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Technical Note: Drainage Strategy at Bedford Road, Hitchin

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Introduction

We have prepared this Technical Note to review the on site drainage provisions for the proposed development of 50 residential units at Bedford Road, Hitchin. The development covers an area of 1.75Ha. The site is presently pasture with existing housing development to the north and west and The Priory School to the south and east. This Technical Note should be read in conjunction with drawing reference "AC_01_017E Drainage Strategy" and "Bedford Road MicroDrainage Simulation Results" which can be found in Appendices A and B respectively.

Surface Water Drainage Strategy

A Flood Risk Assessment (FRA) has been prepared by Arcadis dated December 2025. The Arcadis FRA does not make recommendations concerning the on site drainage.

Levee Consulting have produced a surface water drainage strategy. This is shown on drawing reference: "AC_01_017E Drainage Strategy" and detailed MicroDrainage simulation results have also been provided, please see "Bedford Road MicroDrainage Simulation Results". The surface water drainage system is gravity fed to a detention basin and then discharged by gravity to the River Oughton. Following the SUDS Hierarchy infiltration was also considered.

The site is underlain by superficial deposits of Lowestoft Formation generally comprising Diamicton with the north of the Site underlain by glaciofluvial deposits. Below the superficial deposits are the bedrock deposits of Gault Formation comprising of mudstone. The identified substrata do not offer good infiltration rates. Infiltration testing has subsequently been completed by Geo Integrity. The infiltration testing was unsuccessful and Geo Integrity's report reference "AJW/26-08-18" concluded that infiltration is not viable at Bedford Road. Geo Integrity's report reference "AJW/26-08-18" can be found in Appendix F.

The River Oughton is located approximately 30m north of the site. Anglian Water have requested a connection to the existing watercourse following the SUDS Hierarchy as

infiltration is not viable. The drainage design has been updated to allow for a gravity fed surface water sewer to outfall to the River Oughton. The proposed offsite sewer connection shall be built under a Section 98 Sewer Requisition. The updated surface water drainage arrangement is shown on "AC_01_017E Drainage Strategy" in Appendix A.

The greenfield run-off calculation can be seen in Appendix C. The catchment area has been reduced from 1.75Ha discounting all land unable to drain into the system due to location down to 1.38Ha. The updated QBar is 3.7l/s, Q1 is 3.1l/s, Q30 is 8.3l/s and Q100 is 11.7l/s. We have thus proposed an outfall rate of 3.1l/s to limit all flows to the Q1 greenfield run-off rate.

Attenuation storage is provided by a 1.80m deep detention basin giving an attenuation capacity of 633m^3 allowing for a 300mm freeboard (and upto 773m^3 if freeboard is ignored). The outflow is restricted by a hydrobrake limiting the outflow to 3.1l/s for all storm events.

Additional storage is also provided by permeable pavements. Two areas of low gradient permeable pavements have been modelled in the MicroDrainage model, the contribution of other permeable pavements has presently been ignored but may be reviewed at detailed design.

An Urban Creep factor of 10% has been applied to all roof areas with the MicroDrainage Model.

The Volumetric Run-off Coefficient (Cv) factor in the MicroDrainage Model has been amended to 1.0 as requested by Hertfordshire County Council. We observe however that this is not in keeping with the Wallingford Procedure Volume 4. The Wallingford Procedure Volume 4 provides the technical basis of the Modified Rational Method to be used in Surface Water modelling. It shall be noted that The Wallingford Procedure Volume 4 undertook an extensive study that demonstrated Volumetric Run-off Coefficients should lie between 0.6 and 0.9.

The MicroDrainage Model has been amended to use the FEH 2013 calculation method and considers the 1:2, 1:30 + Climate Change and the 1:100 + Climate Change storm events. We note that Hertfordsire County Council have requested the 1:1 year storm results however the FEH 2013 calculation method does not allow for 1:1 year storms. Please refer to the FEH Web Service for further information. We have separately modelled the 1:30 and 1:100 storm events in FEH 2013 without climate change factors as requested.

A climate change factor of 40% has been used in accordance with Hertfordshire LLFA's Climate Change Allowance Note.

The MicroDrainage simulation results demonstrate there is no flooding within the site for the 1:100 year return period storm inclusive of climate change, nor do water levels within the detention basin exceed the 300mm freeboard. The outfall discharge within the drainage strategy and MicroDrainage Simulation does not exceed the required 3.1l/s.

The proposed surface water drainage strategy also provides treatment of surface water at the detention basin. Following table 26.2 of "The SUDS Manual C753" issued by CIRIA the proposed scheme has pollution indices of 0.5 / 0.4 / 0.5 (Total Suspended Solids / Metals / Hydrocarbons). Table 26.3 indicates that a detention basin provides treatment indices of 0.5 /

0.5 / 0.6 thus the treatment indices exceed the stated pollution indices providing water treatment in compliance with the "The SUDS Manual C753".

The proposed surface water drainage strategy has been updated to include more source control features including 3313m2 of permeable pavements and the detention basin measuring a base area of 387m2. Following the National Standards for Sustainable Drainage Systems Principle 3 an unlined permeable pavement's contribution area is deemed to be twice the pavement's area where infiltration rates are worse than $1x10^{-6}$m/s. Furthermore the contributing area of a Detention Basin is deemed to be five times the basin's base area where infiltration rates are worse than $1x10^{-6}$m/s. The proposed permeable pavements and detention basin have a combined contributing area of 8559m2. The total impermeable area including urban creep is 8090m2. The proposed surface water drainage network thus exceeds the requirements of National Standards for Sustainable Drainage Systems Principle 3.

Foul Water Drainage Strategy

The foul water sewer arrangement is shown on drawing reference: "AC_01_017E Drainage Strategy". The foul water sewer network is gravity fed to the existing public sewer. The Anglian Water Tier 2 Review in Appendix E shows a connection to Manhole 9900 is viable. All offsite sewers shall be constructed under a Section 98 Sewer Requsition.

Appendix A – Surface Water Strategy Drawing

LEGEND

- Proposed AdoptableSurface Water Sewer
- Proposed Adoptable Foul Water Sewer
- Proposed Private Surface Water Drain
- Unlined Permeable Pavement

Table A: Operation and Maintenance Requirements for Cuvlerts, Pipes, Gullies and Manholes

Maintenance Schedule	Required Action	Record Frequency
Regular Maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action.	Monthly for first 3 months and then six monthly.
	Debris removal from catchment surface (where may cause risk to performance).	Monthly.
	Remove sediment from pre-treatment structure (eg gullies).	Annually or as required.
	Clean/jetting of annually or as required pipes and manholes.	As required.

Table B: Operation and Maintenance requirements for Detention Basin

Maintenance Schedule	Required Action	Record Frequency
Regular Maintenance	Remove litter, debris and trash.	Monthly
	Cut grass - for landscaped areas and access routes.	Monthly (during growing season) or as required.
	Cut grass - meadow grass in and around swale.	Half yearly: Spring (before nesting season) and Autumn.
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required.
Occasional Maintenance	Reseed areas of poor vegetation.	As required.
	Prune and trim trees and remove cuttings.	As required.
	Remove sediment from pre-treatment system when 50% full.	As required.
Remedial Actions	Repair erosion and other damage by reseeding or returfing.	As required.
	Repair or rehabilitate inlets, outlets and overflows.	As required.
	Relevel uneven surfaces and reinstate design levels.	As required.
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage.	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies.	Half Yearly
	Inspect infiltration surfaces for compaction and ponding.	Monthly

Table C: Operation and Maintenance requirements for Permeable Pavement

Maintenance Schedule	Required Action	Record Frequency
Regular Maintenance	Cleaning, brush to remove surface dirt and silt build up between blocks.	Bi-Annual
Occasional Maintenance	Redress the surface with 2-4mm gritstone following cleaning/	As required.
Remedial Actions	Repair rutting or broken paving blocks.	As required.
	Repair/rehabilitation of surface and upper substructure if poor operation is encountered and cannot be rectified by cleaning of surface.	As required.
Monitoring	Inspect for poor operation.	Monthly for 3 months following installation.
	Inspect for of evidence of poor operation and or weed growth. Take remedial action if required.	Every 3 months, 48hrs after large storms.
	Check surface is draining adequately during storms.	Annually during storm conditions.

ADOPTABLE DRAINAGE MANHOLE SCHEDULE

MH No.	MANHOLE DIAMETER (mm)	MANHOLE TYPE	COVER LEVEL (m)	INVERT LEVEL (m)	DEPTH TO SOFFIT (m)	EASTING (m)	NORTHING (m)
S2	1200	Type B	57.802	55.60	1.902	517945.146	230804.324
S3	1200	Type B	57.557	55.50	1.757	517952.160	230820.517
S6	---	HEADWALL	---	54.45	---	517925.940	230913.987
S7	---	HEADWALL	---	54.45	---	517906.246	230921.399
S9	1200	Type B	57.894	56.00	1.669	517886.469	230830.784
S10	1350	Type C	57.047	55.50	1.247	517915.48	230837.127
S11	1350	Type B	56.981	54.70	1.831	517944.964	230845.533
S12	1350	Type C	57.722	56.20	1.372	517883.766	230843.426
S13	1350	Type C	56.195	54.65	1.095	517857.772	230913.777
S14	1350	Type C	56.225	54.53	1.245	517903.230	230915.916
S16	1350	Type C	56.365	54.60	1.315	517932.859	230889.096
S18	1200	Type B	57.799	55.90	1.599	517911.283	230794.424
S22	---	HEADWALL	---	54.45	---	517939.148	230936.687
S23	1200	Type B	56.25	54.48	1.545	517939.211	230938.214
S24	---	HEADWALL	---	54.00	---	517929.65	230985.90
F2	1350	Type C	57.817	56.40	1.267	517908.029	230796.777
F3	1200	Type B	57.800	56.10	1.550	517949.275	230808.128
F4	1350	Type C	57.564	56.00	1.414	517949.571	230819.932
F5	1350	Type C	56.909	55.30	1.459	517941.757	230847.392
F6	1350	Type B	56.330	54.65	1.530	517927.193	230900.037
F7	1350	Type C	55.10	53.70	1.25	517902.051	230926.171
F9	1350	Type C	55.141	53.55	1.441	517908.307	230944.275
F10	1350	Type C	57.823	56.45	1.273	517888.656	230834.221
F11	1350	Type C	56.998	55.50	1.348	517919.459	230840.751
F12	1200	Type B	56.265	54.45	1.665	517907.046	230913.496
F13	1200	Type B	54.60	52.664	1.786	517978.232	230997.778
F14	1350	Type C	54.60	52.95	1.50	517967.972	231004.716
F15	1350	Type C	54.40	53.25	1.00	517934.436	230977.447

URBAN CREEP CALCULATION

Manhole No.	Pipe No.	Non-Roof IMP	Roof IMP	Total IMP	Total + 10% Roof IMP
S18	1.000	706.198	112.194	818.392	831.2
S2	1.001	101.864	770.442	872.306	947.0
S3	1.002	723.069	102.675	825.744	840.3
S11	1.003	538.276	197.633	735.909	759.8
S16	1.004	928.937	561.686	1490.624	1546.2
S6	1.005	0.000	0.000	0.000	0.000
S22	1.006	0.000	0.000	0.000	0.000
S23	1.007	0.000	0.000	0.000	0.000
S12	2.000	197.560	0.000	197.560	197.6
S9	2.001	403.439	186.787	590.226	608.7
S10	2.002	416.914	297.228	714.141	739.7
S13	3.000	576.353	180.692	757.045	778.1
S14	3.001	461.133	343.531	804.664	834.4
S7	3.002	0.000	0.000	0.000	0.000

Rev	Date	Comment
A	04.08.25	Layout Updated.
B	17.08.25	Maintenance and Management Schedule Updated.
C	05.09.25	Detention Basin Information Added.
D	03.03.26	Outfall information added.
E	04.10.26	Outfalls updated. Permeable pavements added. Basin amended. Maintenance and Management Schedule updated for Cuvlerts and Permeable Pavements. Urban creep calculation shown.

