

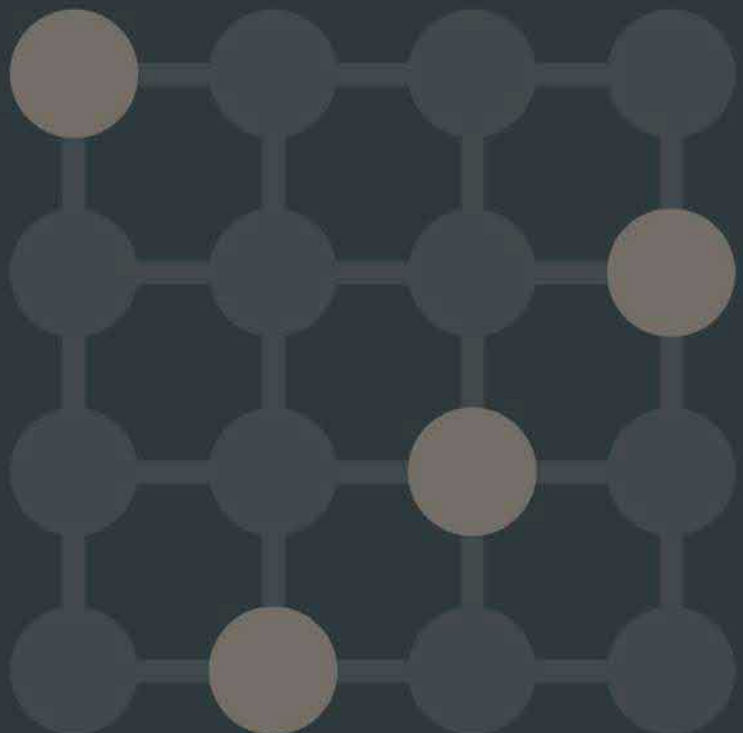
rappor

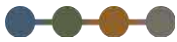


# Gloucester Asbestos, Stroud Road, Gloucester

Gloucester Asbestos Ltd

Drainage Strategy Technical Note  
December 2023





## Document Control

---

Project Number	23-0372	
Project Name	Gloucester Asbestos, Stroud Road, Gloucester	
Document Title	Drainage Strategy Technical Note	
Status	Final	
Client	Gloucester Asbestos Ltd	
	Name	Date
Prepared By	[REDACTED]	May 2023
Checked By	[REDACTED]	June 2023
Approved By	[REDACTED]	June 2023

## Record of Revisions

Revision	Date	Details	Made By
01	26/06/23	Final Issue	KT
02	21/12/23	Final Issue	JB

### Rappor Consultants Ltd

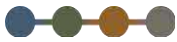
A: CTP House, Knapp Road, Cheltenham, GL50 3QQ

W: [www.rappor.co.uk](http://www.rappor.co.uk)

T: [REDACTED]

E: [REDACTED]

© Rappor Consultants Limited. All rights reserved. The contents of this document must not be copied or reproduced in whole or in part without the written consent of Rappor Consultants Ltd and Gloucester Asbestos Ltd



## Contents

---

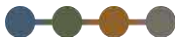
Document Control.....	i
1 Introduction .....	1
2 Existing Site Conditions.....	2
3 Proposed Drainage Strategy .....	4
4 SuDS/Drainage Management.....	7
5 Summary and Conclusions.....	8

## List of Figures and Tables

Table 4.1 Initial Operation and Maintenance Plan .....	7
--	---

## Appendices

- Appendix A – Proposed Development Drawings
- Appendix B – CCTV Survey
- Appendix C – Sewer Records
- Appendix D – Microdrainage Calculations – (QBar)
- Appendix E – Microdrainage Calculations – Storage
- Appendix F – Drainage Strategy



## 1 Introduction

---

- 1.1 Rappor provide expert Transport Planning, Highways, Infrastructure and Flood Risk consultancy services throughout the UK.
- 1.2 Rappor were appointed by Gloucester Asbestos Ltd to provide drainage consultancy in support of a planning application S.23/0327/FUL for the erection of a single building on land occupied for industrial use.
- 1.3 A copy of the proposed development drawings is included within **Appendix A**.
- 1.4 This Technical Note will cover the proposed surface water drainage arrangement and demonstrate compliance with the principles of Sustainable Drainage Systems (SuDS).



## 2 Existing Site Conditions

---

- 2.1 The application site is located off Stroud Road, Gloucester.
- 2.2 The approximate co-ordinates for the centre of the site are E: 383378; N: 212745, with the nearest post code of GL4 0UQ.
- 2.3 The location of the site is bound generally by agricultural land to the west and south with the A4173 along the western boundary.
- 2.4 The current site consists of existing buildings and a permeable gravel forecourt.
- 2.5 Access to the site is via formed junction from A4173 to the south and drop kerb at existing building frontage.

### Topography

- 2.6 Based on OS map data the site falls from the south to the north at an approximate gradient of 1:25 (4%)

### Geology

- 2.7 Geological data held by the British Geological Survey (BGS)<sup>1</sup> shows that the bedrock geology underlying the site is Blue Lias and Charmouth Mudstone Formation.
- 2.8 Soils mapping<sup>2</sup> indicates the underlying soil as lime rich and clayey soils with impeded drainage.

### Existing Drainage

- 2.9 An existing culvert runs south to north through the site, with connectivity to the main watercourse network to the north west. The upstream culvert depth is 0.8m. CCTV survey of the existing culvert is shown in **Appendix B**.
- 2.10 The site currently drains naturally north and to surrounding grassland areas.
- 2.11 An existing 100mm PVC foul rising main is located within the A4173 along the eastern highway boundary.
- 2.12 Severn Trent sewer records are contained in **Appendix C**.

### Infiltration Testing

- 2.13 Based on the geology shown to be underlying the site in the BGS online mapping, it is assumed that infiltration would not provide viable means of surface water discharge. Infiltration testing has not been undertaken at this stage.

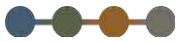
### Flood Risk Vulnerability

- 2.14 The Environment Agency Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood

---

<sup>1</sup> <https://geologyviewer.bgs.ac.uk/>

<sup>2</sup> <http://www.landis.org.uk/soilsclapes/>



defences, since these can be breached, overtopped and may not be in existence for the lifetime of a development.

2.15 Table 1 of NPPF, categorises flood zones into:

- a) Zone 1- Low risk, less than 0.1% Annual Event Probability (AEP) (< 1 in 1000 years)
- b) Zone 2- Medium risk, 0.1% AEP (1 in 1000 - 1 in 100 years)
- c) Zone 3a- High risk, 1% AEP (> 1 in 100 years)
- d) Zone 3b- High risk - Functional Floodplain, 3.33% AEP (>1 in 30 years)

2.16 The site is located within Flood Zone 1 as shown on the Environment Agency Flood Map for Planning<sup>3</sup>. This is the area shown to be at low risk of river flooding.

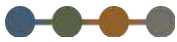
2.17 Risk of flooding from surface water mapping has also been prepared by the Environment Agency<sup>4</sup>, this shows the potential flooding which could occur when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead.

