

Proposed Care Home Development,
Former Battle of Britain Pub Site,
Coldharbour Road, Gravesend

Flood Risk Assessment and Drainage Strategy

For Frontier Estates

Issue 2



FAIRHURST

CONTROL SHEET**CLIENT:** Frontier Estates**PROJECT TITLE:** Battle of Britain Pub, Gravesend**REPORT TITLE:** Flood Risk Assessment and Drainage Strategy**PROJECT REFERENCE:** 144828**DOCUMENT NUMBER:** 100**STATUS:** FINAL

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1.0 Introduction

- 1.1 Fairhurst have been commissioned by Frontier Estates to undertake a Flood Risk Assessment and Drainage Strategy for the construction of new care home on Coldharbour Road in Gravesend, Kent.

2.0 Site Location and Description

- 2.1 The site is located approximately 2.0km southwest of Gravesend Town Centre in northwest Kent. The site has an approximate Grid Reference of TQ636722 and a nearest post code of DA11 7JL. See figure 1 and 2
- 2.2 The site is bounded by Coldharbour Road to the southwest and New House Lane to the northwest. An open school field is situated to the northeast of the site and residential properties along the southeast boundary.
- 2.3 A topographical survey has been performed and the site generally falls from the west to east, falling from 42.28mAOD down to 39.50mAOD.
- 2.4 The development is approximately 2.2km south of the river Thames.

3.0 Development Proposals

- 3.1 The proposed development is for the construction of a care home development comprising 65 units. The new development has a total area of approximately 1543m² GEA and will include all necessary infrastructure works associated with a building of this nature. See Appendix A for development proposals.
- 3.2 The site which is approximately 0.49ha is on the former site of the Battle of Britain Public House which has been demolished, the location where the proposed buildings are to be cited is free of any buildings.

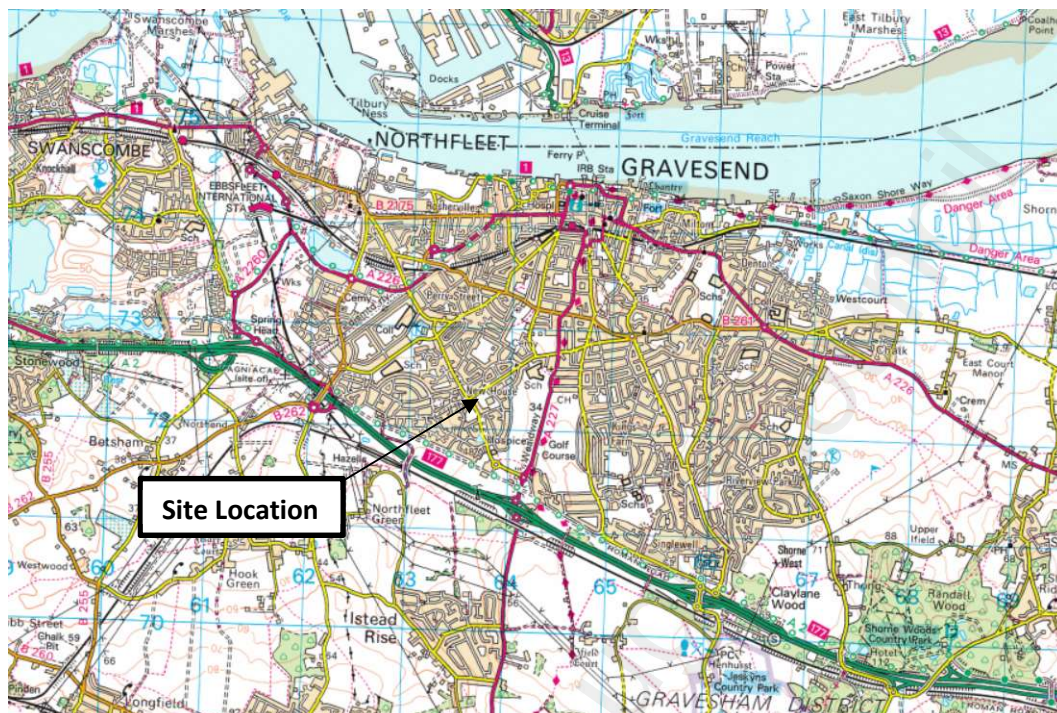


Figure 1 - OS Location Map

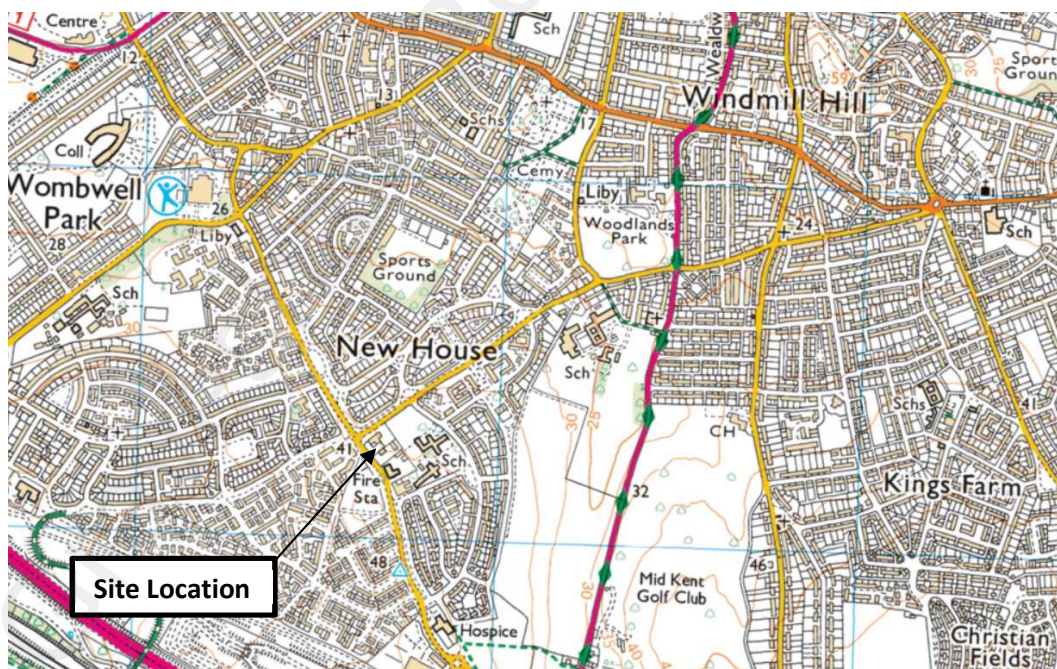


Figure 2 - OS Location Map

4.0 Geology

- 4.1 Information on the British Geological Survey (BGS) website indicates the site has no superficial deposits. The bedrock is the Thanet Formation comprising sand and sedimentary bedrock. See figure 3.
- 4.2 There are no BGS borehole records near the site, however there is a record approximately 780m north west of the site, within the same geological strata, and this indicates that beneath the Thanet Sand Formation there is a bedrock of upper chalk, beginning at a depth of approximately 14.60mbgl.
- 4.3 Site investigation has been undertaken by Applied Geology in October 2021, and this appears to agree with the BGS records. The boreholes undertaken indicate that there is a layer of made ground of varying thicknesses across the site, with Thanet Sand Formation beneath this. The only deviation from BGS records is the indication that there is potentially a layer of head deposits within the north western corner of the site.
- 4.4 Due to the characteristic of the underlying geology of sand, it would imply that infiltration may be an option subject to favourable infiltration results for the disposal of surface water for this development. However, as the Thanet Formation is described as clayey, silty and fine, it is possible these rates are lower than typically expected for a sand stratum.
- 4.5 BGS borehole records can be found in Appendix B.

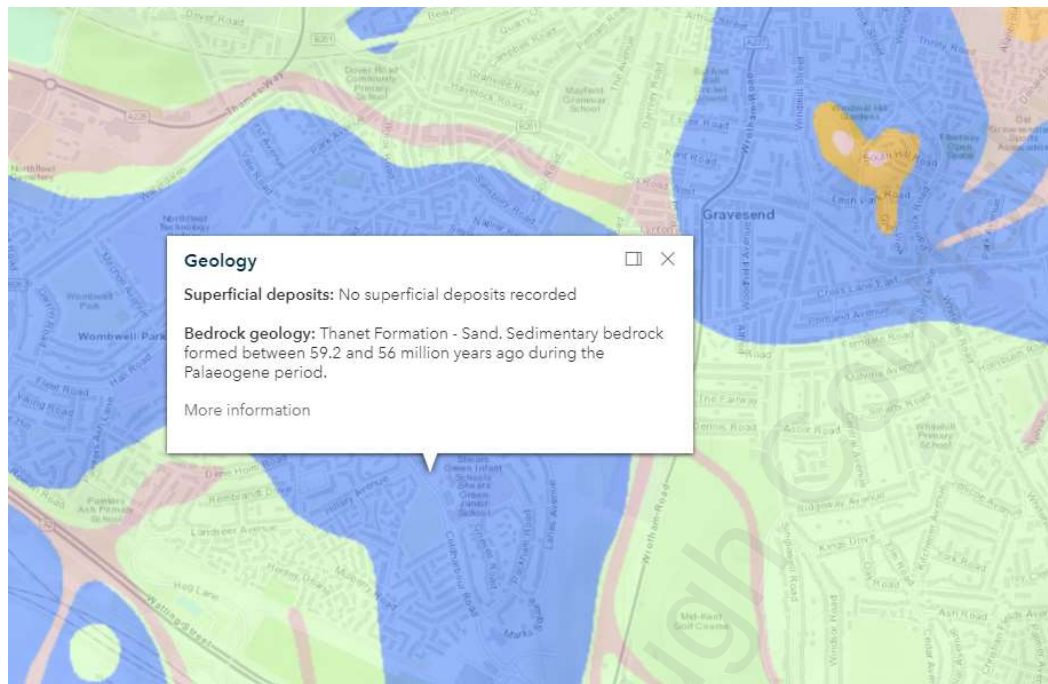


Figure 3: BGS geological mapping.

