Flood Risk Assessment

Anne Howard Gardens, Arundel BN18 9BB

Client

Trustees of the Angmering Park Estate Trust
LAMA Fund

Ref: 13686
Date: July 2025

Consulting Engineers

GTA Civils & Transport Ltd
Maple House
192 – 198 London Road
Burgess Hill
West Sussex, RH15 9RD

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Schedule of Appendices

Issue	Issue date	Compiled	Checked
Preliminary Issue	25 June 2025	JP	FVV
First Issue – for submission	17 July 2025	JP	FVV

1 Introduction

1.1 GTA Civils & Transport Limited was appointed by the Trustees of the Angmering Park Estate Trust LAMA Fund to prepare a Flood Risk Assessment (FRA) report as required by the Environment Agency and Arun District Council in order to achieve Outline Planning Permission.

1.2 This report has been prepared for the Client in relation to the proposed development at Anne Howard Gardens, Arundel BN18 9BB. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

1.3 This report will take the form of a formal Flood Risk Assessment in accordance with the 2025 National Planning Policy Framework (NPPF) and the current Planning Practice Guidance (PPG).

2 Existing Site and Current Flood Conditions

2.1 The application site lies to the north of Arundel village centre, in the area administered by Arun District Council (ADC). The application site is located off from Anne Howard Gardens to the west of the existing 6 dwellings which currently have large front gardens. The existing plots of land are currently in use as allotments. Site location maps and an aerial view are shown in Appendix A.

2.2 Hydrology: the site lies approximately 500m north of the River Arun, which flows broadly southwards to the English Channel. The nearest body of water is the Chalk Springs Trout Fishery some 30m to the west of the A284.

2.3 Topography: a topographic survey is shown in Appendix C. The direction of fall is broadly northeast-southwest, with levels ranging between 19.68m AOD and 14.7m AOD.

2.4 Geology: The BGS's online geology map shows that Tarrant Chalk Member bedrock underlies this area, with no drift overlying.

2.5 Soil soakage testing was carried out on site in accordance with BRE Digest 365 on 30/04/25. The Chalk stratum was encountered, and 3 tests were completed satisfactorily. The lowest infiltration rate of the 3 was the first, which would suggest that the fissures opened up significantly during the 1st test. The lowest rate was calculated as 1.3 x 10^{-5}m/s. Excerpts from the test report are shown in Appendix D. The full report is available upon request.

2.6 Due to the timings of this outline application, full groundwater monitoring and winter infiltration testing could not yet be conducted at the site. No groundwater was encountered at the time of the site investigation, and it is understood that the existing 6 dwellings on Anne Howard Gardens currently drain to soakaways. Further testing shall be conducted at Reserved Matter stage to confirm the groundwater levels and inform the drainage design

2.7 Public sewers: Southern Water's sewer records are shown in Appendix C. A 200mmØ foul sewer flows southeast under Anne Howard Gardens. There are no surface water sewers in this area.

2.8 Fluvial flooding: the Environment Agency's (EA) Rivers and Seas flood map in Appendix B shows this site lying in Flood Zone 1 (FZ1 – Low Risk). Inland sites located in FZ1 have an Annual Exceedance Probability (AEP) of less than 1 in 1000 years (<0.1%) of flooding from rivers or watercourses.

2.9 Surface water flooding: this *can* occur when excess rainwater does not infiltrate into the ground, or is not intercepted by urban drainage systems, and instead flows across the surface. The EA's online

Surface Water Depth Flood Map for the 2040-2060 epoch, in Appendix B, shows the site is not liable to flood from this source.

2.10 Climate Change: the EA provides guidance on the level of climate change to apply for developments. This is on a catchment basis, with this site falling within the Arun and Western Streams Management Catchment. The relevant climate change allowance for new Residential developments is the Central Allowance, which is 25% in this catchment (2080s). It is not expected that, when climate change is applied, the site will become at risk of fluvial flooding, as shown on the mapping Appendix B.

2.11 Artificial sources: flooding from reservoirs, canals and docks. The EA's Reservoirs Flood Map in Appendix B shows this site is not liable to flood from a nearby reservoir failing. There are no docks or canals nearby.

2.12 Groundwater Flooding: Groundwater flooding *can* occur when groundwater rises up from the underlying aquifer to flood subsurface infrastructure or to emerge at the ground surface. ADC's Strategic Flood Risk Assessment (SFRA) includes mapping of areas susceptible to groundwater flooding. This indicates that the site is in an area with less than 25% probability of groundwater emergence, based on geological and hydrogeological conditions.

2.13 The EA's Groundwater Vulnerability Zones (GWVZ) and Groundwater Source Protection Zones (SPZ) mapping shows the site to be overlying a 'High' zone with soluble rock risk. The site is removed from the nearest SPZ (both maps are shown in Appendix B).

2.14 Historical Flooding: the EA's historical flood map in Appendix B shows the site has not been affected by flooding in the past.

2.15 In conclusion, the flood risk profile of this site is **Low**.

3 Proposed Development and Flood Risk Mitigation

3.1 Outline Planning Permission is being sought for up to 6 new dwelling houses, with associated access, parking and landscaping (all matters reserved except access). The proposed site layout is shown in Appendix E.

3.2 As concluded in section 2.15 above, the site's flood risk profile is Low. No further specific flood risk mitigation measures are required beyond the management of development runoff. This is discussed in the next section.

3.3 The Sequential and Exception Tests: Table 2 of Appendix C in the NPPF indicates that residential dwellings are classed as 'More Vulnerable'. More Vulnerable uses are 'appropriate development' in FZ1.

4 Proposed SuDS and Foul Drainage

4.1 The proposed surface water drainage design has assessed the viability of all SUDS measures in accordance with CIRIA's guidance – as set out in the SuDS Manual (C753). The SuDS hierarchy has been applied, with infiltration features as the first option, where practicable.

4.2 As set out in Section 2, the measured soil's high soakage rate indicates good infiltration potential at the site, further corroborated by the existing drainage configuration of the nearby plots. Groundwater levels in the areas are likely to be sufficiently low to enable infiltration features, and it is therefore considered the most appropriate option for the purpose of this outline planning application. It is recommended that further winter testing and monitoring is conducted at Reserved Matter stage to further confirm the exact designs of the proposed soakaways.

4.3 The surface water from the roofs will be routed to individual soakaways, one for each unit – refer to the indicative drainage strategy drawing in Appendix E. All proposed hardstanding will be surfaced with porous paving, allowing for direct infiltration. The existing road bisecting the application site currently sheds to the soft landscaping – it is suggested that this could be formalised through the provision of filter drains, to be detailed at Reserved Matter stage.

4.4 Flow drainage calculations are shown for each soakaway in Appendix F. FEH22 hydrological data – and the lowest soakage rate from the soil test results (1.3×10^{-5}m/s, refer to section 2.5 above) - have been used throughout. Each soakaway's volume has been calculated for the critical '100 years plus 45% Climate Change' storm event.

4.5 Infiltration systems designed to infiltrate runoff for events greater than a 1 month return period are considered to be compliant interception systems to ensure zero runoff from the first 5mm of rainfall for 80% of events during the summer and 50% in the winter.

4.6 Any exceedance flows will follow the natural fall of the land away from the proposed dwellings, towards the soft landscape and the wooded area on the west side boundary.

4.7 Treatment: The discharge from the roofs will be of low hazard so no further treatment is needed for the soakaways; an adequate buffer to the groundwater table will be confirmed at the next stage following groundwater monitoring. The mitigation indices for porous paving in infiltration systems are shown in Table 26.4 of the CIRIA SuDS Manual C753. These are 0.7, 0.6 and 0.7 respectively. The pollution indices for individual property driveways in a standard residential estate are shown in Table 26.2, namely 0.5, 0.4 and 0.4. As the mitigation indices are all larger than the polluting indices no additional treatment is required.

4.8 A draft SuDS Drainage Maintenance Plan (DMP) is shown in Appendix G. This sets out how the various components will be inspected and maintained – in line with Industry Standards as per CIRIA's SuDS Manual C753. The responsibility of maintenance, repair, renewal and replacement of the surface water drainage system will be conferred on to the property owners with all costs shared on an equal basis. The included DMP is a draft version based on the information currently available at this stage; the DMP will be updated as the design progresses.