2.18 This mapping indicates that the site is at low risk of surface water flooding.

---

<sup>3</sup> <https://flood-map-for-planning.service.gov.uk/>

<sup>4</sup> <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>



## 3 Proposed Drainage Strategy

---

### Introduction

- 3.1 A surface water management strategy for the development is proposed to manage and reduce the flood risk posed by surface water runoff from the site. The surface water drainage arrangements for any development site should be such that the volume and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development unless specific off-site arrangements are made and result in the same net effect.
- 3.2 An assessment of the surface water runoff rates was undertaken to determine the surface water options and attenuation requirements for the site and is discussed below.
- 3.3 Sustainable drainage system measures (SuDS) should be used to control the surface water runoff from the proposed development site, thereby managing the flood risk to the site and surrounding areas from surface water runoff. These measures will also improve the quality of water discharged from the site.
- 3.4 The SuDS hierarchy demands that surface water run off should be disposed of as high up the following list as practically possible:
  - a) Into the ground (infiltration) and re-use, or then;
  - b) To a surface water body, or then;
  - c) To a surface water sewer, highway drain or another drainage system, or then;
  - d) To a combined sewer.
- 3.5 Based on the ground conditions underlying the site, infiltration is deemed to be not feasible.
- 3.6 There is no open surface water body within the vicinity of the site, and therefore a positive restricted connection to the existing surface water culvert will be proposed.

### Surface Water

- 3.7 Utilising Microdrainage source control the Greenfield discharge has been calculated, with QBar of **0.1 l/s**. Refer to **Appendix D** for Microdrainage calculations.
- 3.8 The introduction of roof area associated with the proposed development will introduce an impermeable roof area of approximately 240m<sup>2</sup> (0.024ha). The external areas will remain unchanged.
- 3.9 Surface water runoff from the proposed development shall be collected through a system of gutters and downpipes and discharged to an attenuation system. Refer to **Appendix E** for attenuation calculations based on permeable paving.
- 3.10 A discharge rate of 0.1l/s will increase the risk of blockages due to small orifice and therefore for design purposes and in accordance with manufacturers guidance we will use limited discharge rates of **0.2 l/s** for each network for all storms up to and including the 1 in 100 year event with a 40% allowance for climate change.
- 3.11 To demonstrate that the necessary storage volumes can be accommodated on the site an illustrative drainage layout has been prepared and has been included as **Appendix F**.



3.12 The final layout and design of the surface water drainage network will be determined at the detailed design stage and will need to consider site levels to accommodate cover and drainage falls to points of connection.

### Exceedance Events

3.13 The attenuation system will be designed with a capacity up to a 1 in 100-year (plus 40% climate change) event. This provides a betterment (reduction) in runoff when compared to existing undeveloped conditions, where runoff is uncontrolled across all return periods.

3.14 A storm event in excess of this design standard would be extreme and would cause the system to backup (with no sudden deluge), utilising available storage within the pipes and manholes, and would then shed overland following the topography of the site, as per existing conditions.

### Water Quality

3.15 The SuDS Manual (CIRIA C753) states that the design of surface water drainage should consider minimising contaminants in surface water runoff discharged from the site. The level of treatment required depends on the proposed land use, according to the pollution hazard indices. For this site contaminant risks come from the Commercial roofing only.

3.16 To ensure that adequate treatment is provided the SuDS mitigation indices for the development must be equal to, or exceed, the pollution hazard indices. Surface water runoff from commercial roofs is considered to present a **low** hazard to water quality.

3.17 The roof drainage will pass through permeable paving prior to discharge.

3.18 To ensure a suitable mitigation index is achieved the affected stormwater system has been assessed. **Table 3.1** indicates satisfactory water quality is achieved.

3.19 It is also recommended, as good practice, that gullies and chambers have suitable silt traps/catchpits to reduce sediments entering the system.

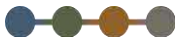
		Pollution Hazard Level	Total suspended solids	Metals	Hydro-carbons
Land Use	<b>Commercial Roofs</b>	<b>Low</b>	<b>0.3</b>	<b>0.2</b>	<b>0.05</b>
Total			<b>0.3</b>	<b>0.2</b>	<b>0.05</b>
SuDS Component	<b>Permeable Paving</b>		<b>0.7</b>	<b>0.6</b>	<b>0.7</b>
Total			<b>0.7</b>	<b>0.6</b>	<b>0.7</b>
Total SuDS Mitigation Indices ≥ Pollution Hazard Indices			<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

(As per C753 The SuDS Manual)

### Water Reuse

3.20 The proposed development provides an opportunity to reuse surface water throughout the provision of rainwater harvesting products.





- 3.21 Rainwater butts should be provided at suitable locations where feasible, to reduce the volume of water entering the underground drainage system and the demand on the water supply network.
- 3.22 Harvested rainwater may be used for external area watering and other applications where a pressurised hose connection is not required. Stored rainwater also provides a source of clean water when hosepipe bans are in effect.

### **Foul Water Management**

- 3.23 Foul water from the proposed dwelling shall be collected through a traditional gravity drainage system and directed to the existing on-site drainage system. This should be considered when setting building and external levels at detailed design stage.



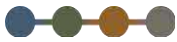
## 4 SuDS/Drainage Management

- 4.1 Maintenance of SuDS features is essential to ensure that the surface water drainage system operates effectively and that flooding of the site and surrounding areas is prevented.
- 4.2 The responsibility of maintaining the drainage components would lie with the development landowner unless responsibility is delegated to an appointed external Management Company.
- 4.3 A full maintenance regime should be carried out to ensure that the drainage system remains operational over its lifetime. **Table 4.1** summarises an initial maintenance plan for the drainage components proposed within the development. The SuDS Manual (CIRIA C753) and manufacturer's guidelines should be referred to for further maintenance information.

Drainage Component	Required Action	Typical Frequency
<b>Pipework, manholes, flow control chambers, catch pits and silt traps</b>	Stabilise adjacent areas	As required
	Remove weeds	As required
	Clear any poor performing structures.	As required
	Inspect all structures for poor operation	Three monthly, 48 hours after large storms in first six months
	Monitor inspection chambers. Inspect silt accumulation rates and determine silt clearance frequencies	Annually
<b>Permeable Paving</b>	Sweep all paving regularly, sweep and suction brush permeable paving in autumn after leaf fall	As required