5.0 Hydrology

- 5.1 The nearest watercourse classed as a main river is a small river 2km to the west of the site, which appears to issue from a spring slightly north of the A2 Watling Street. This river then heads northwards to Sawyer's Lake, 1.8km north west of the site, before discharging into the River Thames.
- 5.2 The River Thames is located approximately 2.2km to the north of the site. The source of which is located in Gloucestershire and flows into the North Sea.
- 5.3 The Environment Agency Flood Map for Planning shows that the site is situated entirely within Flood Zone 1, and is therefore not at risk of fluvial flooding in the event of a storm event with up to a 1 in 1000 year return period (0.1% Annual Exceedance Probability). The flood mapping also shows that the site is not susceptible to surface water flooding See figures 4 and 5.

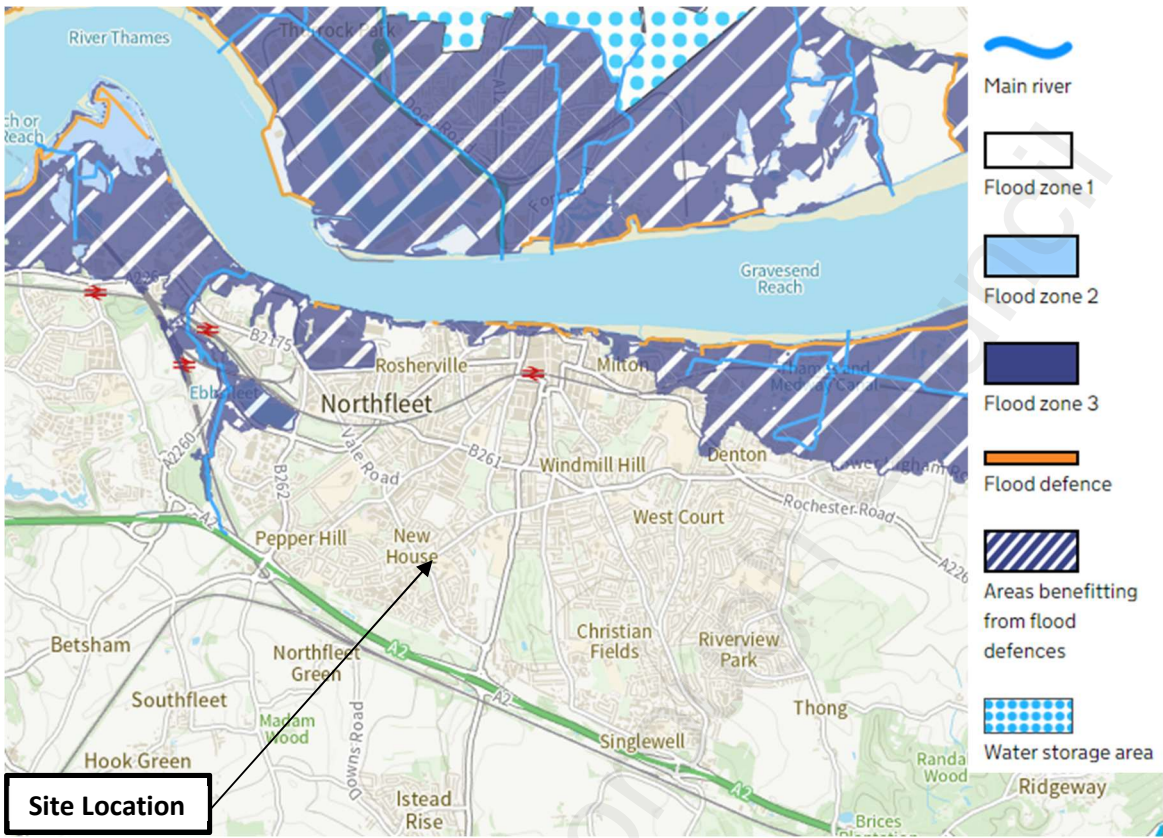


Figure 4 - Flooding form Rivers and Seas



Figure 5 - Flooding from Surface Water

6.0 Hydrogeology

- 6.1 The bedrock stratum beneath the site is designated as a Secondary A aquifer meaning that it has the potential to form supply water for the local area.
- 6.2 The groundwater has a vulnerability class of high. This is presumably due to the sandstone bedrock and its properties of permeability.
- 6.3 No evidence has been found indicating any groundwater flooding on or near to the site.
- 6.4 The boreholes undertaken as part of Applied Geology's investigations on site encountered groundwater on site at a depth of typically between 3.8mAOD to 4.3mAOD.

7.0 Flood History and Records

- 7.1 There is no evidence found of any historic flooding in these areas affecting the site within the EA historic flood map records, or within the Kent Thameside Stage 1 Surface Water Management Plan which contains all reported flood records in the area.

8.0 Sequential and Exception Tests

- 8.1 As this development is for residential accommodation, it is considered that the development has a flood risk vulnerability classification of More Vulnerable. See Appendix C.

Sequential test

- 8.2 Sequential testing is aimed at steering new developments to areas with the lowest probability of flooding. Appendix C shows the Flood Risk Vulnerability Classification as defined by Environment Agency and the type of development compatible with that particular classification.
- 8.3 As the site is located entirely within Flood Zone 1 in an area not at risk from flooding, a sequential Test will not be required.

Exception test

- 8.4 Exception testing is to demonstrate that the development provides wider sustainability benefits to the community that outweighs the flood risk if

development is to take place outside of Flood Zone 1. As the entire site is within Flood Zone 1, an exception test is not required.

9.0 Forms of Flooding

- 9.1 Flooding can originate from a number of different sources and CIRIA C624: Development and Flood Risk Guidance provides a list of those which need to be considered.
- 9.2 These are summarised in Table 1.0 below with a schedule of whether they need to be considered at this site.

Source	Requires considering for this site?
Fluvial	√
Coastal and Tidal	√
Estuarine and Tidal Affected Watercourses	√
Groundwater	√
Overland flow and surface water flooding	√
Artificial Drainage Systems e.g. reservoirs	√
Infrastructure Failure e.g. water mains and sewers.	√

Table 1.0 Forms of Flooding

- 9.3 Fluvial – As previously discussed in Section 5, the site lies entirely within Flood Zone 1, and as such is considered to not have a significant fluvial flood risk.
- 9.4 Coastal and Tidal – The development is within 2.0km of the Thames River and is affected by tidal flows. The Environment Agency flood mapping indicates that the site has no risk of flooding from coastal or tidal sources.
- 9.5 Groundwater – As previously discussed in Section 6.3, the site has no recorded incidents of flooding from ground water.
- 9.6 Overland Flow and Surface Water Flooding – This can occur when the local drainage infrastructure cannot cope with the volume of rainfall in extreme

events and exceed the design capacity of the surface water system. As shown in figure 5, there is no identified risk from surface water flooding.

9.7 Artificial Drainage Systems – Artificial drainage systems are manmade structures that are designed and have the capability to hold water such as reservoirs or canals, and if they failed would cause catastrophic flooding downstream. EA mapping shows that the site is not susceptible to reservoir flooding or other man made water features.

9.8 Infrastructure Failure – This can be caused if a high pressure water main bursts or a sewer blocks and floods. Whilst these types of events occur they are very uncommon, therefore not considered to be an issue at this site.

10.0 Flood Risk, Flood Compensation and Mitigation Measures

10.1 As the site is situated entirely within Flood Zone 1, and is not at risk of flooding from rivers, the sea or surface water, no flood risk mitigation or compensation measures will be required.

11.0 Climate Change

11.1 Climate change is a well-documented occurrence which needs to be taken into account when looking at flooding. Based on the fact that the area of site proposed for development lies within Flood Zone 1 it is considered that the effects of climate change over the accepted lifetime of the development with regard to flood risk will not be an issue.