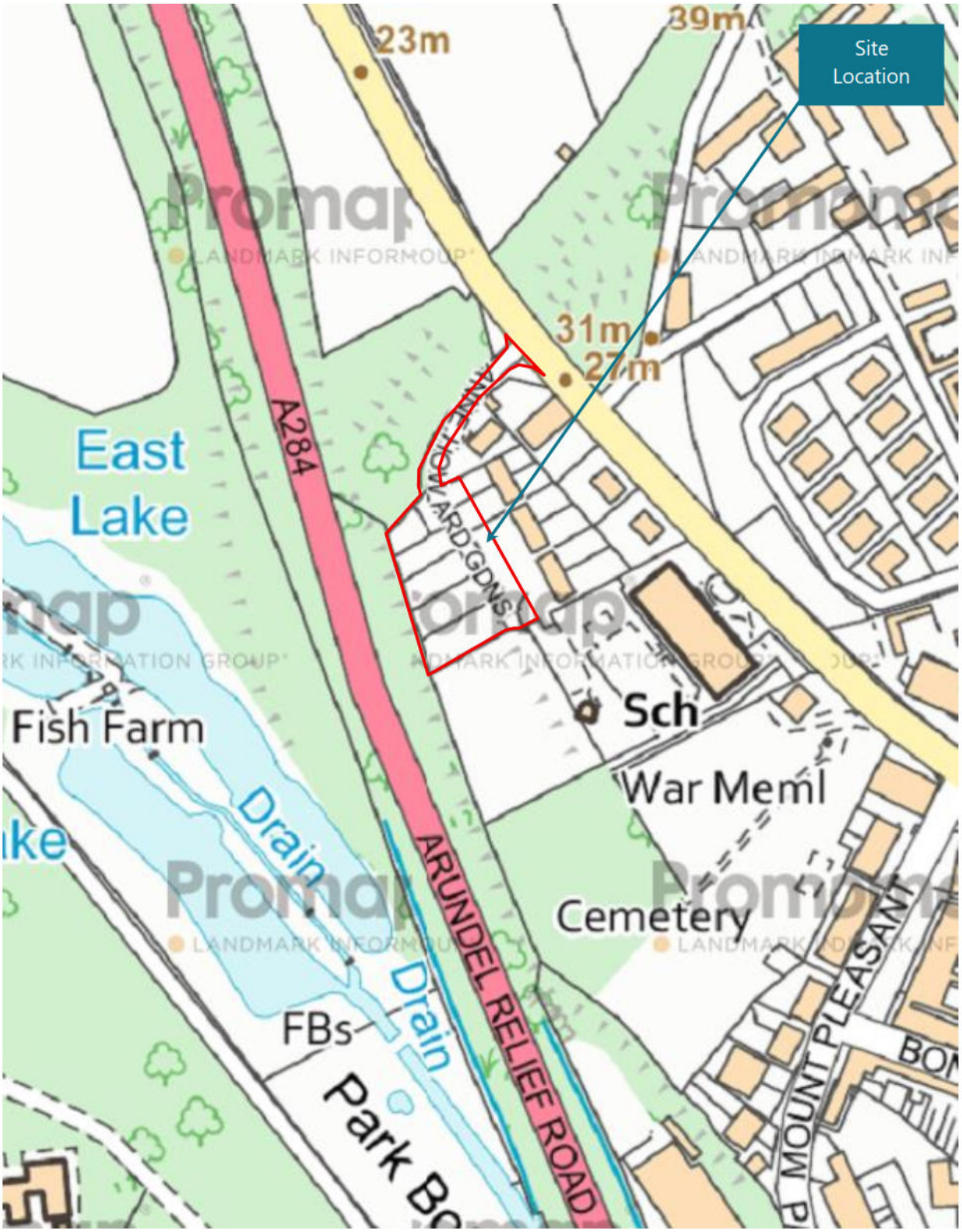
4.9 Foul drainage: the units' foul effluent shall be routed under gravity to the public sewerage that bisects the site, subject to an application to Southern Water under S106, in due course. Southern Water has a legal obligation to provide sufficient capacity in its networks for residential developments.

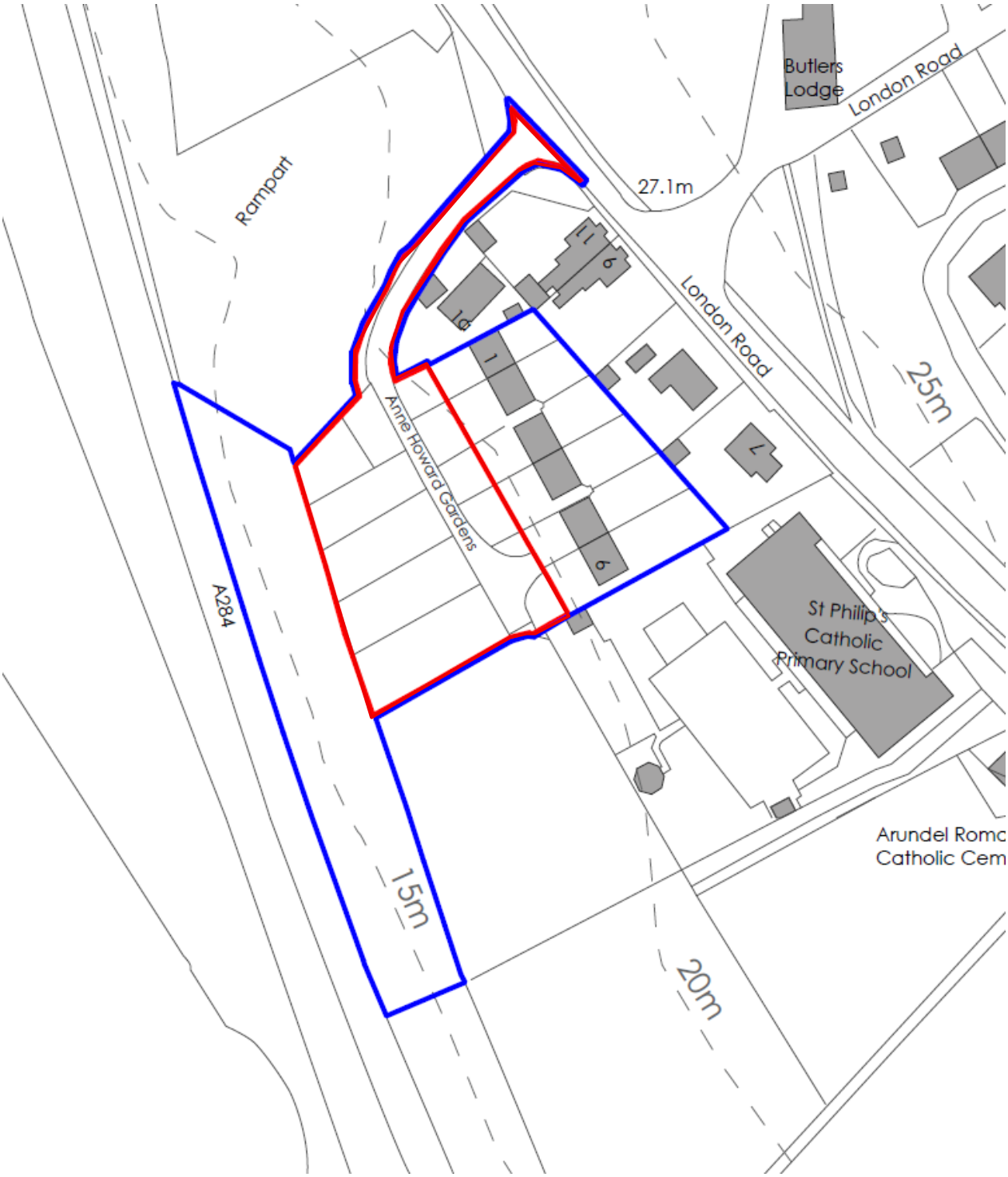
4.10 Conclusion: This development will not increase the flood risk, either on this site or to neighbouring properties, and so complies fully with the 2025 NPPF and current PPG.

