

Pre and Post
Development
Flow Rates Comparison

For

14 Fitzalan Road
Arundel
West Sussex



ARCH ASSOCIATES
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

Pre and Post Development Flow Rates Comparison

for

14 Fitzalan Road
Arundel
West Sussex

Client:

Renaissance Group of Companies Ltd.
Unit 12, Headlands Business Park
Ringwood
Hampshire
BH24 3PB

ISSUE					
Issued By	S Ho				
Date	Aug 2018				
Purpose	Planning				
Approved By	CH				

Project No. RRL025

The Town House, St George's Square, Bishops Waltham, Southampton, Hampshire, SO32 1AF



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1.0 Introduction

Arch Associates has been appointed by Renaissance Retirement to undertake a comparison study of the pre and post development wastewater run-offs into the existing Foul sewer network in response to Southern Water's Consultee comments for a proposed age-restricted retirement apartment block at land south of Fitzalan Road, Arundel, West Sussex. Refer to the Proposed Masterplan presented in **Appendix 1** for details.

Southern Water's Consultee response dated 12th July 2018 comments that Southern Water has undertaken a desk study of the impact that the additional foul sewerage flows from the proposed development will have on the existing public sewer network in Fitzalan Road. The study indicates that there will be an increased risk of flooding unless any required network reinforcement is provided by Southern Water. Refer to Southern Water's correspondence presented in **Appendix 2**.

This report has been prepared in accordance with the requirements set out in Sewers for Adoption 7th Edition and Southern Water's requirements.

2.0 Proposed Development

The proposal is to demolish the existing buildings and erect a block of 46 sheltered apartments for the elderly (comprising 22 x one-bedroom apartments and 24 x two-bedroom apartments age restricted to 60 years and over).

Vehicular access will be gained via the Northern boundary as per the current arrangement. The development will also include the associated pedestrian access, electric buggy/cycle store, refuse bin store and 32 parking spaces.

3.0 Existing Drainage

3.1 Existing Drainage Condition

Review of the Southern Water asset plans (**Appendix 2**) confirms that there is an existing foul main sewer running across the East of the site towards a pumping station across Fitzalan Road to the North of the site. From this pumping station the foul is pumped West via the pumping main in Fitzalan Road before out-falling adjacent the nearby allotment gardens.

There are no recoded surface water sewers in the nearby vicinity of the site.

A CCTV survey report advises that there are both surface and foul water drainage networks presented within the site. Both the 100mm diameter foul water drain pipes and a surface water drainage serving the Blastreat site are found to be connected into the existing Southern Water foul sewer running across the East of the site, where the proposed foul water runoff will be discharging into. Refer to the CCTV Survey report presented in **Appendix 3** of this report.

On the basis that the CCTV survey has no indication of the existing drainage network serving the neighbouring residential site to the west of the Blastreat site, it is anticipated that the foul water run-off generated from this existing residential development site is discharged off into an existing 150mm diameter Southern Water foul main sewer (existing manhole ref. 8801) downstream in Fitzalan Road located to the north-west of the development site. The surface water run-off generated from the existing site is thought to be infiltrated into the soil via soakaway. Given the foul water discharging point for this residential site being further downstream than the proposed discharging point, the foul water run-off from this site will be excluded from the calculation below.

3.2 Existing Drainage Flow Rates

The discharge rate for the existing foul wastewater run-off has been calculated in accordance with Sewers for Adoption 7th Edition, which states

design flow rates for dwellings should be 4000l/day and Thames Water's schedule of Daily Peak Discharge flow rates for manufacturing unit should be 3,630 litres per 100m sq per day. Therefore, the discharge rate for the existing manufacturing unit total floor spaces of 1,300.60m² equates to a peak foul discharge rate of approximately 0.55 litres/second. Refer to **Appendix 4** for the foul drainage calculations.

The overall site area is 3,663m², with the Blastreat site being 2,219.00m² and the neighbouring residential site being 1,443.80m². The Blastreat site is generally either impermeable hardstanding or occupied by building structures, and the total existing impermeable is 2,219.00m².

Micro Drainage software package has been used to determine the combined surface and foul water run-offs generated from the existing developments within the site during the various storm events. The results are presented in the table below:

Table 1: Combined Surface and Foul Water Run-offs from the Existing Developments

Storm Events	Existing Combined Run-off Rates (l/s)
1	31.10
30	76.30
100	98.40

Refer to the Micro Drainage Existing Combined Drainage calculation presented in **Appendix 5**.

4.0 Proposed Foul and Surface Water Drainage

Under the proposals, the foul water run-off from the development site will be discharged off into the existing 150mm public foul sewer in Fitzalan Road; whilst the surface water run-off will be infiltrated into a high-level infiltration blanket set above the groundwater table.

4.1 Foul Water

It is proposed to discharge the foul water run-off from the site into the existing 225mm diameter public foul main sewer in Fitzalan Road which located across the East of the site. The existing public foul sewer will need to be diverted around the site, subject to S185 agreement with Southern Water, and the potential off-site foul lateral from the neighbouring Westbury Lodge will either need to be diverted or divested to form part of the proposed on-site private foul system. Refer to the proposed drainage strategy drawing in **Appendix 6**.

The hydraulic design for the discharge rate for the foul wastewater design has been calculated in accordance with Sewers for Adoption 7th Edition which states design flow rates for dwellings should be 4000l/day. Therefore, the discharge rate for the proposed residential development of 46 dwellings equates to a peak foul discharge rate of approximately 2.13 litres/second. Refer to **Appendix 7** for the foul drainage calculations.

4.2 Surface Water

Geo-Environmental Consultant's Infiltration testing report undertaken in accordance with BRE Digest 365 confirms that the soil infiltration rates recorded within the Alluvium strata are ranging between 3.06×10^{-6} and 9.74×10^{-6} for this site, and is considered to be good permeability. Hence, the surface water run-off from the proposed development is proposed to be infiltrated into the Alluvium strata set above the groundwater table. Refer to the proposed drainage strategy drawing in **Appendix 6**, and Geo-Environmental Consultant's Infiltration testing report in **Appendix 8**.

Given the surface water run-off from the proposed development is to be infiltrated into the soil within the site, it will not impact the Southern Water foul main sewer network in the East of the site.

5.0 Sewerage Run-Offs Comparison and Conclusion

5.1 Pre and Post Development Sewerage Run-Offs Comparison

A summary of the pre and post development sewerage run-offs being discharged into the existing Southern Water foul sewer network is presented in the table below:

Table 2: Summary of the Pre and Post Development Run-offs Comparison

Storm Events	Pre-Development Run-off Rates (l/s) – Surface + Foul	Post-Development Run-off Rates (l/s) – Foul Only
1	31.10	2.13
30	76.30	2.13
100	98.40	2.13

5.2 Conclusion

A CCTV survey report advises that both the existing 100mm diameter foul water drain pipes and an existing surface water drainage serving the Blastreat site are found to be connected into the existing Southern Water foul sewer running across the East of the site, where the proposed foul water runoff will be discharging into.

It is proposed to discharge the foul water run-off from the site into the existing 225mm diameter public foul main sewer in Fitzalan Road, which is located across the East of the site; whilst the surface water run-off from the proposed development will be infiltrated into the soil within the site.

Given that only the foul water run-off from the post-development site will be discharged off into Southern Water's foul main sewer network, this will provide a reduction of over 90% over the existing combined run-off rate. Refer to Table 2 of this report.

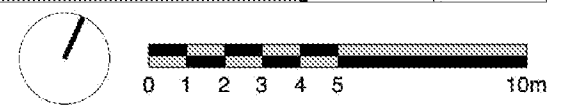
This comparison desk study has demonstrated that the foul sewerage flows under the proposed drainage strategy will be a betterment over the existing combined sewerage flows, and therefore will have no negative impact to Southern Water's existing public sewer network in Fitzalan Road.

APPENDIX 1

Proposed Masterplan



Drawn NN Checked DJ/LM



APPENDIX 2

Southern Water Correspondence and Sewer Plan



Planning and Development Services
Arun District Council
Arun Civic Centre
Maltravers Road
Littlehampton
West Sussex
BN17 5LF

Developer Services
Southern Water
Sparrowgrove House
Sparrowgrove
Otterbourne
Hampshire
SO21 2SW

Tel: 0330 303 0119

Your Ref

AB/36/18/PL

Our Ref

PLAN-023359

Date

12/07/2018

Dear Sirs,

Proposal: Demolition of existing buildings & erection of a block of 46No. sheltered apartments for the elderly (comprising 22 x one bedroom apartments & 24 x two bedroom apartments age restricted to 60 years and over), with associated access electric buggy/cycle stores & refuse bin store & 32No. parking spaces. Resubmission of AB/77/17/PL. This application affects the character and appearance of Arundel Conservation Area.
Site: Blastreat Limited & adj Greenhurst, Fitzalan Road, Arundel, BN18 9JS.
AB/36/18/PL

Thank you for your letter of 06/06/2018.

Please find attached a plan of the sewer records showing the approximate position of a public foul sewer crossing the site. The exact position of the public sewers must be determined on site by the applicant before the layout of the proposed development is finalised.

It might be possible to divert the public sewer, so long as this would result in no unacceptable loss of hydraulic capacity, and the work was carried out at the developer's expense to the satisfaction of Southern Water under the relevant statutory provisions.

Should the applicant wish to divert apparatus:

1. The 225mm diameter sewer requires a clearance of 3 metres either side of the sewer to protect it from construction works and allow for future access for maintenance.

2. No development or new tree planting should be located within 3 metres either side of the external edge of the public sewer
3. No new soakaways should be located within 5 metres of a public sewer.
4. All other existing infrastructure should be protected during the course of construction works.

Alternatively, the applicant may wish to amend the site layout, or combine a diversion with amendment of the site layout. If the applicant would prefer to advance these options, items (1) – (4) above also apply.

In order to protect drainage apparatus, Southern Water requests that if consent is granted, a condition is attached to the planning permission. For example “The developer must advise the local authority (in consultation with Southern Water) of the measures which will be undertaken to divert the public sewers, prior to the commencement of the development.”