11.2 The proposed drainage infrastructure will be designed to take climate change into account therefore mitigating its' effects. The drainage infrastructure will be designed so as not to cause flooding offsite in the 1 in 100 plus 40% climate change rainfall event.

12.0 Existing Drainage

- 12.1 The sewer records which can be found in Appendix D shows that there is an adopted foul water sewer within the gardens of the properties to the north east of the site and another adjacent to the Ambulance Station which is located south east along Coldharbour Road.
- 12.2 There are no adopted surface water sewers in the area, and as such it is assumed that the site currently drains via infiltration.

13.0 Proposed Surface Water Drainage Strategy

- 13.1 Building Regulations Part H3 states that storm water should discharge (in descending order of priority) to:
1. An adequate soakaway or some other adequate infiltration system: or where that is not reasonably practicable,
 2. A watercourse or where that is not reasonably practicable,
 3. A segregated drainage system for storm and foul or if that is not possible,
- 13.2 As the site has been identified to be underlain by sand, it may be suitable for infiltration structures.
- 13.3 Infiltration testing was carried out in two locations by Your Environment to support a prior planning application at the site, the results of which can be found in Appendix E. Test 1 returned infiltration test results of 3.8×10^{-6} m/s. Test 2 did not return any reliable result due to a localised clay, found in the bottom of the hole, no infiltration results were obtained.
- 13.4 Further infiltration testing has been undertaken by Applied Geology in 2021, with tests being undertaken in the south and centre of the site. These gave a rate of 1.1×10^{-5} m/s in the south, and 4.7×10^{-6} m/s in the centre of the site. Subject to targeted testing in the proposed infiltration areas, it is likely that soakaways will be feasible on site, but may need to be oversized in order to account for the relatively low rates. The results of this testing can be found in Appendix E.
- 13.5 British Standards require that soakaways should be located at a minimum of 5m from any building. Within the Groundsure report included in the Site

Investigation report, it is stated that the site has a significant risk of soluble rocks. Typically this would mean soakaways would need to be placed a minimum of 10m from the building, however, as chalk or karstic rocks haven't been encountered to a depth of 12m in the boreholes, it is unlikely that this is required, as soakaways will not discharge directly into the soluble strata.

- 13.6 The site is located within a Source Protection Zone 2, Outer Protection Zone. This is due to the likely permeability of the bedrock, and the nearby Licenced Potable Water abstractions nearby. There are two Southern Water abstraction points nearby, both abstracting a maximum of 92000m³ of water a day. One is located 1126m south west of the site, and the other 1596m to the north east.
- 13.7 The Kent Thameside Water Cycle Strategy provides Table 2 below, stating what impermeable areas can be discharged to groundwater in each zone. As the site only contains roof drainage and a small car park, it is likely that this will be deemed acceptable. However, it is important to include sufficient SuDS features to reduce the risk of pollution to groundwater.
- 13.8 It is proposed to provide permeable parking spaces in order to provide an increase in water quality of runoff from the car parking and access road areas. Beneath these, geocellular infiltration blankets are proposed to drain the car park and roof areas.
- 13.9 The infiltration blankets have been designed to meet a 24hr half drain time for a 1 in 30 year storm. In a 1 in 100 year +climate change storm the north infiltration blanket has a half drain time of 46.5 hours, and the southern has a half drain time of 59 hours. In the event that there are two consecutive 1 in 100 +climate change storms the exceedance flows will largely remain within the southern portion of the car park, eventually making their way offsite out of the northern access, not posing a risk to the building or occupants.
- 13.10 Drawing 144828-2000 in Appendix F shows the proposed drainage layout.
- 13.11 Supporting drainage calculations can be found in Appendix G.

14.0 Proposed Foul Drainage

- 14.1 There are no foul sewers present on site or within the roads immediately adjacent to the site, with all nearby sewers located within 3rd party land. The response to the developer enquiry sent to Southern Water to enquire about the capacity within the network to take the required flows has been received. After a capacity review Southern Water have confirmed that there is currently sufficient capacity in the works to accommodate a foul flow of 0.72 l/s. Appendix H shows the 3 different locations of the manholes with confirmed sufficient capacities; the preferred option being located on Coldharbour Road within the boundary of the Ambulance Station.
- 14.2 The intention is to connect to an existing foul connection that historically served the pub. A drainage trace will be required in order to discover the connection and route. If this is not possible, a new foul connection will be required and will pass through 3rd party land. In this scenario, it will be necessary to requisition a sewer to be constructed by Southern Water. This could take the form of a small section of foul sewer into the adopted highway, which will open up the possibility of constructing a foul sewer in the highway by the developer, or a sewer can be requisitioned right up to the site boundary.

15.0 Sustainable Drainage System (SuDS)

- 15.1 SuDS are a way to improve the existing drainage situation in terms of quantity, quality, biodiversity and amenity. SuDS aim to manage rainfall ideally at source to improve runoff in a way that best suits its proposed surroundings. The main SuDS components are infiltration, retention/detention, control devices and source controls (i.e. green roofs, rain water harvesting etc). At detailed design stage, the health and safety concerns of the end user/residents must be taken into account when incorporating and designing any SuDS features.
- 15.2 The impermeable areas on the site include roof drainage and parking area, and as such don't pose a significant pollution risk. As such the Simple Index Approach to water quality management can be used to assess the risk of pollution to groundwater. As shown below, the use of permeable pavements on site mitigates the risk of pollution, however further SuDS measures may be considered at detailed design stage. This can include rain gardens and water butts that will be driven by the landscape design.

	Land Usage	TSS*	Metals	Hydrocarbons
Pollution Hazard	Roof drainage	0.2	0.2	0.05
	Residential Car Park	0.5	0.4	0.4
	Pollution Indices Total	0.7	0.6	0.45
SuDS Mitigation method	Permeable Pavement	0.7	0.6	0.7
	Soakaway	0.4	0.3	0.3
	Mitigation Indices Total (n.b secondary indices x0.5)	0.9	0.75	0.85
	Total betterment	0.2	0.15	0.4

* = Total Suspended Solids

Table 2.0: Simple Index Approach to water quality management.

16.0 Maintenance

- 16.1 The Maintenance Strategy found in Appendix I contains the following components:-
- Person / organisation etc. responsible for the maintenance.
 - Type of Maintenance – Nature of task and frequency of activity.
 - Ad-hoc maintenance – Details of what action will be taken in an emergency and who will be responsible.
 - Details of response time for emergency and non-emergency works
- 16.2 The frequency of maintenance tasks outlined in the strategy will be conducted for the first annual maintenance assessment period and reviewed accordingly to determine a more effective long term strategy tailored to suit the specific needs of the site.
- 16.2 As the site is privately owned, it is assumed that all drainage will also remain private.
- 16.3 If offsite drainage is required this will be within the adopted highway, and as such will likely be built under a Section 104 agreement, thus eventually passing it over to Southern Water for adoption and maintenance.

17.0 Conclusion

- 17.1 The site is located approximately 2.0km south west of the town of Gravesend in northwest Kent. The nearest post code is DA11 7JL.
- 17.2 The care home is to be constructed on the former site of the now demolished Battle of Britain public house and will include all associated infrastructure.
- 17.3 Environment Agency mapping shows that the site is not affected by fluvial or surface water flooding.
- 17.4 The British Geological Society mapping identifies the area as having an underlying bedrock geology of the Thanet Formation with no superficial deposits. The geotechnical assessment shows that there is sand and sandstone to at least 12m depth, with made ground present across the site.
- 17.5 Infiltration testing undertaken in 2021 indicates that soakaways are likely feasible on site.
- 17.6 Foul drainage will discharge to the existing adopted foul drainage network, the nearest manhole to connect into is located south along Coldharbour Road adjacent to the Ambulance station. It will be necessary to requisition a foul sewer across 3rd party land in order to make this connection.
- 17.7 The soakaways will be designed not to flood for the 1 in 100 year plus 40% climate change storm event. They will also be located a minimum of 5m from any proposed or existing building.
- 17.8 Based on the above it is deemed that there is no reason why the development should not proceed from a flood risk and drainage standpoint.

References:-

- CIRIA C753 The SUDS Manual
- CIRIA C624: Development and Flood Risk Guidance.
- The Building Regulations 2010 (last updated April 2017) – Drainage and Waste Disposal Part H
- www.bgs.co.uk
- Sewerage Sector Guidance
- BS8582 2013 Code Of Practice For Surface Water Management For Development Sites.
- <https://www.gov.uk/government/organisations/environment-agency>
- <https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs>
- <https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-2-Flood-Risk-Vulnerability-Classification>
- Environment agency document - Delivering Benefits Through Evidence Report SC030219
- Kent County Council – Thameside Surface Water Management Plan
- Kent County Council – Thameside Water Cycle Management Strategy

Appendix A

Development Proposals



0m 4m 8m 12m 16m 20m
SCALE 1:200 @ A1

Appendix B

BGS Borehole Records

KEY

- Disturbed Sample
- ↑ Bulk Disturbed Sample
- ↓ Bulk Disturbed Sample
- 105 mm Undisturbed Sample
- | Standard Penetration Test
- △ Water Sample

KENT COUNTY COUNCIL

HIGHWAYS LABORATORY

Sheet 1 of 2

BOREHOLE LOG TQ 67SW 320

Date started 16. 5. 1984. Date completed 18. 5. 1984.