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HITCHIN BEDFORD ROAD

DRAINAGE STRATEGY

SCALE :	1:250
DATE :	AUGUST 2025
DRAWN :	ACG
CHECKED :	
DRG.No. :	AC_01_017

E

Appendix B – MicroDrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.450	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	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 Surface Network 1

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

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	35.271	0.300	117.6	0.083	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	17.647	0.100	176.5	0.095	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	26.030	0.650	40.0	0.084	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	12.928	0.125	103.4	0.020	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	29.697	0.425	69.9	0.061	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	30.659	0.650	47.2	0.074	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	45.214	0.100	452.1	0.076	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	25.834#	0.150	172.2	0.155	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.41	55.900	0.083	0.0	0.0	0.0	1.45	102.4	11.2
1.001	50.00	5.65	55.600	0.178	0.0	0.0	0.0	1.18	83.4	24.1
1.002	50.00	5.83	55.500	0.262	0.0	0.0	0.0	2.49	176.1	35.5
2.000	50.00	5.22	56.200	0.020	0.0	0.0	0.0	0.99	17.5	2.7
2.001	50.00	5.53	56.000	0.081	0.0	0.0	0.0	1.57	62.3	10.9
2.002	50.00	5.76	55.500	0.155	0.0	0.0	0.0	2.30	162.2	21.0
1.003	50.00	6.62	54.700	0.493	0.0	0.0	0.0	0.95	151.0	66.7
1.004	50.00	6.90	54.600	0.648	0.0	0.0	0.0	1.55	245.9	87.7

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Network Design Table for Surface Network 1

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
3.000	45.508	0.120	379.2	0.078	5.00	0.0	0.600	o	450	Pipe/Conduit	
3.001	6.258	0.080	78.2	0.083	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.002	21.042#	0.000	0.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	26.263#	0.000	0.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	1.528	0.020	76.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.007	48.635	0.473	102.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	50.00	5.73	54.650	0.078	0.0	0.0	0.0	1.04	165.1	10.6
3.001	50.00	5.78	54.530	0.161	0.0	0.0	0.0	2.30	365.9	21.8
3.002	50.00	7.58	54.450	0.161	0.0	0.0	0.0	0.19	31.0	21.8
1.005	50.00	12.30	54.450	0.809	0.0	0.0	0.0	0.09	1.6«	109.5
1.006	50.00	12.32	54.450	0.809	0.0	0.0	0.0	1.15	20.3«	109.5
1.007	50.00	12.95	54.430	0.809	0.0	0.0	0.0	1.29	51.3«	109.5

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Manhole Schedules for Surface Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S18	57.799	1.899	Open Manhole	1200	1.000	55.900	300				
S2	57.802	2.202	Open Manhole	1200	1.001	55.600	300	1.000	55.600	300	
S3	57.557	2.057	Open Manhole	1200	1.002	55.500	300	1.001	55.500	300	
S12	57.722	1.522	Open Manhole	1350	2.000	56.200	150				
S9	57.894	1.894	Open Manhole	1200	2.001	56.000	225	2.000	56.075	150	
S10	57.047	1.547	Open Manhole	1350	2.002	55.500	300	2.001	55.575	225	
S11	56.981	2.281	Open Manhole	1350	1.003	54.700	450	1.002	54.850	300	
								2.002	54.850	300	
S16	56.365	1.765	Open Manhole	1350	1.004	54.600	450	1.003	54.600	450	
S13	56.195	1.545	Open Manhole	1350	3.000	54.650	450				
S14	56.225	1.695	Open Manhole	1350	3.001	54.530	450	3.000	54.530	450	
S7	56.250	1.800	Open Manhole	1350	3.002	54.450	450	3.001	54.450	450	
S22	56.250	1.800	Open Manhole	1350	1.005	54.450	150	1.004	54.450	450	
								3.002	54.450	450	
S22	56.250	1.800	Open Manhole	1350	1.006	54.450	150	1.005	54.450	150	
S23	56.250	1.820	Open Manhole	1200	1.007	54.430	225	1.006	54.430	150	
S24	54.400	0.443	Open Manhole	0		OUTFALL		1.007	53.957	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S18	517911.293	230794.425	517911.293	230794.425	Required	
S2	517945.146	230804.324	517945.146	230804.324	Required	
S3	517952.160	230820.518	517952.160	230820.518	Required	
S12	517883.766	230843.426	517883.766	230843.426	Required	
S9	517886.469	230830.784	517886.469	230830.784	Required	
S10	517915.480	230837.127	517915.480	230837.127	Required	

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Manhole Schedules for Surface Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S11	517944.964	230845.533	517944.964	230845.533	Required	
S16	517932.859	230889.096	517932.859	230889.096	Required	
S13	517857.772	230913.777	517857.772	230913.777	Required	
S14	517903.230	230915.916	517903.230	230915.916	Required	
S7	517906.246	230921.399	517906.246	230921.399	Required	
S22	517939.148	230936.687	517939.148	230936.687	Required	
S22	517939.148	230936.687	517939.148	230936.687	Required	
S23	517939.211	230938.214	517939.211	230938.214	Required	
S24	517929.650	230985.900			No Entry	

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PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	300	S18	57.799	55.900	1.599	Open Manhole	1200
1.001	o	300	S2	57.802	55.600	1.902	Open Manhole	1200
1.002	o	300	S3	57.557	55.500	1.757	Open Manhole	1200
2.000	o	150	S12	57.722	56.200	1.372	Open Manhole	1350
2.001	o	225	S9	57.894	56.000	1.669	Open Manhole	1200
2.002	o	300	S10	57.047	55.500	1.247	Open Manhole	1350
1.003	o	450	S11	56.981	54.700	1.831	Open Manhole	1350
1.004	o	450	S16	56.365	54.600	1.315	Open Manhole	1350
3.000	o	450	S13	56.195	54.650	1.095	Open Manhole	1350
3.001	o	450	S14	56.225	54.530	1.245	Open Manhole	1350
3.002	o	450	S7	56.250	54.450	1.350	Open Manhole	1350
1.005	o	150	S22	56.250	54.450	1.650	Open Manhole	1350
1.006	o	150	S22	56.250	54.450	1.650	Open Manhole	1350
1.007	o	225	S23	56.250	54.430	1.595	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	35.271	117.6	S2	57.802	55.600	1.902	Open Manhole	1200
1.001	17.647	176.5	S3	57.557	55.500	1.757	Open Manhole	1200
1.002	26.030	40.0	S11	56.981	54.850	1.831	Open Manhole	1350
2.000	12.928	103.4	S9	57.894	56.075	1.669	Open Manhole	1200
2.001	29.697	69.9	S10	57.047	55.575	1.247	Open Manhole	1350
2.002	30.659	47.2	S11	56.981	54.850	1.831	Open Manhole	1350
1.003	45.214	452.1	S16	56.365	54.600	1.315	Open Manhole	1350
1.004	25.834#	172.2	S22	56.250	54.450	1.350	Open Manhole	1350
3.000	45.508	379.2	S14	56.225	54.530	1.245	Open Manhole	1350
3.001	6.258	78.2	S7	56.250	54.450	1.350	Open Manhole	1350
3.002	21.042#	0.0	S22	56.250	54.450	1.350	Open Manhole	1350
1.005	26.263#	0.0	S22	56.250	54.450	1.650	Open Manhole	1350
1.006	1.528	76.4	S23	56.250	54.430	1.670	Open Manhole	1200
1.007	48.635	102.8	S24	54.400	53.957	0.218	Open Manhole	0

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Free Flowing Outfall Details for Surface Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	S24	54.400	53.957	0.000	0	0

Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 517906 230865 TL 17906 30865
Data Type	Point
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	1.000
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Surface Network 1

Hydro-Brake® Optimum Manhole: S23, DS/PN: 1.007, Volume (m³): 2.1

Unit Reference	MD-SHE-0077-3100-1500-3100
Design Head (m)	1.500
Design Flow (l/s)	3.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	54.430
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.500	3.1
Flush-Flo™	0.338	2.7
Kick-Flo®	0.685	2.2
Mean Flow over Head Range	-	2.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	2.1	1.200	2.8	3.000	4.3	7.000	6.4
0.200	2.6	1.400	3.0	3.500	4.6	7.500	6.6
0.300	2.7	1.600	3.2	4.000	4.9	8.000	6.8
0.400	2.7	1.800	3.4	4.500	5.2	8.500	7.0
0.500	2.6	2.000	3.5	5.000	5.4	9.000	7.2
0.600	2.4	2.200	3.7	5.500	5.7	9.500	7.3
0.800	2.3	2.400	3.8	6.000	5.9		
1.000	2.6	2.600	4.0	6.500	6.1		

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Offline Controls for Surface Network 1

Weir Manhole: S7, DS/PN: 3.002, Loop to PN: 1.006

Discharge Coef 0.544 Width (m) 10.000 Invert Level (m) 54.500

Weir Manhole: S22, DS/PN: 1.005, Loop to PN: 1.006

Discharge Coef 0.544 Width (m) 10.000 Invert Level (m) 54.500

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Storage Structures for Surface Network 1

Porous Car Park Manhole: S16, DS/PN: 1.004

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.5
Membrane Percolation (mm/hr)	1000	Length (m)	92.0
Max Percolation (l/s)	140.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	55.715	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S13, DS/PN: 3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.5
Membrane Percolation (mm/hr)	1000	Length (m)	34.8
Max Percolation (l/s)	53.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	55.550	Cap Volume Depth (m)	0.400

Tank or Pond Manhole: S22, DS/PN: 1.006

Invert Level (m) 54.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	387.4	0.501	410.4	1.001	434.2	1.501	458.8
0.101	391.9	0.601	415.1	1.101	439.0	1.601	463.8
0.201	396.5	0.701	419.8	1.201	443.9	1.701	468.9
0.301	401.1	0.801	424.5	1.301	448.9	1.800	473.9
0.401	405.7	0.901	429.3	1.401	453.8		

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

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 Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 517906 230865 TL 17906 30865
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

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, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S18	15 Summer	2	+0%	30/15 Summer				55.985
1.001	S2	15 Summer	2	+0%	30/15 Summer				55.743
1.002	S3	15 Summer	2	+0%	30/15 Summer				55.611
2.000	S12	15 Summer	2	+0%	100/15 Summer				56.251
2.001	S9	15 Summer	2	+0%	30/15 Summer				56.076
2.002	S10	15 Summer	2	+0%	30/15 Summer				55.587
1.003	S11	15 Summer	2	+0%	30/15 Summer				54.961
1.004	S16	360 Winter	2	+0%	30/15 Summer				54.887
3.000	S13	360 Winter	2	+0%	30/60 Summer				54.886
3.001	S14	360 Winter	2	+0%	30/30 Summer				54.886
3.002	S7	360 Winter	2	+0%	30/15 Summer		2/15 Summer	54	54.886
1.005	S22	360 Winter	2	+0%	2/15 Summer		2/15 Summer	54	54.886
1.006	S22	360 Winter	2	+0%	2/15 Summer				54.886

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S18	-0.215	0.000	0.17			16.4	OK	
1.001	S2	-0.157	0.000	0.45			32.3	OK	
1.002	S3	-0.189	0.000	0.29			46.3	OK	
2.000	S12	-0.099	0.000	0.25			4.0	OK	
2.001	S9	-0.149	0.000	0.24			14.2	OK	
2.002	S10	-0.213	0.000	0.18			26.7	OK	
1.003	S11	-0.189	0.000	0.60			82.1	OK	
1.004	S16	-0.163	0.000	0.10		332	20.3	OK	
3.000	S13	-0.214	0.000	0.02			2.5	OK	
3.001	S14	-0.094	0.000	0.02			4.2	OK	
3.002	S7	-0.014	0.000	0.00	6.9		0.1	OK	
1.005	S22	0.286	0.000	0.29	15.4		1.3	SURCHARGED	
1.006	S22	0.286	0.000	0.26			2.8	SURCHARGED	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.007	S23	360 Winter	2	+0%	2/15 Winter				54.886

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	S23	0.231	0.000	0.05			2.6	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

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 Coeffiecient 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 3
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
FEH Rainfall Version 2013
Site Location GB 517906 230865 TL 17906 30865
Data Type Point
Cv (Summer) 1.000
Cv (Winter) 1.000

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, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S18	15 Summer	30	+40%	30/15 Summer				56.574
1.001	S2	15 Summer	30	+40%	30/15 Summer				56.455
1.002	S3	15 Summer	30	+40%	30/15 Summer				56.263
2.000	S12	15 Summer	30	+40%	100/15 Summer				56.299
2.001	S9	15 Summer	30	+40%	30/15 Summer				56.230
2.002	S10	15 Summer	30	+40%	30/15 Summer				55.946
1.003	S11	15 Summer	30	+40%	30/15 Summer				55.723
1.004	S16	480 Winter	30	+40%	30/15 Summer				55.653
3.000	S13	480 Winter	30	+40%	30/60 Summer				55.652
3.001	S14	480 Winter	30	+40%	30/30 Summer				55.652
3.002	S7	480 Winter	30	+40%	30/15 Summer		2/15 Summer	54	55.652
1.005	S22	480 Winter	30	+40%	2/15 Summer		2/15 Summer	54	55.652
1.006	S22	480 Winter	30	+40%	2/15 Summer				55.652
1.007	S23	480 Winter	30	+40%	2/15 Winter				55.650