- End of Report -

Appendix A

Site Location Maps & Aerial Photo

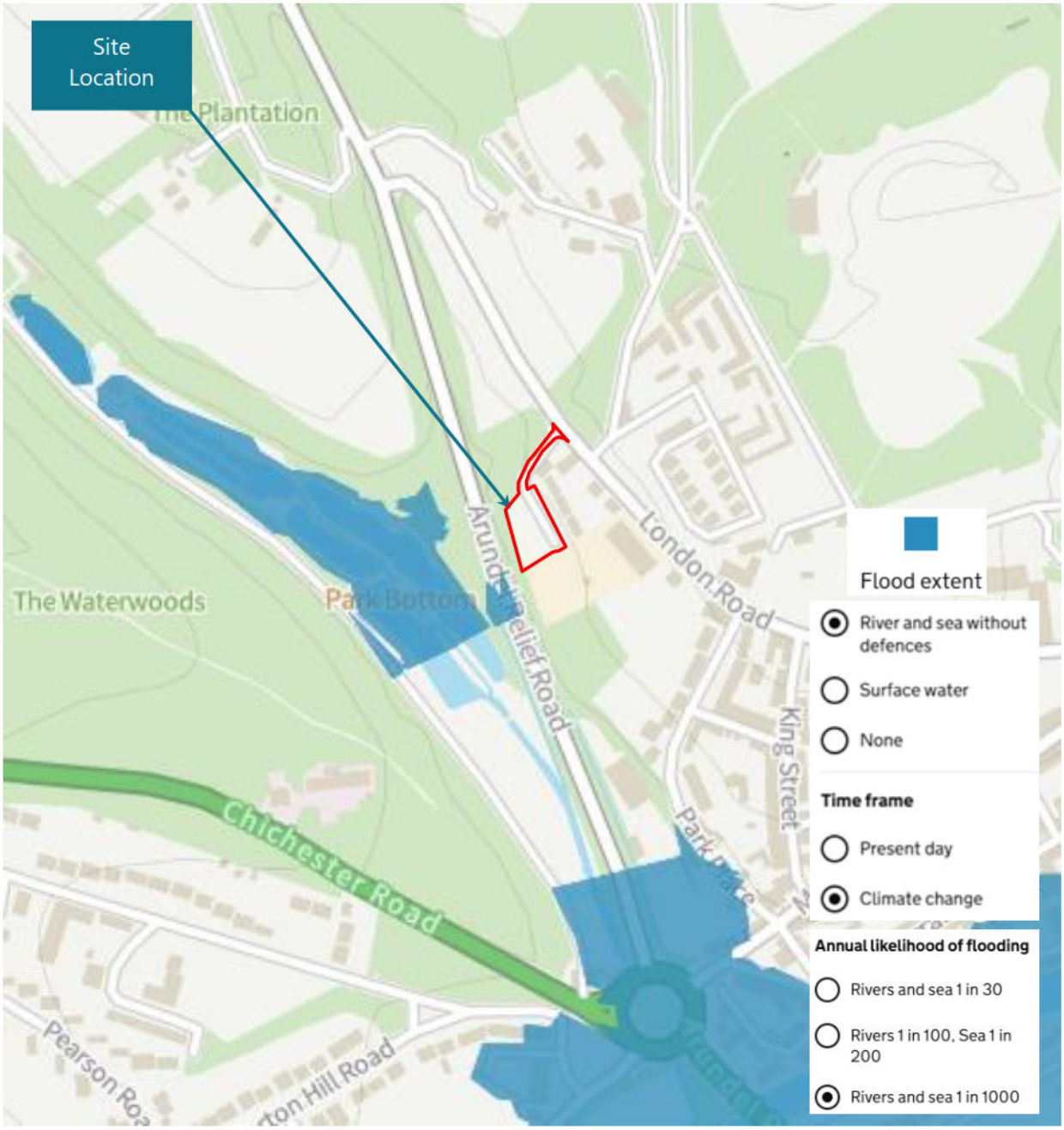



Butlers Lodge
London Road
Rampart
27.1m
11
6
16
1
London Road
25m
Anne Howard Gardens
7
6
A284
St Philip's Catholic Primary School
Arundel Roma
Catholic Cem
15m
20m