Scheme PROPOSED SOAKAWAYS, HALL ROAD, NORTHFLEET.
(see drawing No. L/SD.2/17/1)

Location TQ 6320 7287

Borehole No. 740 Ground Level 28.37m. A.O.D.

Sample			Section	Depth about O.D. or below Ground Level	Thickness of Stratum m.	Description of Soil	Penetration Test	
No.	Type	Depth m.					Pen't'n mm.	No. of Blows
				0.10	0.10	TOPSOIL		
1	●	0.50	x x x	0.80	0.70	Dark orange brown silty fine SAND with a trace of clay and some rounded coarse flint gravel and cobbles.		
2	●	1.00	x x			Brown silty fine SAND.		
3	●	2.00	x x x	3.50				
4	●	3.00	x x x					
5	●	4.00	x x x	4.30				
6	●	5.00	x x x			Orange brown mottled yellow and grey, very silty fine SAND.		
7	●	6.00	x x x	5.50				
8	●	7.00	x x x					
9	●	8.00	x x x	9.80				
10	●	9.00	x x x					
11	●	10.00	x x x			As next sheet.		

Appendix C

Flood Risk Vulnerability Tables

Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification see table D2	Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	√	√	√	√	√
Zone 2	√	√	Exception test required	√	√
Zone 3a	Exception test required	√	X	Exception test required	√
Zone 3b 'Functional Flood plain'	Exception test required	√	X	X	X

Key:

√ Development is appropriate

X Development should not be permitted

Table D.2: Flood Risk Vulnerability Classification

Essential Infrastructure	- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. - Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. - Wind turbines.
Highly Vulnerable	- Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. - Emergency dispersal points. - Basement dwellings. - Caravans, mobile homes and park homes intended for permanent residential use. - Installations requiring hazardous substances consent.¹⁹ (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'²⁰).
More Vulnerable	- Hospitals. - Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. - Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. - Non-residential uses for health services, nurseries and educational establishments.

	- Landfill and sites used for waste management facilities for hazardous waste.²¹ - Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	- Police, ambulance and fire stations which are not required to be operational during flooding. - Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure. - Land and buildings used for agriculture and forestry. - Waste treatment (except landfill and hazardous waste facilities). - Minerals working and processing (except for sand and gravel working). - Water treatment works which do not need to remain operational during times of flood. - Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-compatible development	- Flood control infrastructure. - Water transmission infrastructure and pumping stations. - Sewage transmission infrastructure and pumping stations. - Sand and gravel workings. - Docks, marinas and wharves. - Navigation facilities. - MOD defence installations. - Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. - Water-based recreation (excluding sleeping accommodation). - Lifeguard and coastguard stations. - Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. - Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Appendix D

Southern Water Sewer Records



Mark Hayward
Fairhurst
Cornwall Buildings
45-51 Newhall Street
Birmingham
West Midlands
B3 3QR

Your ref

Our ref
SWS-KENT-CC-005728

Date
22 September 2021

Contact
Tel 0330 303 0119

Dear Mr Hayward,

Level 1 Capacity Check Enquiry: Battle of Britain Pub, Coldharbour Road, Gravesend, Kent, DA11 7JL.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

There is currently adequate capacity in the local sewerage network to accommodate a foul flow of **0.72 l/s** for the above development at manhole reference **TQ63727101**, **TQ63726302** or **TQ63727210**. Please note that no surface water flows (existing or proposed) can be accommodated within the existing foul sewerage system unless agreed by the Lead Local Flood Authority in consultation with Southern Water, after the hierarchy Part H3 of Building Regulations has been complied with.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: [Developer Services Portal \(southernwater.co.uk\)](https://southernwater.co.uk/developer-services-portal)

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.



Should it be necessary to contact us please quote our above reference number relating to this application by email at southernwaterplanning@southernwater.co.uk

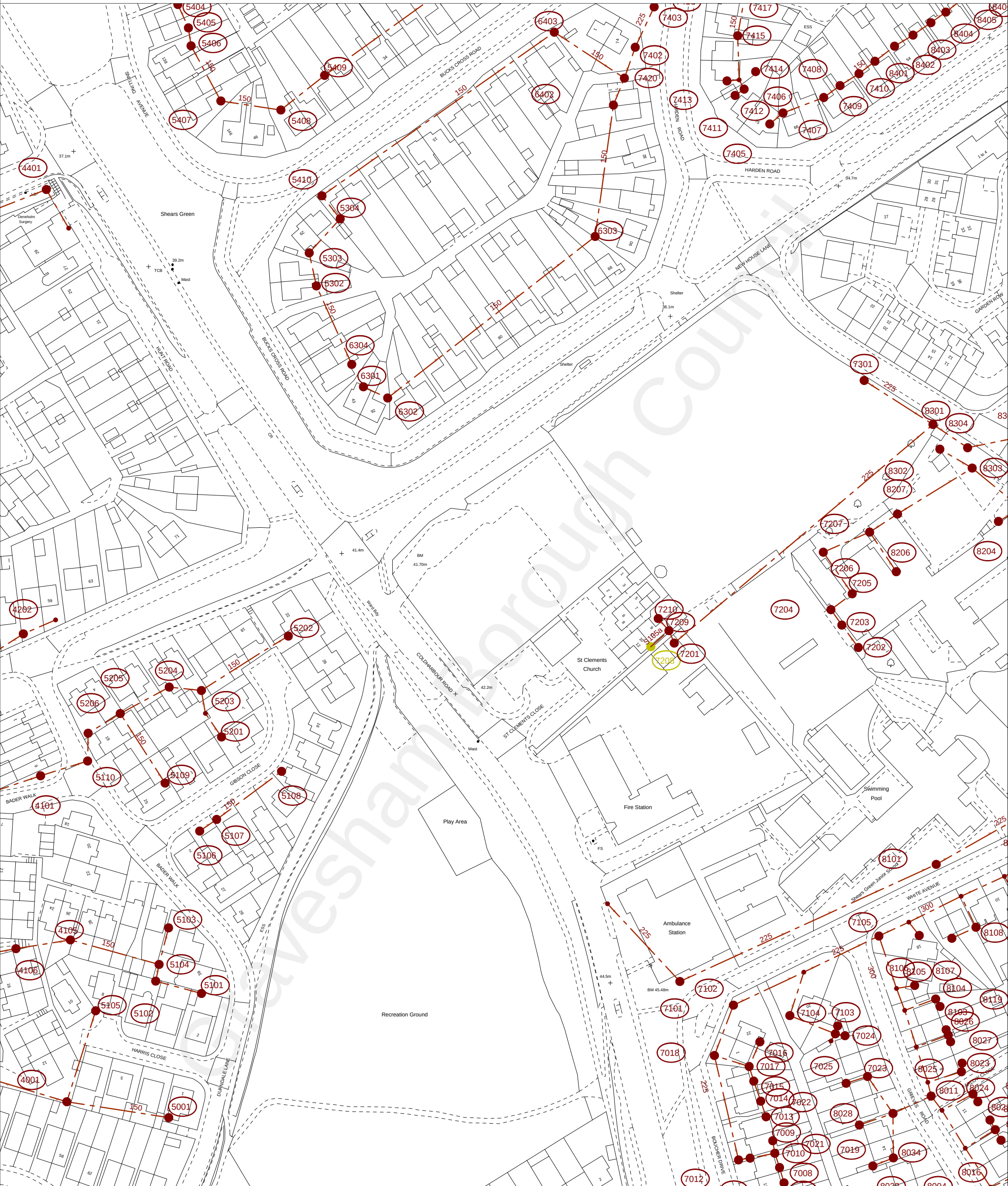
Yours sincerely,

Growth Planning Team
Business Channels

southernwater.co.uk/developing-building/planning-your-development

Gravesham Borough Council

SOUTHERN WATER



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

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

O.S. REF: TQ6372SE

Scale: 1:1250

Sewer Plot

WARNING: BAC pipes are constructed of Bonded Asbestos Cement
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement



Printed By: Mercy

Date: 19-8-2021

Site Plan

Requested By:

SOUTHERN WATER

The figure is a detailed sewer map from Southern Water. It shows a residential area with numerous streets including Bucks Cross Road, Harden Road, New House Lane, St Clements Close, Coldwarrior Road X, Gibson Close, Bader Walk, Harris Close, and Durdale Lane. A central area is outlined in pink and labeled "SITE". The map features a dense network of red dashed lines representing sewer pipes, many of which are labeled with numbers like 150, 225, 300, and 450. Numerous circular manhole covers are shown, each containing a unique identification number (e.g., 5401, 6302, 7201, 8101). Two specific manholes are highlighted with red rectangular boxes: one at location 6302 near Bucks Cross Road and another at location 7201 near St Clements Church. Other landmarks include Shears Green, Denholm Surgery, TCB Mast, Shelter, Fire Station, Ambulance Station, Swimming Pool, and St Clements Church. A large diagonal watermark reading "Sham Borough Council" is visible across the center of the map.