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S18	0.374	0.000	0.52			48.8	SURCHARGED	
1.001	S2	0.555	0.000	1.35			96.5	SURCHARGED	
1.002	S3	0.463	0.000	0.91			143.1	SURCHARGED	
2.000	S12	-0.051	0.000	0.76			12.1	OK	
2.001	S9	0.005	0.000	0.90			52.2	SURCHARGED	
2.002	S10	0.146	0.000	0.62			91.9	SURCHARGED	
1.003	S11	0.573	0.000	1.97			267.7	SURCHARGED	
1.004	S16	0.603	0.000	0.20			40.8	SURCHARGED	
3.000	S13	0.552	0.000	0.03		210	5.0	SURCHARGED	
3.001	S14	0.672	0.000	0.06			9.9	SURCHARGED	
3.002	S7	0.752	0.000	0.00	12.9		0.2	SURCHARGED	
1.005	S22	1.052	0.000	0.33	36.6		1.5	SURCHARGED	
1.006	S22	1.052	0.000	0.27			2.9	SURCHARGED	
1.007	S23	0.995	0.000	0.06			2.8	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

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 Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 517906 230865 TL 17906 30865
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

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, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S18	15 Summer	100	+40%	30/15 Summer				57.442
1.001	S2	15 Summer	100	+40%	30/15 Summer				57.325
1.002	S3	15 Summer	100	+40%	30/15 Summer				57.024
2.000	S12	15 Summer	100	+40%	100/15 Summer				56.954
2.001	S9	15 Summer	100	+40%	30/15 Summer				56.862
2.002	S10	15 Summer	100	+40%	30/15 Summer				56.483
1.003	S11	15 Summer	100	+40%	30/15 Summer				56.165
1.004	S16	960 Winter	100	+40%	30/15 Summer				55.947
3.000	S13	960 Winter	100	+40%	30/60 Summer				55.946
3.001	S14	960 Winter	100	+40%	30/30 Summer				55.946
3.002	S7	960 Winter	100	+40%	30/15 Summer		2/15 Summer	54	55.946
1.005	S22	960 Winter	100	+40%	2/15 Summer		2/15 Summer	54	55.946
1.006	S22	960 Winter	100	+40%	2/15 Summer				55.946
1.007	S23	960 Winter	100	+40%	2/15 Winter				55.940

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S18	1.242	0.000	0.67			62.8	SURCHARGED	
1.001	S2	1.425	0.000	1.71			122.6	SURCHARGED	
1.002	S3	1.224	0.000	1.13			178.0	SURCHARGED	
2.000	S12	0.604	0.000	1.28			20.4	SURCHARGED	
2.001	S9	0.637	0.000	0.96			55.5	SURCHARGED	
2.002	S10	0.683	0.000	0.71			104.9	SURCHARGED	
1.003	S11	1.015	0.000	2.41			327.5	SURCHARGED	
1.004	S16	0.897	0.000	0.14		605	29.1	SURCHARGED	
3.000	S13	0.846	0.000	0.02		875	3.5	FLOOD RISK	
3.001	S14	0.966	0.000	0.04			7.2	FLOOD RISK	
3.002	S7	1.046	0.000	0.19	9.2		9.9	SURCHARGED	
1.005	S22	1.346	0.000	0.27	26.6		1.3	SURCHARGED	
1.006	S22	1.346	0.000	0.29			3.2	SURCHARGED	
1.007	S23	1.285	0.000	0.06			3.1	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

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 Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 517906 230865 TL 17906 30865
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

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, 240, 360, 480, 960, 1440
Return Period(s) (years)	30, 100
Climate Change (%)	0, 0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S18	15 Summer	30	+0%	100/15 Summer			
1.001	S2	15 Summer	30	+0%	30/15 Summer			
1.002	S3	15 Summer	30	+0%	100/15 Summer			
2.000	S12	15 Summer	30	+0%				
2.001	S9	15 Summer	30	+0%				
2.002	S10	15 Summer	30	+0%	100/15 Summer			
1.003	S11	15 Summer	30	+0%	30/15 Summer			
1.004	S16	480 Winter	30	+0%	30/15 Summer			
3.000	S13	480 Winter	30	+0%	30/120 Summer			
3.001	S14	480 Winter	30	+0%	30/60 Summer			
3.002	S7	480 Winter	30	+0%	30/30 Summer		30/15 Summer	36
1.005	S22	480 Summer	30	+0%	30/15 Summer		30/15 Summer	36
1.006	S22	480 Winter	30	+0%	30/15 Summer			

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S18	56.030	-0.170	0.000	0.38			35.7	OK
1.001	S2	55.916	0.016	0.000	1.09			78.2	SURCHARGED
1.002	S3	55.704	-0.096	0.000	0.72			112.9	OK
2.000	S12	56.279	-0.071	0.000	0.54			8.6	OK
2.001	S9	56.135	-0.090	0.000	0.66			38.3	OK
2.002	S10	55.652	-0.148	0.000	0.50			74.5	OK
1.003	S11	55.386	0.236	0.000	1.51			205.8	SURCHARGED
1.004	S16	55.304	0.254	0.000	0.13			27.9	SURCHARGED
3.000	S13	55.302	0.202	0.000	0.02			3.4	SURCHARGED
3.001	S14	55.302	0.322	0.000	0.04			6.8	SURCHARGED
3.002	S7	55.302	0.402	0.000	0.01	9.2		0.3	SURCHARGED
1.005	S22	55.303	0.703	0.000	0.27	37.9		1.3	SURCHARGED
1.006	S22	55.302	0.702	0.000	0.26			2.8	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S18	
1.001	S2	
1.002	S3	
2.000	S12	
2.001	S9	
2.002	S10	
1.003	S11	
1.004	S16	
3.000	S13	
3.001	S14	
3.002	S7	
1.005	S22	
1.006	S22	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.007	S23	480 Winter	30	+0%	30/15 Summer				55.303

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	S23	0.648	0.000	0.05			2.6	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

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 Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 517906 230865 TL 17906 30865
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

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, 240, 360, 480, 960, 1440
Return Period(s) (years)	30, 100
Climate Change (%)	0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S18	15 Summer	100	+0%	100/15 Summer			
1.001	S2	15 Summer	100	+0%	30/15 Summer			
1.002	S3	15 Summer	100	+0%	100/15 Summer			
2.000	S12	15 Summer	100	+0%				
2.001	S9	15 Summer	100	+0%				
2.002	S10	15 Summer	100	+0%	100/15 Summer			
1.003	S11	15 Summer	100	+0%	30/15 Summer			
1.004	S16	480 Winter	100	+0%	30/15 Summer			
3.000	S13	480 Winter	100	+0%	30/120 Summer			
3.001	S14	480 Winter	100	+0%	30/60 Summer			
3.002	S7	480 Winter	100	+0%	30/30 Summer		30/15 Summer	36
1.005	S22	480 Winter	100	+0%	30/15 Summer		30/15 Summer	36
1.006	S22	480 Winter	100	+0%	30/15 Summer			
1.007	S23	480 Winter	100	+0%	30/15 Summer			

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S18	56.369	0.169	0.000	0.47			44.0	SURCHARGED
1.001	S2	56.248	0.348	0.000	1.28			91.5	SURCHARGED
1.002	S3	56.085	0.285	0.000	0.84			132.1	SURCHARGED
2.000	S12	56.294	-0.056	0.000	0.70			11.1	OK
2.001	S9	56.161	-0.064	0.000	0.85			49.6	OK
2.002	S10	55.829	0.029	0.000	0.60			88.1	SURCHARGED
1.003	S11	55.616	0.466	0.000	1.85			251.9	SURCHARGED
1.004	S16	55.590	0.540	0.000	0.19			39.0	SURCHARGED
3.000	S13	55.589	0.489	0.000	0.03		106	4.6	SURCHARGED
3.001	S14	55.589	0.609	0.000	0.06			9.5	SURCHARGED
3.002	S7	55.589	0.689	0.000	0.00	12.5		0.2	SURCHARGED
1.005	S22	55.589	0.989	0.000	0.32	34.3		1.5	SURCHARGED
1.006	S22	55.589	0.989	0.000	0.28			3.0	SURCHARGED
1.007	S23	55.591	0.936	0.000	0.06			2.7	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S18	
1.001	S2	
1.002	S3	
2.000	S12	
2.001	S9	
2.002	S10	
1.003	S11	
1.004	S16	
3.000	S13	
3.001	S14	
3.002	S7	
1.005	S22	
1.006	S22	
1.007	S23	

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Appendix C – Greenfield Run-off Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	1.380	Urban	0.000
SAAR (mm)	567	Region Number	Region 6

Results	**l/s**
QBAR Rural	3.7
QBAR Urban	3.7
Q100 years	11.7
Q1 year	3.1
Q30 years	8.3
Q100 years	11.7

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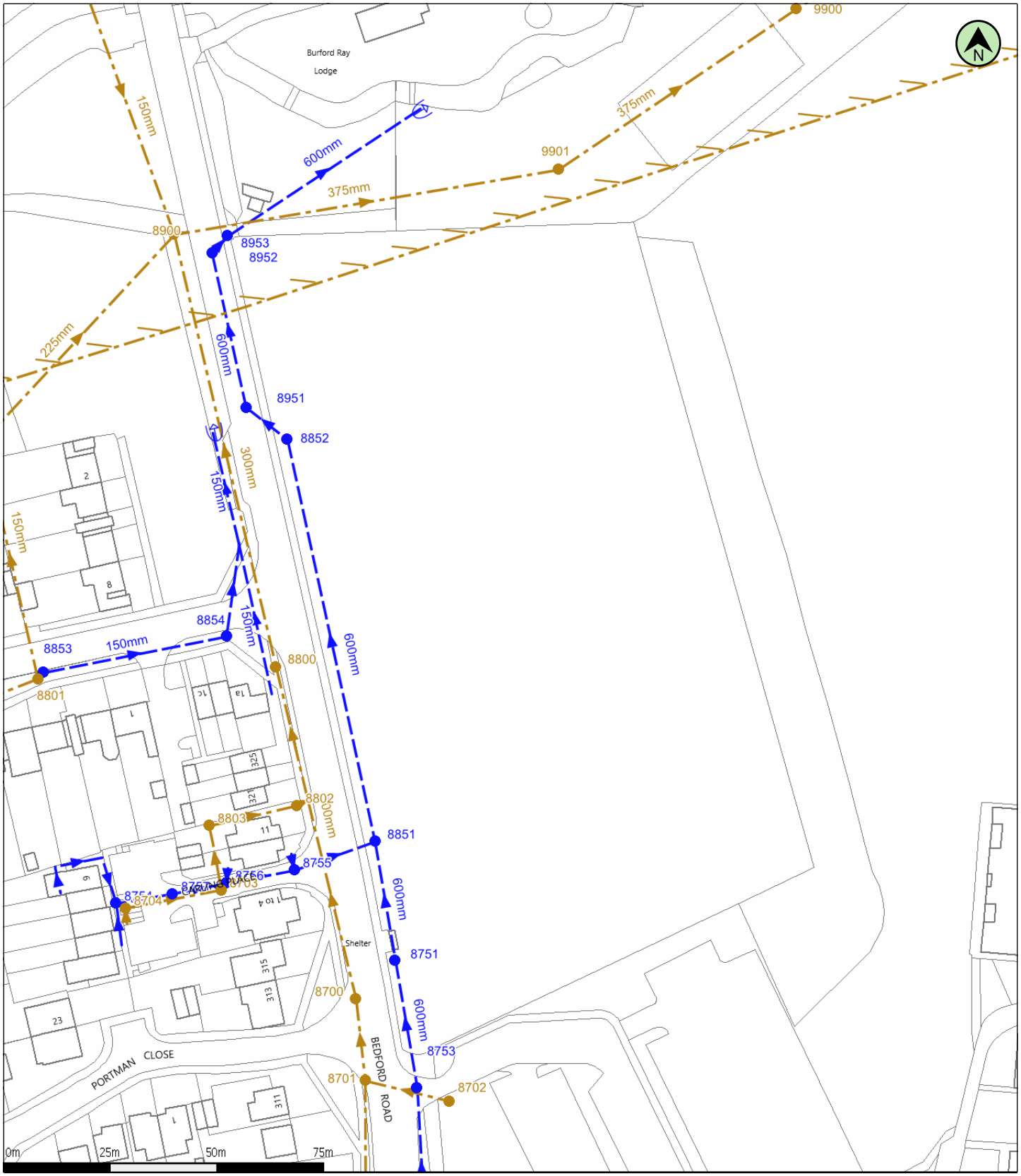
Appendix D – Anglian Water Asset Plan



(c) Crown copyright and database rights 2021 Ordnance Survey 100019209	Scale: 1:1250	Date: 09/08/21	Wastewater Plan A4
Data updated: 30/06/21	Map Centre: 517912,230862	Our Ref: 618559 - 1	Powered by digdat

Foul Sewer	Outfall*	Sewage Treatment Works	
Surface Sewer			
Combined Sewer			
Final Effluent	Inlet*	Public Pumping Station	
Rising Main*			
Private Sewer*			
Decommissioned Sewer*	Manhole*	Decomissioned Pumping Station	

*(Colour denotes effluent type)

utilitysitesearch@outlook.com

hitchin

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information or this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2021 Ordnance Survey 100022432.This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
8700	F	58.693	56.733	1.96
8701	F	58.882	56.952	1.93
8702	F	-	-	-
8703	F	-	-	-
8704	F	-	-	-
8800	F	57.489	55.309	2.18
8801	F	58.177	55.677	2.5
8802	F	-	-	-
8803	F	-	-	-
8900	F	55.763	53.163	2.6
9900	F	54.149	52.664	1.485
9901	F	54.449	52.839	1.61
8751	S	59.082	56.072	3.01
8753	S	59.214	56.354	2.86
8754	S	-	-	-
8755	S	-	-	-
8756	S	-	-	-
8757	S	-	-	-
8851	S	58.526	55.776	2.75
8852	S	56.663	55.053	1.61
8853	S	57.934	56.404	1.53
8854	S	-	-	-
8951	S	56.355	55.085	1.27
8952	S	55.703	54.503	1.2
8953	S	55.773	54.173	1.6

Appendix E – Anglian Water Pre-app

Tier 2 Pre-Planning Assessment Report

Foul Water Drainage Feasibility Study

Anglian Water Reference Number:	**PPE-26-008410**
Report Engineer:	**Maks Zdunek**
Publication Date:	**30/09/2026**
Expiration Date:	**30/09/2027**
Site Name:	**Land East Of Bedford Road And North Of The Priory School Hitchin Hertfordshire**
Development Details:	**50 Dwellings**
Site National Grid Reference:	**TL 17921 30861**
Development Type:	**Greenfield**
Planning Application Status:	**Unknown**

This report has been produced for Levee Consulting Ltd and is to be submitted as part of a developed drainage strategy should planning permission be sought.