Site
Location

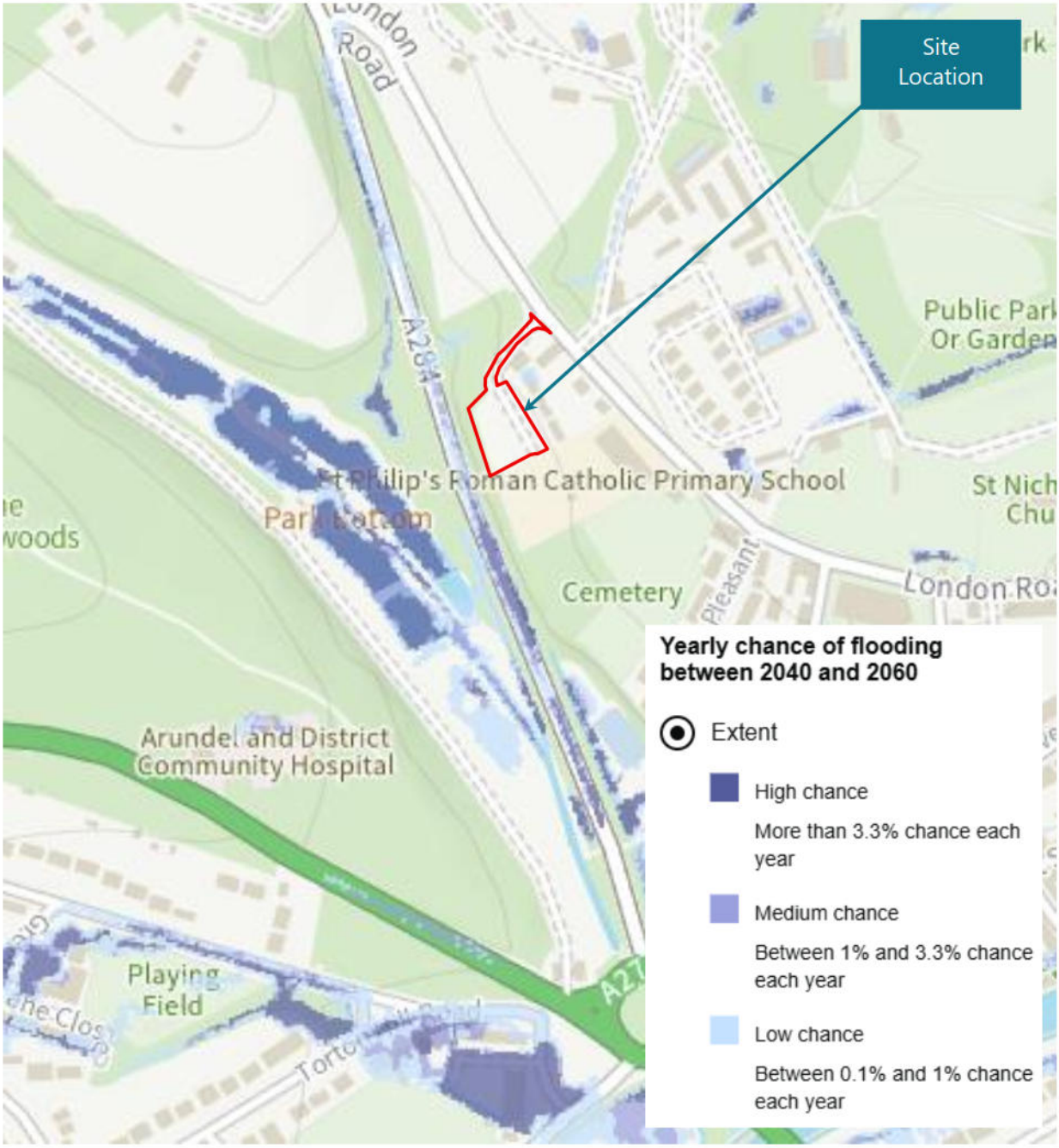
Appendix B

Environment Agency Flood Maps



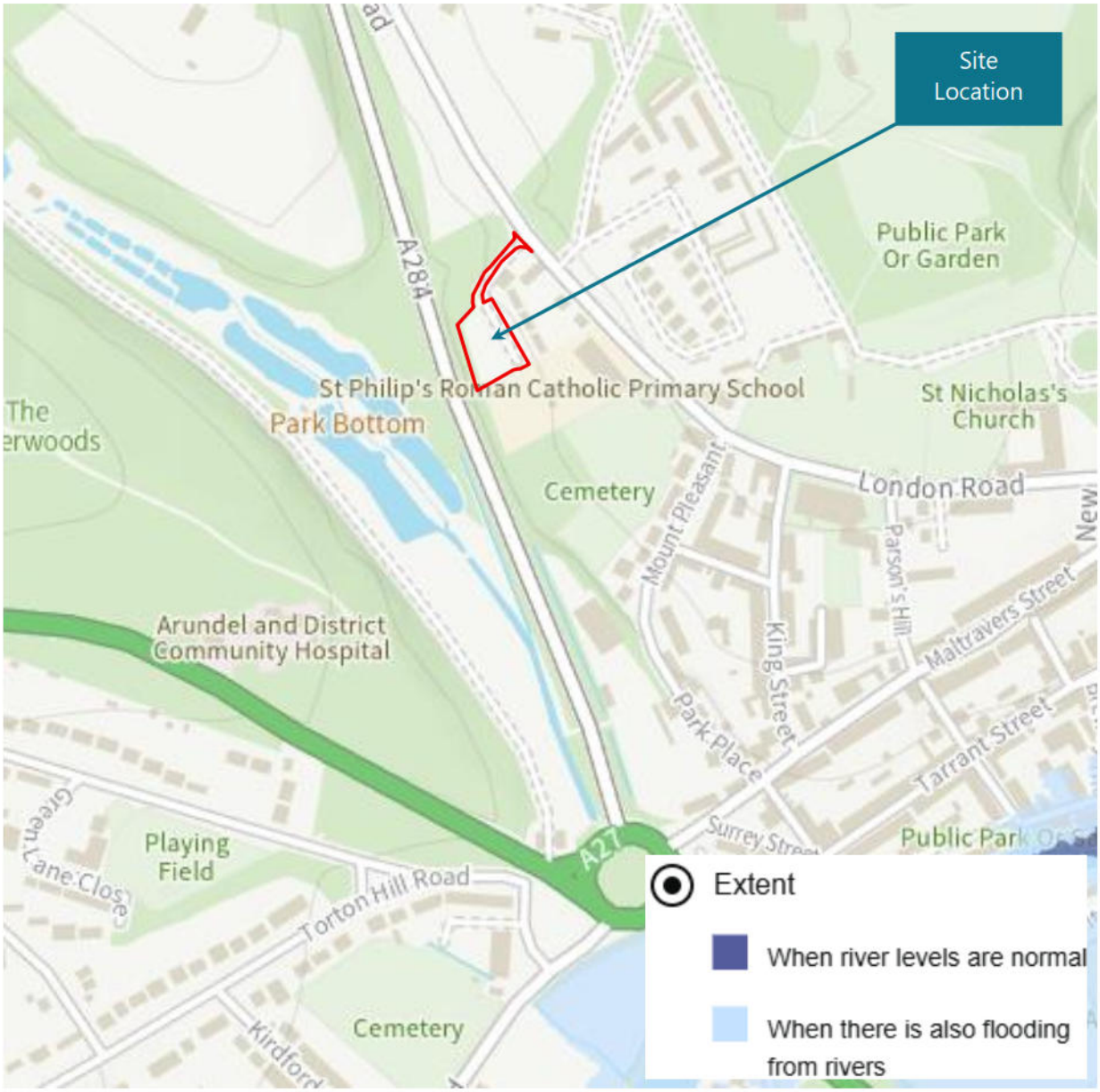
EA's Online Rivers and Seas Flood Map (1 in 1000yrs Without Defences - Climate Change)

The site lies in Flood Zone 1 (FZ1)



EA's Online Surface Water Flood Map
(Yearly chance of flooding between 2040 and 2060)

The site is not liable to flood from this source



EA's Online Risk of Flooding from Reservoirs Map

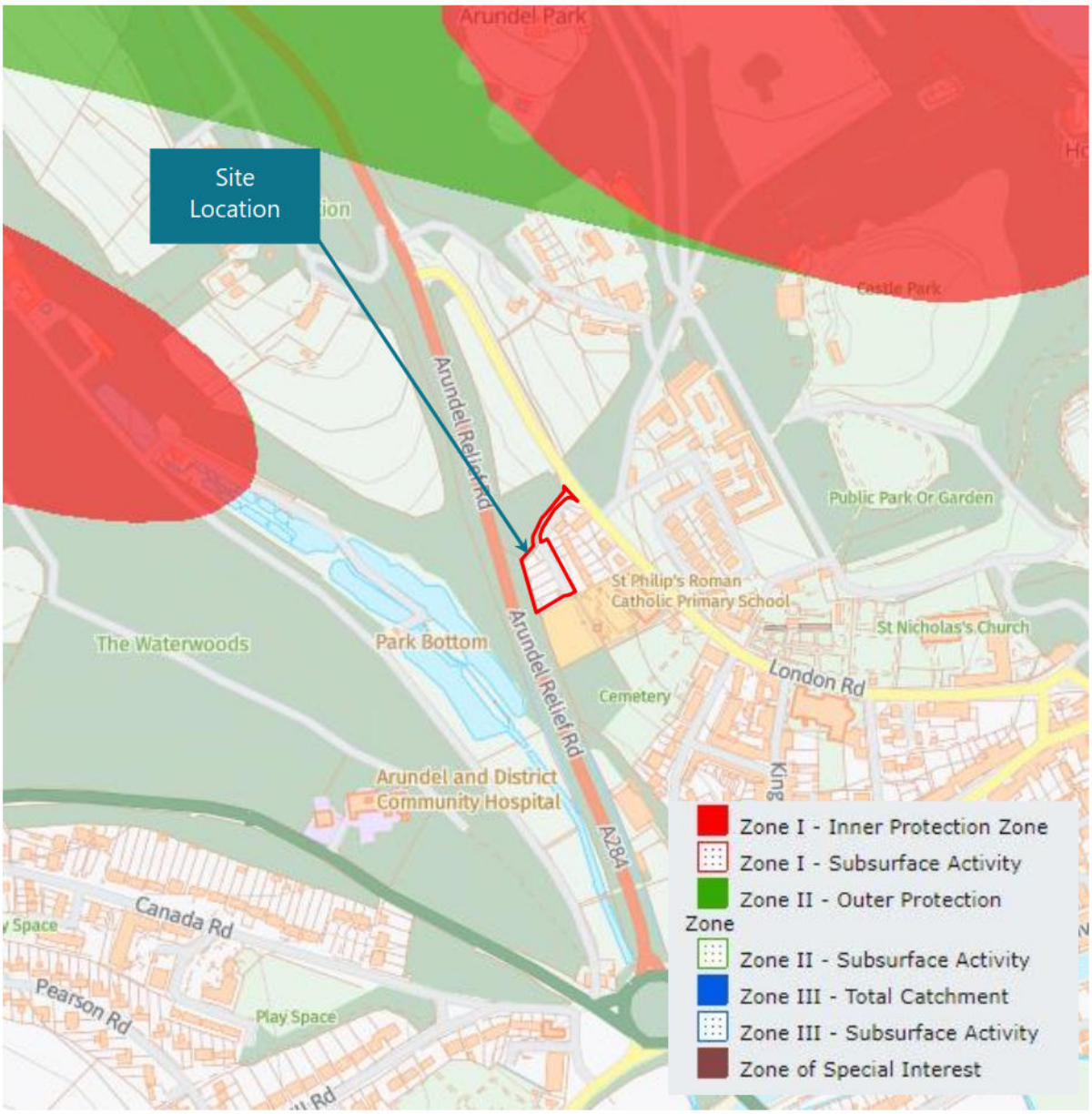
The site is removed from this risk

Environment Agency's Online Historical Flood Map

The site has not been affected by flooding in the past

Environment Agency's Groundwater Vulnerability Zone Map

The application site overlies a 'High' Groundwater Vulnerability Zone with Soluble Rock Risk