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.

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O.S. REF: TQ6372SE

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Sewer Plot

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

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

N

Printed By: Mercy

Date: 19-8-2021

Site Plan

Requested By:

Appendix E

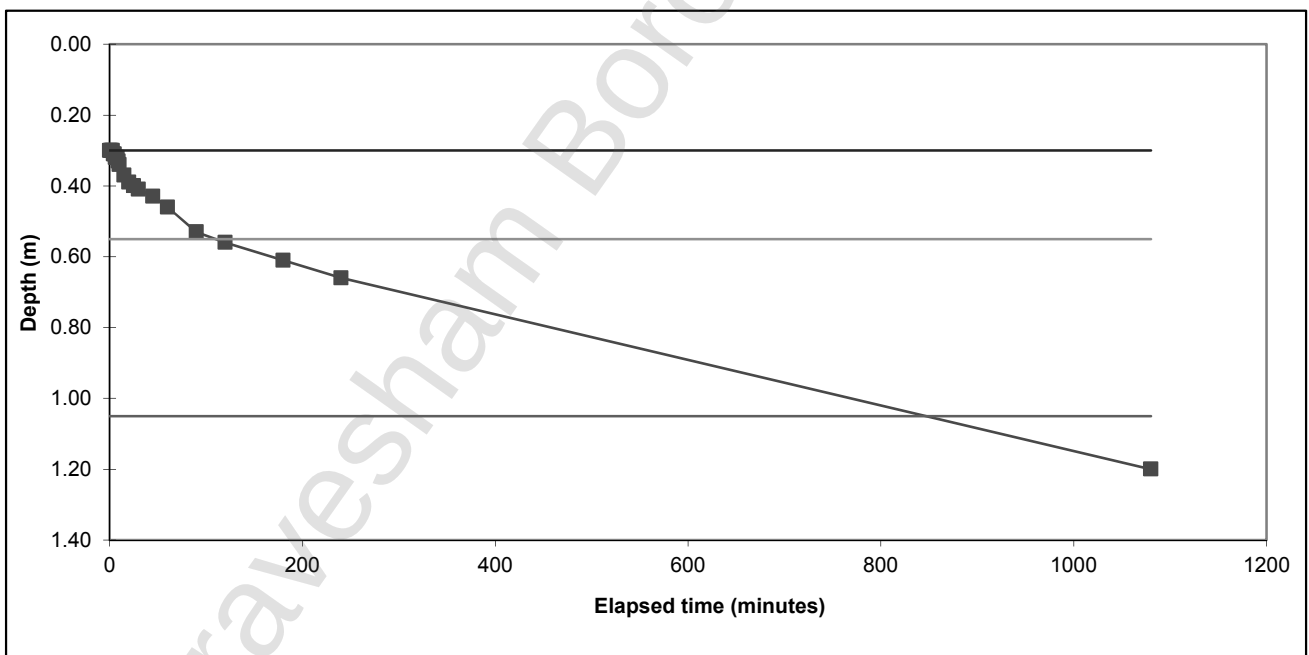
Previous planning application soakage tests & Applied Geology testing

Your Environment

Soakaway Test

Trial Pit No:	TP1	Test No:	1	Date:	
Length (m):	1.900	Datum Height:		0.00 m agl	
Width (m):	0.70	Granular infill:	None		
Depth (m):	1.30	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.300	30	0.410
1	0.300	45	0.430
2	0.300	60	0.460
3	0.300	90	0.530
4	0.310	120	0.560
5	0.310	180	0.610
6	0.320	240	0.660
7	0.320	1080	1.200
8	0.320		
9	0.330		
10	0.340		
15	0.370		
20	0.390		
25	0.400		



Start water depth for analysis (mbgl):	0.30	Elapsed time (mins):	110.0
75% effective depth (mbgl):	0.55		
50% effective depth (mbgl):	0.80	Elapsed time (mins):	846.7
25% effective depth (mbgl):	1.05		
Base of soakage zone (mbgl):	1.30		

Volume outflow between 75% and 25% effective depth (m ³):	0.665
Mean surface area of outflow (m ²):	3.93
(side area at 50% effective depth + base area)	
Time for outflow between 75% and 25% effective depth (mins):	736.7

Soil infiltration rate (m/s):	3.8E-6
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Remarks	Results processed following BRE 365 (2007).
---------	---

Client:		TP1
Site:		

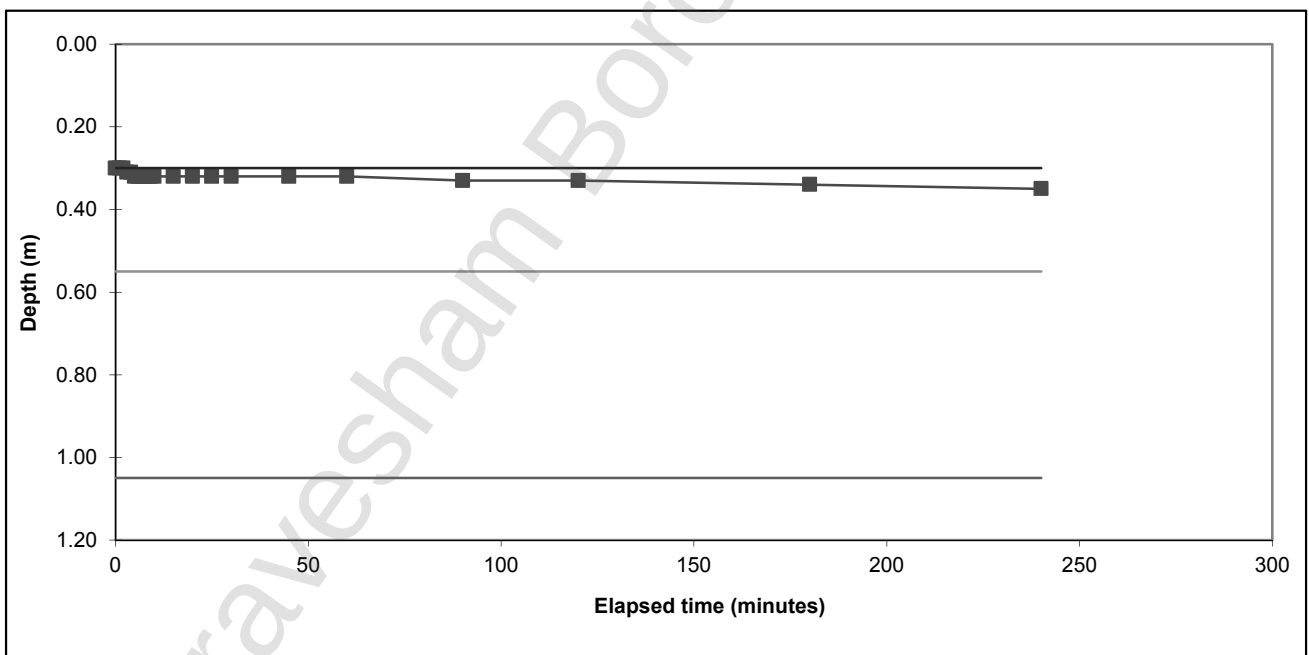
Gravesham Borough Council

Your Environment

Soakaway Test

Trial Pit No:	TP2	Test No:	1	Date:	
Length (m):	1.800	Datum Height:		0.00 m agl	
Width (m):	0.80	Granular infill:	None		
Depth (m):	1.30	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.300	30	0.320
1	0.300	45	0.320
2	0.300	60	0.320
3	0.310	90	0.330
4	0.310	120	0.330
5	0.320	180	0.340
6	0.320	240	0.350
7	0.320		
8	0.320		
9	0.320		
10	0.320		
15	0.320		
20	0.320		
25	0.320		



Start water depth for analysis (mbgl):	0.30	Elapsed time (mins):	#N/A
75% effective depth (mbgl):	0.55		
50% effective depth (mbgl):	0.80	Elapsed time (mins):	#N/A
25% effective depth (mbgl):	1.05		
Base of soakage zone (mbgl):	1.30		

Volume outflow between 75% and 25% effective depth (m³):

Mean surface area of outflow (m²): 4.04
(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
-------------------------------	---