Furthermore, due to changes in legislation that came in to force on 1st October 2011 regarding the future ownership of sewers it is possible that a sewer now deemed to be public could be crossing the above property. Therefore, should any sewer be found during construction works, an investigation of the sewer will be required to ascertain its condition, the number of properties served, and potential means of access before any further works commence on site.

The applicant is advised to discuss the matter further with Southern Water, Sparrowgrove House Sparrowgrove, Otterbourne, Hampshire SO21 2SW (Tel: 0330 303 0119) or www.southernwater.co.uk.

Southern Water has undertaken a desk study of the impact that the additional foul sewerage flows from the proposed development will have on the existing public sewer network.

This initial study indicates that there is an increased risk of flooding unless any required network reinforcement is provided by Southern Water.

Any such network reinforcement will be part funded through the New Infrastructure Charge with the remainder funded through Southern Water’s Capital Works programme.

Southern Water and the Developer will need to work together in order to review if the delivery of our network reinforcement aligns with the proposed occupation of the development, as it will take time to design and deliver any such reinforcement.

Southern Water hence requests the following condition to be applied:

“Occupation of the development is to be phased and implemented to align with the delivery by Southern Water of any sewerage network reinforcement required to ensure that adequate waste water network capacity is available to adequately drain the development”

It may be possible for some initial dwellings to connect pending network reinforcement. Southern Water will review and advise on this following consideration of the development program and the extent of network reinforcement required.

Southern Water will carry out detailed network modelling as part of this review which may require existing flows to be monitored. This will enable us to establish the extent of works required (If any) and to design such works in the most economic manner to satisfy the needs of existing and future customers.

Our assessment of the timescales needed to deliver network reinforcement will consider an allowance for the following:

- Initial feasibility, detail modelling and preliminary estimates.
- Flow monitoring (If required)
- Detail design, including land negotiations.
- Construction.

The overall time required depends on the complexity of any scheme needed to provide network reinforcement.

Southern Water will seek however to limit the timescales to a maximum of 24 months from a firm commitment by the developer to commence construction on site and provided that Planning approval has been granted.

The Council’s Building Control officers or technical staff should be asked to comment on the adequacy of soakaways to dispose of surface water from the proposed development.

The applicant should be advised that a wastewater grease trap should be provided on the kitchen waste pipe or drain installed and maintained by the owner or operator of the premises.

Due to the vibration, noise and potential odour generated by sewage pumping stations, no habitable rooms should be located closer than 15 metres to the boundary of an existing pumping station site.

We request that should this application receive planning approval, the following condition is attached to the consent: “Construction of the development shall not commence until details of the proposed means of foul and surface water sewerage

disposal have been submitted to, and approved in writing by, the Local Planning Authority in consultation with Southern Water.”

Following initial investigations, Southern Water can provide a water supply to the site. Southern Water requires a formal application for connection and on-site mains to be made by the applicant or developer. We request that should this application receive planning approval, the following informative is attached to the consent:

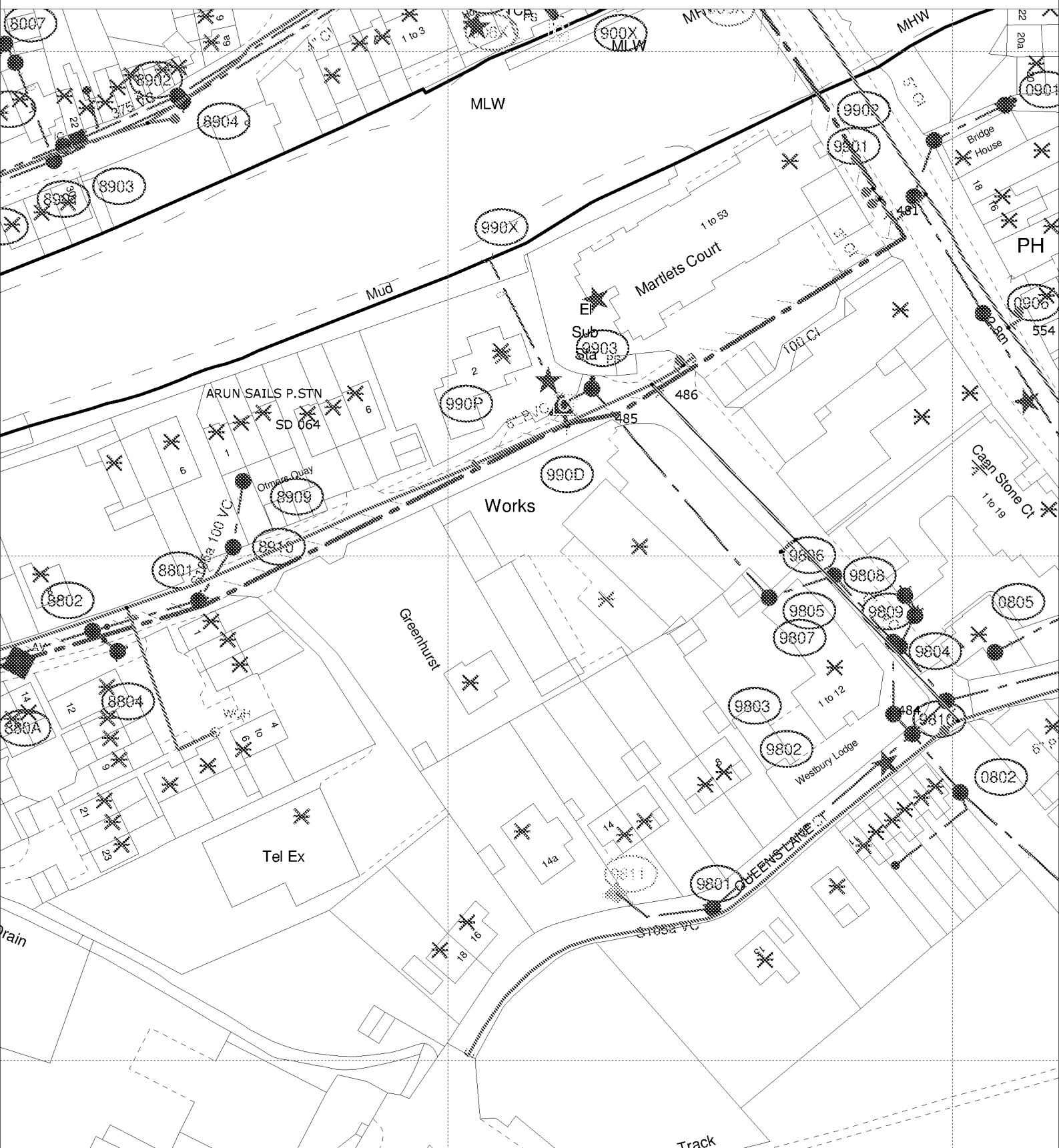
“A formal application for connection to the water supply is required in order to service this development. Please contact Southern Water, Sparrowgrove House Sparrowgrove, Otterbourne, Hampshire SO21 2SW (Tel: 0330 303 0119) or www.southernwater.co.uk”.

Yours sincerely,



Developer Services

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530

O.S. REF: TQ0106NE

Scale: 1:1000

Screen Print

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

ARUN DISTRICT COUNCIL AB/36/18/PL



Printed By: chandne

Date: 12-6-2018

Southern Water MapGuide Browser

Requested By:





502174

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape
0801X	2.28		150	VC	CIRC	9010Y			150	CI	CIRC												
0802X	2.2		150	VC	CIRC	9010X			150	VC	CIRC												
0803X	2.74	0.44	150	VC	CIRC	9050X	4.15	1.71	375	CP	CIRC												
0804X	2.71		150	VC	CIRC	9801X	2.33		225	VC	CIRC												
0805X			UNK	UNK	CIRC	9802X	2.42		225	VC	CIRC												
0806X			UNK	UNK	CIRC	9803X	2.68		150	VC	CIRC												
0807X			UNK	UNK	CIRC	9804X	2.56		150	VC	CIRC												
0901X	3.18	1.49	150	VC	CIRC	9805X	2.69		150	VC	CIRC												
0902X	3.01	0.75	150	VC	CIRC	9806X	2.74	1.98	150	VC	CIRC												
0906X			150	VC	CIRC	9807X	2.875		225	VC	CIRC												
7001Y	9.48	5	200	VC	CIRC	9808X	2.635	0.01	250	DI	CIRC												
7001X	8.48	5.98	200	VC	CIRC	9809X	2.545	0.03	225	VC	CIRC												
7001Y	8.48	5	200	VC	CIRC	9800X			UNK	UNK	UNK												
7002X	8.3		200	VC	CIRC	9810X	2.535	0.06	225	VC	CIRC												
7002Y	9.3	5.58	200	VC	CIRC	9901X	3.54		150	VC	CIRC												
7003X	8.06	3	200	VC	CIRC	9902X	3.55	1.33	150	VC	CIRC												
7006X			UNK	UNK	UNK	9903X	3.01	-0.51	225	VC	CIRC												
7007X			UNK	UNK	UNK	9904X	3.38	3.37	150	CI	CIRC												
7008X			UNK	UNK	CIRC	9905X	3.38	3.37	100	PVC	CIRC												
7009X	3.82	2.71	150	VC	CIRC																		
7010X			UNK	UNK	CIRC																		
7011X			UNK	UNK	CIRC																		
7801X	2.89	-1.13	225	VC	CIRC																		
7802X	3.01	-1.27	225	VC	CIRC																		
7803X	3.18	-1.43	225	VC	CIRC																		
7804X	2.08	-0.84	150	VC	CIRC																		
7805X	2.79		100	CI	CIRC																		
7901X	3.31	2.38	200	VC	CIRC																		
7902X	3.19	2.24	200	VC	CIRC																		
7903X	3.85	2.06	375	VC	CIRC																		
7904X	3.17	1.88	375	VC	CIRC																		
7905X	3.6	1.63	150	VC	CIRC																		
7906X	3.5	2.38	375	VC	CIRC																		
7907X	3.52	2.4	150	VC	CIRC																		
7908X	3.85	2.52	150	VC	CIRC																		
7909X			UNK	UNK	CIRC																		
7910X			UNK	UNK	CIRC																		
7911X			UNK	UNK	CIRC																		
7912X			100	VC	CIRC																		
7913X			100	VC	CIRC																		
8007X	3.65	2.04	150	VC	CIRC																		
8010X			150	VC	CIRC																		
8011X			UNK	UNK	UNK																		
8013X			UNK	UNK	CIRC																		
8014X			UNK	UNK	CIRC																		
8801X	3.03	1.68	150	VC	CIRC																		
8802X	3.14	-0.88	225	VC	CIRC																		
8804X	3.12	1.52	150	VC	CIRC																		
8901X	3.25		225	VC	CIRC																		
8902X	3.35	2.22	375	VC	CIRC																		
8903X	3.2	2.15	375	VC	CIRC																		
8904X	3.35		225	VC	CIRC																		
8905X	3.6	1.98	150	VC	CIRC																		
8906X	3.45	1.7	150	VC	CIRC																		
8907X			375	VC	CIRC																		
8908X			150	VC	CIRC																		
8909X			100	VC	CIRC																		
8910X			UNK	UNK	CIRC																		
8911X			100	VC	CIRC																		
9005X	4.04		200	VC	CIRC																		
9006X	3.34	2.22	375	VC	CIRC																		
9007X	3.41		225	VC	CIRC																		
9008X	3.42	2.33	375	VC	CIRC																		
9009X	3.42		UNK	UNK	CIRC																		
900FX	3.43	3.42	100	PVC	CIRC																		