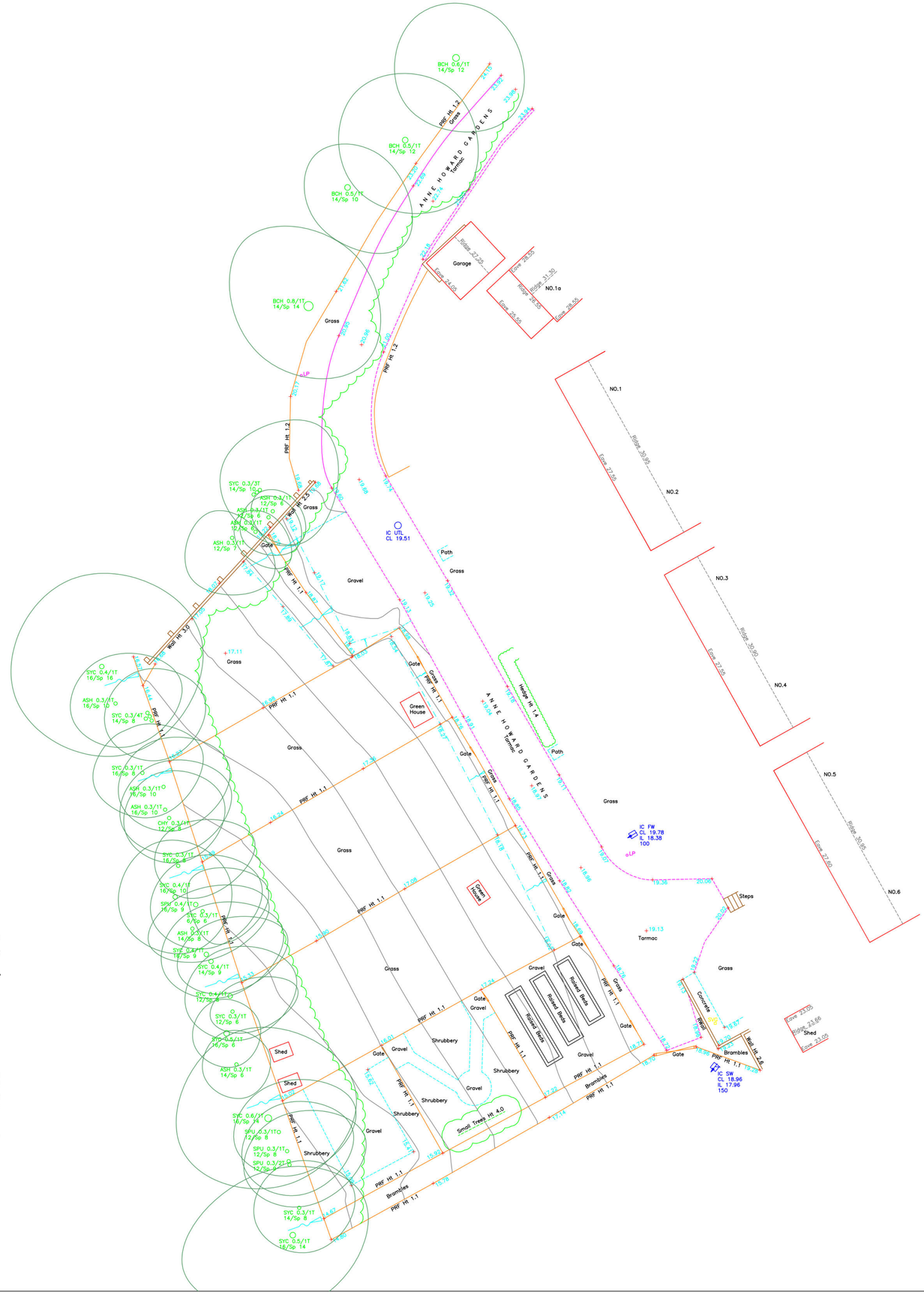
Environment Agency's Online Groundwater Source Protection Zones Map

The site is removed from the nearest Groundwater Source Protection Zone

Appendix C

Topographic Survey & Sewer Records

"Survey Standards Defined"



LEGEND

ALDER	ALD	BARBED WIRE FENCE	BWF	BOLLARD	B
ASH	ASH	CORRUGATED IRON FENCE	CIF	BELISHA BEACON	BB
BEECH	BCH	CLOSE BOARD FENCE	CBF	BRITISH TELECOM INSPECTION COVER	BTIC
CEDAR	CED	CHAIN LINK FENCE	CLF	BUS STOP	BS
CHERRY	CHY	CRASH BARRIER	CB	CABLE TELEVISION INSPECTION COVER	CATV
DEAD	DED	IRON RAILINGS	IRF	CONTROL BOX	CB
ELM	ELM	INTERWOVEN FENCE	IWF	EARTHING ROD	ER
FIR	FIR	LARCH LAP FENCE	LLF	ELECTRICITY CABLE PIT	ELCP
FRUIT	FRT	MISCELLANEOUS FENCE	Misc F	ELECTRICITY SUPPLY	ES
HAWTHORN	HAW	POST AND CHAIN FENCE	PCF	FIRE HYDRANT	FH
HAZEL	HZL	POST AND RAIL FENCE	PRF	FLAG STAFF	FS
HOLLY	HLY	POST AND WIRE FENCE	PWF	FLOWERBED	FB
HORSE CHESTNUT	HCH	WIRE MESH FENCE	WMF	FOOTPATH	FP
HORNBEAM	HRM	TRELLIS	TLS	INSPECTION COVER	IC
LIME	LIM	RETAINING WALL	RWall	LAMP POST	LP
LOCUST	LOC			LETTER BOX	LB
LONDON PLANE	LPN	BED LEVEL	BL	LITTER BIN	BIN
MAGNOLIA	MAG	COVER LEVEL	CL	KERB OUTLET	KO
MAPLE	MPL	DAMP PROOF COURSE	DPC	NAME PLATE	NP
OAK	OAK	FLOOR LEVEL	FL	NOTICE BOARD	NB
PINE	PNE	INVERT LEVEL	IL	CAMERA POST	CAM
POPLAR	POP	OUTFALL LEVEL	OL	OVERHEAD CABLE	OHC
PRUNUS	PNS	THRESHOLD LEVEL	THL	POST	P
RHODODENDRONS	RDN	FOUL WATER	FW	RAIN WATER PIPE	RWP
ROWAN	RWN	SURFACE WATER	SW	RAISED FLOWERBED	RFB
SILVER BIRCH	SIB	UNABLE TO LIFT	UTL	REFLECTOR POST	RP
SORBUS	SOR	OBSTRUCTED	OBS	ROAD SIGN	RS
SWEET CHESTNUT	SCH	WATER LEVEL	WL	RODDING EYE	RE
SYCAMORE	SYC			SERVICE MARKER POST	SMP
WALNUT	WNT	CONCRETE	Conc	SOIL VENT PIPE	SVP
WILLOW	WLW	PAVING SLABS	PS	STOP COCK	SC
YEW	YEW	BRICK PAVING	BP	STOP VALVE	SV
SPECIES UNKNOWN	SPU	STONE SETS	SS	TELEGRAPH POLE	TP
		TACTILE PAVING	Tac	TELEPHONE CALL BOX	TCB
		DRAINAGE CHANNEL	DRC	TRAFFIC LIGHTS	TL
				WATER METER	WM
				WATER TAP	Tap

TREES .3 / 3T / 12 / Sp 10
(Bol Size) (No of Bols) (Height) (Spread)
Spreads and heights are indicative only

0 1 2 5 10 20
Metres

DRAINAGE
Invert levels, pipe sizes and pipe connections have been surveyed by visual inspection only and therefore the complete accuracy of this information cannot be guaranteed