Anglian Water will use this report as the basis for any forthcoming planning application response relevant to this application.

Anglian Water cannot reserve capacity and therefore you are recommended to formally apply for a connection at your earliest convenience. Please note that available capacity in both the receiving network and Water Recycling Centre (WRC) can be reduced at any time due to increased requirements from existing businesses and houses as well as from new housing and new commercial developments.

Should you have any questions regarding the information contained in this report, please contact Growth, Planning and Capacity on 03450 263 912.

Summary

Please note that our assessment process was updated on the 1st April 2025. We recommend reviewing this report in its entirety. You can also read our FAQ's

Easements We have assessed above and below ground operational assets in relation to your proposed development site
Water Recycling Centre (WRC) We have assessed the receiving Water Recycling Centre to determine whether it can process the increased flows and effluent quality arising from your development and continue to meet its permitted discharge consents. Our reference data tables are updated in April each year (following submission to regulators). Previously identified headroom may no longer be available.
Foul Drainage Network - Sustainable Point of Connection (SPOC) We have assessed the receiving foul water drainage system to identify a sustainable point of connection for your site to connect to the public sewerage network without causing a detriment to the operation of the system.
Infrastructure Costs The network infrastructure charge per dwelling is set for the 2026-27 charging period at £600.00. For a development of 50 dwellings the total infrastructure charge will total £30,000.00 excluding VAT. Please note that you should also budget for infrastructure charges on non-household premises where applicable and these will be calculated according to the number and type of water fittings in the premises. This is called the “relevant multiplier” method of calculating the charge. The relevant multiplier will be applied to the figures set out in our 2026-27 Developer Charging Arrangements to arrive at the amount payable. Details of the relevant multiplier for each fitting can be found on our website.

Section 1 - Anglian Water Assets and Easements

The comments contained within this report relate to the public water mains and sewers indicated on our records. Your attention is drawn to the disclaimer in the useful information section of this report.

Pipes – We have identified pipework infrastructure within the boundaries of your site

Other Assets – We do not have other assets within 20 m of your site

Source Protection Zone (SPZ) – Your site does not sit within an identified SPZ

Water Recycling Centre (WRC) – Your site is not within a WRC encroachment zone

The proposed development site boundary is highlighted on Anglian Water's asset record in figure 1. Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence.

Any potential instances of asset encroachment are to be identified and addressed at planning. Anglian Water are unable to permit development either over or within the easement strip without prior consent. The extent of asset easements are available in Table 1 for used water and Table 2 for potable water. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Used Water Easements – Measured either side of the centre line (m)						
	Depth to Invert (m)					
Sewer Diameter(mm)	< 3	3 - 4	4 - 5	5 - 6	6 - 7.5	> 7.5
< 150	3.0	3.0	4.0	5.0	6.0	4.0
150 - 299	3.0	3.0	4.0	5.0	6.0	4.0
300 - 449	3.0	3.0	4.0	5.0	6.0	4.0
450 - 600	3.5	4.0	5.0	6.0	6.0	4.0
601 - 749	3.5	4.0	5.0	6.0	6.0	4.0
750 - 924	4.0	5.0	5.0	6.5	6.5	5.0
925 - 1000	5.0	5.0	6.0	6.5	6.5	5.0

Table 1: Anglian Water used water asset easements

Potable Water Easements - Measured either side of the centre line (m)	
Potable Mains Pipe Diameter (mm)	Distance either side of the centre line (m)
< 150	2.25
150 - 449	3.0
450 - 749	4.5
750 >	6

Table 2: Anglian Water potable water asset easements

If it is not possible to avoid our assets then these may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). You will need to make a formal application if you would like a diversion to be considered; please note that in some instances assets cannot be diverted; it is therefore vital to engage with our Drainage team prior to finalising site layout. The Drainage team can be contacted by calling 03456 066 087. Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

For your information, please be aware:

- We need to inform you that sewer mains (600mm and 175mm) run within your site boundary that may be affected by the proposed development.
- Anglian Water does not permit existing assets to be located within the curtilage of the proposed development buildings and we do not permit permeable paving or suds features over our assets. These assets should be located in areas of public open space and/or adoptable highways to ensure on-going maintenance and access is possible.
- Development is not permissible either over or within the established easement strip of any public asset without Anglian Water's granted prior consent.
- A new developments site layout must adhere to the required easements. You may also discuss potential diversions with us.
- Please be aware that existing water mains/public sewers should be located in highway or open space and not in private gardens or curtilages.
- Rising mains may not be located under play equipment or SUDS features. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.
- No significant planting can be located in the designated easement strip, to ensure that root intrusion does not pose a risk to our assets. Where necessary and to maintain the aesthetics of the proposed landscaping, ornamental/low lying hedges or similar are considered acceptable, but should be limited.
- In any case where site levels are to be altered within an easement strip, Anglian Water will request a CCTV survey is undertaken to understand the existing condition of the affected sewer and potential impact of this proposal. The footage and accompanying report should be provided to Anglian Water alongside any observations or recommendations (should these be identified) by your designer. In addition, the manholes in this area would also need to be raised to finished level. Anglian Water would expect photographs confirming the existing construction of these chambers and a design drawing which illustrates how this outcome will be achieved whilst maintaining compliance with Design and Construction Guidance (DCG) standards.
- Anglian Water will expect confirmation of the established measures that will allow 24 hour unencumbered access for assets within the vicinity of the development. It is beneficial to understand how awareness of Anglian Water's need for access to provide this in perpetuity will be established going forward. It can be assumed that plot transfers (if appropriate) will contain covenants/rights relating to these assets; we would appreciate clarification on this point.
- It is the developer's responsibility to ensure the correct sight surveys are completed i.e. trial holes, to ascertain the exact location of Anglian Water assets. You should then present your findings to Anglian Water – we may need to complete formal risk assessments (at the developers cost) for certain asset types.

Figure 1: The site boundary for the proposed development as shown on Anglian Water asset records.

Section 2 – Used Water Assessment

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving Water Recycling Centre and determine the headroom available to manage the increased effluent flows and effluent quality from your development.

Water Recycling Centre

When assessing Dry Weather Flow (DWF) headroom at the receiving Water Recycling Centre (WRC), we apply a three-year Q90 DWF average (2023–2025), together with the flows associated with sites that already benefit from planning consent.

Our DWF dataset is reviewed and updated annually in consultation with the Environment Agency. This ensures that our planning assessments reflect the most up-to-date information regarding the WRC's compliance with its environmental permit and its ability to accommodate additional flows from new development without creating an unacceptable risk of breaching environmental legislation. This approach also ensures that there is no pollution or deterioration of the receiving watercourse.

Based on the above assessment, Hitchin WRC is within the acceptance parameters and can accommodate the flows from the proposed growth.

The available capacity at all Water Recycling Centres in the Anglian Water region is updated annually in April. This update ensures the most current data is used in evaluating developments. Consequently, the available headroom will change for Hitchin WRC which could potentially change the recommendation of our pre-planning capacity assessment and our planning response, both of which will be in line with the most recent flow figures for Hitchin Water Recycling Centre.

Used Water Network

Our assessment has been based on your development flows connecting to the nearest foul water sewer of the same size or greater pipe diameter that may sustainably drain the site.

The infrastructure to convey foul water flows to the receiving sewerage network is the responsibility of the developer.

Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream of the point of connection, including making the connection to our existing network.

This connection point has been determined in reference to the calculated discharge flow and on this basis, a 150mm internal diameter pipe is required to drain the development site. We have assessed the sustainable point of connection, which is to the 375mm sewer to the northeast of the development site, at any point downstream of manhole MH9900 located at National Grid reference (NGR) TL 17977 30997. The cover level is 54.15 and the invert level is 52.66.

Anglian Water has assessed the local foul sewerage network up to the water recycling centre and determined that the additional foul flow from the proposed development would not create an unacceptable risk of flooding to our existing customers and the environment.

In line with the Sewage Sector Guidance - Appendix C - Design and Construction Guidance (DCG) - Sewerage Sector Guidance - approved documents | Water UK, the pumped discharge will need to connect via an intermediate manhole and at least 5 metres of an appropriately sized gravity sewer. The pump rate and configuration of the connection will be determined with your detailed design. You should submit this detail with your Section 106 new connection application.

Anglian Water cannot reserve capacity and therefore you are recommended to formally apply for a connection at your earliest convenience. Please note that available capacity in our network can be reduced at any time due to increased requirements from existing businesses and dwellings as well as from new housing and new commercial developments.

Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

Considerations for Manhole Connections - When connecting to a manhole, it is essential to consider the management of existing flows whilst the connection is taking place. Similarly, the existing configuration of the manhole (including existing connections and access ladders/landings) should be determined beforehand to ensure the proposed connection is feasible. Man entry requirements at the manhole must be carefully planned and executed in accordance with confined space procedures and Anglian Water requirements to ensure safety and compliance.

Requirements for Sewer Connections - In cases where the connection is made directly to the sewer rather than a manhole, the developer will be responsible for conducting a condition survey of the sewer. This survey is necessary to confirm that the sewer is structurally sound and capable of accommodating the proposed connection without compromising its integrity. For sewers of 375mm diameter or greater, a saddle connection at a 10 or 2 o'clock angle is generally preferred. The method and mode of connection will be fully considered as part of your Section 106 sewer connection application.

Used Water Budget Costs

For a development site that benefits from full planning permission, infrastructure charges are raised on a standard basis of one charge per new connection, one each for water supply and drainage connections.

Infrastructure charges are applied to each new property connecting to the public water and sewerage network. The infrastructure charge type is set out in Section 146(2) of the Water Industry Act 1991.

The charge should be paid by any party that wishes to build or develop a property and is payable upon request of connection.

The sewerage infrastructure charge per dwelling is set for the 2026-27 charging period at £600.00. For a development of 50 dwellings the total infrastructure charge will total £30,000.00 excluding VAT.

Please note that you should also budget for infrastructure charges on non-household premises where applicable and these will be calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge. The relevant multiplier will be applied to the figures set out in our 2026-2 Developer Charging Arrangements to arrive at the amount payable. Details of the relevant multiplier for each fitting can be found on our website.

Figure 2: Showing your water recycling foul point of connection

Section 3 – Useful Information

Water Industry Act – Key used water sections

Section 98:
This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:
This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:
This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:
This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185:
This provides you with the right to have a public sewerage asset diverted. Details on how to make a formal application for a new sewer, new connection or diversion are available on our website or via our Development Services team on 0345 60 66 087.

Surface Water Drainage

All surface water must be managed in line with Building Regs / Sewer Sector Guidance (SSG). Our guidance document and Surface Water policy detail our requirements and expectations. You must explore all on-site options per the SUDS hierarchy before speaking to us about a possible connection to our SW drainage network. We recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for your site to discuss your application.

Sustainable drainage systems

Some existing urban drainage systems have additional risks of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. Our preferred method of surface water disposal is through the use of Sustainable Drainage Systems or SuDS. SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website.

Private sewer transfers

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

Surface water sewers and lateral drains that do not discharge to the public sewer, e.g. those that discharged to a watercourse.

Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility. Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

It is anticipated that all new sewer applications will need to have an approved Section104 application ahead of a Section 106 connection.

Encroachment

Anglian Water operates a risk based approach to development encroachment on our above and below ground infrastructure and assets.

Locating our assets

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from digdat.