Remarks	Results processed following BRE 365 (2007). The pit did not empty in 4hrs. The soakage rate achieved has been extrapolated and suggests that the pit would empty in 18hrs suggesting a soakage rate of 3.8×10^{-6} (Poor drainage characteristics)
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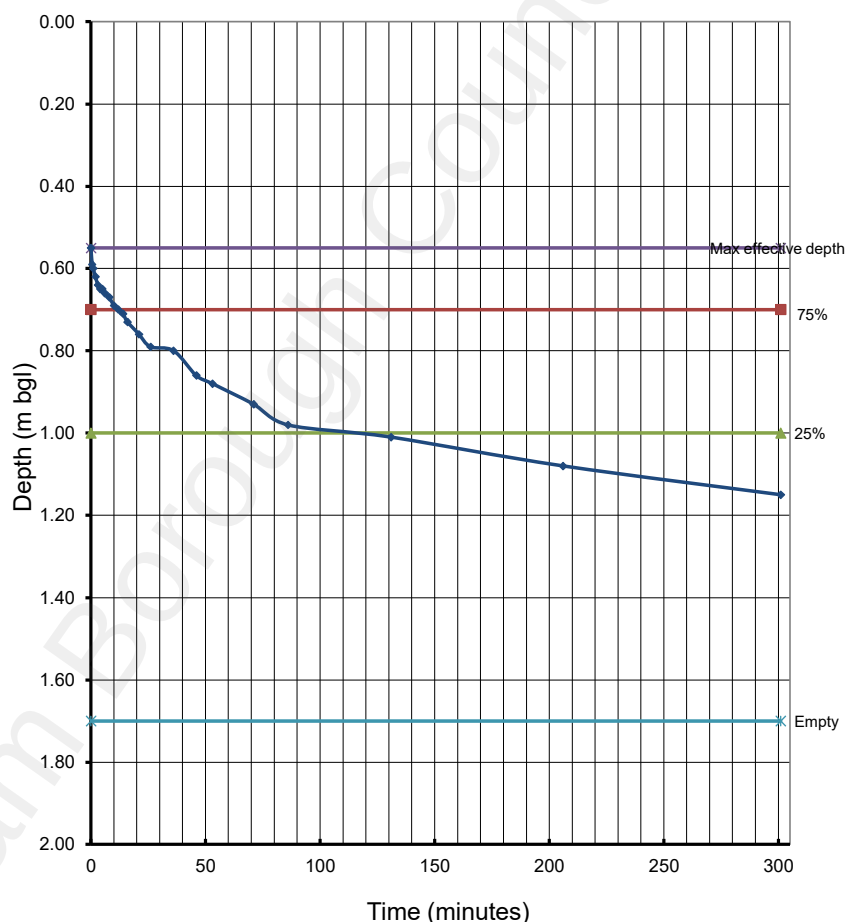
Client: Site:		TP1
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Gravesham Borough Council

IN SITU SOAKAWAY TEST RESULT

Trial Pit No.	TP6
Date	06/08/2021
Operator	DH
Test Strata	Thanet Sand
Stability of pit	Stable
Backfill used	None

Filling	1 of 1
Trial Pit Length (m)	2.40
Trial Pit Width (m)	0.60
Trial Pit Depth (m)	1.70
Amount of Backfill placed (m)	0
Assumed Backfill Void Ratio	N/A

[illegible]

Initial Water Level (m)	0.55	Total internal surface area of pit (m ²)	11.64
Final Water Level (m)	1.15	Effective area of loss (m ²)	6.54
Change in Water Level (m)	0.60	Volume outflowing between 75% and 25% effective depth (m ³)	0.43
Effective Depth at 25% (tp25) (m)	1.00	Time at 25% (tp25) (minutes)	115
Effective Depth at 75% (tp75) (m)	0.70	Time at 75% (tp75) (minutes)	12

Soil Infiltration Rate (m/s)	1.1E-05
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Notes: 1. Undertaken in general accordance with BRE DG 365 method
2. Based on extrapolated data NO

* Based on actual drop in water level recorded

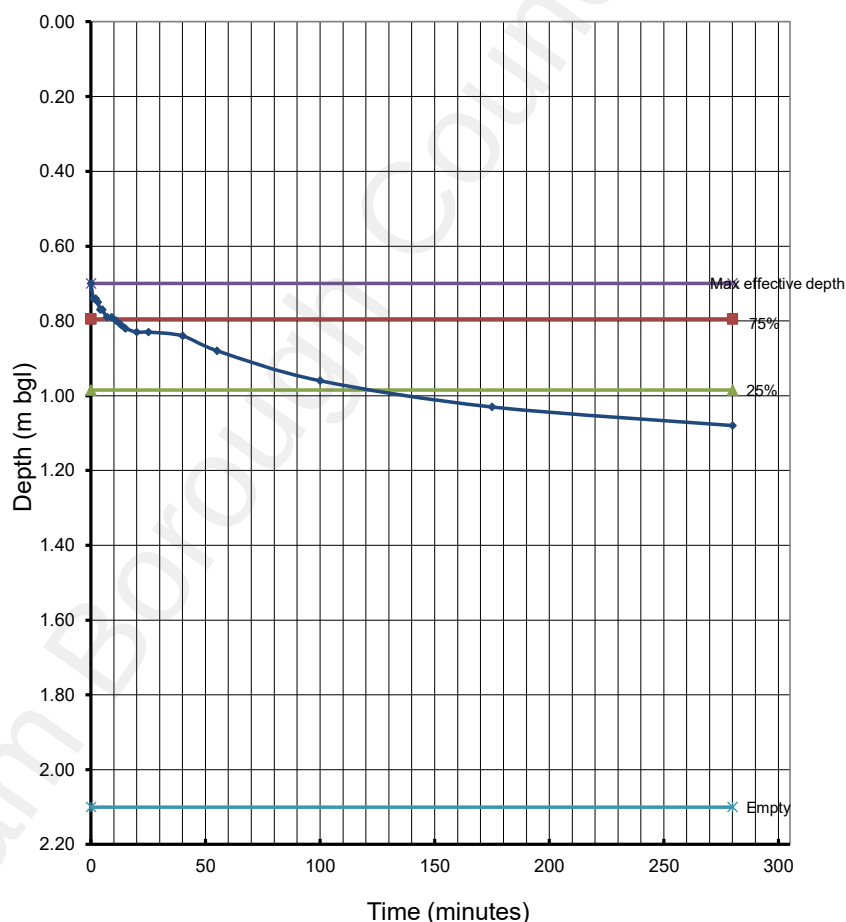
Client:	Frontier Estates Ltd
Project:	Coldharbour Road, Gravesend
Project No.	AG3309-21

APPLiED GEOLOGY

IN SITU SOAKAWAY TEST RESULT

Trial Pit No.	TP7
Date	06/08/2021
Operator	DH
Test Strata	Thanet Sand
Stability of pit	Stable
Backfill used	None

Filling	1 of 1
Trial Pit Length (m)	2.20
Trial Pit Width (m)	0.60
Trial Pit Depth (m)	2.10
Amount of Backfill placed (m)	0
Assumed Backfill Void Ratio	N/A

[illegible]

Initial Water Level (m)	0.70	Total internal surface area of pit (m ²)	13.08
Final Water Level (m)	1.08	Effective area of loss (m ²)	8.10
Change in Water Level (m)	0.38	Volume outflowing between 75% and 25% effective depth (m ³)	0.25
Effective Depth at 25% (tp25) (m)	0.99	Time at 25% (tp25) (minutes)	120
Effective Depth at 75% (tp75) (m)	0.80	Time at 75% (tp75) (minutes)	11

Soil Infiltration Rate (m/s)	4.7E-06
------------------------------	---------

Notes: 1. Undertaken in general accordance with BRE DG 365 method
2. Based on extrapolated data NO

* Based on actual drop in water level recorded

Client:	Frontier Estates Ltd	
Project:	Coldharbour Road, Gravesend	
Project No.	AG3309-21	

Appendix F

Proposed Drainage Layout



Coldharbour Road

New House Lane

AIR SPADING OR SIMILAR TO BE
CONSIDERED THROUGH RPA

CONNECTION TO ADOPTED FOUL DRAINAGE NEAR
AMBULANCE STATION. INVERT TBC. PRIVATE
PUMP STATION POTENTIALLY REQUIRED ON SITE.