LINE STYLES / COLOURS	MATERIALS	LEGEND - SEWERS
Orange: Road	Al: Aluminium	Manhole (M)
Green: Road System Sewer	BAG: Reinforced Adhesive Concrete	Manhole (M)
Blue: Road Vacuum Main	BAG: Bag (Engineering)	Manhole (M)
Red: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Yellow: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Light Blue: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Dark Blue: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Grey: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Black: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
White: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Light Green: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Dark Green: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Light Yellow: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Dark Yellow: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Light Grey: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
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Light Dark Green: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Dark Dark Green: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Light Light Yellow: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Dark Light Yellow: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Light Dark Yellow: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Dark Dark Yellow: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)
Light Light Grey: Road Vacuum Main	CG: Concrete Gas Inlet	Manhole (M)

APPENDIX 3

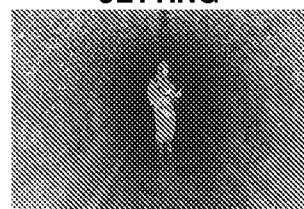
CCTV Survey Report



CCTV SURVEYS



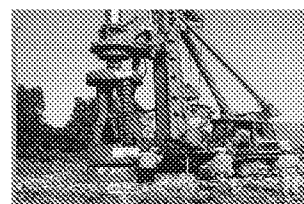
**HIGH PRESSURE
JETTING**



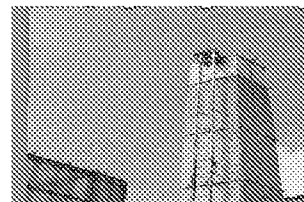
**MAN ENTRY
SURVEYS**



RELINING & REPAIRS



PILING SURVEYS



CHIMNEY SURVEYS



**5 SUFFOLK ROAD
MALDON
ESSEX
CM9 6AX**



CCTV REPORT

CLIENT	RENAISSANCE RETIREMENT
LOCATION	FITZALAN ROAD ARUNDEL
DATE	07/02/2018
REF	071165
DVD No	001

Graded defect count per section

This section shows the number of graded defects per individual survey. A grade 5 defect being serious and indicating more urgent repair. Grade 3-4 defects are less serious and are less urgent concerning repair. Grade 1-2 defects are relatively minor and could be monitored and/or repaired if thought necessary.

Section: 1 Start: G1 End: C1 Road: FITZALAN ROAD

Length: 3.36 Use: Surface Water Depth: 0 Place: ARUNDEL

From To	Dia	Material	G1 - 2	G3 - 4	G5
00.00m - 03.36m	100	Vitrified Clay (i.e. all clayware)	1	1	0

Section: 2 Start: C1 End: LAT A Road: FITZALAN ROAD

Length: 1.61 Use: Combined Depth: 0 Place: ARUNDEL

From To	Dia	Material	G1 - 2	G3 - 4	G5
00.00m - 01.61m	100	Vitrified Clay (i.e. all clayware)	0	1	0

Section: 3 Start: C1 End: LAT C Road: FITZALAN ROAD

Length: 2.77 Use: Combined Depth: 0 Place: ARUNDEL

From To	Dia	Material	G1 - 2	G3 - 4	G5
00.00m - 02.77m	100	Vitrified Clay (i.e. all clayware)	1	0	0

Section: 4 Start: C1 End: LAT D Road: FITZALAN ROAD

Length: 18 Use: Combined Depth: 0 Place: ARUNDEL

From To	Dia	Material	G1 - 2	G3 - 4	G5
00.00m - 18.00m	100	Vitrified Clay (i.e. all clayware)	1	5	0

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	4	Grade 3 Defects	7	Grade 4 Defects	0	Grade 5 Defects	0
-----------------	---	-----------------	---	-----------------	---	-----------------	---	-----------------	---

MANHOLE INSPECTION REPORT

UTILITY SURVEYS LTD

5 SUFFOLK ROAD
MALDON
ESSEX
CM9 6AX

LOCATION: FITZALAN ROAD ARUNDEL

JOB REF: 071165

CLIENT: RENAISSANCE RETIREMENT

DATE: 07/02/2018

MH No. C1 DEPTH. 3.05 COVER. RH CONSTRUCTION. Br REMARKS. 2x GATE VALVES			
MH No. C2 DEPTH. COVER. CONSTRUCTION. REMARKS.	INTERNAL MANHOLE		
MH No. F1 DEPTH. 3.08 COVER. SH CONSTRUCTION. Co Ring REMARKS.			
MH No. 9903 DEPTH. 3.56 COVER. SH CONSTRUCTION. Co Ring REMARKS.			
MH No. S1 DEPTH. 1.14 COVER. RH CONSTRUCTION. Br REMARKS.			
KEY: C - Circular L - Light Duty Co - Concrete S - Square M - Medium Duty Br - Brick T - Triangular H - Heavy Duty R - Rectangular			

A, Copies of site hand written Daily Record Sheets

B, Annotated Site Drawings

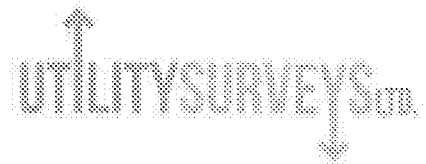
CCTV Sewer Survey – Daily Record Sheet

Date 07/02/2018 Job No 071165

Client RENAISSANCE RETIREMENT

Site Address FITZALAN ROAD
ARUNDEL
BH18 9JS

Rig Manager S. GARDINER Operative M. CAMPBELL



5 Suffolk Road
Maldon
Essex
CM9 6AX

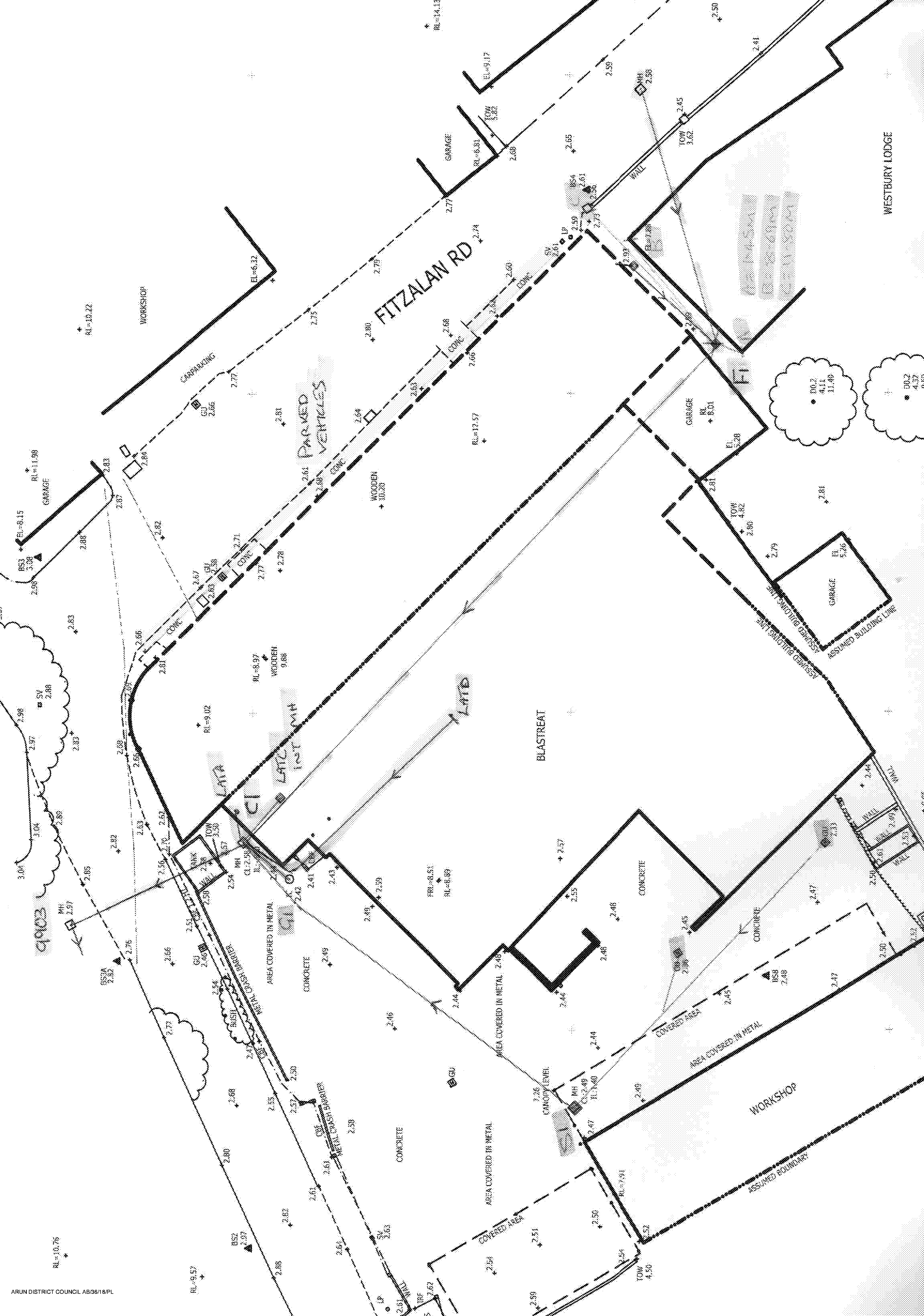
Manhole		Sewer dia.	Recorded Metreage	Survey Abandoned	Remarks
Start	Finish				
G1	C1	100	3-36		
C1	LATA	100	1-61	-	BEND DOWN
C1	LATC	100	2-77		INTERNAL MANHOLE C2
C1	LATD	100	18-00		ENCrustATION
TOTAL					