*(As per C753 The SuDS Manual)*

**Table 4.1** Initial Operation and Maintenance Plan



## 5 Summary and Conclusions

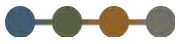
---

### Summary

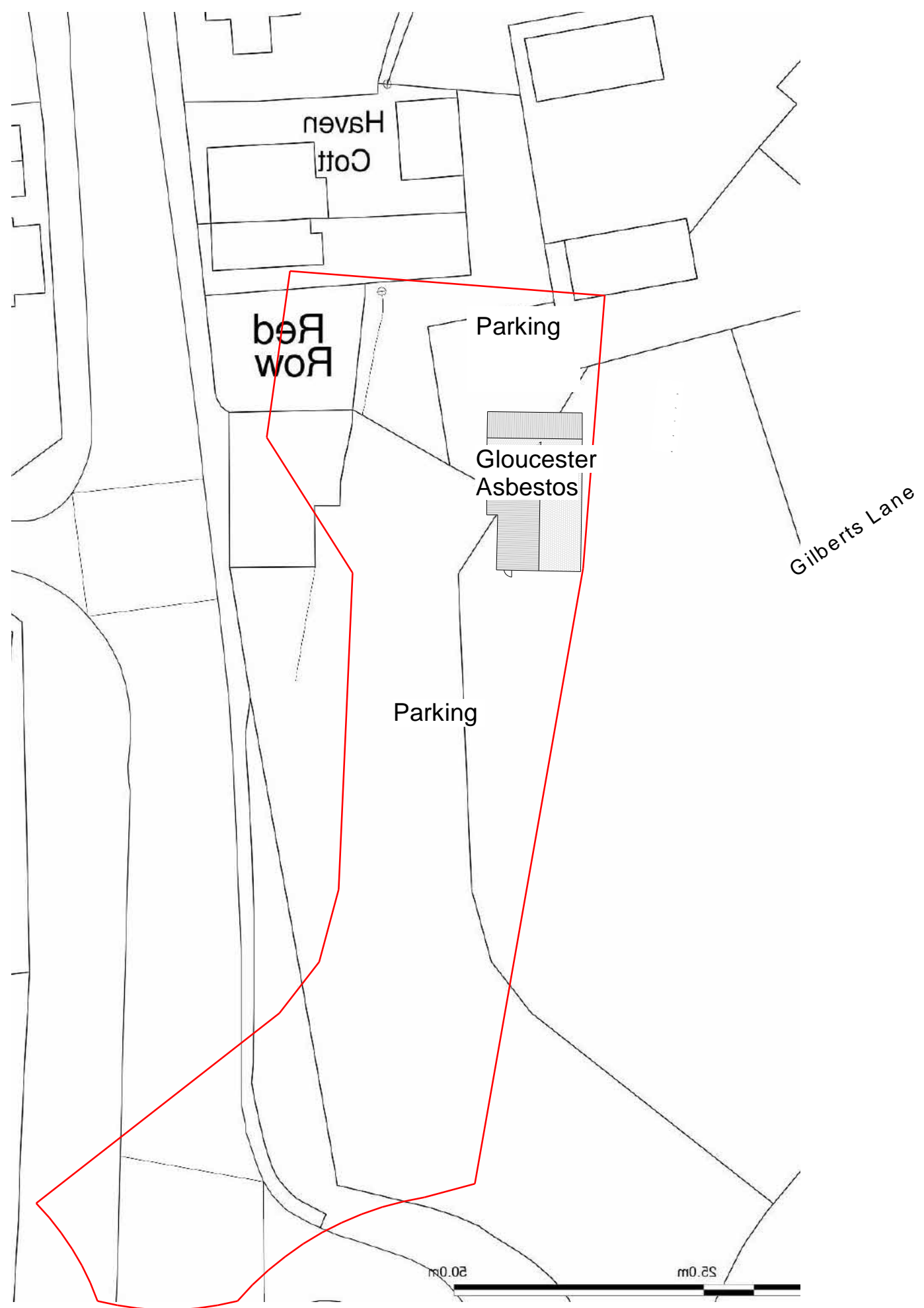
- 5.1 This Drainage Strategy Technical Note has considered the surface water and foul drainage arrangements for the proposed development and ensured compliance with the principles of SuDS and that the flood risk posed from surface water from the site is managed.

### Conclusions

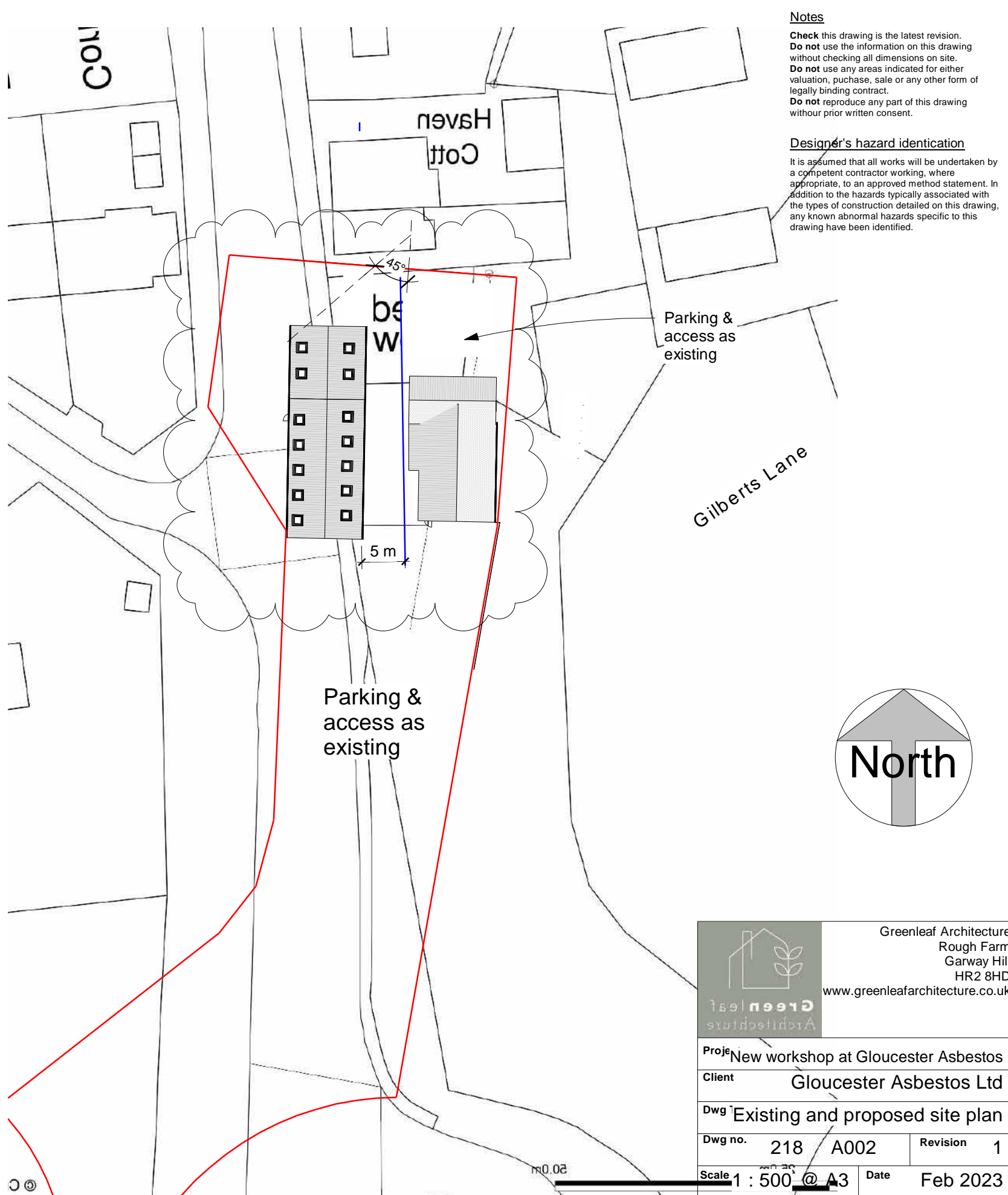
- 5.2 Surface water runoff from the proposed development is to be discharged to the existing culvert via an attenuation system which has been sized to accommodate the 100-year plus 40% climate chance event. Runoff from the existing external areas will drain directly to ground.
- 5.3 Foul water from the site shall be directed to the existing on-site system.