All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge. We have more information on our website.

Charging arrangements
Our charging arrangements and summary for this year's water and used water connection and infrastructure charges can be found on our website here.

Environmental Incentives
Following regulatory guidance and changes to the charging rules the Infrastructure Charge for connections to our water network will no longer attract an income offset discount after 31st March 2025. This will be replaced with a new Environmental Incentive Scheme (EIS) aimed at promoting water efficiency and sustainability.

Anglian Water's EIS has been developed in accordance with the Environmental Incentive Common Framework (EICF), which was released by Ofwat in December 2024. For this charging year, 2026-27, and in accordance with Ofwat guidance, only household properties will be eligible for our EIS. We will continue to reassess this for future charging years.

There are two elements to our EIS;

Water Environmental Incentive
The applicant must demonstrate the newly connected property is designed to achieve consumption of 90 litres per person per day (pppd) or less.
Post property connection, we will conduct compliance audits on the first connected property and 10% of the remaining properties on a random basis.

Sewerage Environmental Incentive
Post property connection for redeveloped brownfield sites we will complete a site inspection to confirm the removal of surface water flows.

Environmental Component
This charge is used solely to fund the Environmental Incentive and is uniformly applied upon connection of each developed property; this includes connections which do not qualify for the Environmental Incentive.

Environmental Incentives	Charge per property
Water Environmental Incentive	-500
Environmental Incentive Component Charge Water	100
Additional Water EIS Audit (per premises)	84
Sewerage Environmental Incentive (50% of Sewerage Infra)	-202
Environmental Incentive Component Charge Sewerage	0

Our EIS will be available between 1st April 2025 and 31st March 2030 and during this period, we reserve the right to make any amendments to the EIS as we may see fit, including amendments to the value of both Environmental Incentives and the Component Charges. The EIS may close on 31st March 2030, therefore, to qualify for the Environmental Incentives, your plot must be connected to our network and validated by us. Please refer to our Developer Charging Arrangements for full details. To learn more or apply for our environmental incentive scheme please visit our website Water Environmental Incentive Scheme

Section 4 - Disclaimer

The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content.

Furthermore, in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

This report is valid from the date issued and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s). Our pre-planning reports are valid for 12 months. Please note Anglian Water cannot reserve capacity and available capacity in our network can be reduced at any time due to increased requirements from existing businesses and houses as well as from new housing and new commercial developments.

Appendix F – Geo Integrity Infiltration Testing Report

4 Church Street
Maids Moreton
MK18 1QE

01280 816409
07858 367 125
www.geo-integrity.co.uk
info@geo-integrity.co.uk

Our Ref: AJW/26-08-18

Arte Construction Ltd
6 Snow Hill
London
EC1A 2AY

11th September 2026

For the attention of Jamie Rickard

Dear Jamie,

BRE365 Soakaway Testing – Land East of Bedford Road and North of The Priory School, Hitchin, SG5 2UR

Following receipt of the acceptance for our proposal E03883 on the 21st August 2026 we have pleasure in providing you with our interpretative soakaway letter report for the site at the Land East of Bedford Road and North of The Priory School, Hitchin, SG5 2UR; grid reference 517917, 230869. This is a soakaway letter report and should not be relied upon for geotechnical design purposes.

1 Objectives and Sitework Information

The site is located to the north west of the town of Hitchin, North Hertfordshire. The site is roughly trapezium shaped and approximately 3.82 ac in area. The site is slightly sloping north westwards, with a maximum fall of 4m. At the time of fieldwork, the site was a gated grass field bordered by hedgerows.

The objectives of this site investigation were:-

- To conduct infiltration tests following BRE Digest 365.

From the 1st to the 2nd September 2026, we attended site and undertook five infiltration tests in machine excavated trial pits and calculated the infiltration rate in accordance with BRE Digest 365. We also excavated two additional trial pits to further investigate the geologies underlying the site.

The trial pits were excavated using a JCB 3CX. The two additional trial pits, TP 1 and TP 2, were excavated to depths 2.50m and 2.30m respectively. The five soakaway trial pits (SA 1-5) were excavated to varying depths between 1.05m and 1.50m bgl. The pits were filled with water using a

mobile water bowser and the infiltration of the water was then monitored. The depths of the BRE365 soakaway test trial pits were decided by Geo-Integrity and the location of them were decided by the client, the locations of these can be seen on the Exploratory Hole Location Plan attached.

2 Published Geology

Reference to the British Geological Survey website indicates that the site is directly underlain by superficial deposits of the Lowestoft Formation, covering two-thirds of the site (south and centre). Spanning the northern third of the site are superficial Glaciofluvial Deposits. Both of these superficial deposits were formed during the Quaternary period. Underlying the site and superficial deposits is the bedrock strata of the Gault Formation, which originates from the Cretaceous.

2.1 Superficial Deposits

According to the BGS "The **Lowestoft Formation** forms an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content. The carbonate content of the till matrix is about 30%, and tills within the underlying Happisburgh Formation have less than 20%.". The thickness of the Lowestoft Formation is "extremely variable. It is thickest in buried valleys where locally up to 60 m may be present".

"**Glaciofluvial deposits** were deposited by meltwater streams. Includes mostly coarse-grained sediments (i.e. sand and gravel) with some finer-grained layers (i.e. clay and silt). Sand and gravel, locally with lenses of silt, clay or organic material." The thickness of this deposit is not recorded.

2.2 Bedrock

The BGS characterises **Gault Formation** as "Pale to dark grey or blue-grey clay or mudstone, glauconitic in part, with a sandy base. Discrete bands of phosphatic nodules (commonly preserving fossils), some pyrite and calcareous nodules. The thickness of Gault Formation is "About 2m in north Norfolk, thickening southwards to 20m in Cambridgeshire, 60m in Bedfordshire, and 90 to 110m in the Weald".

3 Ground Conditions Encountered

The ground conditions encountered during the investigation generally match the anticipated geology. The Trial Pits Logs (SA 1-SA 5 and TP 1 and TP 2) are attached below.

INTEGRITY

3.1 Topsoil

Topsoil was encountered in both TP 1 and TP 2, and SA 1 and SA 4 from ground level to varying depths between 0.20m to 0.40m. The topsoil generally consisted of loose brown slightly gravelly clayey topsoil with fine to medium flint gravels and soft dark brown silty clay.

3.2 Made Ground

Made Ground was encountered in three of the trial pits (SA 2, SA 3 and SA 5) from ground level to varying depths between 0.20m and 0.60m. The Made Ground generally consisted of loose brown slightly gravelly slightly clayey topsoil and firm orange-brown slightly sandy gravelly clay with fine to coarse flint chalk and rare brick.

3.3 Lowestoft Formation

Weathered Lowestoft Formation was encountered in SA 1, SA 3 and TP 1 from approximately between 0.20m to 1.05m. It consisted of stiff to very stiff brown slightly sandy slightly gravelly silt, with fine to medium chalk gravel.

The Lowestoft Formation was encountered in all of the trial pits from between 0.40m to 1.05m to a maximum depth between 1.05m to 2.50m. This was generally encountered as firm to very stiff greyish-brown slightly sandy gravelly clay, with fine to coarse angular to sub-rounded chalk and flint gravels. The Lowestoft Formation in SA 3 was recovered as stiff grey-brown sandy gravelly clayey silt with fine to medium chalk. SA 1, SA 2, SA 5 had cobble sized pockets of greyish-orange silty sand and gravel. TP 2 also featured cobbles of flint.

3.4 Glaciofluvial Deposits

Glaciofluvial Deposits were identified in TP 2 from 0.20m to 0.80m and comprised orange-brown clayey silty sand and gravel, with fine to coarse sub-angular to sub-rounded flint and quartzite gravels. Possible Glaciofluvial Deposits were encountered in SA 4 from 0.40m to 0.70m and consisted of stiff orange-brown slightly sandy gravelly clay, with the same gravels as seen in the glaciofluvial deposits in TP 2. The full soil description can be seen in the trial pit logs attached.

3.5 Groundwater

No groundwater was encountered during this investigation to a maximum depth of 2.50m.

INTEGRITY

4 BRE365 Soakaway Testing

The soakaway pits were tested for their infiltration potential using the methods set out in BRE Digest 365.

The predominant test response zone for SA 1-5 was the Lowestoft Formation. The test response zone in SA 1 also included part of the weathered Lowestoft Formation. The test response zone of SA 4 also partially included possible Glaciofluvial deposits.

Only SA1 and SA 2 managed to complete one test., all other locations failed to complete a single test over the course of the testing. This may be because of the soil's coarse secondary factors as cobble sized pockets of silty sand and gravel in the Lowestoft Formation, and gravity as the site was slightly sloping north westwards. SA 1 and SA 2 appeared to be situated near the highest point of the site.

A summary of the results can be seen below, and the full results are attached.

BRE365 Soakaway Infiltration Testing Results (m/s)			
Location (response zone)	**Test 1 (Depth)**	**Test 2 (Depth)**	**Test 3**
SA 1 (Lowestoft Formation)	2.70×10^{-6}m/s (1.50m)	Test not complete (1.34m)	N/A
SA 2 (Lowestoft Formation)	1.20×10^{-6}m/s (1.04m)	Test not complete (0.97m)	N/A
SA 3 (Lowestoft Formation)	Test not complete (1.01m)	N/A	N/A
SA 4 (Lowestoft Formation)	Test not complete (1.05m)	N/A	N/A
SA 5 (Lowestoft Formation)	Test not complete (1.35m)	N/A	N/A

5 Soil Infiltration Comments

Information gathered from the site investigation shows the soakaways were generally unsuccessful over the course of the testing this is due to the cohesive nature of the soils in the trial pits.

In TP 1 and TP 2 the Lowestoft Formation was encountered to depths 2.30m to 2.50m, and even at these depths it consisted of cohesive soils.

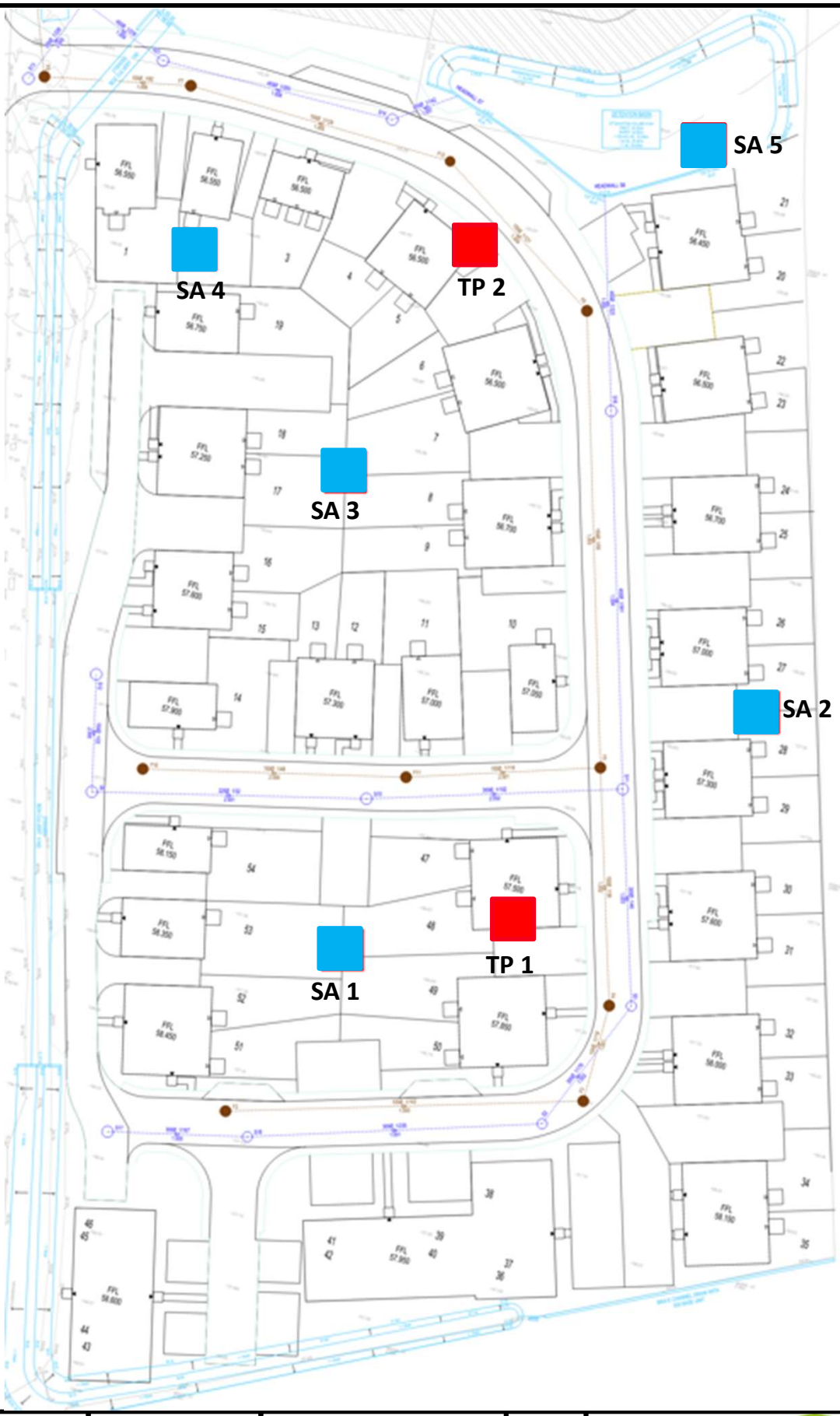
Given the results of the testing, although two locations completed a single test, soakaway drainage is considered unlikely to be viable on the site.