GEOCELLULAR INFILTRATION
BLANKET BENEATH PERMEABLE
PAVEMENTS
17m x 5m x 0.8m
IL:38.20

GEOCELLULAR INFILTRATION
BLANKET BENEATH PERMEABLE
PAVEMENTS
27m x 5m x 0.8m
IL:37.411

Do not scale from this drawing.					
SAFETY HEALTH AND ENVIRONMENTAL INFORMATION					
IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.					
RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO.					
CONSTRUCTION					
DEMOLITION					
FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE					
IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.					
KEY					
— PROPOSED STORM WATER SEWER ⊕ PROPOSED STORM WATER MANHOLE — PROPOSED FOUL WATER SEWER ⊕ PROPOSED FOUL WATER MANHOLE ▨ PROPOSED PERMEABLE PAVEMENT ▨ PROPOSED PERMEABLE PAVEMENT WITH GEOCELLULAR INFILTRATION BLANKET BENEATH ▨ GEOCELLULAR INFILTRATION BLANKET					
NOTES: - LAYOUT TAKEN FROM 3172-HIA-ZZ-XX-M3-A-9901-Site Model-S0-P1 - INFILTRATION RATES BASED ON REPORT 3172-HIA-ZZ-XX-M3-A-9901-Site Model-S0-P1, DRAINAGE DESIGN IS SUBJECT TO TARGETED INFILTRATION TESTING. - FOUL DESIGN IS SUBJECT TO CONFIRMATION OF SUITABILITY OF CONNECTION AND OF INVERT LEVEL OF DOWNSSTREAM FOUL NETWORK. A PRIVATE PUMPING STATION MAY BE REQUIRED. - ALL 150Ø FOUL DRAINAGE TO BE LAID AT 1:150 U.N.O. - ALL 100Ø FOUL DRAINAGE TO BE LAID AT 1:100 U.N.O.					
Rev.	Date	Description	Drawn	Chkd.	Appd.
FAIRHURST					
Clifton Heights Triangle West Clifton BRISTOL BS8 3AA Tel: 0117 925 0259 Fax: 0844 381 4412					
Client: FRONTIER					
Project Title: BATTLE OF BRITAIN PUB COLDHARBOUR ROAD GRAVESEND					
Drawing Title: PROPOSED DRAINAGE STRATEGY					
Scale of A1: 1:200		Status: Planning			
Drawn: MF	Checked: MH	Approved: MH			
Date: 15/11/22	Date: 15/11/22	Date: 15/11/22			
Drawing No.: 144828/2000					Revision: —

Appendix G

Microdrainage Calculations

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11 Woodside Terrace Glasgow G3 7XQ	Battle of Britain Pub Coldharbour Road Gravesend	
Date 09/05/2022 14:56 File Windes.MDX	Designed by MDF Checked by MH	
Micro Drainage	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

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	0.419	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.600
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)	900

Designed with Level Soffits

Network Design Table for Storm

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
S1.000	11.919	0.118	100.9	0.010	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	7.663	0.076	100.9	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	17.079	0.169	101.1	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	11.546	0.114	101.3	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	5.708	0.057	100.9	0.012	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	11.754	0.116	100.9	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	6.195	0.061	100.9	0.013	4.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	12.283	0.122	100.9	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.002	7.557	0.075	100.9	0.016	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.003	15.198	0.151	100.9	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	9.736	0.324	30.0	0.004	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)
S1.000	50.00	4.20	39.700	0.010	0.0	0.0	0.0	1.00	17.7	1.4
S1.001	50.00	4.33	39.582	0.018	0.0	0.0	0.0	1.00	17.7	2.5
S1.002	50.00	4.61	39.506	0.027	0.0	0.0	0.0	1.00	17.7	3.6
S1.003	50.00	4.80	39.337	0.036	0.0	0.0	0.0	1.00	17.6	4.9
S1.004	50.00	4.90	39.223	0.049	0.0	0.0	0.0	1.00	17.7	6.6
S1.005	50.00	5.09	39.166	0.053	0.0	0.0	0.0	1.00	17.7	7.2
S2.000	50.00	4.10	39.700	0.013	0.0	0.0	0.0	1.00	17.7	1.8
S2.001	50.00	4.31	39.639	0.020	0.0	0.0	0.0	1.00	17.7	2.7
S2.002	50.00	4.43	39.517	0.036	0.0	0.0	0.0	1.00	17.7	4.8
S2.003	50.00	4.69	39.442	0.039	0.0	0.0	0.0	1.00	17.7	5.3
S1.006	50.00	5.16	38.975	0.097	0.0	0.0	0.0	2.40	95.2	13.1

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Date 09/05/2022 14:56 File Windes.MDX	Designed by MDF Checked by MH	
Micro Drainage	Network 2019.1	

Network 2019.1

Network Design Table for Storm

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
S1.007	3.774	0.440	8.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	5.872	0.800	7.3	0.042	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	4.431	0.010	466.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	5.689	0.056	100.9	0.008	4.00	0.0	0.600	o	150	Pipe/Conduit	
S3.001	13.537	0.134	100.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.002	10.490	0.104	100.9	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.003	15.775	0.156	100.9	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.004	11.416	0.113	100.9	0.007	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.005	20.352	0.202	100.9	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	6.585	0.065	100.9	0.008	4.00	0.0	0.600	o	150	Pipe/Conduit	
S4.001	11.810	0.117	100.9	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.002	13.589	0.135	100.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.006	4.929	0.246	20.0	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.007	7.102	0.024	300.0	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.008	8.232	0.007	1266.5	0.000	0.00	0.0	0.600	o	300	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)
S1.007	50.00	5.18	38.651	0.097	0.0	0.0	0.0	4.50	178.7	13.1
S1.008	50.00	5.20	38.211	0.138	0.0	0.0	0.0	4.86	193.2	18.7
S1.009	50.00	5.32	37.411	0.138	0.0	0.0	0.0	0.60	23.8	18.7
S3.000	50.00	4.09	39.700	0.008	0.0	0.0	0.0	1.00	17.7	1.1
S3.001	50.00	4.32	39.644	0.008	0.0	0.0	0.0	1.00	17.7	1.1
S3.002	50.00	4.50	39.509	0.017	0.0	0.0	0.0	1.00	17.7	2.2
S3.003	50.00	4.76	39.406	0.028	0.0	0.0	0.0	1.00	17.7	3.8
S3.004	50.00	4.95	39.249	0.035	0.0	0.0	0.0	1.00	17.7	4.8
S3.005	50.00	5.21	39.061	0.040	0.0	0.0	0.0	1.30	51.7	5.4
S4.000	50.00	4.11	39.700	0.008	0.0	0.0	0.0	1.00	17.7	1.1
S4.001	50.00	4.31	39.635	0.018	0.0	0.0	0.0	1.00	17.7	2.4
S4.002	50.00	4.53	39.518	0.021	0.0	0.0	0.0	1.00	17.7	2.8
S3.006	50.00	5.24	38.859	0.068	0.0	0.0	0.0	2.94	116.9	9.2
S3.007	50.00	5.39	38.613	0.106	0.0	0.0	0.0	0.75	29.8	14.4
S3.008	50.00	5.71	38.200	0.106	0.0	0.0	0.0	0.43	30.6	14.4

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.009	S	39.410	37.401	0.000	0	0

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Micro Drainage Network 2019.1		

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S3.008	S	39.900	38.194	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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	4
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.419		

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Date 09/05/2022 14:56 File Windes.MDX	Designed by MDF Checked by MH	
Micro Drainage Network 2019.1		
<u>Online Controls for Storm</u> <u>Orifice Manhole: S14, DS/PN: S1.009, Volume (m³): 2.4</u> Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 37.411 <u>Orifice Manhole: S26, DS/PN: S3.008, Volume (m³): 2.2</u> Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 38.200		
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11 Woodside Terrace Glasgow G3 7XQ	Battle of Britain Pub Coldharbour Road Gravesend																																																																																																													
Date 09/05/2022 14:56 File Windes.MDX	Designed by MDF Checked by MH																																																																																																													
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<u>Storage Structures for Storm</u> <u>Porous Car Park Manhole: S13, DS/PN: S1.008</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>5.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>32.5</td></tr><tr><td>Max Percolation (l/s)</td><td>45.1</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>38.810</td><td>Membrane Depth (mm)</td><td>0</td></tr></table> <u>Cellular Storage Manhole: S14, DS/PN: S1.009</u> <table><tr><td>Invert Level (m)</td><td>37.411</td><td>Safety Factor</td><td>2.0</td></tr><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.01692</td><td>Porosity</td><td>0.95</td></tr><tr><td>Infiltration Coefficient Side (m/hr)</td><td>0.00000</td><td></td><td></td></tr></table> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>135.0</td><td>135.0</td><td>0.801</td><td>0.0</td><td>180.6</td></tr><tr><td>0.800</td><td>135.0</td><td>180.6</td><td></td><td></td><td></td></tr></table> <u>Porous Car Park Manhole: S20, DS/PN: S3.007</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>5.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>34.9</td></tr><tr><td>Max Percolation (l/s)</td><td>48.5</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>39.300</td><td>Membrane Depth (mm)</td><td>0</td></tr></table> <u>Cellular Storage Manhole: S26, DS/PN: S3.008</u> <table><tr><td>Invert Level (m)</td><td>38.200</td><td>Safety Factor</td><td>2.0</td></tr><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.01692</td><td>Porosity</td><td>0.95</td></tr><tr><td>Infiltration Coefficient Side (m/hr)</td><td>0.00000</td><td></td><td></td></tr></table> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>85.0</td><td>85.0</td><td>0.801</td><td>0.0</td><td>120.2</td></tr><tr><td>0.800</td><td>85.0</td><td>120.2</td><td></td><td></td><td></td></tr></table>			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0	Membrane Percolation (mm/hr)	1000	Length (m)	32.5	Max Percolation (l/s)	45.1	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	38.810	Membrane Depth (mm)	0	Invert Level (m)	37.411	Safety Factor	2.0	Infiltration Coefficient Base (m/hr)	0.01692	Porosity	0.95	Infiltration Coefficient Side (m/hr)	0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	135.0	135.0	0.801	0.0	180.6	0.800	135.0	180.6				Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0	Membrane Percolation (mm/hr)	1000	Length (m)	34.9	Max Percolation (l/s)	48.5	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	39.300	Membrane Depth (mm)	0	Invert Level (m)	38.200	Safety Factor	2.0	Infiltration Coefficient Base (m/hr)	0.01692	Porosity	0.95	Infiltration Coefficient Side (m/hr)	0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	85.0	85.0	0.801	0.0	120.2	0.800	85.0	120.2			
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Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																																																									
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Micro Drainage		Network 2019.1	