## Appendix A – Proposed Development Drawings



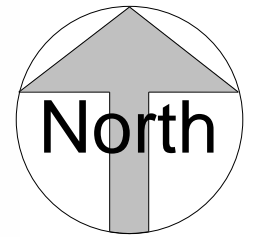
**Site as existing**  
1 : 500



**Site as proposed**  
1 : 500

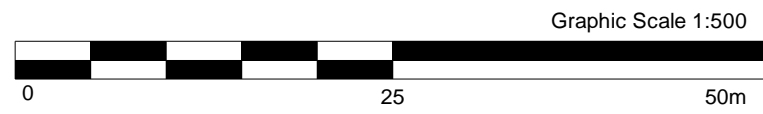
**Notes**  
 Check this drawing is the latest revision.  
 Do not use the information on this drawing without checking all dimensions on site.  
 Do not use any areas indicated for either valuation, purchase, sale or any other form of legally binding contract.  
 Do not reproduce any part of this drawing without prior written consent.

**Designer's hazard identification**  
 It is assumed that all works will be undertaken by a competent contractor working, where appropriate, to an approved method statement. In addition to the hazards typically associated with the types of construction detailed on this drawing, any known abnormal hazards specific to this drawing have been identified.

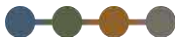


Greenleaf Architecture  
 Rough Farm  
 Garway Hill  
 HR2 8HD  
 www.greenleafarchitecture.co.uk

Project			New workshop at Gloucester Asbestos		
Client			Gloucester Asbestos Ltd		
Dwg			Existing and proposed site plan		
Dwg no.	218	A002	Revision	1	
Scale	1 : 500 @ A3		Date	Feb 2023	



Graphic Scale 1:500



## Appendix B – CCTV Survey

**Project**

**Project Name:** Gloucester Asbestos Ltd\_ Stroud Road\_ GL4 0UQ

**Project Description:** Condition and Connectivity

**Project Date:** 12/10/2023

**Inspection Standard:** MSCC5 Sewers & Drainage GB (SRM5 Scoring)

## Table of Contents

Project Name	Project Number	Project Date
Gloucester Asbestos Ltd_ Stroud Road_ GL4 0UQ		12/10/2023

Project Information .....	P-1
Project Pictures .....	P-3
Section Item 1: SMH1 > LINE X (SMH1X) .....	1
Section Item 2: LINE A > SMH1 (LINE AX) .....	7



**Project Information**

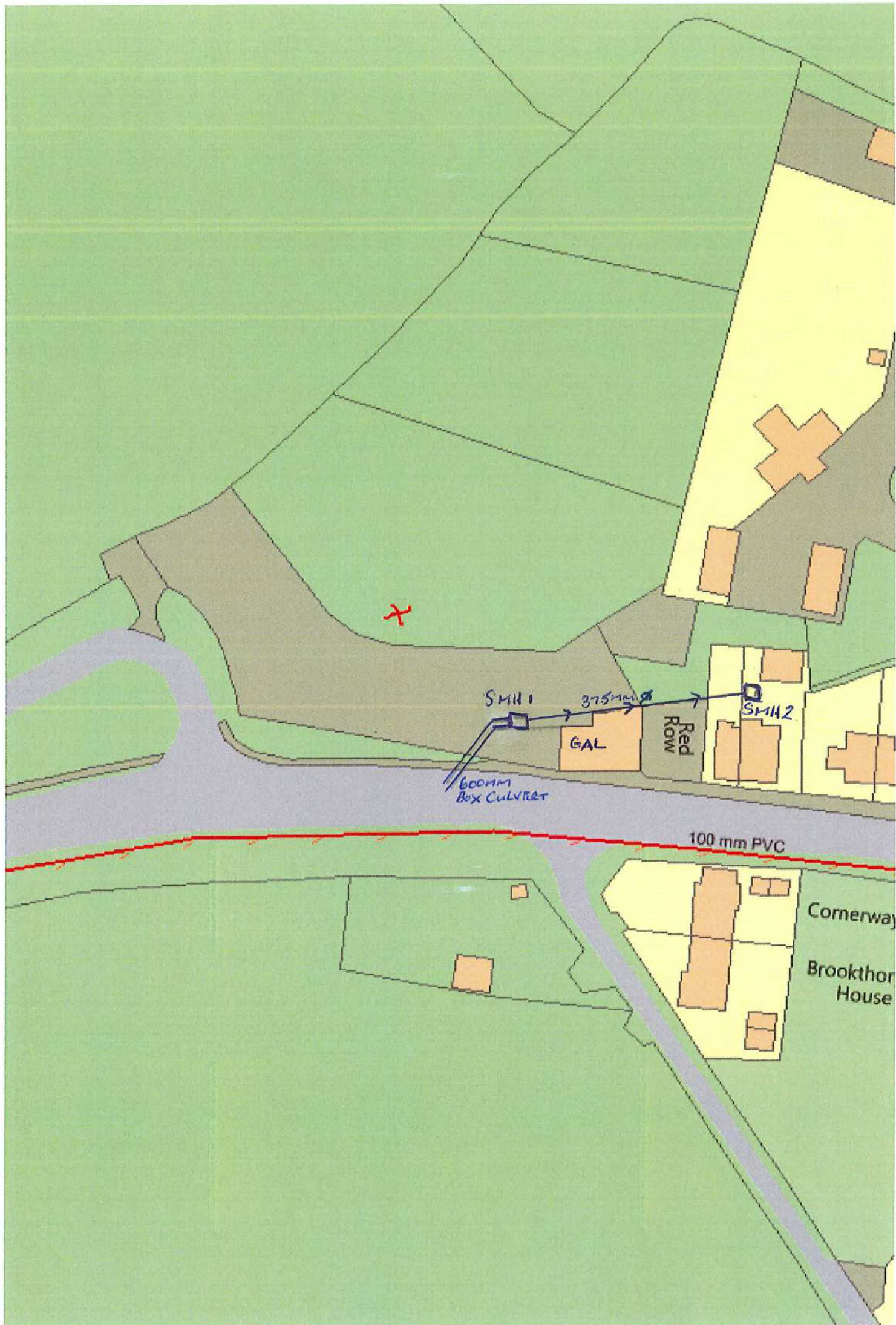
Project Name	Project Number	Project Date
Gloucester Asbestos Ltd_ Stroud Road_ GL4 0UQ		12/10/2023

**Site**

**Department:** Gloucester Asbestos Ltd  
**Street:** Stroud Road,  
**County:** GL4 0UQ

**Contractor**

**Company:** Cotswold Drain Service Ltd.  
**Street:** Cotswold Yard, Gloucester Road  
**Town or City:** Staverton  
**County:** Cheltenham  
**Post Code:** GL51 0TF  
**Phone:** [REDACTED]  
**Email:** [REDACTED]



**Project Information**

Project Name	Project Number	Project Date
Gloucester Asbestos Ltd_ Stroud Road_ GL4 0UQ		12/10/2023

**Project Notes**

As requested, we attended site to undertake a CCTV survey of the underground drainage system to ascertain condition and connectivity.

The surveyed pipework is made up of 375 and 600mm Concrete material and serves Surface water drainage.

The survey has shown that the pipework as typical defects and mass roots and debris obstructing flow.

**Recommendations**

Sections 1 and 2 - Attend site with a Jet Vac unit, clean and clear the pipework and re-survey and report findings with further recommendations.