We trust this information is satisfactory to you. In the event of any queries please contact us.

Yours sincerely

[redacted]

Amber Jeacock West B.Sc. FGS.
Geotechnician
Geo-Integrity Ltd.



Key

- BRE365 Soakaway Trial Pit
- Trial Pit

Exploratory Hole Location Plan	SITE:- Land East of Bedford Road, Hitchin, SG5 2UR	Drawn AJW	
JOB NO.:- 26-08-18	CLIENT:- Arte Construction	Checked MB	
4 Church Street Maids Moreton MK18 1QE	Scale: Not To Scale, for indicative purposes only		

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Site	Trial Pit Number
Land East of Bedford Road and North of The Priory School, Hitchin, SG5 2UR	SA 1

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD)	Client Arte Construction	Job Number 26-08-18
	Location 517919 E 230819 N	Dates 01/09/2026-02/09/2026	Project Contractor Geo-Integrity	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25) 0.25	TOPSOIL. Loose brown slightly gravelly slightly clayey TOPSOIL. Gravel is fine to medium flint.		
					(0.80) 1.05	WEATHERED LOWESTOFT FORMATION. Stiff brown slightly sandy slightly gravelly clayey SILT. Gravel is fine to medium chalk.		
					(0.45) 1.50	LOWESTOFT FORMATION. Firm greyish-brown slightly sandy gravelly CLAY, with pockets of greyish-orange silty sand and gravel. Gravel is fine to coarse angular to sub-rounded chalk and flint.		
						Complete at 1.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	AJW	26-08-18.SA 1

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Site	Trial Pit Number
Land East of Bedford Road and North of The Priory School, Hitchin, SG5 2UR	SA 2

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD)	Client Arte Construction	Job Number 26-08-18
	Location 517956 E 230865 N	Dates 01/09/2026-02/09/2026	Project Contractor Geo-Integrity	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30) 0.30	MADE GROUND. Loose brown slightly gravelly slightly clayey TOPSOIL. Gravel is fine to coarse flint and chalk.		
					(0.30) 0.60	MADE GROUND. Firm brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to sub-rounded chalk, flint and rare brick.		
					(0.50) 1.10	LOWESTOFT FORMATION. Firm greyish-brown slightly sandy gravelly CLAY, with rare pockets of greyish-orange silty sand and gravel. Gravel is fine to coarse angular to sub-rounded chalk and flint.		
						Complete at 1.10m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	AJW	26-08-18.SA 2

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Site	Trial Pit Number
Land East of Bedford Road and North of The Priory School, Hitchin, SG5 2UR	SA 3

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number
			Arte Construction	26-08-18
	Location	**Dates**	**Project Contractor**	**Sheet**
	517906 E 230879 N	01/09/2026-02/09/2026	Geo-Integrity	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	MADE GROUND. Loose brown slightly gravelly slightly clayey TOPSOIL. Gravel is fine to coarse flint, chalk and rare brick.		
					(0.20) 0.40	WEATHERED LOWESTOFT FORMATION. Stiff brown slightly sandy slightly gravelly clayey SILT. Gravel is fine to medium chalk.		
0.80	D				(0.70) 1.10	LOWESTOFT FORMATION. Recovered as stiff grey-brown sandy gravelly clayey SILT. Gravel is fine to medium chalk. Complete at 1.10m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	AJW	26-08-18.SA 3

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Site	Trial Pit Number
Land East of Bedford Road and North of The Priory School, Hitchin, SG5 2UR	SA 4

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD)	Client Arte Construction	Job Number 26-08-18
	Location 517877 E 230909 N	Dates 01/09/2026-02/09/2026	Project Contractor Geo-Integrity	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40) 0.40	TOPSOIL. Loose brown slightly gravelly clayey TOPSOIL. Gravel is fine to medium flint.		
					(0.30) 0.70	POSSIBLE GLACIOFLUVIAL DEPOSITS. Stiff orange-brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint and chalk.		
					(0.35) 1.05	LOWESTOFT FORMATION. Very stiff greyish-brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to sub-rounded chalk and flint.		
						Complete at 1.05m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	AJW	26-08-18.SA 4

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Site	Trial Pit Number
Land East of Bedford Road and North of The Priory School, Hitchin, SG5 2UR	SA 5

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number
			Arte Construction	26-08-18
	Location	**Dates**	**Project Contractor**	**Sheet**
	517933 E 230931 N	01/09/2026-02/09/2026	Geo-Integrity	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	MADE GROUND. Loose brown slightly gravelly clayey TOPSOIL. Gravel is fine to medium flint and rare brick.		
					(0.25) 0.45	MADE GROUND. Firm orange-brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded chalk, flint and occasional brick.		
					(0.85) 1.30	LOWESTOFT FORMATION. Stiff greyish-brown slightly sandy gravelly CLAY, with rare pockets of greyish-orange silty sand and gravel. Gravel is fine to coarse angular to sub-rounded chalk and flint.		
						Complete at 1.30m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	AJW	26-08-18.SA 5

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Site	Trial Pit Number
Land East of Bedford Road and North of The Priory School, Hitchin, SG5 2UR	TP 1

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD)	Client Arte Construction	Job Number 26-08-18
	Location 517914 E 230843 N	Dates 01/09/2026-02/09/2026	Project Contractor Geo-Integrity	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30) 0.30	TOPSOIL. Soft dark brown silty CLAY.		
					(0.60) 0.90	WEATHERED LOWESTOFT FORMATION. Very stiff brown slightly gravelly clayey SILT. Gravel is fine to medium sub-angular to sub-rounded flint and chalk.		
					(1.60) 2.50	LOWESTOFT FORMATION. Firm to stiff grey-brown gravelly silty CLAY. gravel is fine to coarse sub-angular to sub-rounded chalk and flint.		
						Complete at 2.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	LA	26-08-18.TP 1

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Machine : JCB 3CX **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)**	**Client** Arte Construction	**Job Number** 26-08-18
	Location 517899 E 230919 N	**Dates** 01/09/2026-02/09/2026	**Project Contractor** Geo-Integrity	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL. Soft dark brown silty CLAY.		
					(0.60) 0.80	GLACIOFLUVIAL DEPOSITS. Orange-brown clayey silty SAND AND GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded flint and quartzite.		
					(1.50) 2.30	LOWESTOFT FORMATION. Firm occasionally soft brown-grey slightly gravelly slightly cobbly silty CLAY. Gravel is fine to coarse sub-angular to sub-rounded chalk and flint, and cobbles of flint.		
						Complete at 2.30m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	LA	26-08-18.TP 2

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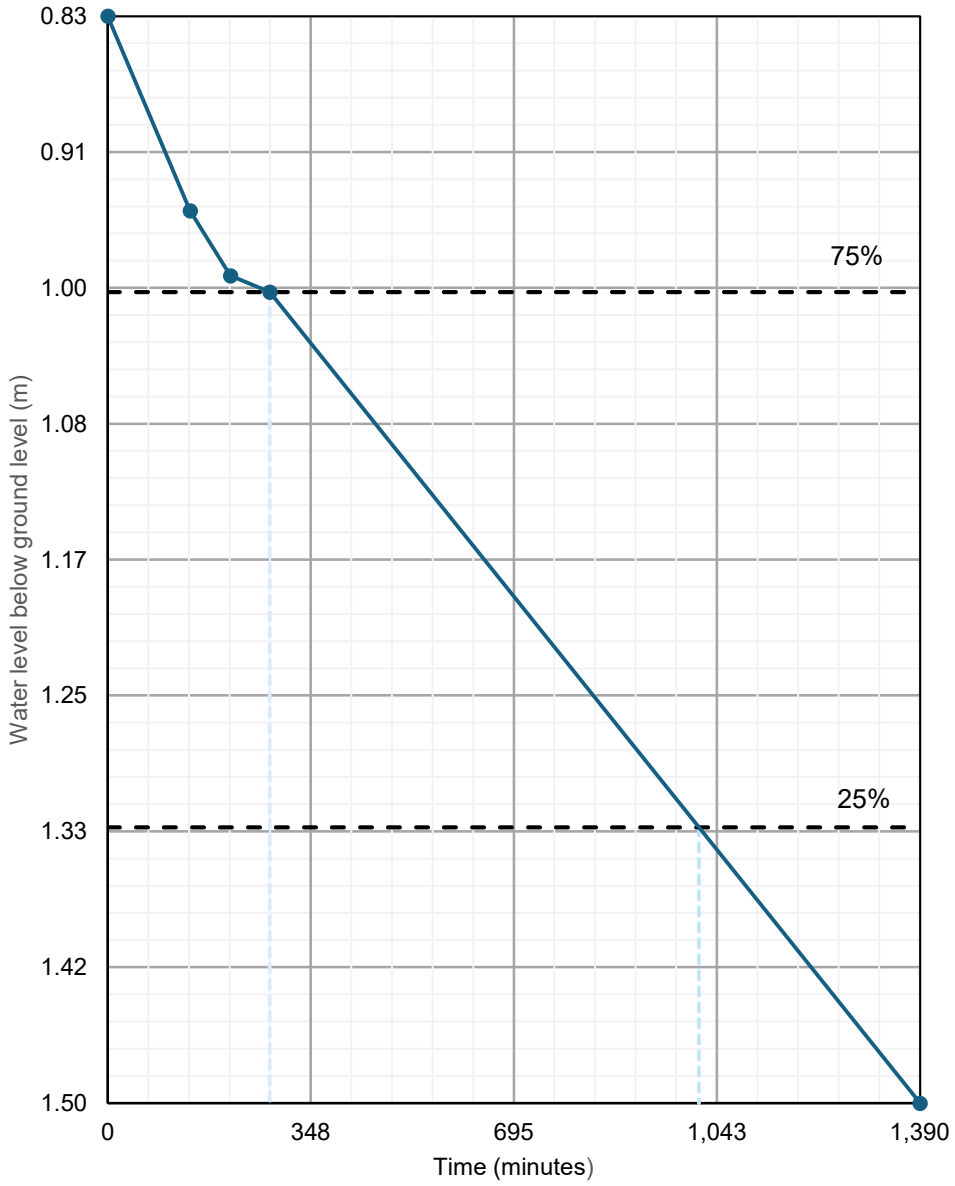
Trial Pit Infiltration Testing to BRE Digest 365

Location: Land East of Bedford Road, Hitchin, SG5 2UR
Report Ref: 26-08-18
Date of Test: 1-2/9/2026
Dimensions: 0.50m(W) x 1.70m(L) x 1.50m(D)

Test Location: SA 1
Test Number: Test 01
Groundwater: >1.50m

Test Response Zone:
0.83m to 1.05m: WEATHERED LOWESTOFT FORMATION
1.05m to 1.50m: LOWESTOFT FORMATION

Time (mins)	Depth (m)
0	0.83
141	0.95
210	0.99
277	1.00
1390	1.50



Calculated Soil Infiltration Rate, f, = 2.7x10^{-6} m/s

Comments:

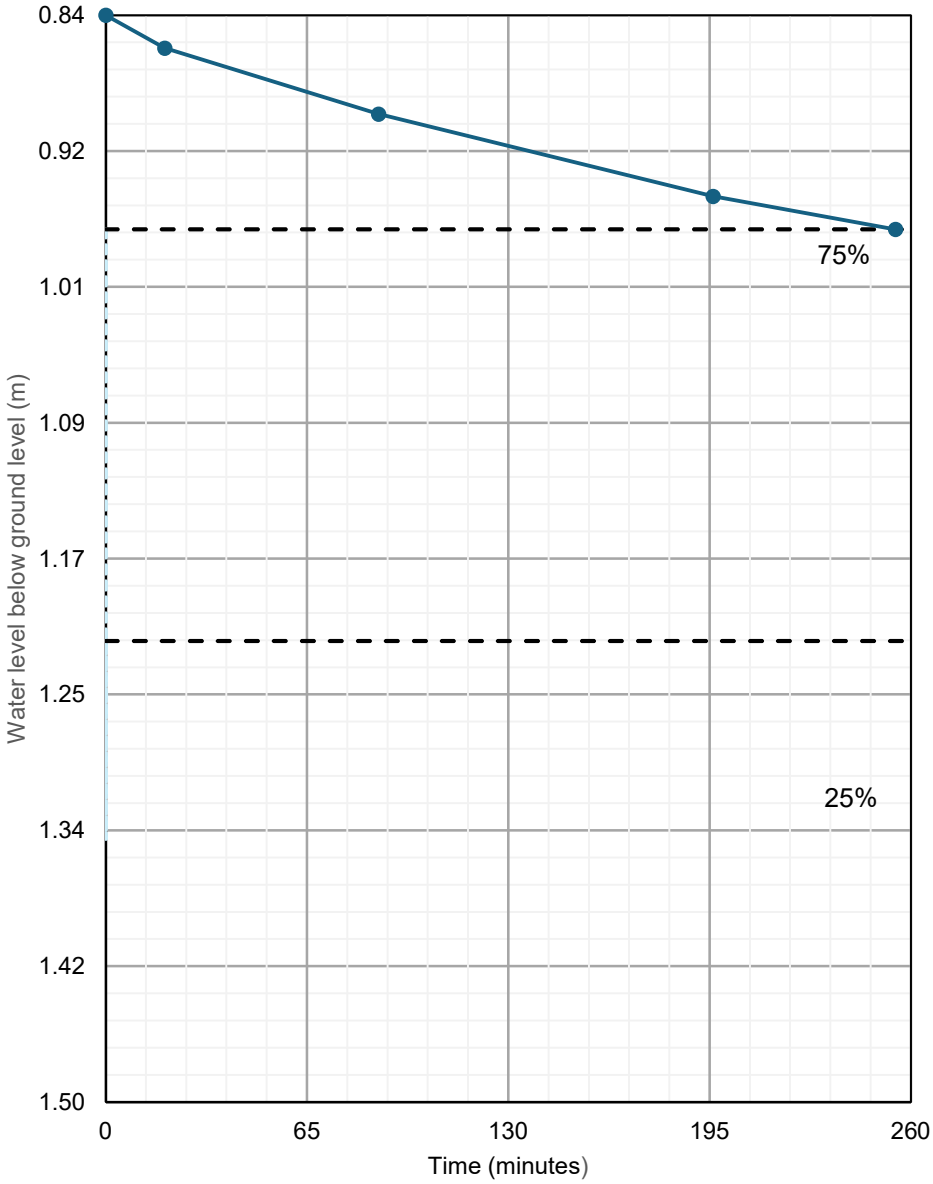
Trial Pit Infiltration Testing to BRE Digest 365

Location: Land East of Bedford Road, Hitchin, SG5 2UR
Report Ref: 26-08-18
Date of Test: 1-2/9/2026
Dimensions: 0.50m(W) x 1.70m(L) x 1.34m(D)

Test Location: SA 1
Test Number: Test 02
Groundwater: >1.50m

Test Response Zone:
0.83m to 1.05m: WEATHERED LOWESTOFT FORMATION
1.05m to 1.50m: LOWESTOFT FORMATION

Time (mins)	Depth (m)
0	0.84
19	0.86
88	0.90
196	0.95
255	0.97



Soil infiltration rate could not be calculated (0.13m drop, 74% empty, in 255 minutes)

Comments:

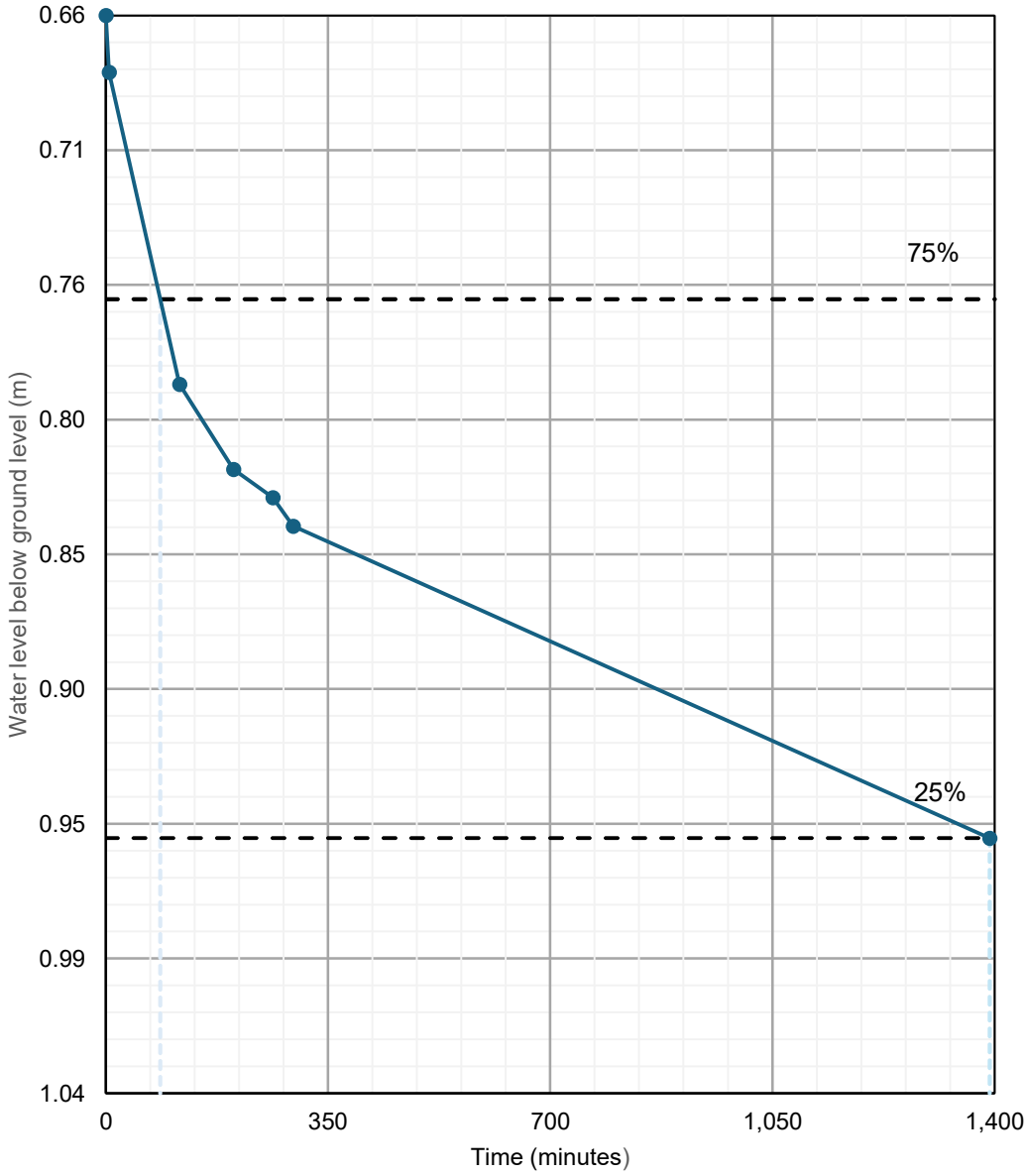
Trial Pit Infiltration Testing to BRE Digest 365

Location: Land East of Bedford Road, Hitchin, SG5 2UR
Report Ref: 26-08-18
Date of Test: 1-2/9/2026
Dimensions: 0.50m(W) x 1.70m(L) x 1.04m(D)

Test Location: SA 2
Test Number: Test 01
Groundwater: >1.04m

Test Response Zone:
0.60m to 1.10m: LOWESTOFT FORMATION

Time (mins)	Depth (m)
0	0.66
5	0.68
116	0.79
201	0.82
263	0.83
295	0.84
1392	0.95



Calculated Soil Infiltration Rate, f, = 1.2x10^{-6} m/s

Comments:

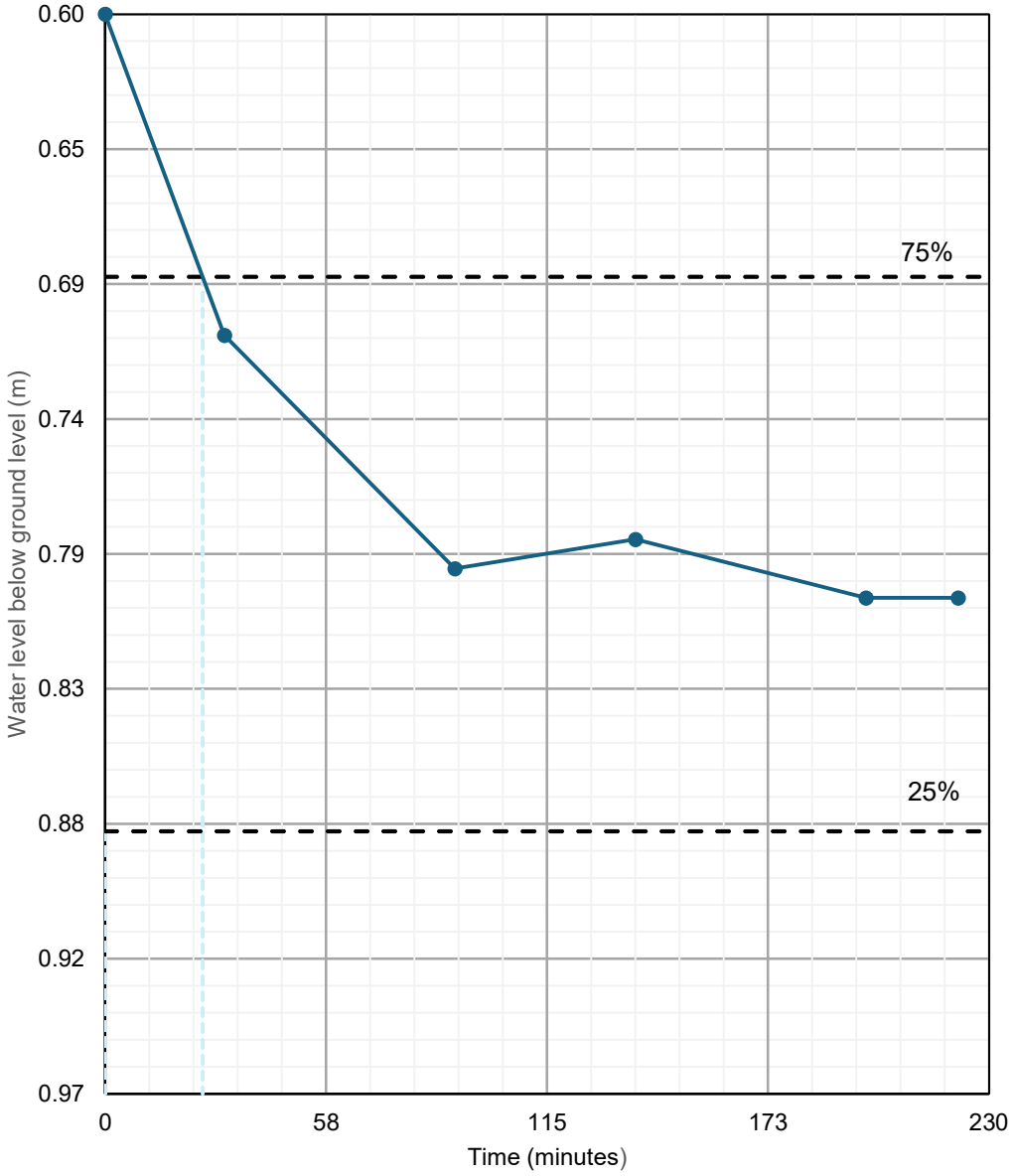
Trial Pit Infiltration Testing to BRE Digest 365

Location: Land East of Bedford Road, Hitchin, SG5 2UR
Report Ref: 26-08-18
Date of Test: 1-2/9/2026
Dimensions: 0.50m(W) x 1.70m(L) x 0.97m(D)

Test Location: SA 2
Test Number: Test 02
Groundwater: >1.04m

Test Response Zone:
0.60m to 1.10m: LOWESTOFT FORMATION

Time (mins)	Depth (m)
0	0.60
31	0.71
91	0.79
138	0.78
198	0.80
222	0.80



Soil infiltration rate could not be calculated (0.20m drop, 46% empty, in 222 minutes)

Comments:

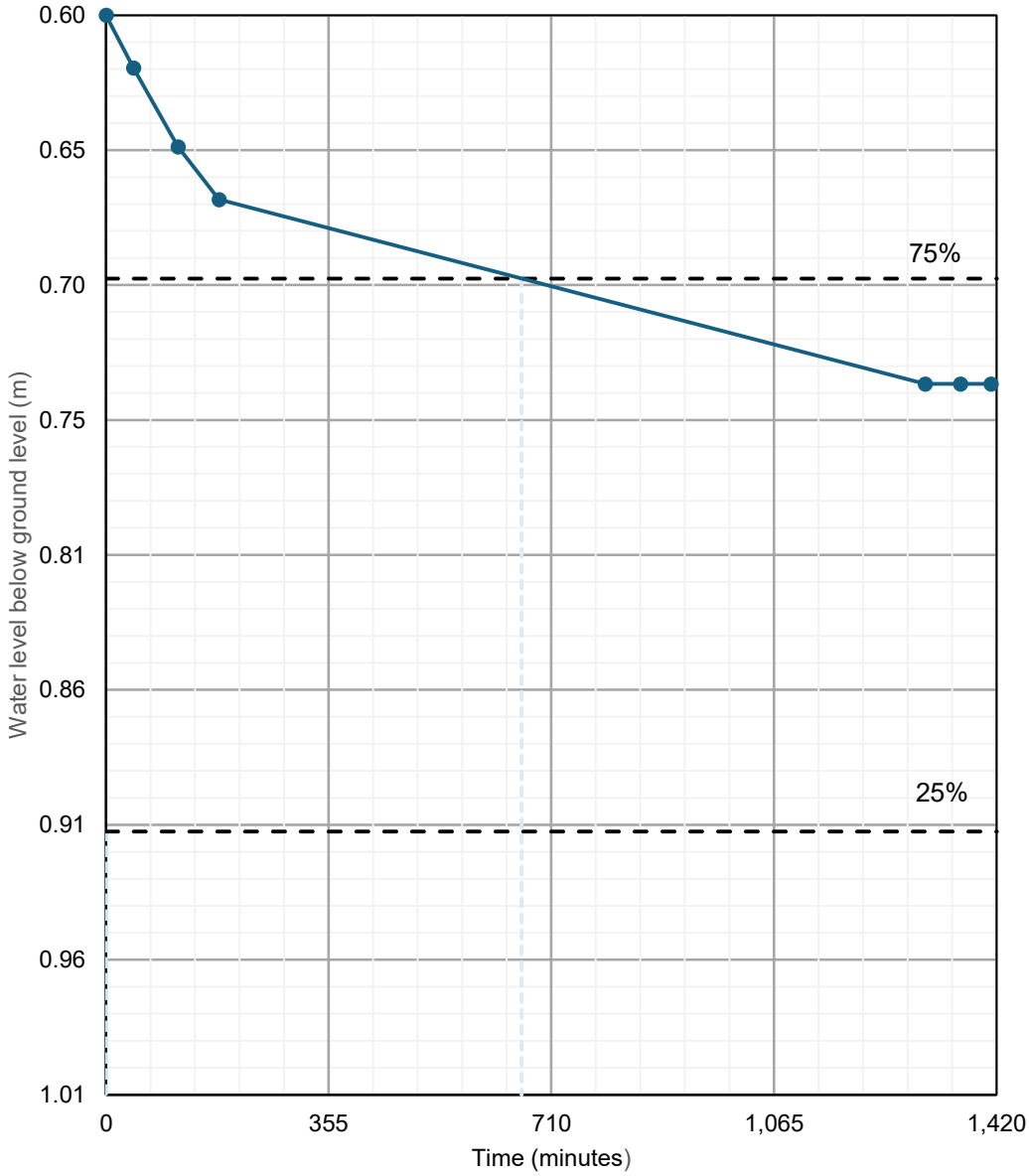
Trial Pit Infiltration Testing to BRE Digest 365

Location: Land East of Bedford Road, Hitchin, SG5 2UR
Report Ref: 26-08-18
Date of Test: 1-2/9/2026
Dimensions: 0.50m(W) x 1.70m(L) x 1.01m(D)

Test Location: SA 3
Test Number: Test 01
Groundwater: >1.01m

Test Response Zone:
0.40m to 1.10m: LOWESTOFT FORMATION

Time (mins)	Depth (m)
0	0.60
44	0.62
115	0.65
180	0.67
1306	0.74
1362	0.74
1411	0.74



Soil infiltration rate could not be calculated (0.14m drop, 66% empty, in 1411 minutes)

Comments:

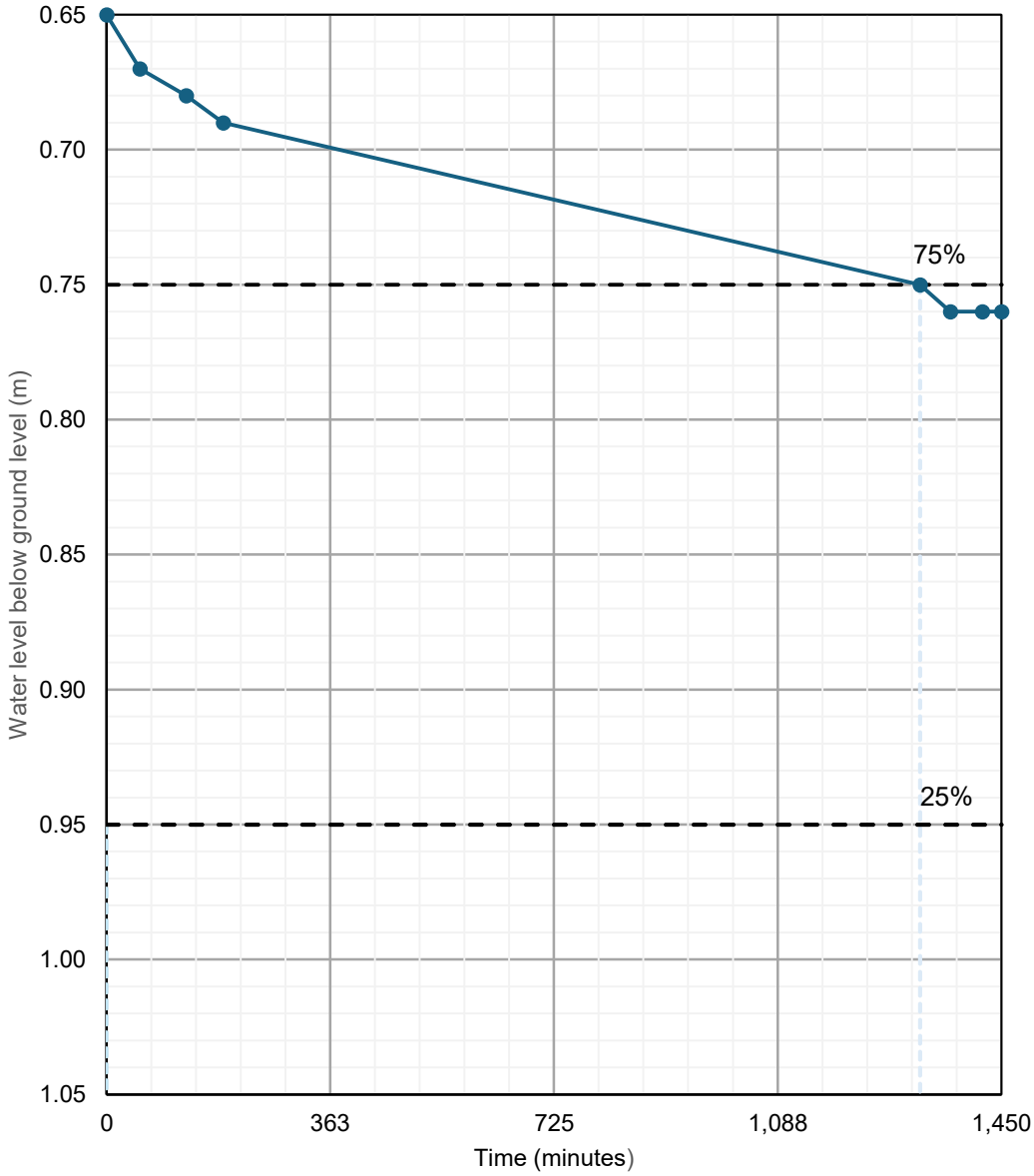
Trial Pit Infiltration Testing to BRE Digest 365

Location: Land East of Bedford Road, Hitchin, SG5 2UR
Report Ref: 26-08-18
Date of Test: 1-2/9/2026
Dimensions: 0.60m(W) x 1.60m(L) x 1.05m(D)

Test Location: SA 4
Test Number: Test 01
Groundwater: >1.05m

Test Response Zone:
0.40m to 0.70m: POSSIBLE GLACIOFLUVIAL DEPOSITS
0.70m to 1.05m: LOWESTOFT FORMATION

Time (mins)	Depth (m)
0	0.65
54	0.67
129	0.68
189	0.69
1318	0.75
1367	0.76
1419	0.76
1450	0.76



Soil infiltration rate could not be calculated (0.11m drop, 73% empty, in 1450 minutes)

Comments:

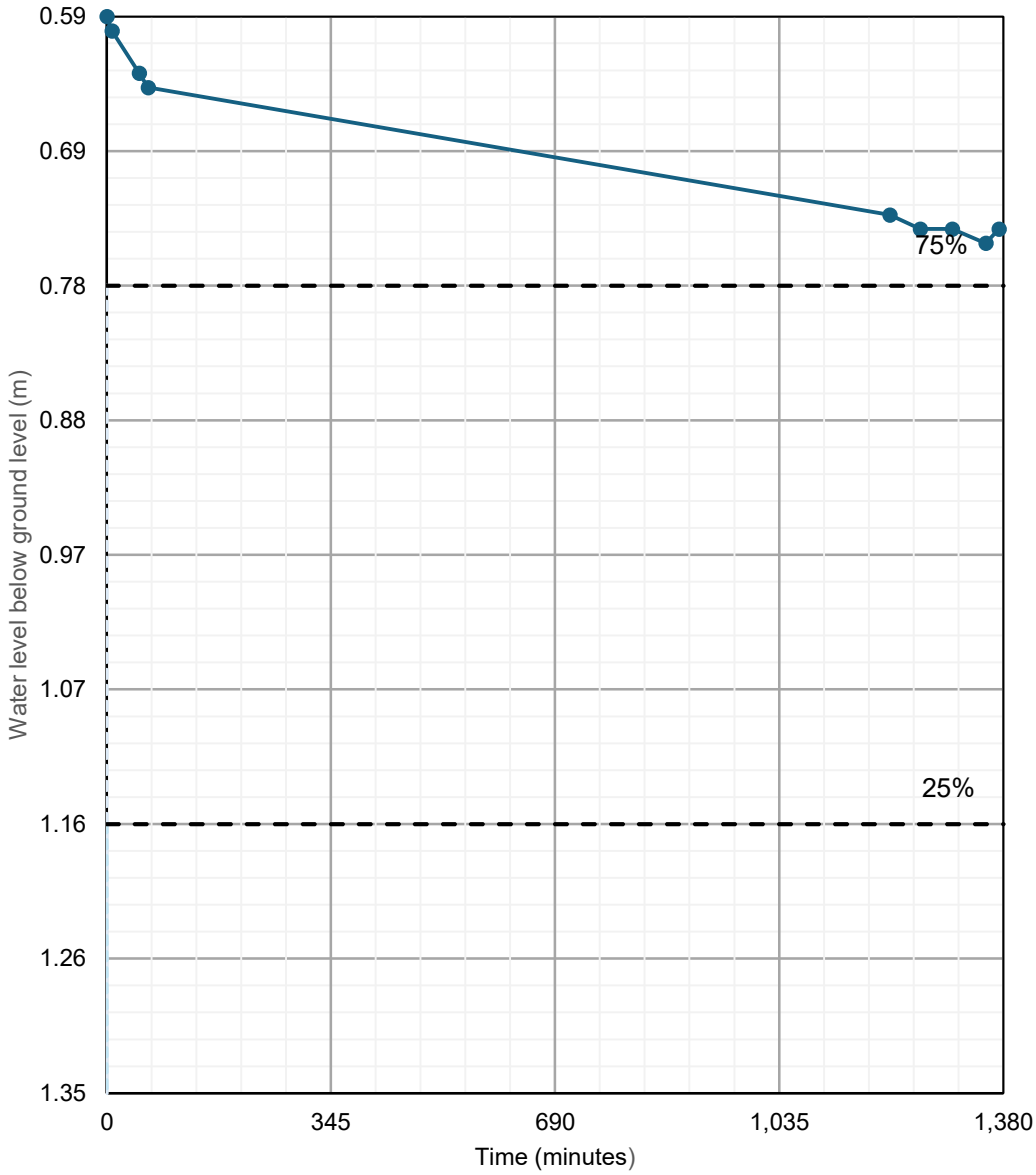
Trial Pit Infiltration Testing to BRE Digest 365

Location: Land East of Bedford Road, Hitchin, SG5 2UR
Report Ref: 26-08-18
Date of Test: 1-2/9/2026
Dimensions: 0.50m(W) x 1.70m(L) x 1.35m(D)

Test Location: SA 5
Test Number: Test 01
Groundwater: >1.35m

Test Response Zone:
0.45m to 1.30m: LOWESTOFT FORMATION

Time (mins)	Depth (m)
0	0.59
8	0.60
50	0.63
64	0.64
1205	0.73
1252	0.74
1301	0.74
1353	0.75
1373	0.74



Soil infiltration rate could not be calculated (0.16m drop, 79% empty, in 1373 minutes)

Comments: