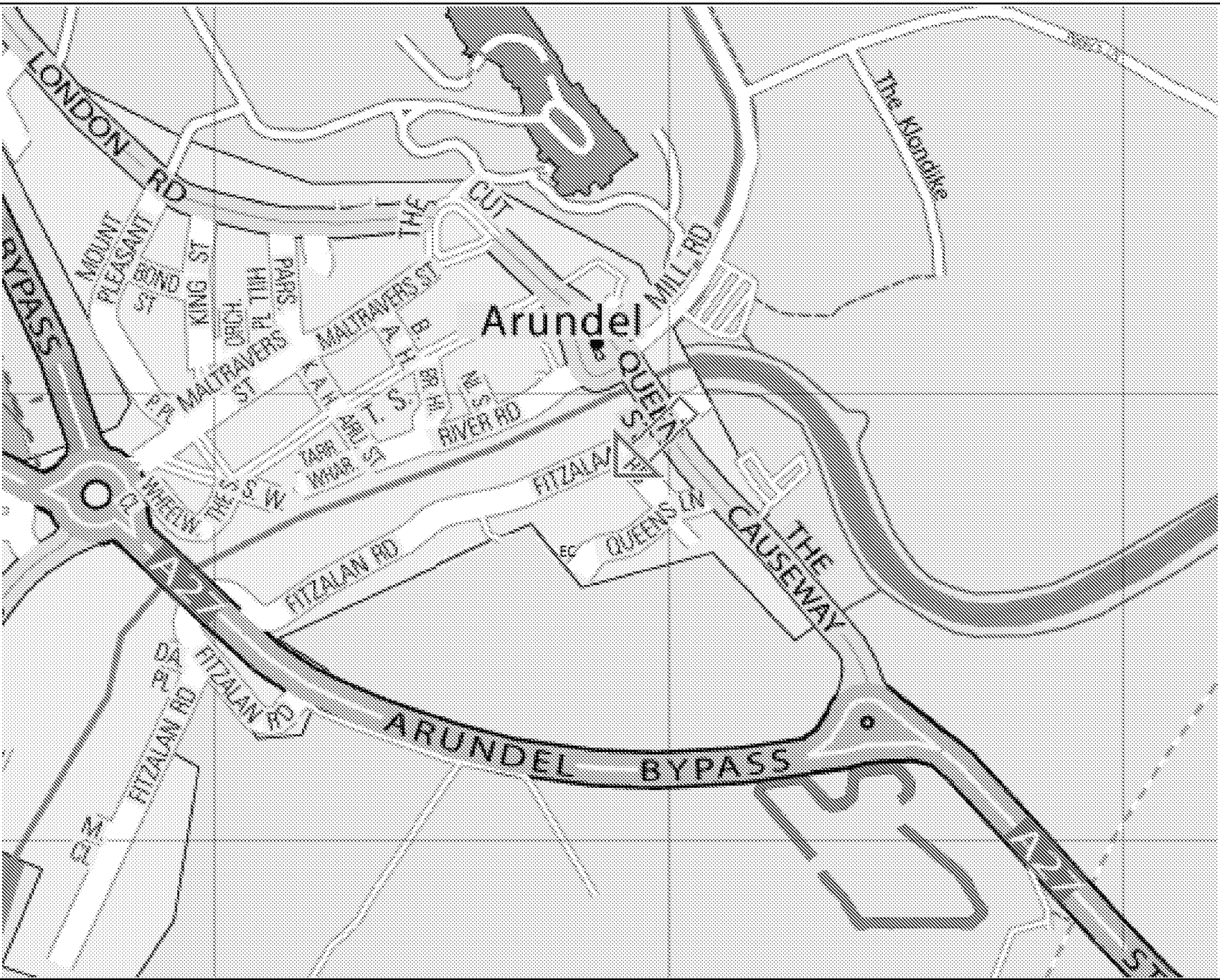
1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client as indicated.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. In addition to the above REC Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
7. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
8. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
9. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
10. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.
11. REC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.
12. Rather, this investigation has been undertaken to provide a preliminary characterisation of the existing sub-surface geotechnical characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.
- 13.** This investigation has been undertaken to reasonably characterise existing sub-surface conditions and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

Attachment 2
Drawings

KEY:



The client must not amend any drawing, design or other intellectual property produced by REC Ltd, without permission in writing from REC Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, REC Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or other intellectual property.



REC Ltd
Basepoint Winchester,
1 Winnall Valley Rd,
Winchester, SO23 0LD

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Job Title:
**GreenHurst & 14
Fitzalan Road, Arundel**

Client:
**Renaissance
Retirement Ltd**

Job No: **1CO102284**
Drawn By: **MN**
Approved by: **RL**

Notes:
Extracted from Street
Map
(Not to scale)

Drawing Title:
**1CO102284.002 -001
Site Location Plan**

KEY:



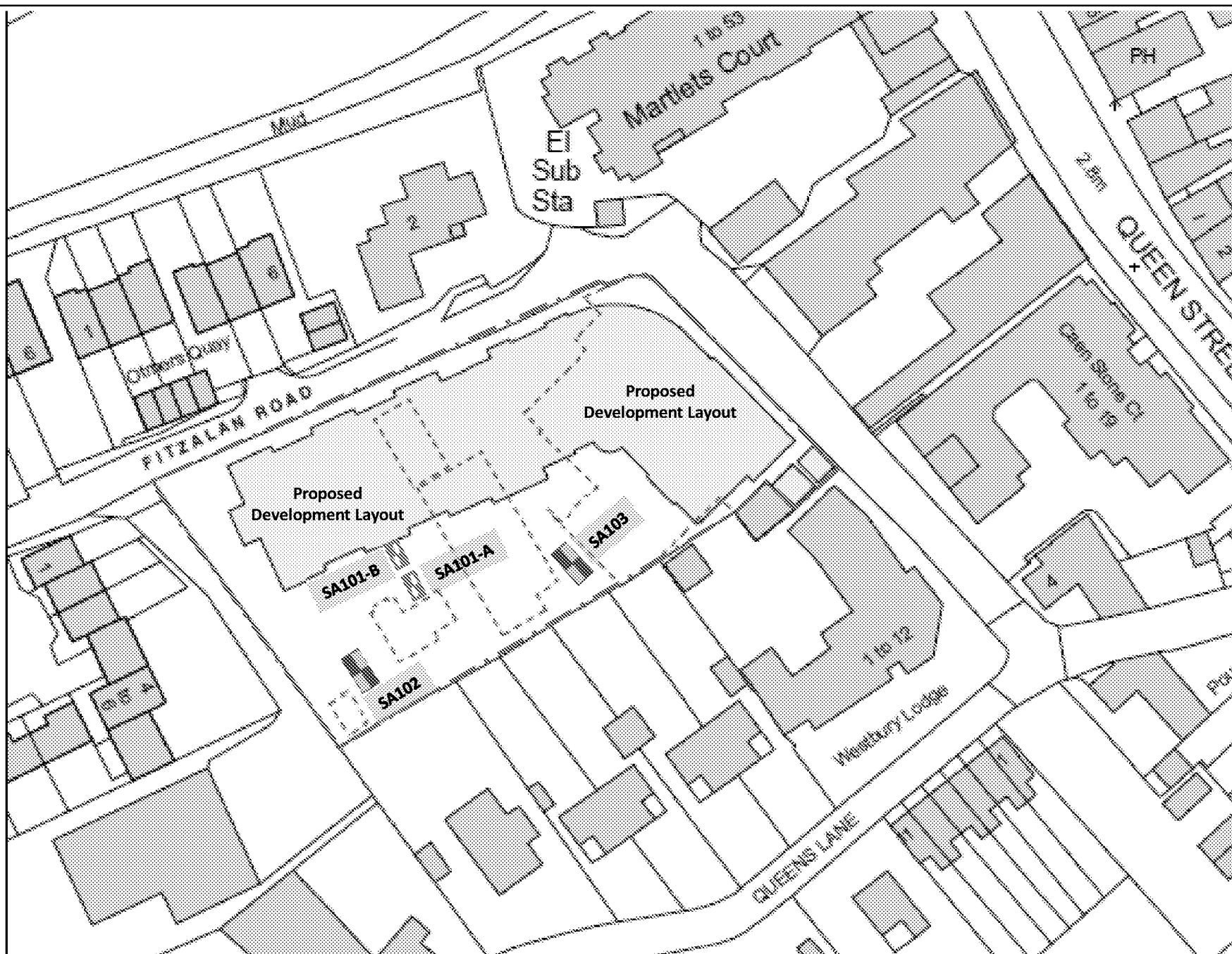
 Redline Site Boundary

 Existing Building Layout

 Trial Pits with Soakage Test

 Trial Pits

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REC



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Basepoint Winchester,
1 Winnall Valley Rd,
Winchester, SO23 0LD

t + 44 1329 847783
recLtd.co.uk

Job Title:

**Greenhurst & 14
Fitzalan Road, Arundel**

Client:

**Renaissance
Retirement Ltd**

Job No: **1CO102284**

Drawn By: **MN**

Approved by: **CT**

Notes:

Map extracted from
'Location and Block
Plan' Ref: 1650 50
(Not to scale)

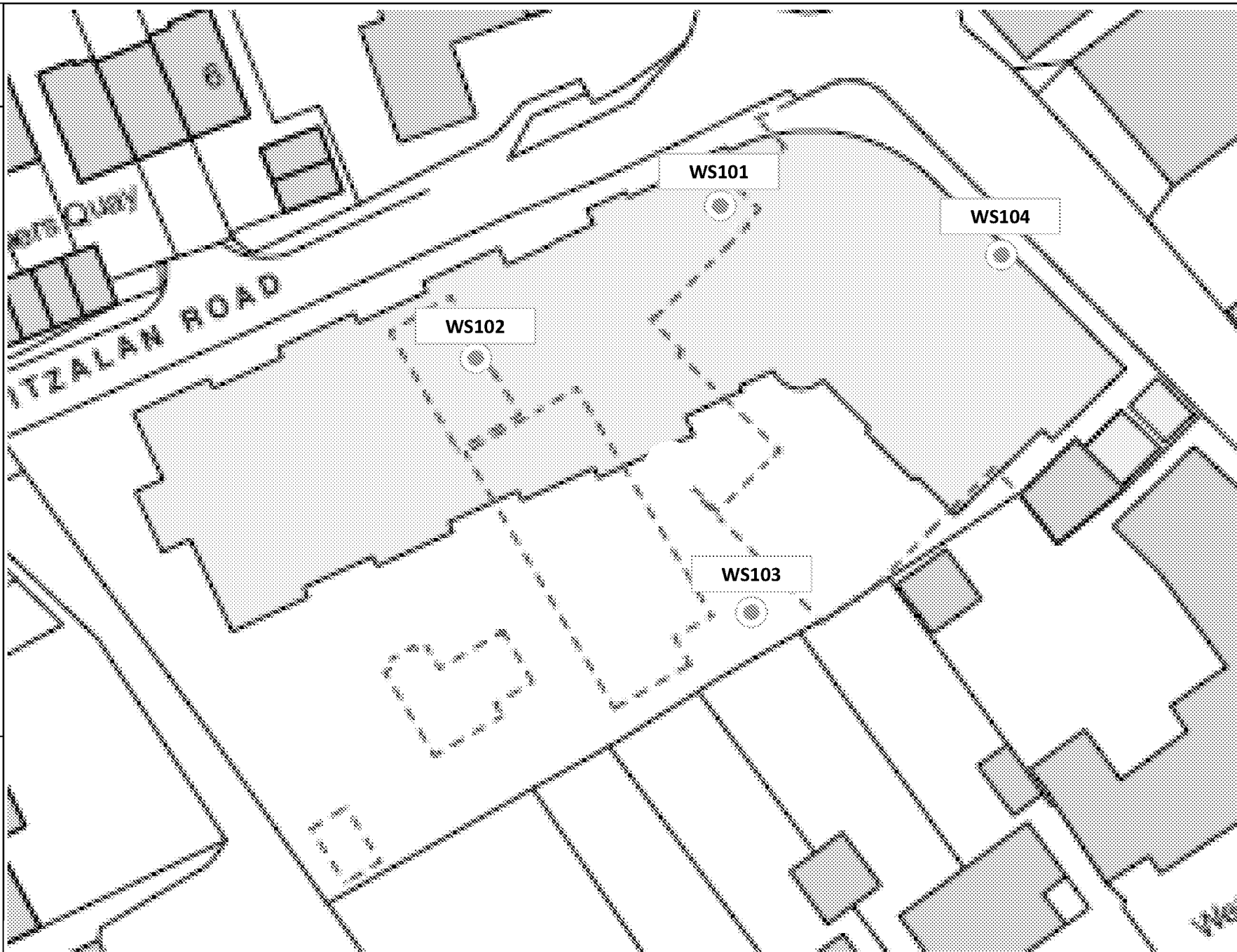
Drawing Title:

**1CO102284.002 –002 Trial
Pits/Soil Infiltration Test
Location Plan**

KEY:


 Window Sample Location

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Job Title:

**14 Fitzalan Road,
Arundel**

Client:

Renaissance Group of
Companies

Job No: **1CO102284**

Drawn By: CT

Approved by: CT

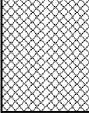
Notes:

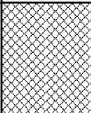
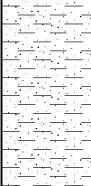
Not to scale

Drawing Title:

**Existing Exploratory Hole
Locations 08/02/18**

Attachment 3
Exploratory Hole Logs

   		Trial Pit Log			Borehole No. SA101-A Sheet 1 of 1				
Project Name: Arundel		Proj. ID: 1CO102284		Easting: Northing:		Hole Type TP			
Location: 14 Fitzalan Road, Arundel, West Sussex, BN18 9JS		Plant: 8ton Excavator		Level (m AOD): Final Depth (m): 0.50		Scale: 1:20			
Client: Renaissance Group of Companies		Crew: BPH Plant		Start Date: 12/02/2018 End Date: 12/02/2018		REC Engineer: MN			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.30	ES	HVP=52 HVP=53 HVP=58	0.30 0.50		 	Grass over dry and friable dark grey slightly gravelly sandy CLAY with abundant rootlets. Sand is fine to coarse. Gravel is angular to subrounded fine to medium flint, brick and white chalk. [MADE GROUND]	
		0.40 - 0.50	ES					Soft to firm light brown to brown sandy CLAY. Sand is fine to coarse. [ALLUVIUM]	
		0.50							
		0.50							
End of Borehole at 0.50m									
Remarks: Location cleared for buried services using a Cable Avoidance Tool (CAT). Groundwater encountered at 0.50mbgl rising to 0.40mbgl after 60 minutes. Soil Infiltration test aborted due to groundwater ingress. Location backfilled with arisings in reverse order and made safe upon completion. Stability: Stable								Pit Dimensions Length: 2.00 Width: 0.50 Depth: 0.50	 CONCEPT LIFE SCIENCES BUILDING BETTER TOMORROWS

   		Trial Pit Log			Borehole No. SA101-B Sheet 1 of 1					
Project Name: Arundel		Proj. ID: 1CO102284		Easting: Northing:		Hole Type TP				
Location: 14 Fitzalan Road, Arundel, West Sussex, BN18 9JS		Plant: 8ton Excavator		Level (m AOD): Final Depth (m): 1.50		Scale: 1:20				
Client: Renaissance Group of Companies		Crew: BPH Plant		Start Date: 12/02/2018 End Date: 12/02/2018		REC Engineer: MN				
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.30			Grass over dry and friable dark grey slightly gravelly sandy CLAY with abundant rootlets. Sand is fine to coarse. Gravel is angular to subrounded fine to medium flint, brick and white chalk. [MADE GROUND]		
					1.00			Soft to firm light brown to brown sandy CLAY. Sand is fine to coarse. [ALLUVIUM]	1	
		1.00 - 1.40	D		1.50			Soft light grey to brown sandy CLAY. Sand is fine to coarse. [ALLUVIUM]		
							End of Borehole at 1.50m			2
										3
										4

Remarks: Location cleared for buried services using a Cable Avoidance Tool (CAT). Groundwater encountered at 1.40mbgl rising to 0.50mbgl after 60 minutes. Soil infiltration test aborted due to groundwater ingress. Location backfilled with arisings in reverse order and made safe upon completion. Stability: Unstable		Pit Dimensions Length: 1.50 Width: 0.50 Depth: 1.50	 CONCEPT LIFE SCIENCES ULTIMATE SOLUTIONS
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ARUN DISTRICT COUNCIL AB/36/18/PL

   		Trial Pit Log			Borehole No. SA103 Sheet 1 of 1				
Project Name: Arundel		Proj. ID: 1CO102284		Easting: Northing:		Hole Type TP			
Location: 14 Fitzalan Road, Arundel, West Sussex, BN18 9JS		Plant: 8ton Excavator		Level (m AOD): Final Depth (m): 0.90		Scale: 1:20			
Client: Renaissance Group of Companies		Crew: BPH Plant		Start Date: 12/02/2018 End Date: 12/02/2018		REC Engineer: MN			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15			Concrete. [MADE GROUND]	
		0.40 - 0.50	ES		0.30			Light brown sandy GRAVEL. Sand is fine to coarse. Gravel is angular to well-rounded fine to coarse flint. [MADE GROUND]	
					0.70			Grey to reddish brown slightly clayey sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint, brick and concrete. Cobbles are angular to subangular brick and concrete. [MADE GROUND]	
		0.80 - 0.90	ES		0.90			Soft to firm light brown to brown sandy CLAY. Sand is fine to coarse. [ALLUVIUM]	
End of Borehole at 0.90m									
									1
									2
									3
									4
									5
Remarks: Location cleared for buried services using a Cable Avoidance Tool (CAT). No groundwater encountered. Soil infiltration test undertaken at depth within the location. Location backfilled with arisings in reverse order and finished with hard mixed concrete capping. Stability: Stable								Pit Dimensions Length: 1.90 Width: 0.85 Depth: 0.90	
 CONCEPT LIFE SCIENCES 01 753 460 274									

Attachment 4
Soil Infiltration Test Certificate

Remarks -

Ground Description:

0.00-0.10 **MADE GROUND:**
Asphalt.

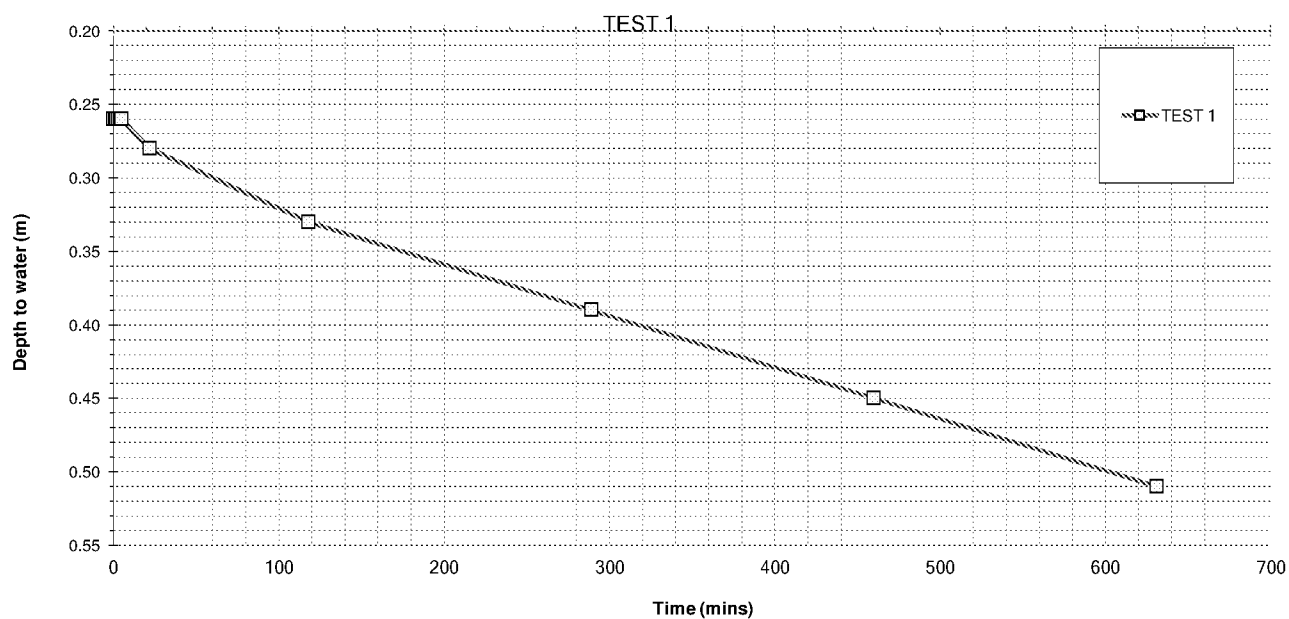
0.10-0.25 **MADE GROUND:**
Cream to light brown slightly clayey SAND and GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint, brick, concrete, slate, relic white chalk. Cobbles are angular to subangular flint and brick.

0.25-0.55 **ALLUVIUM:**
Soft to firm light brown to brown sandy CLAY. Sand is fine to coarse.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.26				
1	0.26				
2	0.26				
3	0.26				
4	0.26				
5	0.26				
22	0.28				
118	0.33				
289	0.39				
460	0.45				
631	0.51				
* Indicate extrapolated figure					
Effective Storage Depth	m	0.29			
75% Effective Storage Depth	m	0.22			
(i.e. depth below GL)	m	0.33			
25% Effective Storage Depth	m	0.07			
(i.e. depth below GL)	m	0.48			
Effective Storage Depth 75%-25%	m	0.15			
Time to fall to 75% effective depth	mins	118.00			
Time to fall to 25% effective depth	mins	530.00			
V (75%-25%)	m3	0.16			
a (50%)	m2	1.88			
t (75%-25%)	mins	462.00			
SOIL INFILTRATION RATE	m/s	3.06E-06			

DESIGN SOIL INFILTRATION RATE, f

3.06E-06

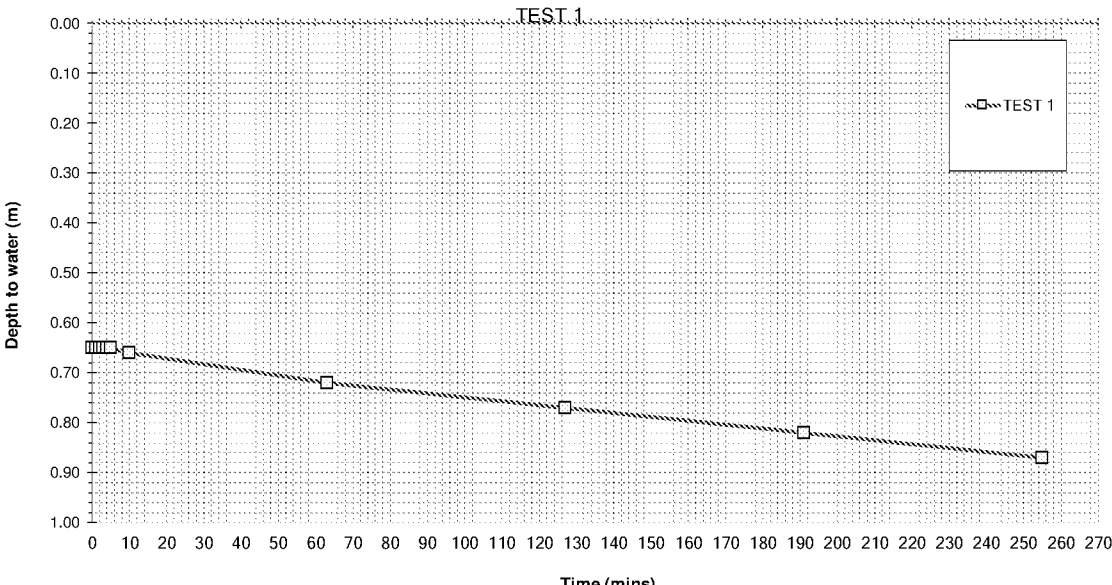


 REC RESILIENT ENVIRONMENTAL CONSULTANTS	Site Arundel Job Number 1CO102284 Date of Test 12/02/2018	Trial Pit Number..... SA103 Length..... 1.90 m Width..... 0.85 m Depth..... 0.90 m Groundwater Level..... Not encountered m
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Remarks - Ground Description: 0.00-0.15 MADE GROUND: Concrete 0.15-0.30 MADE GROUND: Light brown sandy GRAVEL. Sand is fine to coarse. Gravel is angular to well-rounded fine to coarse flint. 0.30-0.70 MADE GROUND: Grey to reddish brown slightly clayey sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint, brick and concrete. Cobbles are angular to subangular brick and concrete. 0.70-0.90 ALLUVIUM: Soft to firm light brown to brown sandy CLAY. Sand is fine to coarse.	TEST 1 Time(min) Depth to Water (m)	TEST 2 Time(min) Depth to Water (m)	TEST 3 Time(min) Depth to Water (m)
	0 0.65 1 0.65 2 0.65 3 0.65 4 0.65 5 0.65 10 0.66 63 0.72 127 0.77 *191 0.82* *255 0.87*		
	* Indicate extrapolated figure		
Effective Storage Depth m 75% Effective Storage Depth m (i.e. depth below GL) m 25% Effective Storage Depth m (i.e. depth below GL) m Effective Storage Depth 75%-25% m Time to fall to 75% effective depth mins Time to fall to 25% effective depth mins V (75%-25%) m ³ a (50%) m ² t (75%-25%) mins	0.25 0.19 0.71 0.06 0.54 0.13 80.00 210.00 0.20 2.30 150.00		
SOIL INFILTRATION RATE m/s	9.74E-06		

DESIGN SOIL INFILTRATION RATE, f	9.74E-06
---	-----------------

TEST 1



Time (mins)

A CONCEPT LIFE SCIENCES COMPANY


Attachment 5
Site Photographs



PLATE 1: 8ton Rubber Tracked Machine used for trial pitting.



PLATE 2: Trial pits SA101-A and SA101-B showing groundwater ingress after excavation.

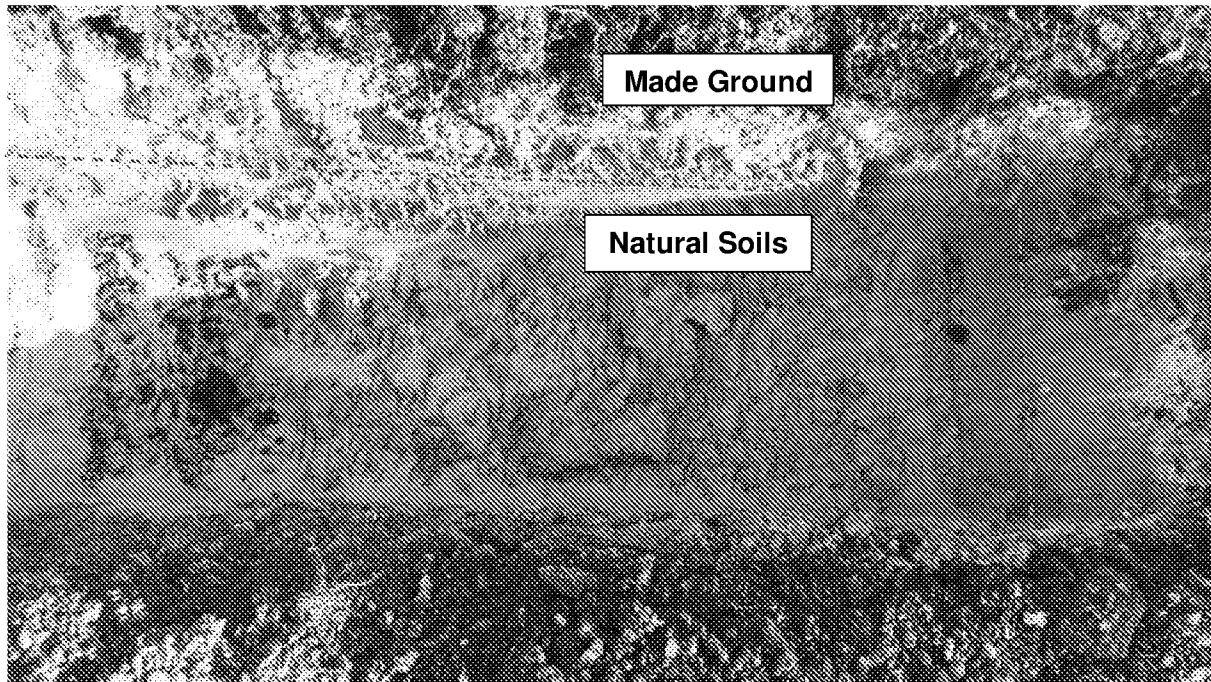


PLATE 3: Trial Pit showing encountered ground condition prior to soil infiltration test.



PLATE 4: Excavated soil from SA101-B showing light grey to light brown sandy CLAY (Alluvium).

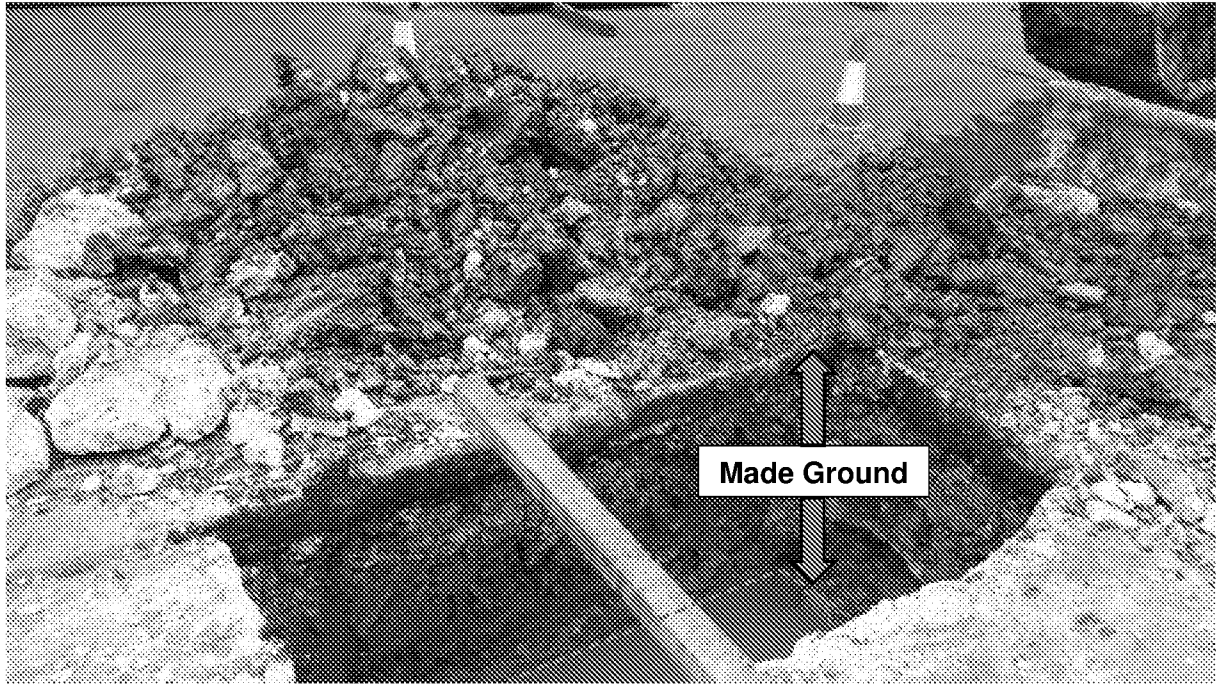


PLATE 5: Soil infiltration test in progress within SA103 (Blastreat Ltd compound).



PLATE 6: Backfilled and instated concrete hard standing (Blastreat Ltd compound).