**Project Pictures**

Project Name	Project Number	Project Date
Gloucester Asbestos Ltd_ Stroud Road_ GL4 0UQ		12/10/2023



DSC02018



DSC02019



DSC02020



DSC02021



DSC02022



DSC02023

## Project Pictures

Project Name	Project Number	Project Date
Gloucester Asbestos Ltd_ Stroud Road_ GL4 0UQ		12/10/2023



DSC02024

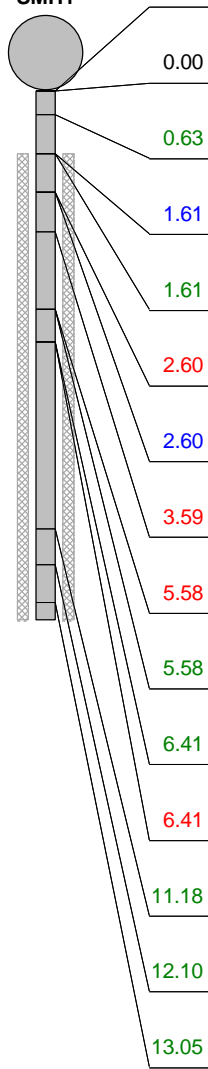


DSC02025

## Section Inspection - 19/10/2023 - SMH1X

Item No. 1	Insp. No. 1	Date 19/10/23	Time 21:48	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Specified	PLR SMH1X
Operator Not Specified		Vehicle Van pack		Camera Mainline	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	GL4 0Uq	Inspection Direction:	Downstream	Upstream Node:	SMH1
Road:	Stroud Road	Inspected Length:	48.45 m	Upstream Pipe Depth:	0.800 m
Location:	Property or buildings	Total Length:	48.45 m	Downstream Node:	LINE X
Surface Type:		Joint Length:		Downstream Pipe Depth:	
Use:	Surface water	Pipe Shape:	Circular		
Type of Pipe:	Gravity drain/sewer	Dia/Height:	375 mm		
Flow Control:	No flow control	Material:	Concrete		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		
Comments:	Debris, root ingress and defects noted				
Recommendations:	Clean pipework and re-survey				

Scale:	1:193	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 0.80 m SMH1		0.00	WL	Water level, 0% of the vertical dimension			
		0.00	MH	Startnode, manhole, reference: SMH1	00:00:00	SMH1X_b 95f4870-4f a2-426a-8	
		0.63	RFJ	Roots, fine at joint	00:00:20	SMH1X_8 85ab768-8 c54-405c-	2
		1.61	WL	Water level, 15% of the vertical dimension	00:00:27	SMH1X_2 d5870d9-f b26-4858-	
		1.61	S01 DEX	Settled deposits, other, 15% cross-sectional area loss, start	00:00:27		
		2.60	JDM	Joint displaced, medium	00:00:34	SMH1X_8 a35c796-c 733-40ce-a	1 / 3
		2.60	WL	Water level, 15% of the vertical dimension	00:00:34		
		3.59	OJM	Open joint, medium	00:00:40	SMH1X_b ec6f80d-dc e7-4835-8	1
		5.58	OJM	Open joint, medium	00:00:52		1
		5.58	RFJ	Roots, fine at joint	00:00:52	SMH1X_c 18a7041-9 d22-4cdb-	2
		6.41	RFJ	Roots, fine at joint	00:00:58		2
		6.41	JDM	Joint displaced, medium	00:00:58	SMH1X_e 1206aec-1 7cc-426f-8	1 / 3
		11.18	RFJ	Roots, fine at joint	00:01:27		2
		12.10	RFJ	Roots, fine at joint	00:01:33		2
		13.05	RFJ	Roots, fine at joint	00:01:39	SMH1X_e a7c40a2-d 2a6-43ca-9	2



## Section Inspection - 19/10/2023 - SMH1X

Item No. 1	Insp. No. 1	Date 19/10/23	Time 21:48	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Specified	PLR SMH1X
Operator Not Specified		Vehicle Van pack		Camera Mainline	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Scale:	1:193	Position [m]	Code	Observation	MPEG	Photo	Grade	
		13.95	RMJ	Roots, mass at joint, 25% cross-sectional area loss	00:01:44	SMH1X_1 2570131-3 300-499d-	5	
		14.34	JN	Junction at 3 o'clock, 100mm dia	00:01:46			
		16.59	RFJ	Roots, fine at joint	00:02:00	SMH1X_0 7097504-8 e01-4bd2-	2	
		17.62	RFJ	Roots, fine at joint	00:02:06	SMH1X_c 29a90ee-f2 58-47c6-a	2	
		18.62	WL	Water level, 30% of the vertical dimension	00:02:12			
		18.80	S02	CUW	Loss of vision, camera under water, start	00:02:13	SMH1X_7 cc8c424-d 79c-400e-	
		24.07	OJM	Open joint, medium	00:02:44		1	
		24.07	F02	CUW	Loss of vision, camera under water, finish	00:02:44	SMH1X_0 63f1c2e-7a 18-4d95-8	
		25.08	JDM	Joint displaced, medium	00:02:50	SMH1X_e 10e47b0-9 b97-4679-	1 / 3	
		26.00	RFJ	Roots, fine at joint	00:02:56	SMH1X_0 ea55e5c-d 473-4f04-a	2	
		26.87	RFJ	Roots, fine at joint	00:03:01	SMH1X_d 305c559-d db9-492d-	2	
		27.81	RMJ	Roots, mass at joint, 30% cross-sectional area loss	00:03:07	SMH1X_3 9e3fe2e-2c f7-4c61-a3	5	
		27.81	WL	Water level, 20% of the vertical dimension	00:03:07			
		29.03	WL	Water level, 25% of the vertical dimension	00:03:14			
		29.06	CXBI	Connection defective, blocked and intruding at 12 o'clock, 150mm dia, intrusion: 25%	00:03:14	SMH1X_7f 7a1bf8-93 4b-4edd-a	4	
		30.25	RM	Roots, mass, 60% cross-sectional area loss	00:03:30	SMH1X_c 5a0ea96-c b5c-4a7b-a	5	
		31.38	S03	CUW	Loss of vision, camera under water, start	00:03:44	SMH1X_3 8d3d146-b aa5-4250-	
		34.50	F03	CUW	Loss of vision, camera under water, finish	00:04:18		
		48.44	F01	DEX	Settled deposits, other, 15% cross-sectional area loss, finish	00:06:30		3
		48.45	MHF	Finish node, manhole, reference: LINE X	00:06:30	SMH1X_9 ec9ca48-5 20a-4286-		

Construction Features

Miscellaneous Features

Structural Defects

Service & Operational Observations

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
6	1.0	0.1	6.0	1.0	18	17.0	3.1	150.0	5.0

## Section Pictures - 19/10/2023 - SMH1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	SMH1X		



SMH1X\_b95f4870-4fa2-426a-8192-8b1cd1919709\_20231019\_215355\_061.jpg, 00:00:00, 0.00 m  
Startnode, manhole, reference: SMH1



SMH1X\_885ab768-8c54-405c-b348-cd1dca354b3f\_20231019\_215407\_864.jpg, 00:00:20, 0.63 m  
Roots, fine at joint



SMH1X\_2d5870d9-fb26-4858-88ba-4e31f1436847\_20231019\_215422\_796.jpg, 00:00:27, 1.61 m  
Water level, 15% of the vertical dimension



SMH1X\_8a35c796-c733-40ce-ab8b-f39d3adb1ead\_20231019\_215447\_341.jpg, 00:00:34, 2.60 m  
Joint displaced, medium



SMH1X\_bec6f80d-dce7-4835-89f9-17849e65ee8d\_20231019\_215505\_428.jpg, 00:00:40, 3.59 m  
Open joint, medium