NORTHPOINT
The survey grid is based on National Grid co-ordinates

LEVELS
Levels are related to an OSBM Value 31.763m located on 10 London Road

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07834 520923
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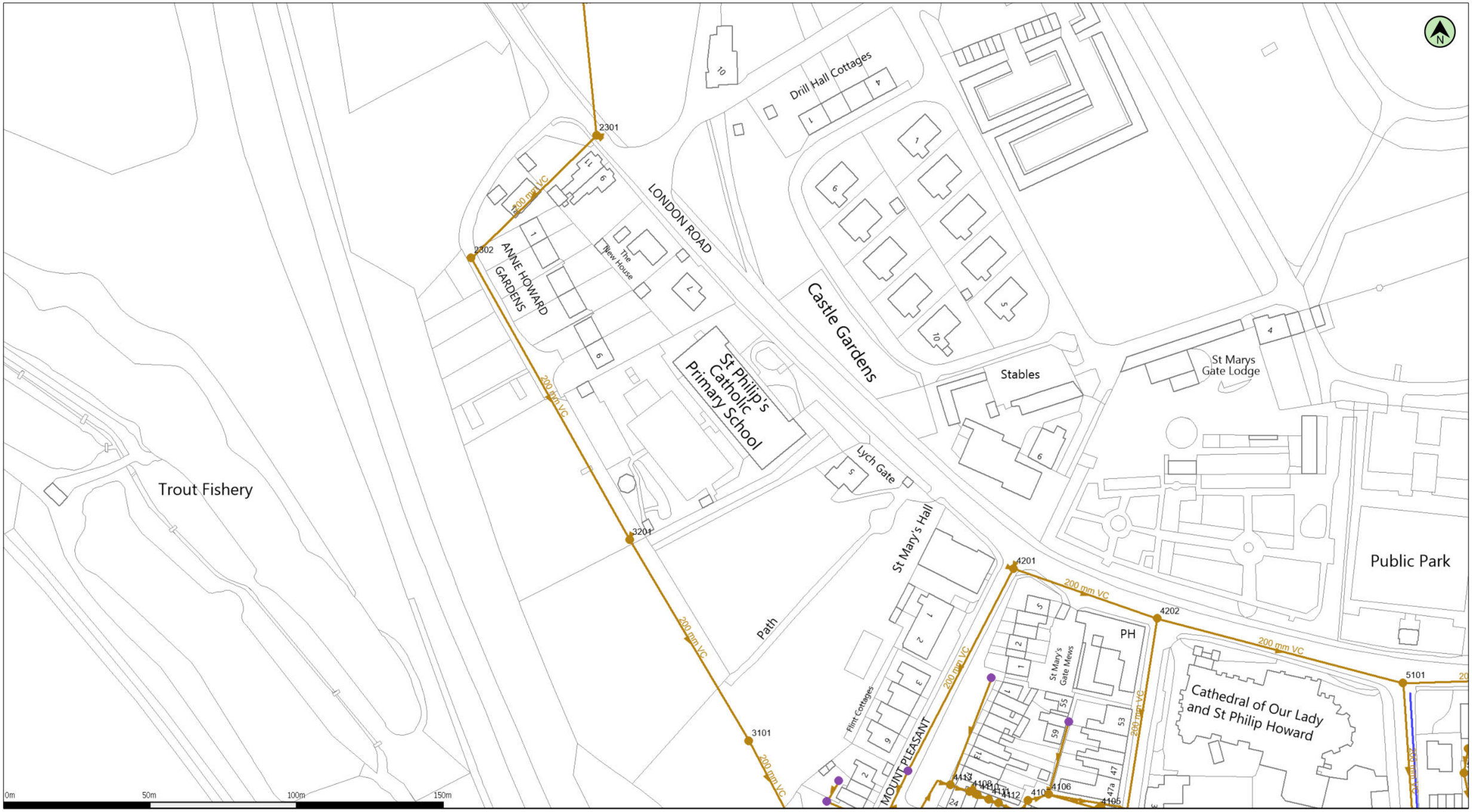
Client	Savills on behalf of Angmering Park Estate
Location	Anne Howard Gardens Arundel BN18 9BB
Type of Survey	Topographical
Scale 1:200	Date May 2025
Drawing Number 1 of 1	Q A Checked rf
Ref No	060525-3452



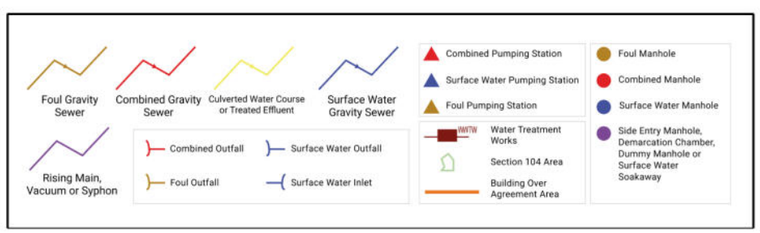
Date: 09/04/25 | Scale: 1:1250 | Map Centre: 501345,107282 | Data updated: 20/03/25 | Our Ref: 1739777 - 1

Wastewater Plan A3
Powered by digdat

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. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2025 Ordnance Survey AC0000808122 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

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



kdaines@gtacivils.co.uk

13686/FVV

WATER for LIFE from Southern Water

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
2301	F	26.89	23.98	
2302	F	19.51	17.98	
3101	F	20.20	16.95	
3201	F	19.61	17.41	
4106	F	28.54	28.25	
4107	F	28.26	26.59	
4108	F	26.57	25.59	
4110	F	0.00	0.00	
4111	F	0.00	0.00	
4112	F	0.00	0.00	
4113	F	0.00	0.00	
4201	F	32.18	30.16	
4202	F	32.70	29.85	
5101	F	31.20	29.00	
5103	F	0.00	0.00	
5104	F	0.00	0.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix D

Excerpts from BRE Digest 365 Soil Soakage Test Report

The works were completed on the 30th April 2025 under the supervision of a Geo-Environmental Engineer from iPlant and was carried out in general accordance with BS5930:2015+A1:2020 and BRE Digest 365.

In summary, the investigation undertaken included:

- Excavation of 1no. trial pit (TP01).
- Subsequent infiltration testing.

The location of the exploratory position was selected free of buried services.

The trial pit was logged in accordance with BS EN ISO 14688 and 14689 with any groundwater conditions noted.

Upon completion, the trial pit was backfilled, compacted and made good to existing levels and finishes, with any surplus spoil bagged up and removed from site.

Reference to the British Geological Survey databases indicates that the site and surrounding areas are underlain by the Tarrant Chalk Member bedrock. No superficial deposits are indicated to underlie the site.

Ground Conditions

The following ground conditions were encountered during the works:

Topsoil

Topsoil was encountered in TP01 to a depth of 0.30m bgl and comprised dark brown sandy gravelly TOPSOIL with constituents of chalk and flint.

Tarrant Chalk Member

Bedrock deposits were encountered in TP01 at a depth of 0.30m bgl to a depth of 1.05m bgl and comprised structureless CHALK composed of sandy subangular to rounded GRAVEL with low cobble content.

Groundwater

Groundwater was not encountered during the investigation.

It should be noted that groundwater levels are dependent upon seasonal variations and can change after periods of prolonged rainfall or drought.

During the soakaway tests the water achieved a fall from 75% to 25% of the effective depth of the storage volume in the pit on all three tests. The results obtained from the soakaway tests are summarised below:

TP and Test Number	Dimensions (m)	Depth (m bgl)	Infiltration Rate (m/sec)	Drainage Characteristics
TP01 Test 1	1.10 x 0.45	1.05	1.3×10^{-5}	Good
TP01 Test 2	1.10 x 0.45	1.05	2.7×10^{-5}	Good
TP01 Test 3	1.10 x 0.45	1.05	1.6×10^{-5}	Good

Conclusion

The soils encountered at the site were found to be destructured Chalk beneath topsoil. The soakage rates obtained during the investigation were found to be good. Given the data from the test, it is considered that the use of soakaways is suitable for this site.

Appendix E

Proposed Site Layout & SuDS Drainage Strategy Layout

Rampart

South Downs National Park

27.1m

Summer Sun Path

A284

Winter Sun Path

Permeable shared surfaces

Indicative positions of soakaways (5m min. from buildings and 2m min. from highway)

Root Protection Zone

Schedule of Areas

UNIT	No. of Bedrooms	Size GEA	Size GIA
1	2 Bed 3 person	74	66
2	2 Bed 4 person	78	69
3	2 Bed 4 person	82	73
4	2 Bed 3 person	74	66
5	2 Bed 3 person	74	66
6	2 Bed 3 person	74	66

SITE AREA: WITHIN THE RED LINE: 0.26Ha

PROPOSED SCHEME - OUTLINE APPLICATION 1:200

0 1 2 3 4 5 10
1:200 Scale in Metres

N

1 Jewry Street
Winchester
Hampshire
SO23 8RZ
t: 01962 857413
w: www.savills.co.uk

RIBA Chartered Practice

Swan House
Market Square
Petworth
West Sussex
GU28 0AN
t: 01798 345980
w: www.savills.co.uk

REVISIONS

REV	DESCRIPTION	BY	CHEC	DATE
A	Red/blue line added	DWS	CP	10.06.25
B	Design mods	DWS	CP	12.06.25
C	Red and Blue line adjusted, drawing scale changed	DWS	CP	25.06.25

INSTRUCTION _ DWG _ REV: 693580_205C	SCALES @ A1: 1:200	PROJECT TITLE: ANNE HOWARD GARDENS, ARUNDEL BN18 9BA
WORK STAGE: 2-CONCEPT DESIGN	ISSUE STATUS: PLANNING	CLIENT: ANGMERING ESTATE
DRAWN BY: DWS / CHECKED BY: CP / DATE: JUNE 2025		DRAWING TITLE: SITE PLAN - PROPOSED: OUTLINE APP
		BIM ISSUE REFERENCE: ANG -SAV- - - -A-693580_205C

savills

N

LEGEND

- Cellular Soakaway
- Permeable Paved Area
- Existing foul water drain

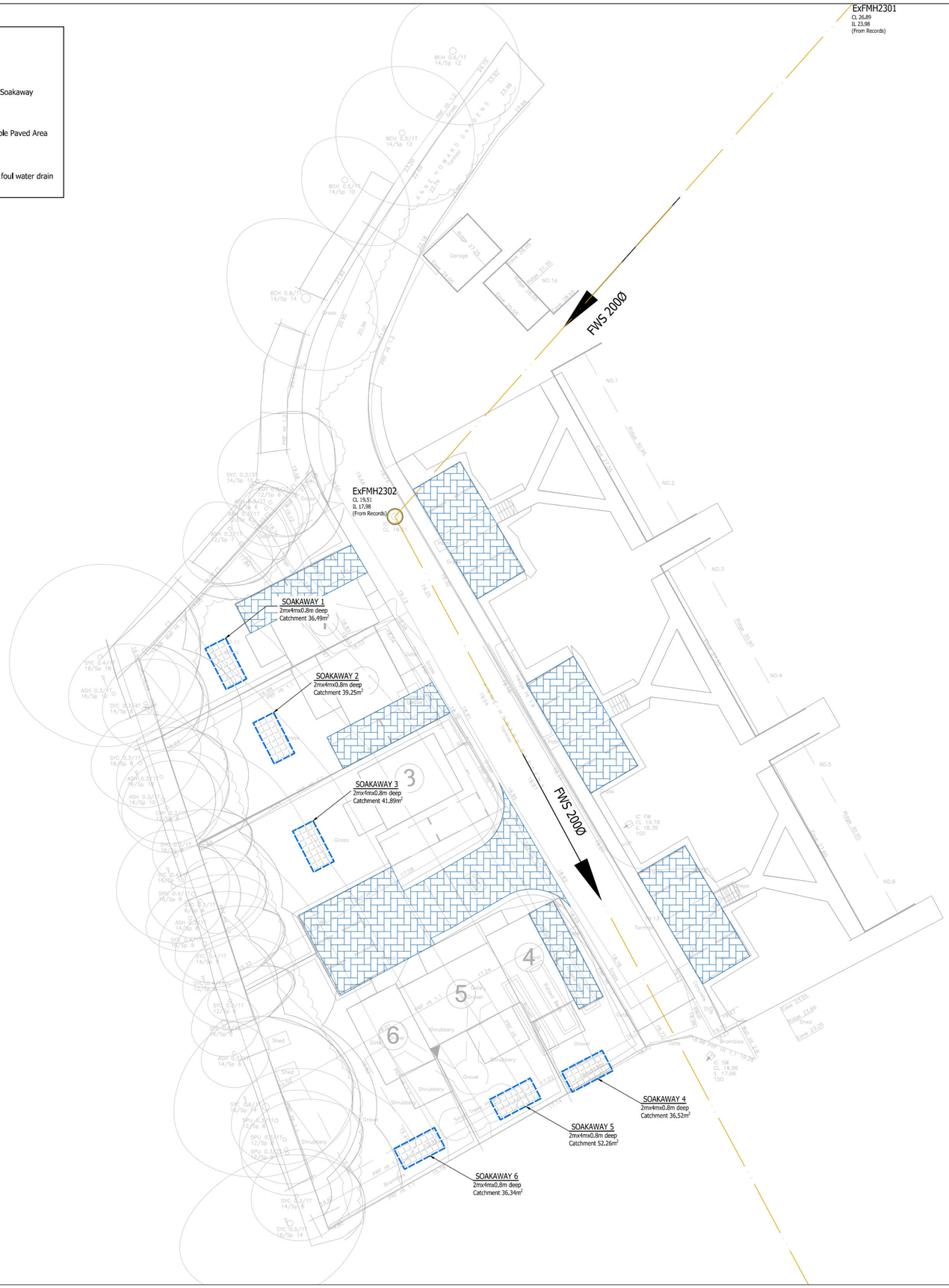
DESIGN NOTES

1. STORAGE DESIGN BASED ON 1 IN 100 YR STORM + 45 %. DESIGNED FOR AN INFILTRATION RATE OF $1.3x10^{-5}$ m/s. RATE OBTAINED IN MAY 2025 BY IPLANT CONTRACTING

2. DRAIN POINTS AND LOCATIONS TO BE CONFIRMED BY ARCHITECT.

3. CONTRACTOR TO ESTABLISH LOCATIONS OF ALL EXISTING SERVICES PRIOR TO COMMENCING.

4. EXISTING TREES TO BE PROTECTED WHERE EXCAVATIONS RUN CLOSE. ANY DRAIN ROUTE THROUGH ROOT PROTECTION AREAS TO BE INSTALLED IN ACCORDANCE WITH ARBORICULTURAL SPECIALIST REQUIREMENTS.



GENERAL NOTES

1. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations , record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. any discrepancies shall be notified to gta prior to works commencing.

2. Tender or billing drawings shall not be used for construction or the ordering of materials.

3. Do not scale. All dimensions and levels to be site confirmed.

4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.

5. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.

6. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

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It is your responsibility to ensure that the correct issue or revision of the DWG data file is being used and requests for updated information made accordingly.

9. Should any apparent discrepancies between the data contained within the DWG file and the current contract drawings become evident, it must be reported back to GTA Civils & Transport as soon as reasonably practicable. Precedence should be given to the current contract drawings (PDF) unless advised otherwise.