Standing Time Metrage check ☒ Length OK

Reason for standing time

Remarks C1 LAT B DISPLACED JOINT, C1 LAT E DISPLACED JOINT
F1 - C1 HEAVY FLOW C1 - 9903 HEAVY FLOW

Special Instructions; Site Contact –



WESTBURY LODGE

FITZALAN RD

WORKSHOP

BLASTREAT

PARVED
VEHICLES

CP1003

APPENDIX 4

Existing Foul Water Drainage Calculation

Foul Water Existing Flows

	DWF (l/day)	Daily Design / Peak Flow (l)	No. of Units	Q l/s	
General Housing per dwelling (3 persons)	600	4000	1	0.05	
School per pupil	80	528			
Assembly Hall per seat	10	66			
Cinema per seat	10	66			
Theatre per seat	10	66			
Sports Hall per person	50	330			
Hotel per room	550	3630			
Guest House per room	200	1320			
Motel per room	300	1980			
Holiday Apartment per person	150	990			
Leisure Park per person	220	1452			
Caravan Pk standard per space	250	1650			
Caravan Pk serviced per space	450	2970			
Camping site standard per space	200	1320			
Camping site serviced per space	350	2310			
Public House per seat	150	990			
Restaurant/Day Care Centre per person	270	1782			
Drive in restaurant per seat	380	2508			
Hospital per bed	750	4950			
Nursing/Care Homes per bed	375	2475			
Offices per 100m ²	750	4950			
Shopping Centre per 100m ²	400	2640			
Warehouse per 100m ²	150	990			
Commercial premises per 100m ²	300	1980			
Manufacturing unit per 100m ²	550	3630	13.00596	0.55	
			Total Flow =	0.6 l/s	(6x DWF)

**Sourced from Thames Water Foul Flows*

APPENDIX 5

Existing Combined Drainage calculations

Arch Associates Limited		Page 1
Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	14 FITZALAN ROAD, ARUNDEL WEST SUSSEX EXISTING COMBINED SEWER	
Date 13/08/2018	Designed by SH	
File RRL025 EXISTING	Checked by CH	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Test Combined Sewer

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.700	Add Flow / Climate Change (%)	0
Ratio R	0.343	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	550	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	500	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	2.478	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm Test Combined Sewer

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	26.500	1.870	14.2	0.222	4.00	0.0	0.600	o	325	Pipe/Conduit	
1.001	12.000	0.120	100.0	0.000	0.00	0.0	0.600	o	325	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	68.81	4.13	1.400	0.222	0.0	0.6	0.0	3.43	138.9	41.9
1.001	67.90	4.28	0.470	0.222	0.0	0.6	0.0	1.31	52.0	41.9

Arch Associates Limited			Page 2
Town House St Geroge's Square	14 FITZALAN ROAD, ARUNDEL		
Bishops Waltham	WEST SUSSEX		
Southampton SO32 1AF	EXISTING COMBINED SEWER		
Date 13/08/2018	Designed by SH		
File RRL025 EXISTING	Checked by CH		
XP Solutions	Network 2018.1		

Manhole Schedules for Storm Test Combined Sewer

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	Pipes In Invert Level (m)	Diameter (mm)	Backdr. (mm)
1	2.490	1.090	Open Manhole	1200	1.000	1.400	225			
2	2.580	3.050	Open Manhole	1200	1.001	-0.470	225	1.000	-0.470	225
Ex MH 9903	2.970	3.560	Open Manhole	1200		OUTFALL		1.001	-0.590	225

Free Flowing Outfall Details for Storm Test Combined Sewer

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.001	Ex MH 9903	2.970	-0.590	-0.590	1200	0

Arch Associates Limited		Page 3
Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	14 FITZALAN ROAD, ARUNDEL WEST SUSSEX EXISTING COMBINED SEWER	
Date 13/08/2018	Designed by SH	
File RRL025 EXISTING	Checked by CH	
XP Solutions	Network 2018.1	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm Test Combined Sewer

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.343
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.700 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760, 7200,
8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Event	Duration (mins)	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	US/CL (m)
1.000	1	15 minute 1 year Summer I+0%	15				2.490
1.001	2	15 minute 1 year Summer I+0%	15	30/15 Summer			2.580

Water Surcharged Flooded

PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Overflow Vol (m³)	Infil. Flow (l/s)	Infil. Vol (m³)
1.000	1	1.475	-0.150	0.000	0.24				
1.001	2	-0.330	-0.085	0.000	0.70				

Arch Associates Limited		Page 4
Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	14 FITZALAN ROAD, ARUNDEL WEST SUSSEX EXISTING COMBINED SEWER	
Date 13/08/2018 File RRL025 EXISTING	Designed by SH Checked by CH	
XP Solutions		Network 2018.1

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm Test Combined Sewer

PN	US/MH Name	Discharge Vol (m ³)	Pipe Flow		Status
			(l/s)		
1.000	1	11.999	31.0		OK
1.001	2	12.127	31.1		OK

Arch Associates Limited		Page 5
Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	14 FITZALAN ROAD, ARUNDEL WEST SUSSEX EXISTING COMBINED SEWER	
Date 13/08/2018	Designed by SH	
File RRL025 EXISTING	Checked by CH	
XP Solutions		Network 2018.1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Test Combined Sewer

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.343
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.700 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760, 7200,
8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Event	Duration (mins)	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	US/CL (m)
1.000	1	15 minute 30 year Winter I+0%	15				2.490
1.001	2	15 minute 30 year Winter I+0%	15	30/15 Summer			2.580

Water Surcharged Flooded

PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Overflow Vol (m³)	Infil. Flow (l/s)	Infil. Vol (m³)
1.000	1	1.524	-0.101	0.000	0.59				
1.001	2	-0.009	0.236	0.000	1.72				

Arch Associates Limited		Page 6
Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	14 FITZALAN ROAD, ARUNDEL WEST SUSSEX EXISTING COMBINED SEWER	
Date 13/08/2018	Designed by SH	
File RRL025 EXISTING	Checked by CH	
XP Solutions	Network 2018.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Test Combined Sewer

PN	US/MH Name	Pipe Discharge		Pipe Flow (l/s)	Status
		Vol (m³)			
1.000	1	33.114		75.9	OK
1.001	2	33.193		76.3	SURCHARGED

Arch Associates Limited		Page 7
Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	14 FITZALAN ROAD, ARUNDEL WEST SUSSEX EXISTING COMBINED SEWER	
Date 13/08/2018	Designed by SH	
File RRL025 EXISTING	Checked by CH	
XP Solutions		Network 2018.1

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Test Combined Sewer

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.343
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.700 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760, 7200,
8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Event	Duration (mins)	First (X) Surge	First (Y) Flood	First (Z) Overflow	US/CL (m)
1.000	1	15 minute 100 year Winter I+0%	15				2.490
1.001	2	15 minute 100 year Summer I+0%	15	30/15 Summer			2.580

Water Surcharged Flooded

PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Overflow Vol (m³)	Infil. Flow (l/s)	Infil. Vol (m³)
1.000	1	1.548	-0.077	0.000	0.76				
1.001	2	0.228	0.473	0.000	2.21				

Arch Associates Limited		Page 8
Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	14 FITZALAN ROAD, ARUNDEL WEST SUSSEX EXISTING COMBINED SEWER	
Date 13/08/2018 File RRL025 EXISTING	Designed by SH Checked by CH	
XP Solutions		Network 2018.1