SMH1X\_c18a7041-9d22-4cdb-b142-e95d9b6b8000\_20231019\_215525\_810.jpg, 00:00:52, 5.58 m  
Roots, fine at joint



## Section Pictures - 19/10/2023 - SMH1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	SMH1X		



SMH1X\_e1206aec-17cc-426f-8ea0-5966a2ee4935\_20231019\_215540\_650.jpg, 00:00:58, 6.41 m  
Joint displaced, medium



SMH1X\_ea7c40a2-d2a6-43ca-905d-944eba992b6c\_20231019\_215615\_174.jpg, 00:01:39, 13.05 m  
Roots, fine at joint



SMH1X\_12570131-3300-499d-a56e-1378067cbf55\_20231019\_215628\_599.jpg, 00:01:44, 13.95 m  
Roots, mass at joint, 25% cross-sectional area loss



SMH1X\_07097504-8e01-4bd2-a716-56a4448125cf\_20231019\_215657\_698.jpg, 00:02:00, 16.59 m  
Roots, fine at joint



SMH1X\_c29a90ee-f258-47c6-a05d-786affb5dbc7\_20231019\_215707\_301.jpg, 00:02:06, 17.62 m  
Roots, fine at joint



SMH1X\_7cc8c424-d79c-400e-b2e2-48fdf6cc3eb5\_20231019\_215731\_108.jpg, 00:02:13, 18.80 m  
Loss of vision, camera under water, start

## Section Pictures - 19/10/2023 - SMH1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	SMH1X		



SMH1X\_063f1c2e-7a18-4d95-852b-5b14d665d795\_20231019\_215759\_756.jpg, 00:02:44, 24.07 m  
Loss of vision, camera under water, finish



SMH1X\_e10e47b0-9b97-4679-b11a-c3080e9dbed7\_20231019\_215813\_462.jpg, 00:02:50, 25.08 m  
Joint displaced, medium



SMH1X\_0ea55e5c-d473-4f04-abbb-7345b45689fe\_20231019\_215823\_264.jpg, 00:02:56, 26.00 m  
Roots, fine at joint



SMH1X\_d305c559-ddb9-492d-b870-5d4fdb75086b\_20231019\_215832\_566.jpg, 00:03:01, 26.87 m  
Roots, fine at joint



SMH1X\_39e3fe2e-2cf7-4c61-a331-9cc1021f688a\_20231019\_215853\_268.jpg, 00:03:07, 27.81 m  
Roots, mass at joint, 30% cross-sectional area loss



SMH1X\_7f7a1bf8-934b-4edd-a8df-ee5f6865581c\_20231019\_215926\_148.jpg, 00:03:14, 29.06 m  
Connection defective, blocked and intruding at 12 o'clock,

## Section Pictures - 19/10/2023 - SMH1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	SMH1X		



SMH1X\_c5a0ea96-cb5c-4a7b-a4e3-b509a4127004\_20231019\_215949\_612.jpg, 00:03:30, 30.25 m  
Roots, mass, 60% cross-sectional area loss



SMH1X\_38d3d146-baa5-4250-876b-8ad34a82a5a0\_20231019\_220006\_429.jpg, 00:03:44, 31.38 m  
Loss of vision, camera under water, start



SMH1X\_9ec9ca48-520a-4286-9957-903a5a0b1306\_20231019\_220044\_228.jpg, 00:06:30, 48.45 m  
Finish node, manhole, reference: LINE X

## Section Inspection - 19/10/2023 - LINE AX

Item No. 2	Insp. No. 1	Date 19/10/23	Time 21:48	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Specified	PLR LINE AX
Operator Not Specified		Vehicle Van pack		Camera Mainline	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village: Road: Location: Surface Type:	GL4 0Uq Stroud Road Property or buildings	Inspection Direction: Inspected Length: Total Length: Joint Length:	Upstream 13.96 m 13.96 m	Upstream Node: Upstream Pipe Depth: Downstream Node: Downstream Pipe Depth:	LINE A  SMH1
Use: Type of Pipe: Flow Control: Year Constructed: Inspection Purpose:	Surface water Gravity drain/sewer No flow control Not Specified Routine inspection	Pipe Shape: Dia/Height: Material: Lining Type: Lining Material:	Rectangular 600 mm Concrete No Lining No Lining	Width: 600 mm	
Comments: Recommendations:	Mass debris and root ingress noted Clean pipework and re-survey				

Scale:	1:121	Position [m]	Code	Observation	MPEG	Photo	Grade
		0.00	WL	Water level, 0% of the vertical dimension			
		0.00	MH	Start node, manhole, reference: SMH1	00:00:00	LINE AX_ff863d 2b-e0f7-48	
		0.00	S01	DEX Settled deposits, other, 20% cross-sectional area loss, start	00:00:00		
		0.91	LL	Line deviates left	00:00:44	LINE AX_ad111 e71-d890-	
		1.36	JN	Junction at 3 o'clock, 450mm dia	00:01:13	LINE AX_4ccdd 0d8-8175-	
		1.36	JN	Junction at 10 o'clock, 375mm dia	00:01:18	LINE AX_420de 7e1-fac0-4	
		11.35	JN	Junction at 10 o'clock, 375mm dia	00:02:19	LINE AX_34980 52a-d127-	
		12.35	H	Hole in drain or sewer from 11 o'clock to 1 o'clock: ROOT INGRESS	00:02:24	LINE AX_51119 c05-b6b0-	4
		13.96	F01	DEX Settled deposits, other, 20% cross-sectional area loss, finish	00:02:57		4
		13.96	SA	Survey abandoned: DEBRIS	00:02:57	LINE AX_a1456 e14-928e-	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
1	80.0	5.7	80.0	4.0	1	5.0	5.0	70.0	5.0



## Section Pictures - 19/10/2023 - LINE AX

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
2	Upstream	LINE AX		



LINE  
AX\_ff863d2b-e0f7-4883-8025-b4bf28c6dd62\_20231019\_22024  
0\_280.jpg, 00:00:00, 0.00 m



LINE  
AX\_ad111e71-d890-40ca-8293-4bb85ce7d392\_20231019\_220  
250\_136.jpg, 00:00:44, 0.91 m



LINE  
AX\_4ccdd0d8-8175-43f6-ba67-e70630ffb58c\_20231019\_22030  
5\_366.jpg, 00:01:13, 1.36 m



LINE  
AX\_420de7e1-fac0-4654-bbaf-c77d502d9206\_20231019\_2203  
18\_263.jpg, 00:01:18, 1.36 m



LINE  
AX\_3498052a-d127-4d37-9be3-90f08fa7e227\_20231019\_2203  
39\_900.jpg, 00:02:19, 11.35 m



LINE  
AX\_51119c05-b6b0-4d53-b790-fe8b2b8e773f\_20231019\_2204  
16\_451.jpg, 00:02:24, 12.35 m

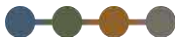
## Section Pictures - 19/10/2023 - LINE AX