Rev	Amendments	Date	Dsn	Chk
P1	INITIAL ISSUE	23/06/25	NG	FVV

Status: PRELIMINARY

Client: SAVILLS

Architect:

Project: ANNE HOWARD GARDENS ARUNDEL

Title: DRAINAGE STRATEGY

Date	Scale @ A1
JUNE 2025	1:200
Clients Ref.	Project Ref. 13686

gta Civils & Transport
Maple House, 192-198 London Road,
Burgess Hill, West Sussex, RH15 9RD
Tel.01444 871444 Web: www.gtacivils.co.uk

Drawing Number	Rev.
13686-1101	P1

Appendix F

Drainage Calculation Sheets

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
CONTROL M/HOLE	0.004	5.00	0.0	12.000	1200	2.000

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	2160	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node CONTROL M/HOLE Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.04680	Invert Level (m)	10.000	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.04680	Time to half empty (mins)	609	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	2.000	Number Required	1
Porosity	0.95	Pit Length (m)	4.000		

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	CONTROL M/HOLE	464	10.359	0.359	0.6	3.1311	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)
480 minute summer	CONTROL M/HOLE	Infiltration	0.1

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	45	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
CONTROL M/HOLE	0.004	5.00	0.0	12.000	1200	2.000

Node CONTROL M/HOLE Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.04680	Invert Level (m)	10.000	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.04680	Time to half empty (mins)	609	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	2.000	Number Required	1
Porosity	0.95	Pit Length (m)	4.000		

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	CONTROL M/HOLE	464	10.359	0.359	0.6	3.1311	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
480 minute summer	CONTROL M/HOLE	Infiltration	0.1

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	45	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
CONTROL M/HOLE	0.004	0.0	12.000	1200	2.000

Node CONTROL M/HOLE Soakaway Storage Structure

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Safety Factor	2.0	Pit Width (m)	2.000	Number Required	1
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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	CONTROL M/HOLE	464	10.359	0.359	0.6	3.1311	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
480 minute summer	CONTROL M/HOLE	Infiltration	0.1

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	45	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
CONTROL M/HOLE	0.004	0.0	12.000	1200	2.000

Node CONTROL M/HOLE Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.04680	Invert Level (m)	10.000	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.04680	Time to half empty (mins)	609	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	2.000	Number Required	1
Porosity	0.95	Pit Length (m)	4.000		

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	CONTROL M/HOLE	464	10.359	0.359	0.6	3.1311	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
480 minute summer	CONTROL M/HOLE	Infiltration	0.1

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	45	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
CONTROL M/HOLE	0.005	0.0	12.000	1200	2.000

Node CONTROL M/HOLE Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.04680	Invert Level (m)	10.000	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.04680	Time to half empty (mins)	609	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	2.000	Number Required	1
Porosity	0.95	Pit Length (m)	4.000		

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute summer	CONTROL M/HOLE	600	10.460	0.460	0.6	4.0176	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
600 minute summer	CONTROL M/HOLE	Infiltration	0.1

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	45	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
CONTROL M/HOLE	0.004	0.0	12.000	1200	2.000

Node CONTROL M/HOLE Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.04680	Invert Level (m)	10.000	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.04680	Time to half empty (mins)	609	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	2.000	Number Required	1
Porosity	0.95	Pit Length (m)	4.000		

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	CONTROL M/HOLE	464	10.359	0.359	0.6	3.1311	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
480 minute summer	CONTROL M/HOLE	Infiltration	0.1

Appendix G

Draft SuDS Drainage Maintenance Plan

Maintenance Responsibilities

It is the overarching responsibility of each **site owner** to ensure the Drainage Infrastructure is maintained in accordance with this Maintenance Plan.

The responsibility of maintenance, repair, renewal and replacement of the surface water drainage system will be conferred on to the property owners with all costs shared on an equal basis. These arrangements will be administered in the Transfer Document TP1 of each property at the point of sale with the same responsibilities transferring with each property to the successors in title.

Contamination or Dilution of Spillage

The Environment Agency would prefer all spillages on any highway to be contained to prevent any downstream contamination. However, this cannot always be achieved, depending on the nature of the spillage. In all circumstances involving the spillage of substances on the highway it is important that the Environment Agency are notified as soon as possible so that they can provide advice and take appropriate action.

Prompt action following a spillage can prevent or reduce its effects, whilst inappropriate action may cause or worsen the pollution effects. In the design of the drainage on this site, a number of measures have been put in place to prevent any pollution entering the groundwater such as Green roofs and permeable paving. The permeable paving sub-base is lined with a geotextile fabric.

In the event of a spillage on site it is the responsibility of the freeholders to clear up any spillage before it enters the drainage system. The primary method of dealing with any spillage of Hydrocarbons should be to use sand to soak up the leak and prevent any Hydrocarbons entering the drainage system. Once sand has been contaminated it should not be washed into the drainage system but disposed of by a Licensed Contractor.

Environment Agency – Emergency Contact Number
In the event of a spillage the Environment Agency should be contacted to notify the event and seek advice. The Environment Agency's Incident Hotline is **0800 80 70 60** (Freephone 24hrs).

Health and Safety

All those responsible for and involved in the maintenance of the site drainage systems should be safety-conscious and comply with the relevant health and safety legislation. This includes:

- The Health and Safety at Work etc Act 1974
- The Management of Health and Safety at Work Regulations 1999
- The Workplace (Health, Safety and Welfare) Regulations 1992

Each freeholder is responsible for suitable risk assessment and management to ensure safe working conditions and practices. Measures to protect potential visitors also need to be considered.

Specialist contractors used should work to industry guidelines and be able to demonstrate safe working practices.

Employers have a duty to employees to inform them about the risks of their work environment and to decrease the risk as far as reasonably practicable. Appropriate personal protective equipment (PPE) should be provided and policies implemented based on risk assessment.

Operatives should be trained for working near water. Risks of contaminated water should be considered. Checking for open cuts and using nitrile gloves, waterproof plasters etc is advised.

Entry of pipes, chambers, tanks and culverts should be avoided wherever possible. Work should be carried out from the surface using appropriate equipment. In the event that entry cannot be avoided to perform a critical task, the required safety training, protection measures and precautions must be implemented prior to entry. Lone working should never be attempted.

For further information refer to Section 36 of The SuDS Manual (CIRIA C753).

Permeable Pavings

Regular inspection and maintenance are important for the effective operation of porous paved areas.

The surfaces should be kept clear of debris and/or cleaned as necessary.

Damaged surfaces should be repaired as soon as possible. Please contact the contractor who installed the surfacing.

Areas subject to snow, ice and frost can be treated using Rock Salt; however, this may be harmful to plants and can damage surrounding metal or concrete surfaces. Excessive snow should be shovelled away using a plastic snow shovel, taking care not to damage the surfacing. Do not use a wire brush ice remover.

Permeable paving maintenance and monitoring requirements are described in the following table:

Schedule	Action	Frequency
Regular Maintenance	Brushing and vacuuming	Three times per year at end of winter, mid-summer, after autumn leaf fall, or as required based on specific observations
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
Remedial Actions	Remedial work to any depressions, rutting and cracked or broken blocks or deformations in the permeable paving (if applicable) considered detrimental to the structural performance	As required

	Rehabilitation of surface and upper structure	As required
Monitoring	Initial Inspection Inspect for evidence of poor operation and / or weed growth Inspect silt accumulation rates and establish appropriate brushing techniques	Monthly for 3 months after installation 3 monthly & 48hrs. after large storms Annually

Drains, Manholes, Gullies, Silt Catchpits

Regular inspection/maintenance is required to ensure the effective long-term operation of private drains, manholes, gullies & silt pits.

Check hydrobrake orifice is clear and retention tank door is closed. Check function of retention tank door and oil if necessary.

Operation and maintenance requirements for drains, gullies and silt pits are described in the following table:

Schedule	Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action. Debris removal from gullies & silt pits, channel drains (where may cause risks to performance). Lift and inspect receiving manholes to check for any blockages. **Particular attention should be given to the control manhole containing the flow control device**	6 Monthly intervals Weekly Six-monthly
Remedial Actions	Repair any damaged gully gratings or manhole covers Replace / fix any loose channel drain covers	As required As required
Monitoring	Carry out full CCTV survey to confirm ongoing integrity of all drains. Inspect all gullies and silt pits & drainage channels during the survey	10-yearly intervals

Inspection of manholes and removal of silt from silt catchpits should be undertaken by a specialist contractor.

Cellular Soakaways

Inspection Frequency and Maintenance Requirements: as per table below:

Schedule	Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the structure from above, check surface of filter for blockage by sediment, algae or other matter	Annually
	Remove and replace surface infiltration medium as necessary	Annually, or as required
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Remedial Actions	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	As required
	Survey inside of tank for sediment build-up and remove if necessary	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Civil Engineering - Transport Planning - Flood Risk

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[redacted]

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