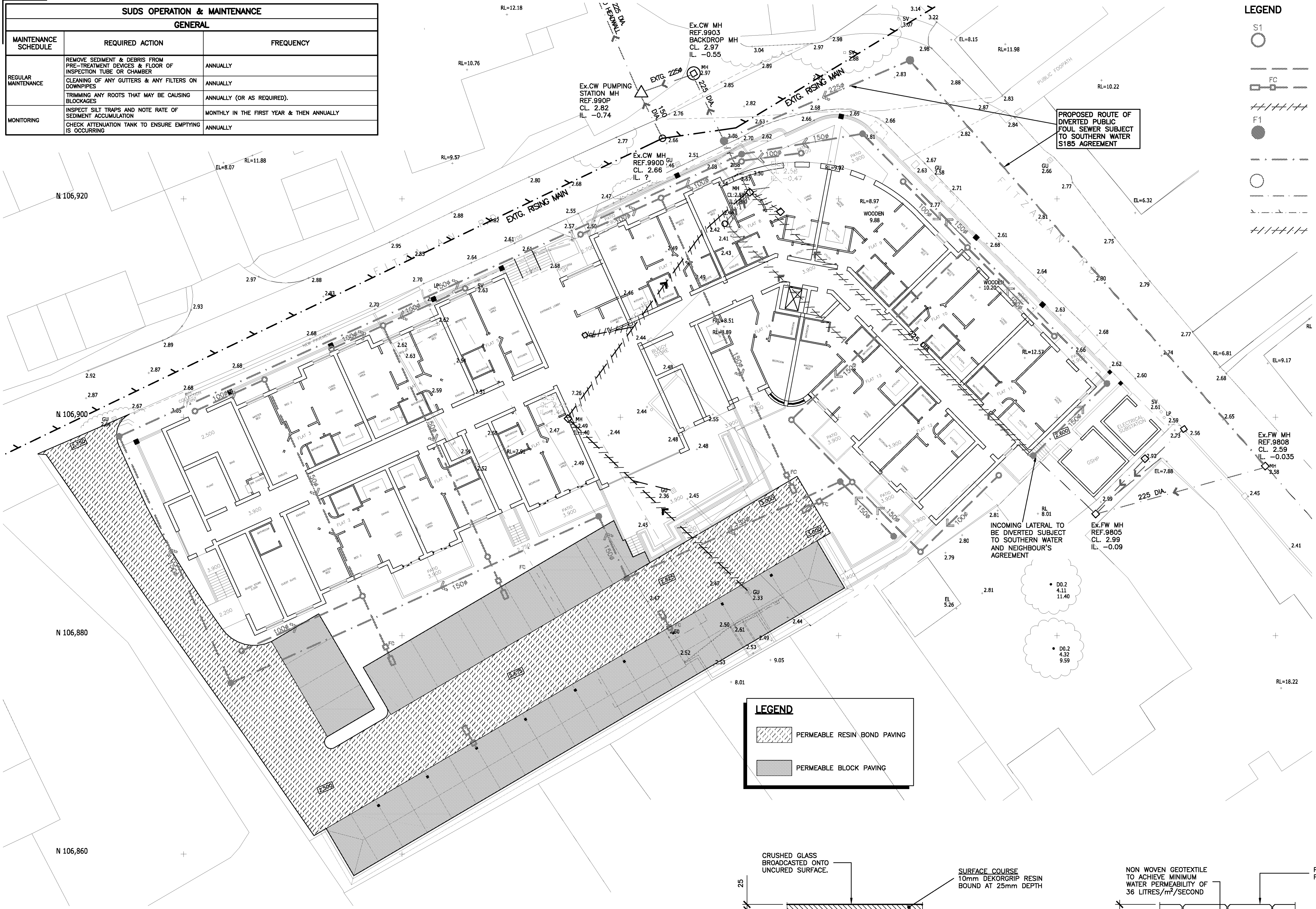
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Test Combined Sewer

PN	US/MH Name	Pipe Discharge		Pipe Flow (l/s)	Status
		Vol (m³)			
1.000	1	42.891		98.3	OK
1.001	2	38.027		98.4	SURCHARGED

APPENDIX 6

Drainage Strategy Drawing

SUDS OPERATION & MAINTENANCE		
GENERAL		
MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
REGULAR MAINTENANCE	REMOVE SEDIMENT & DEBRIS FROM PRE-TREATMENT DEVICES & FLOOR OF INSPECTION TUBE OR CHAMBER	ANNUALLY
	CLEANING OF ANY GUTTERS & ANY FILTERS ON DOWNPIPES	ANNUALLY
MONITORING	TRIMMING ANY ROOTS THAT MAY BE CAUSING BLOCKAGES	ANNUALLY (OR AS REQUIRED).
	INSPECT SILT TRAPS AND NOTE RATE OF SEDIMENT ACCUMULATION	MONTHLY IN THE FIRST YEAR & THEN ANNUALLY
	CHECK ATTENUATION TANK TO ENSURE EMPTYING IS OCCURRING	ANNUALLY



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DRAWING
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LEGEND

- S1
- FC
- F1
- 150mm Dia. PVCu. SN4 STORM WATER DRAIN (U.N.O.)
- FILTRATION CHAMBER
- EXISTING SURFACE WATER DRAIN TO BE ABANDONED
- FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS)
- 150mm Dia. PVCu. SN4 FOUL WATER DRAIN (U.N.O.)
- EXISTING FOUL WATER MANHOLE
- EXISTING FOUL WATER DRAIN
- EXISTING RISING FOUL WATER DRAIN
- EXISTING FOUL WATER DRAIN TO BE ABANDONED

NOTES

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GENERAL NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND DETAILS.
- ALL FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED DIMENSIONS.
- ANY DISCREPANCIES BETWEEN THIS DRAWING AND OTHER INFORMATION IS TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO THE COMMENCEMENT OF THE WORKS ON SITE.
- THE MAIN CONTRACTOR SHALL BE RESPONSIBLE FOR THE SETTING OUT AND ACCURACY OF ALL DIMENSIONS.
- THE CONTRACTOR IS TO ENSURE THE STABILITY AND STRUCTURAL INTEGRITY OF THE EXISTING PROPERTY AT ALL TIMES DURING WORKS AND IS TO BE RESPONSIBLE FOR ALL PROPPING AND SHORING AS REQUIRED.
- MAIN CONTRACTOR TO PROVIDE AND FIX SUITABLE BRACING AND PROPPING FOR ALL ELEMENTS IN THE TEMPORARY CONDITION DURING CONSTRUCTION STAGE, SUCH AS TO ENSURE STRUCTURE STABILITY AT ALL TIMES.
- IT IS THE CONTRACTORS SOLE RESPONSIBILITY FOR ASCERTAINING SAFE DISPOSAL OF ANY OFF-SITE EXCAVATED SPOIL, NO CLAIM RESULTING FROM ABNORMAL TIP REQUIREMENTS WILL BE ENTERTAINED.

DRAINAGE

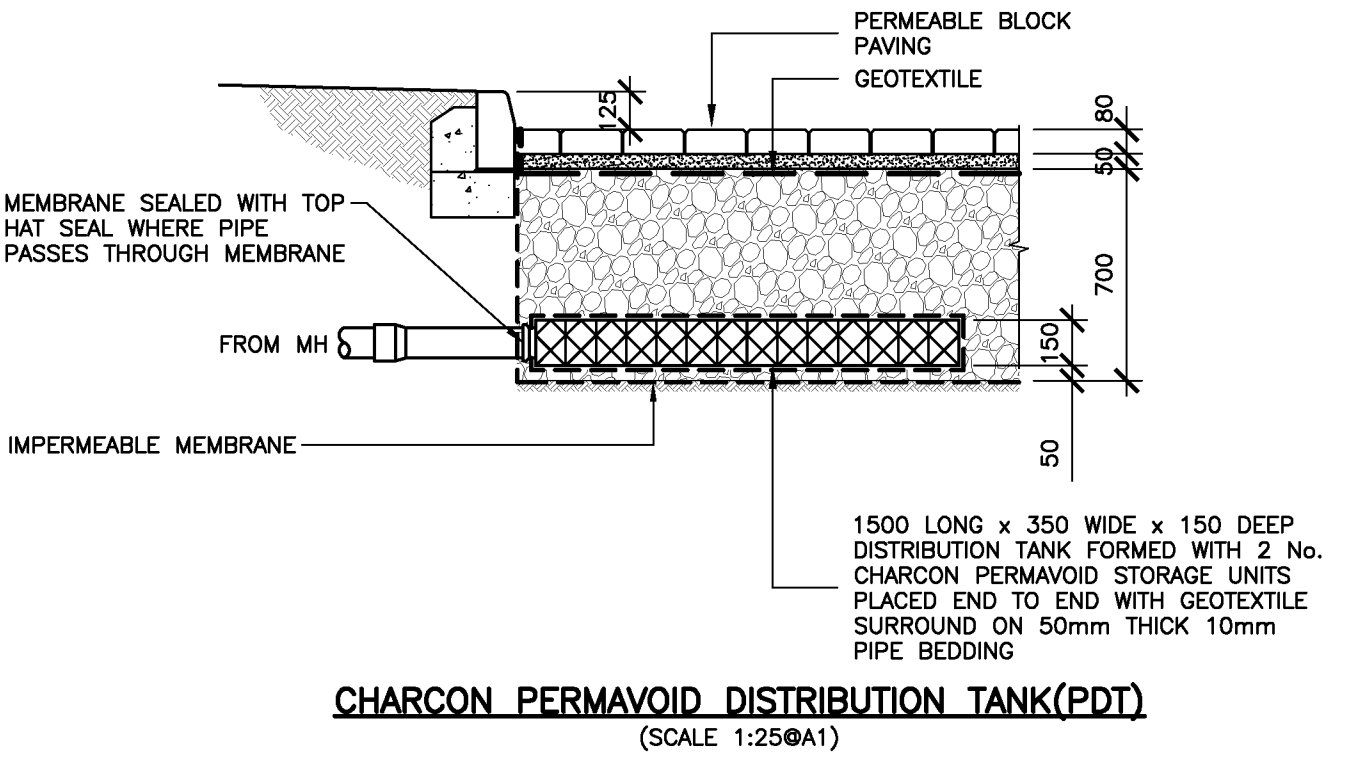
- ALL MATERIALS AND WORKMANSHIP TO 'SEWERS FOR ADOPTION, 7th EDITION'
- ALL MATERIALS AND WORKMANSHIP TO COMPLY WITH BS EN 752-1:1996
- WHEN USING VITRIFIED CLAY PIPEWORK WITH FLEXIBLE JOINTS, SUPERSTRENGTH SHALL BE USED. ALL ADOPTABLE WORKS SHALL USE V.C PIPEWORK. FOR NON-ADOPTED SYSTEM PVCU-SN4 CLASS PIPEWORK AND FITTINGS MAY BE SUBSTITUTED.
- CONCRETE ENCASEMENT, MINIMUM 150 BED AND HAUNCH, TO BE USED ON PIPEWORK UNDER ROADS WITH LESS THAN 1200 COVER TO CROWN.
- UNLESS OTHERWISE STATED, ALL PIPEWORK TO BE BEDDED AND SURROUNDED IN 10mm SINGLE SIZE AGGREGATE UP TO 450mm DIAMETER. FOR LARGER PIPEWORK, 20mm SHALL BE USED.
- REFER TO MANHOLE SCHEDULE FOR SIZES, COVERS ETC.
- ALL MATERIALS TO COMPLY WITH THE RELEVANT BS-EN, LATEST EDITION, FOR PIPEWORK AND FITTINGS.
- UPON COMPLETION, ALL WORKS TO BE THOROUGHLY CLEANED BY FLUSHING.

CDM REGULATIONS 2015

ARCH ASSOCIATES HAVE CONSIDERED AND, WHERE REASONABLY PRACTICABLE, AVOIDED FORESEEABLE RISKS IN THE PREPARATION OF THIS DESIGN SHOWN ON THIS AND RELATED DRAWINGS. SIGNIFICANT RISKS WHICH REMAIN AND ASSOCIATED CONTROL MEASURES ARE IDENTIFIED BELOW AND SHOULD BE GIVEN PARTICULAR ATTENTION BY THE MAIN CONTRACTOR ON SITE.

ACTIVITY	HAZARD	CONTROL

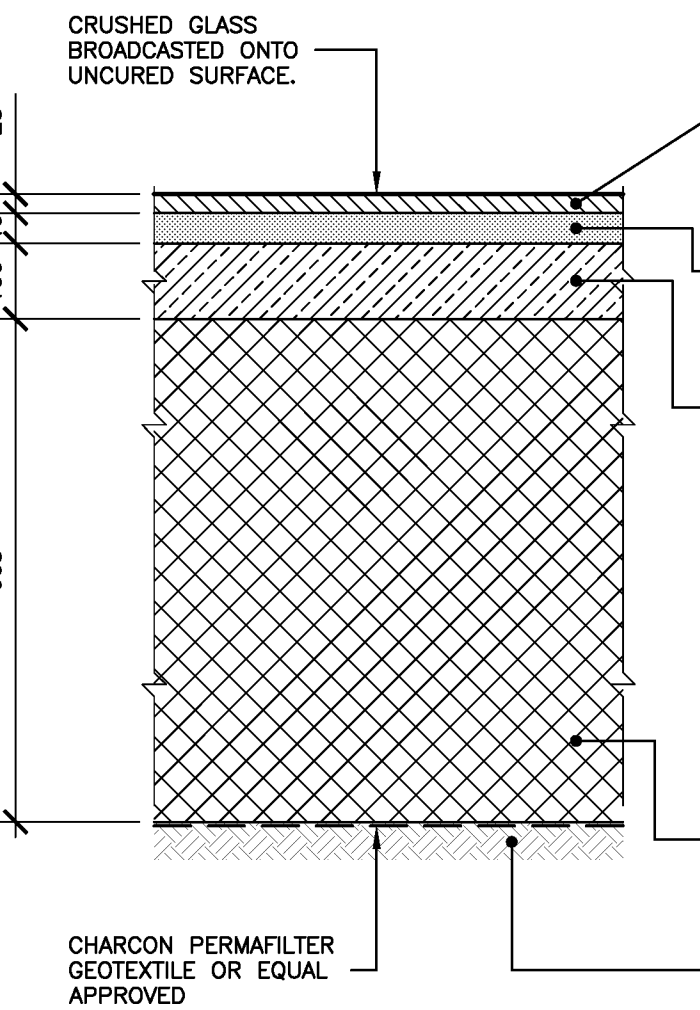
NOTE: THE ABOVE ASSESSMENT RECORDS ONLY THOSE ELEMENTS CONSIDERED UNUSUAL, DIFFICULT TO MANAGE OR OUTSIDE OF THE ANTICIPATED EXPERTISE OF A COMPETENT CONTRACTOR



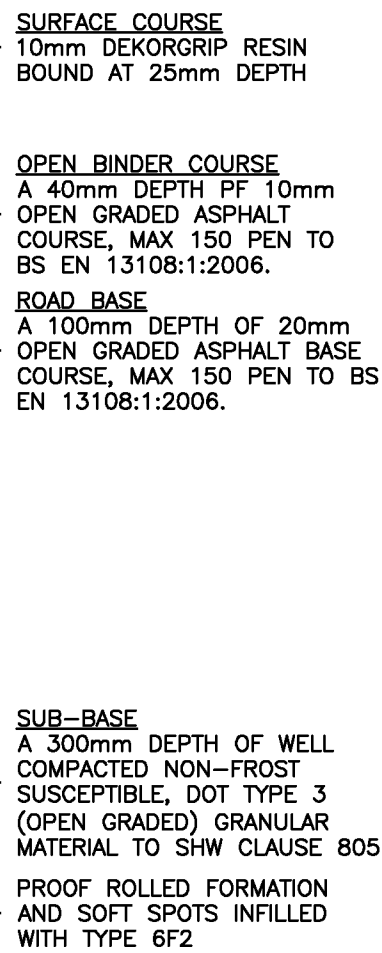
OPERATION AND MAINTENANCE REQUIREMENTS FOR PERMEABLE PAVING		
MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
REGULAR MAINTENANCE	BRUSHING AND VACUUMING (STANDARD COSMETIC SWEEP OVER WHOLE SURFACE)	ONCE A YEAR, AFTER AUTUMN LEAF FALL, OR REDUCED FREQUENCY AS REQUIRED, BASED ON SITE-SPECIFIC OBSERVATIONS OF CLOGGING OR MANUFACTURER'S RECOMMENDATIONS - PAY PARTICULAR ATTENTION TO AREAS WHERE WATER RUNS ONTO PERVIOUS SURFACE FROM ADJACENT IMPERMEABLE AREAS AS THIS AREA IS MOST LIKELY TO COLLECT THE MOST SEDIMENT
OCCASIONAL MAINTENANCE	STABILISE AND MOW CONTRIBUTING AND ADJACENT AREAS	AS REQUIRED
	REMOVAL OF WEEDS OR MANAGEMENT USING GLYPHOSATE APPLIED DIRECTLY INTO THE WEEDS BY AN APPLICATOR RATHER THAN SPRAYING	AS REQUIRED - ONCE PER YEAR ON LESS FREQUENTLY USED PAVEMENTS
REMEDIAL ACTIONS	REMEDIAL ANY LANDSCAPING WHICH, THROUGH VEGETATION MAINTENANCE OR SOIL SUP, HAS BEEN RAISED TO WITHIN 50mm OF THE LEVEL OF THE PAVING	AS REQUIRED
	REMEDIAL WORK TO ANY DEPRESSIONS, RUTTING AND CRACKED OR BROKEN BLOCKS CONSIDERED DETRIMENTAL TO THE STRUCTURAL PERFORMANCE OR A HAZARD TO USERS, AND REPLACE LOST JOINTING MATERIAL	AS REQUIRED
	REHABILITATION OF SURFACE AND UPPER SUB-STRUCTURES BY REMEDIAL SWEEPING	EVERY 10 TO 15 YEARS OR AS REQUIRED (IF INFILTRATION PERFORMANCE IS REDUCED DUE TO SIGNIFICANT CLOGGING)
MONITORING	INITIAL INSPECTION	MONTHLY FOR THREE MONTHS AFTER INSTALLATION
	INSPECT FOR EVIDENCE OF POOR OPERATION AND/OR WEED GROWTH - IF REQUIRED, TAKE REMEDIAL ACTION	THREE-MONTHLY, 48 HOURS AFTER LARGE STORMS IN FIRST SIX MONTHS
	INSPECT SILT ACCUMULATION RATES AND ESTABLISH APPROPRIATE BRUSHING FREQUENCIES	ANNUALLY
	MONITOR INSPECTION CHAMBERS	ANNUALLY
	INSPECT TREATED TIMBER EDGING AND REPLACE AS AND WHEN REQUIRED,	ANNUALLY

LEGEND

- PERMEABLE RESIN BOND PAVING
- PERMEABLE BLOCK PAVING



PERMEABLE RESIN BOUND SURFACE
CONSTRUCTION DETAIL
(SCALE 1:10@A1)



PERMEABLE BLOCK PAVING
CONSTRUCTION DETAIL
(SCALE 1:10@A1)

P2	10.04.18	BUILDING LAYOUT AMENDED	JH
P1	05.07.17	PRELIMINARY ISSUE FOR COMMENT	JH
Revision	Date	Description	By

ARCH ASSOCIATES
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

The Town House, St. George's Square, Bishops Walkham, Southampton, Hampshire, SO22 1AF.
Telephone: 01489 970004 Email: admin@archassociates.co.uk Web: www.archassociates.co.uk

ace
architectural engineering design environment

Client
RENAISSANCE RETIREMENT

Architect
ASPIRE ARCHITECTS LLP

Project Title
PROPOSED DEVELOPMENT
FITZALAN ROAD, ARUNDEL,
WEST SUSSEX

Drawing Title
DRAINAGE STRATEGY

Scale 1:200	Paper Size A1	Date JULY 2017	Drawn By JH	Checked By CH
Project No. RRL025	Drawing No. 500	Revision P2		

APPENDIX 7

Proposed Foul Water Drainage Calculation

Foul Water Design Flows

	DWF (l/day)	Daily Design / Peak Flow (l)	No. of Units	Q l/s
General Housing per dwelling (3 persons)	600	4000	46	2.13
School per pupil	80	528		
Assembly Hall per seat	10	66		
Cinema per seat	10	66		
Theatre per seat	10	66		
Sports Hall per person	50	330		
Hotel per room	550	3630		
Guest House per room	200	1320		
Motel per room	300	1980		
Holiday Apartment per person	150	990		
Leisure Park per person	220	1452		
Caravan Pk standard per space	250	1650		
Caravan Pk serviced per space	450	2970		
Camping site standard per space	200	1320		
Camping site serviced per space	350	2310		
Public House per seat	150	990		
Restaurant/Day Care Centre per person	270	1782		
Drive in restaurant per seat	380	2508		
Hospital per bed	750	4950		
Nursing/Care Homes per bed	375	2475		
Offices per 100m ²	750	4950		
Shopping Centre per 100m ²	400	2640		
Warehouse per 100m ²	150	990		
Commercial premises per 100m ²	300	1980		
Manufacturing unit per 100m ²	550	3630		
			Total Flow =	2.1 l/s (6x DWF)

**Sourced from Thames Water Foul Flows*

APPENDIX 8

Extracts of Infiltration Testing Report



Ref: 1CO102284/180229/L1R1

Date: 8th March 2018

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

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 identified, rising to 0.40m and 0.50m respectively after 60 minutes. 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) 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) NP

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.