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
2	Upstream	LINE AX		

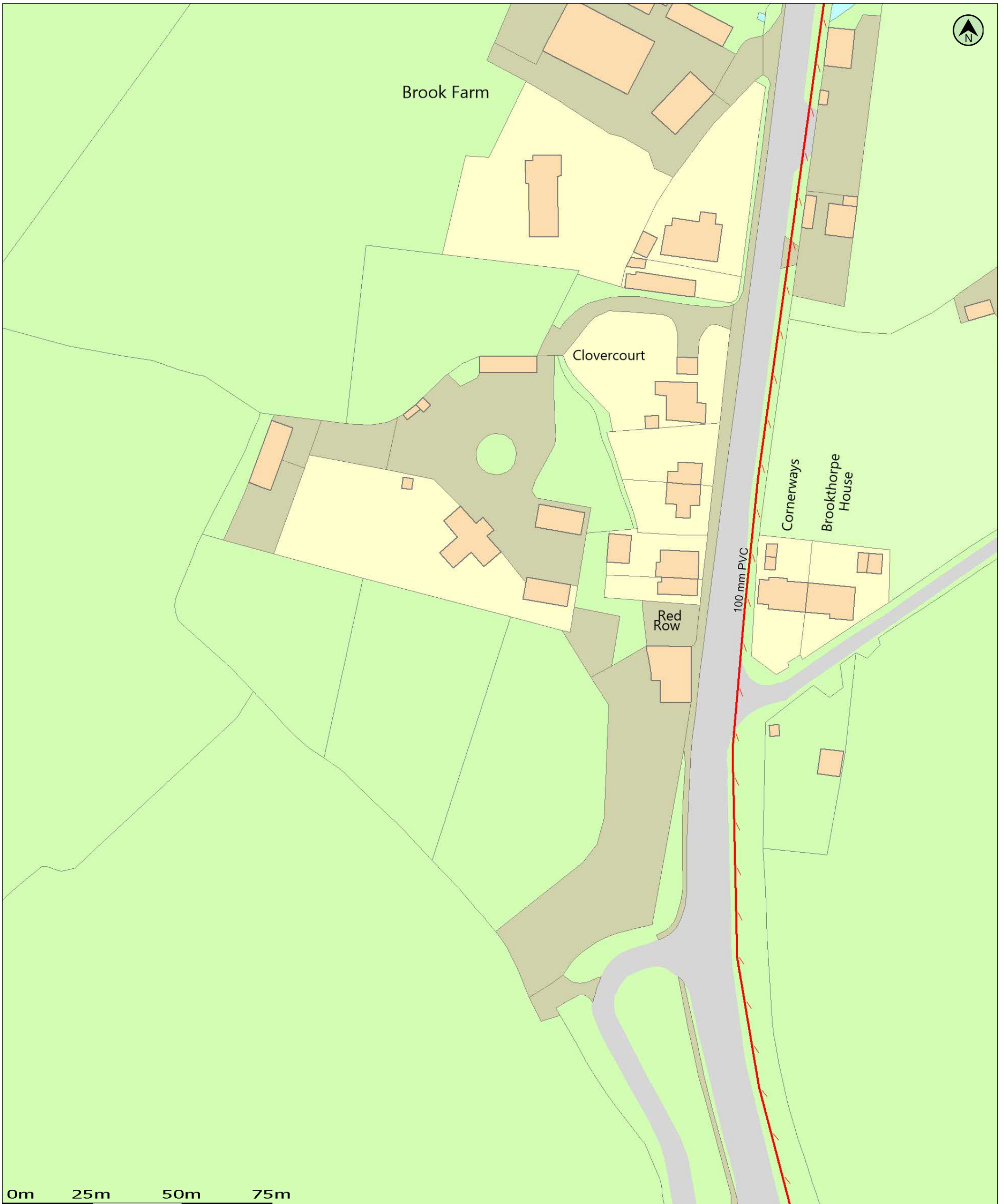


LINE

AX\_a1456e14-928e-421d-9efd-792032cd9115\_20231019\_2204  
49\_476.jpg, 00:02:57, 13.96 m



## Appendix C – Sewer Records



(c) Crown copyright and database rights 2023 Ordnance Survey 100031673  
 Data updated: 14/04/23

Scale: 1:1000  
 Map Centre: 383342,212783

Date: 12/05/23  
 Our Ref: 1174899 - 1

Wastewater Plan A3  
 Powered by digdat

Public Foul Gravity/Lateral Drain		Highway Drain		Manhole Foul	
Public Combined Gravity/Lateral Drain		Overflow Pipe		Manhole Surface	
Public Surface Water Gravity/Lateral Drain		Disposal Pipe		Abandoned Pipe	
Pressure Foul		Culverted Water Course		Chamber	
Pressure Combined		Pumping Station			
Pressure Surface Water		Fitting			

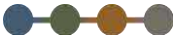
Section 104 sewers are shown in green  
 Private sewers are shown in magenta

Gloucester Asbestos



Do not scale off this map. The plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems. Reproduction by permission of Ordnance Survey on behalf of HMSO. ©Crown Copyright and database rights 2023 All rights reserved. Ordnance Survey licence number 100031673. Document users other than SEVERN TRENT WATER business users are advised that this document is provided for reference purpose only and is subject to copyright, therefore, no further copies should be made from it.





## Appendix D – Microdrainage Calculations (Qbar)

CTP House, Knapp Road  
Cheltenham  
Gloucestershire, GL50 3QQ



Date 13/06/2023 17:25  
File

Designed by [REDACTED]  
Checked by

Innovyze Source Control 2020.1.3

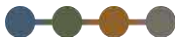
ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	0.024	Urban	0.000
SAAR (mm)	700	Region Number	Region 4

**Results I/s**

QBAR Rural	0.1
QBAR Urban	0.1
Q1 year	0.1
Q1 year	0.1
Q30 years	0.2
Q100 years	0.3



## Appendix E – Microdrainage Calculations (Storage)



Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1022 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.260	0.260	0.0	0.1	0.1	6.6	O K
30 min Summer	0.354	0.354	0.0	0.1	0.1	8.9	O K
60 min Summer	0.455	0.455	0.0	0.1	0.1	11.5	O K
120 min Summer	0.558	0.558	0.0	0.2	0.2	14.1	Flood Risk
180 min Summer	0.616	0.616	0.0	0.2	0.2	15.5	Flood Risk
240 min Summer	0.652	0.652	0.0	0.2	0.2	16.4	Flood Risk
360 min Summer	0.694	0.694	0.0	0.2	0.2	17.5	Flood Risk
480 min Summer	0.718	0.718	0.0	0.2	0.2	18.1	Flood Risk
600 min Summer	0.731	0.731	0.0	0.2	0.2	18.4	Flood Risk
720 min Summer	0.737	0.737	0.0	0.2	0.2	18.6	Flood Risk
960 min Summer	0.741	0.741	0.0	0.2	0.2	18.7	Flood Risk
1440 min Summer	0.740	0.740	0.0	0.2	0.2	18.7	Flood Risk
2160 min Summer	0.725	0.725	0.0	0.2	0.2	18.3	Flood Risk
2880 min Summer	0.701	0.701	0.0	0.2	0.2	17.7	Flood Risk
4320 min Summer	0.647	0.647	0.0	0.2	0.2	16.3	Flood Risk
5760 min Summer	0.594	0.594	0.0	0.2	0.2	15.0	Flood Risk
7200 min Summer	0.546	0.546	0.0	0.2	0.2	13.8	Flood Risk
8640 min Summer	0.503	0.503	0.0	0.1	0.1	12.7	Flood Risk
10080 min Summer	0.466	0.466	0.0	0.1	0.1	11.7	O K
15 min Winter	0.260	0.260	0.0	0.1	0.1	6.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.448	0.0	5.9	19
30 min Summer	79.010	0.0	7.5	34
60 min Summer	50.812	0.0	11.7	64
120 min Summer	31.621	0.0	14.5	124
180 min Summer	23.637	0.0	16.2	182
240 min Summer	19.105	0.0	17.2	242
360 min Summer	14.037	0.0	18.6	362
480 min Summer	11.286	0.0	19.6	482
600 min Summer	9.522	0.0	20.2	600
720 min Summer	8.282	0.0	20.7	716
960 min Summer	6.640	0.0	21.4	818
1440 min Summer	4.854	0.0	21.7	1066
2160 min Summer	3.541	0.0	30.1	1472
2880 min Summer	2.828	0.0	32.0	1876
4320 min Summer	2.055	0.0	33.6	2720
5760 min Summer	1.637	0.0	37.3	3512
7200 min Summer	1.371	0.0	39.0	4320
8640 min Summer	1.186	0.0	40.5	5096
10080 min Summer	1.049	0.0	41.8	5848
15 min Winter	117.448	0.0	5.9	19