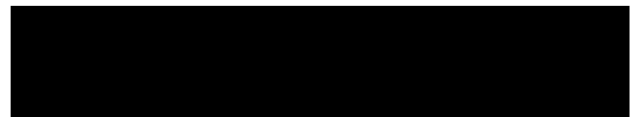
We trust this letter and its enclosures are clear. Should you have any queries, please contact the undersigned.

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

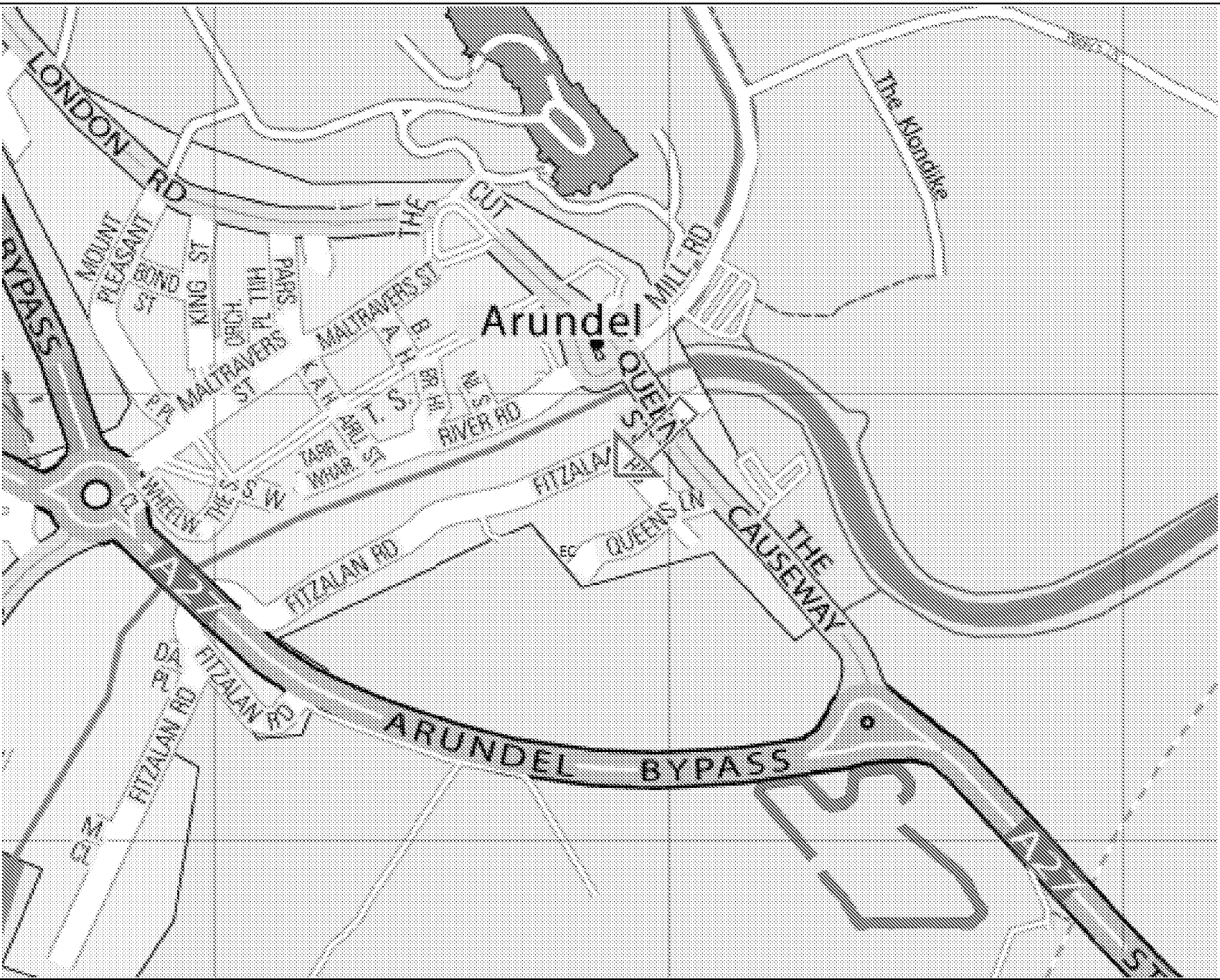
1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client as indicated.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive 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 be 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.



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recld.co.uk

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

Client:
**Renaissance
Retirement Ltd**

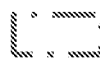
Job No: **1CO102284**
Drawn By: **MN**
Approved by: **RL**

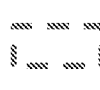
Notes:
Extracted from Street
Map
(Not to scale)

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

KEY:



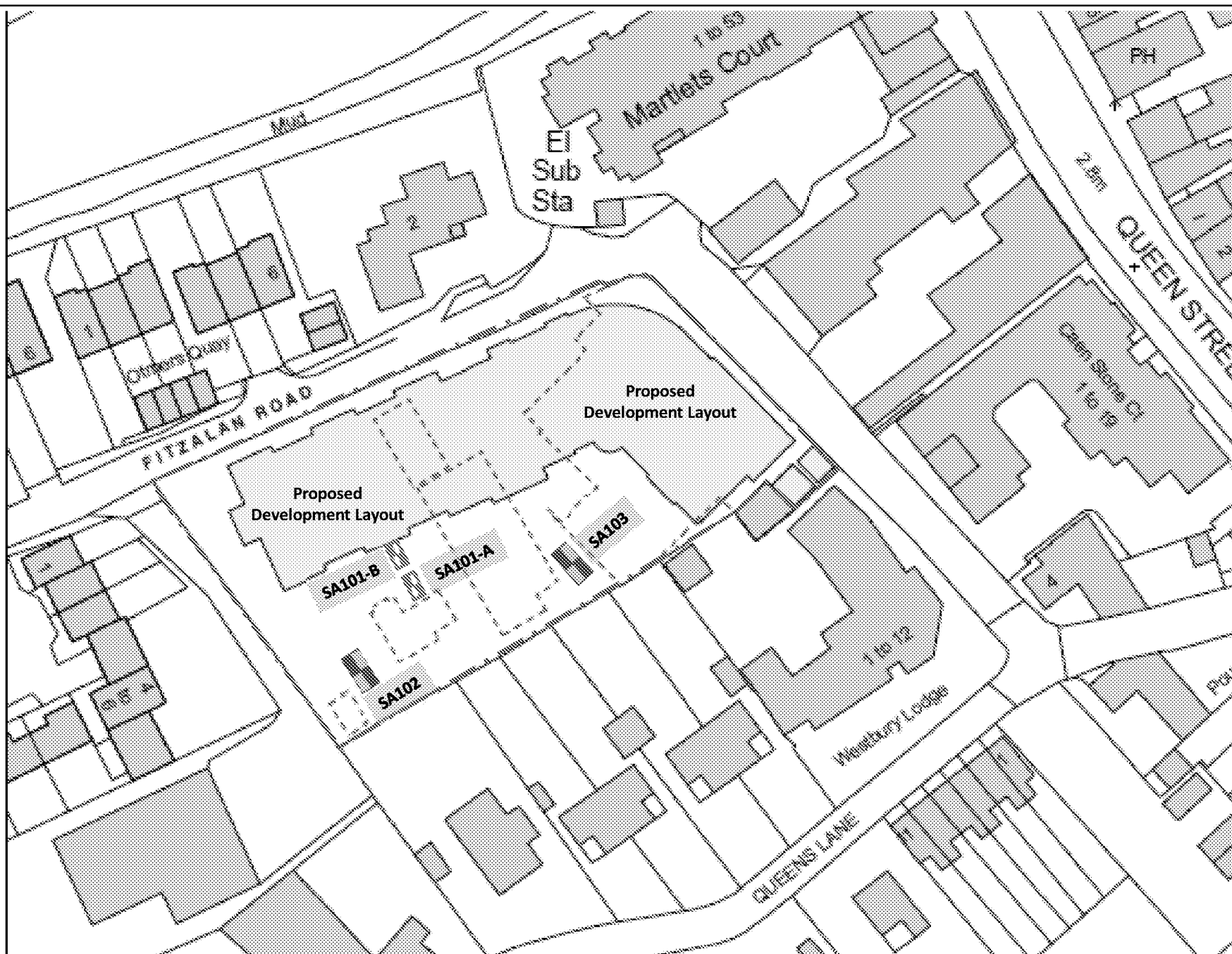
 Redline Site Boundary

 Existing Building Layout

 Trial Pits with Soakage Test

 Trial Pits

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REC



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1 Winnall Valley Rd,
Winchester, SO23 0LD

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rec ltd.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)

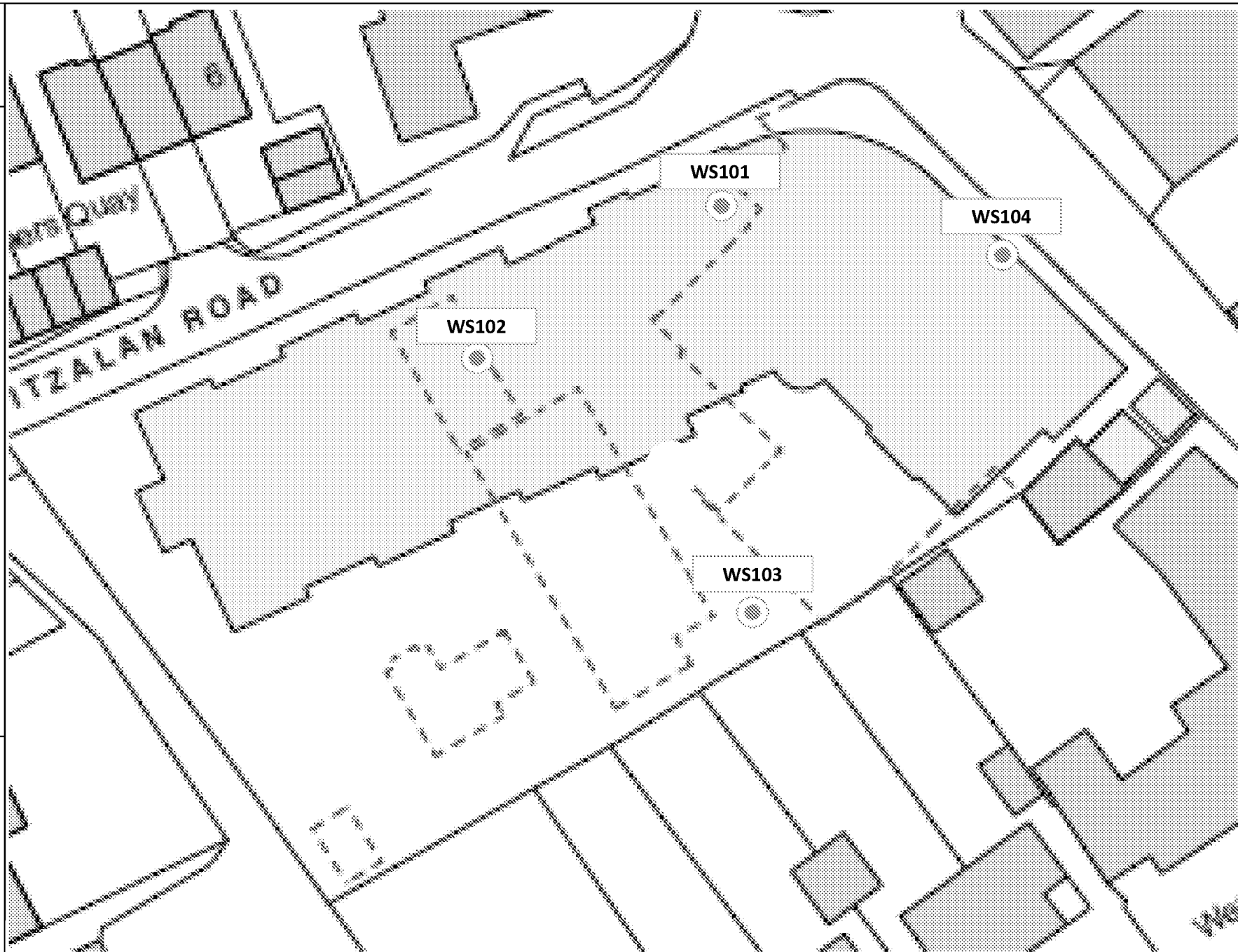
Drawing Title:

**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

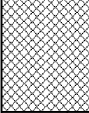
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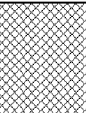
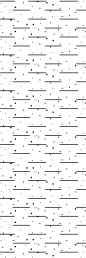
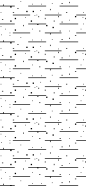
Not to scale

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						End of Borehole at 0.50m		
		0.50								
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 AN ISO 9001 CERTIFIED COMPANY

   		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
--	--	--	--

   		Trial Pit Log			Borehole No. SA102				
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): 0.55		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					
		0.10 - 0.25	ES		0.10			Asphalt	
		0.30 - 0.40	ES		0.25			[MADE GROUND] Cream to light brown slightly clayey sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint, brick, concrete, slate and white chalk. Cobbles are angular to subangular flint and brick.	
		0.50		HVP=73	0.55			[MADE GROUND] Soft to firm light brown to brown sandy CLAY. Sand is fine to coarse.	
		0.50		HVP=82			[ALLUVIUM]		
		0.50		HVP=94				End of Borehole at 0.55m	
Remarks: Location cleared for buried services using a Cable Avoidance Tool (CAT). No groundwater encountered. Soil infiltration undertaken at depth within the location. Location backfilled with arisings in reverse order and made safe upon completion. Stability: Stable								Pit Dimensions Length: 2.20 Width: 0.50 Depth: 0.55	 CONCEPT LIFE SCIENCES QUALITY AND SAFETY

   		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 ESTABLISHED 2012									

Attachment 4
Soil Infiltration Test Certificate

Remarks -

Ground Description:

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

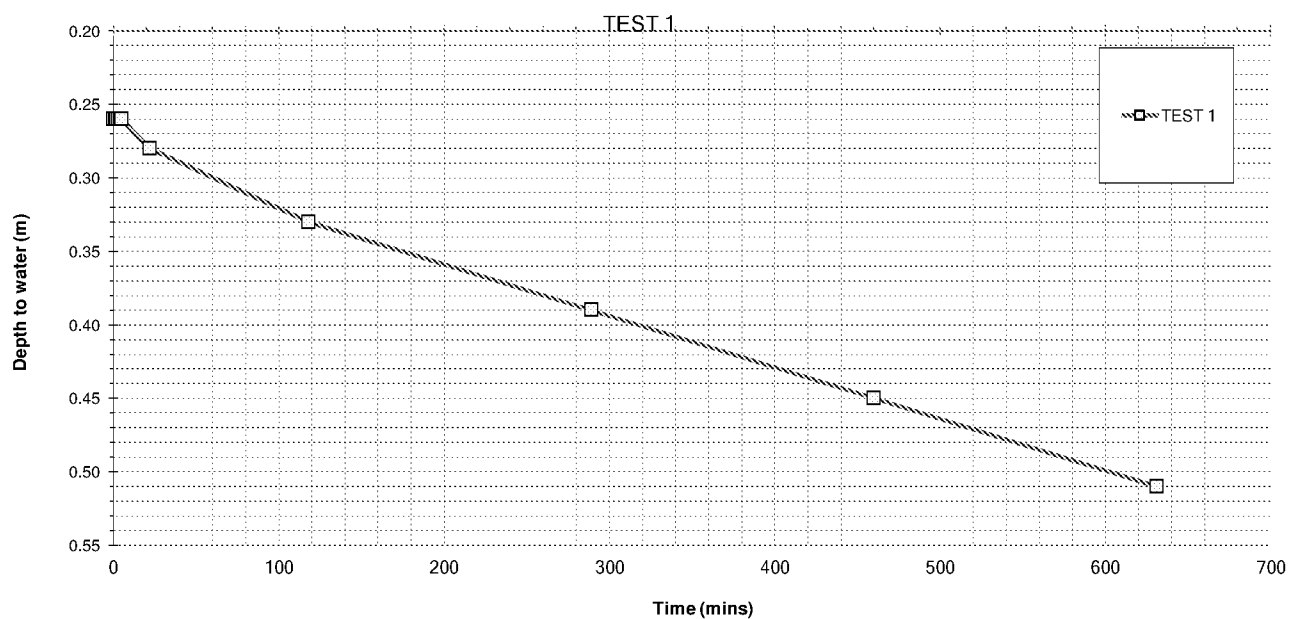
0.10-0.25 **MADE GROUND:**
Cream to light brown slightly clayey SAND and GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint, brick, concrete, slate, relic white chalk. Cobbles are angular to subangular flint and brick.

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

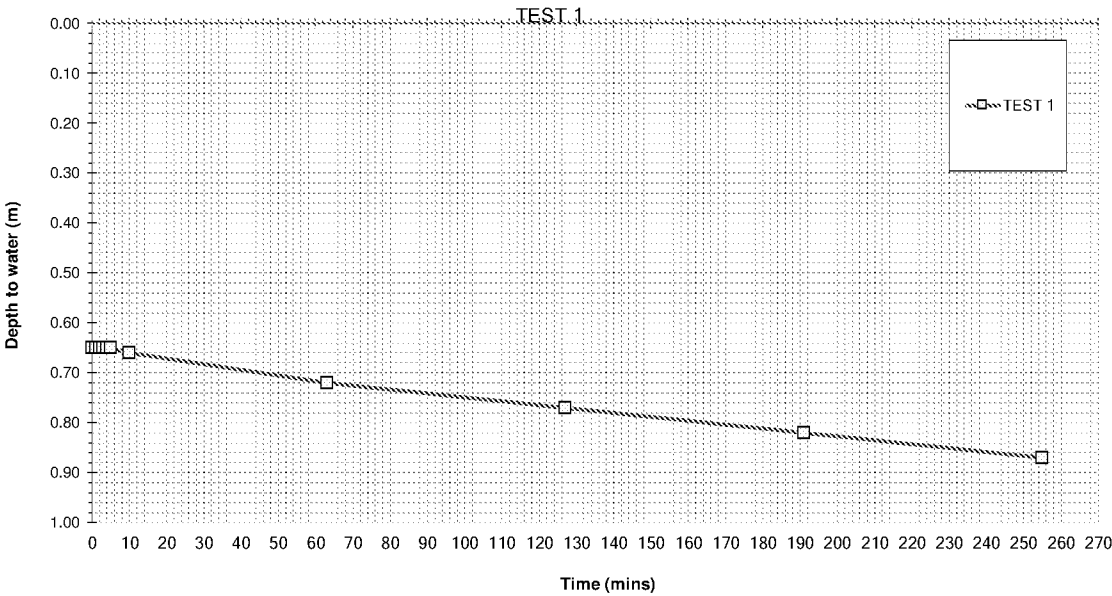


 REC SOLUTIONS	Site Arundel Job Number 1CO102284 Date of Test 12/02/2018	Trial Pit Number..... SA103 Length..... 1.90 m Width..... 0.85 m Depth..... 0.90 m Groundwater Level..... Not encountered m
---	--	--

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	TEST 2	TEST 3	
	Time(min)	Depth to Water (m)	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	0.25		
75% Effective Storage Depth	m	0.19		
(i.e. depth below GL)	m	0.71		
25% Effective Storage Depth	m	0.06		
(i.e. depth below GL)	m	0.54		
Effective Storage Depth 75%-25%	m	0.13		
Time to fall to 75% effective depth	mins	80.00		
Time to fall to 25% effective depth	mins	210.00		
V (75%-25%)	m3	0.20		
a (50%)	m2	2.30		
t (75%-25%)	mins	150.00		
SOIL INFILTRATION RATE	m/s	9.74E-06		

DESIGN SOIL INFILTRATION RATE, f	9.74E-06
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TEST 1



A CONCEPT LIFE SCIENCES COMPANY