CTP House, Knapp Road Cheltenham Gloucestershire, GL50 3QQ	Gloucester Asbestos Storage Calcs 100 Yr plus 40% cc
Date 13/06/2023 File	Designed by RM Checked by KT




Innovyze Source Control 2020.1.3

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.354	0.354	0.0	0.1	0.1	8.9	O K
60 min Winter	0.455	0.455	0.0	0.1	0.1	11.5	O K
120 min Winter	0.559	0.559	0.0	0.2	0.2	14.1	Flood Risk
180 min Winter	0.617	0.617	0.0	0.2	0.2	15.5	Flood Risk
240 min Winter	0.653	0.653	0.0	0.2	0.2	16.5	Flood Risk
360 min Winter	0.695	0.695	0.0	0.2	0.2	17.5	Flood Risk
480 min Winter	0.721	0.721	0.0	0.2	0.2	18.2	Flood Risk
600 min Winter	0.735	0.735	0.0	0.2	0.2	18.5	Flood Risk
720 min Winter	0.742	0.742	0.0	0.2	0.2	18.7	Flood Risk
<b>960 min Winter</b>	<b>0.745</b>	<b>0.745</b>	<b>0.0</b>	<b>0.2</b>	<b>0.2</b>	<b>18.8</b>	<b>Flood Risk</b>
1440 min Winter	0.738	0.738	0.0	0.2	0.2	18.6	Flood Risk
2160 min Winter	0.712	0.712	0.0	0.2	0.2	17.9	Flood Risk
2880 min Winter	0.676	0.676	0.0	0.2	0.2	17.0	Flood Risk
4320 min Winter	0.600	0.600	0.0	0.2	0.2	15.1	Flood Risk
5760 min Winter	0.531	0.531	0.0	0.2	0.2	13.4	Flood Risk
7200 min Winter	0.470	0.470	0.0	0.1	0.1	11.8	O K
8640 min Winter	0.418	0.418	0.0	0.1	0.1	10.5	O K
10080 min Winter	0.374	0.374	0.0	0.1	0.1	9.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	79.010	0.0	7.5	33
60 min Winter	50.812	0.0	11.7	62
120 min Winter	31.621	0.0	14.5	122
180 min Winter	23.637	0.0	16.2	180
240 min Winter	19.105	0.0	17.2	238
360 min Winter	14.037	0.0	18.6	354
480 min Winter	11.286	0.0	19.6	468
600 min Winter	9.522	0.0	20.3	580
720 min Winter	8.282	0.0	20.7	688
<b>960 min Winter</b>	<b>6.640</b>	<b>0.0</b>	<b>21.4</b>	<b>894</b>
1440 min Winter	4.854	0.0	21.7	1110
2160 min Winter	3.541	0.0	30.1	1576
2880 min Winter	2.828	0.0	32.0	2020
4320 min Winter	2.055	0.0	33.7	2896
5760 min Winter	1.637	0.0	37.3	3696
7200 min Winter	1.371	0.0	39.0	4536
8640 min Winter	1.186	0.0	40.5	5280
10080 min Winter	1.049	0.0	41.8	6056

CTP House, Knapp Road Cheltenham Gloucestershire, GL50 3QQ	Gloucester Asbestos Storage Calcs 100 Yr plus 40% cc	
Date 13/06/2023 <b>File</b>	Designed by RM Checked by KT	

Innovyze	Source Control 2020.1.3
----------	-------------------------


Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.024

<b>Time (mins)</b>	<b>Area</b>
<b>From: To:</b>	<b>(ha)</b>
0      4	0.024

CTP House, Knapp Road Cheltenham Gloucestershire, GL50 3QQ	Gloucester Asbestos Storage Calcs 100 Yr plus 40% cc	
Date 13/06/2023 File	Designed by RM Checked by KT	

Innovyze	Source Control 2020.1.3
----------	-------------------------

Model Details

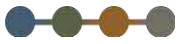
Storage is Online Cover Level (m) 0.800

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	14.0
Max Percolation (l/s)	23.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	0
Invert Level (m)	0.000	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 0.000



## Appendix F – Drainage Strategy





Notes:

1. Do not scale from this drawing. All dimensions are in metres, unless stated otherwise.
2. This drawing is based on the Architect's layout "218 Gloucester Asbestos Ltd - Sheet - A002 - Existing and proposed site plan.dwg" received 06/12/2023.
3. Drawing to be read in conjunction with all other drawings. Any discrepancies are to be reported to the engineer 5 working days in advance of undertaking any work.
4. Culvert location based on CCTV survey by Cotswold Drain Service Ltd dated 12/10/2023 as shown on Architect layout.
5. Design subject to levels verification.

KEY

- PROPOSED SURFACE WATER DRAINAGE
- EXISTING CULVERT

SMH2  
DEPTH UNKNOWN

DISCHARGE TO EXISTING CULVERT  
IL TBC (ASSUMED 0.8m DEPTH)  
DEPTH TO BE VERIFIED PRIOR TO CONSTRUCTION

FLOW CONTROL MANHOLE LIMITING  
FLOWS TO 0.2L/S FOR ALL STORMS UP  
TO AND INCLUDING 100YR PLUS 40%  
ALLOWANCE FOR CLIMATE CHANGE

PERMEABLE PAVING TO PROVIDE  
MIN 16m<sup>3</sup> ATTENUATION VOLUME

Red  
Row

Parking &  
access as  
existing

A4173

PROPOSED  
BUILDING

EXISTING  
BUILDING

Gilberts Lane

SMH1  
DEPTH 0.8m

P2	21.12.23	UPDATED LAYOUT	JB	RS
P1	13.06.23	PLANNING ISSUE	RM	KT
Rev	Date	Details	By	Chkd

rappor



CLIENT: GLOUCESTER ASBESTOS LTD

PROJECT: GLOUCESTER ASBESTOS STROUD ROAD, GLOUCESTER

TITLE: DRAINAGE STRATEGY

SCALE @ A1:	DATE:	DRAWN:	CHECKED:	APPROVED:
1:100	12.06.23	RM	KT	KT

STATUS: PLANNING

DRAWING NO:	REVISION:
230372-RAP-XX-XX-DR-C-3500	P2

# rappor



Rappor Consultants Ltd

[www.rappor.co.uk](http://www.rappor.co.uk)

Cheltenham  
Bristol  
London  
Bedford  
Exeter  
Cirencester