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.417
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	1	+0%	100/15 Summer			
S1.001	S2	15 Winter	1	+0%	100/15 Summer			
S1.002	S3	15 Winter	1	+0%	100/15 Summer			
S1.003	S4	15 Winter	1	+0%	30/15 Winter			
S1.004	S5	15 Winter	1	+0%	30/15 Summer			
S1.005	S6	15 Winter	1	+0%	30/15 Summer			
S2.000	S7	15 Winter	1	+0%	100/15 Summer			
S2.001	S8	15 Winter	1	+0%	100/15 Summer			
S2.002	S9	15 Winter	1	+0%	100/15 Summer			
S2.003	S10	15 Winter	1	+0%	100/15 Summer			
S1.006	S7	15 Winter	1	+0%				
S1.007	S8	15 Winter	1	+0%				
S1.008	S13	15 Winter	1	+0%	100/1440 Winter			
S1.009	S14	600 Winter	1	+0%	30/60 Summer			
S3.000	S13	15 Winter	1	+0%				
S3.001	S14	15 Summer	1	+0%				
S3.002	S15	15 Winter	1	+0%	100/15 Summer			

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Micro Drainage				Network 2019.1				
<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>								
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.003	S16	15 Winter	1	+0%	100/15 Summer			
S3.004	S17	15 Winter	1	+0%	100/15 Summer			
S3.005	S18	15 Winter	1	+0%	100/360 Winter			
S4.000	S20	15 Winter	1	+0%				
S4.001	S21	15 Winter	1	+0%				
S4.002	S22	15 Winter	1	+0%	100/1440 Winter			
S3.006	S19	15 Winter	1	+0%	100/15 Summer			
S3.007	S20	15 Winter	1	+0%	30/15 Summer			
S3.008	S26	720 Winter	1	+0%	30/60 Winter			
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Level Status
S3.003	S16	39.453	-0.102	0.000	0.22		3.6	OK
S3.004	S17	39.304	-0.096	0.000	0.28		4.5	OK
S3.005	S18	39.110	-0.176	0.000	0.11		5.0	OK
S4.000	S20	39.728	-0.122	0.000	0.08		1.2	OK
S4.001	S21	39.673	-0.111	0.000	0.15		2.4	OK
S4.002	S22	39.559	-0.109	0.000	0.17		2.7	OK
S3.006	S19	38.912	-0.172	0.000	0.12		8.7	OK
S3.007	S20	38.734	-0.104	0.000	0.56		13.2	OK
S3.008	S26	38.395	-0.105	0.000	0.00		0.0	OK
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Micro Drainage

Battle of Britain Pub

Coldharbour Road

Gravesend

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

for Storm

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 4

Number of Online Controls 2

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.417

Region England and Wales Cv (Summer) 0.750

M5-60 (mm) 20.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status ON

Inertia Status OFF

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+0%	100/15 Summer			
S1.001	S2	15 Summer	30	+0%	100/15 Summer			
S1.002	S3	15 Summer	30	+0%	100/15 Summer			
S1.003	S4	15 Winter	30	+0%	30/15 Winter			
S1.004	S5	15 Winter	30	+0%	30/15 Summer			
S1.005	S6	15 Winter	30	+0%	30/15 Summer			
S2.000	S7	15 Winter	30	+0%	100/15 Summer			
S2.001	S8	15 Summer	30	+0%	100/15 Summer			
S2.002	S9	15 Summer	30	+0%	100/15 Summer			
S2.003	S10	15 Winter	30	+0%	100/15 Summer			
S1.006	S7	15 Winter	30	+0%				
S1.007	S8	15 Winter	30	+0%				
S1.008	S13	15 Winter	30	+0%	100/1440 Winter			
S1.009	S14	960 Winter	30	+0%	30/60 Summer			
S3.000	S13	15 Winter	30	+0%				
S3.001	S14	15 Summer	30	+0%				
S3.002	S15	15 Summer	30	+0%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	39.749	-0.101	0.000	0.23		3.7	OK	
S1.001	S2	39.652	-0.080	0.000	0.44		6.8	OK	
S1.002	S3	39.590	-0.066	0.000	0.60		9.8	OK	
S1.003	S4	39.488	0.001	0.000	0.79		12.7	SURCHARGED	
S1.004	S5	39.415	0.042	0.000	1.14		16.6	SURCHARGED	
S1.005	S6	39.342	0.026	0.000	1.13		18.1	SURCHARGED	
S2.000	S7	39.760	-0.090	0.000	0.33		5.0	OK	
S2.001	S8	39.710	-0.079	0.000	0.46		7.4	OK	
S2.002	S9	39.626	-0.041	0.000	0.87		13.2	OK	
S2.003	S10	39.553	-0.039	0.000	0.90		14.6	OK	
S1.006	S7	39.078	-0.122	0.000	0.42		33.5	OK	
S1.007	S8	38.744	-0.132	0.000	0.36		33.7	OK	
S1.008	S13	38.308	-0.128	0.000	0.38		47.5	OK	
S1.009	S14	37.814	0.178	0.000	0.00		0.0	SURCHARGED	
S3.000	S13	39.745	-0.105	0.000	0.20		2.9	OK	
S3.001	S14	39.687	-0.107	0.000	0.18		2.9	OK	
S3.002	S15	39.575	-0.085	0.000	0.39		6.2	OK	

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<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>								
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.003	S16	15 Winter	30	+0%	100/15 Summer			
S3.004	S17	15 Winter	30	+0%	100/15 Summer			
S3.005	S18	15 Summer	30	+0%	100/360 Winter			
S4.000	S20	15 Winter	30	+0%				
S4.001	S21	15 Summer	30	+0%				
S4.002	S22	15 Summer	30	+0%	100/1440 Winter			
S3.006	S19	15 Summer	30	+0%	100/15 Summer			
S3.007	S20	15 Winter	30	+0%	30/15 Summer			
S3.008	S26	960 Winter	30	+0%	30/60 Winter			
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Level Exceeded
S3.003	S16	39.492	-0.063	0.000	0.63		10.4	OK
S3.004	S17	39.353	-0.046	0.000	0.82		13.0	OK
S3.005	S18	39.147	-0.139	0.000	0.31		14.6	OK
S4.000	S20	39.745	-0.105	0.000	0.20		3.0	OK
S4.001	S21	39.702	-0.083	0.000	0.41		6.6	OK
S4.002	S22	39.591	-0.077	0.000	0.48		7.7	OK
S3.006	S19	38.953	-0.132	0.000	0.36		25.0	OK
S3.007	S20	38.882	0.044	0.000	1.65		38.7	SURCHARGED
S3.008	S26	38.707	0.207	0.000	0.00		0.0	SURCHARGED
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	40.183	0.333	0.000	0.35	5.6	FLOOD RISK	
S1.001	S2	40.162	0.430	0.000	0.67	10.2	FLOOD RISK	
S1.002	S3	40.128	0.472	0.000	0.90	14.9	SURCHARGED	
S1.003	S4	39.988	0.501	0.000	1.26	20.1	SURCHARGED	
S1.004	S5	39.801	0.428	0.000	1.86	27.2	SURCHARGED	
S1.005	S6	39.602	0.286	0.000	1.86	29.8	SURCHARGED	
S2.000	S7	40.035	0.185	0.000	0.56	8.3	SURCHARGED	
S2.001	S8	40.015	0.226	0.000	0.77	12.3	SURCHARGED	
S2.002	S9	39.943	0.276	0.000	1.44	21.9	SURCHARGED	
S2.003	S10	39.780	0.188	0.000	1.49	24.3	SURCHARGED	
S1.006	S7	39.116	-0.084	0.000	0.71	56.3	OK	
S1.007	S8	38.814	-0.062	0.000	0.03	2.7	OK	
S1.008	S13	38.814	0.378	0.000	0.03	3.8	SURCHARGED	
S1.009	S14	38.814	1.178	0.000	0.00	0.0	SURCHARGED	
S3.000	S13	39.762	-0.088	0.000	0.36	5.3	OK	
S3.001	S14	39.722	-0.072	0.000	0.32	5.2	OK	
S3.002	S15	39.702	0.043	0.000	0.65	10.3	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharges	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.003	S16	1440 Winter	100	+40%	100/15 Summer			
S3.004	S17	1440 Winter	100	+40%	100/15 Summer			
S3.005	S18	1440 Winter	100	+40%	100/360 Winter			
S4.000	S20	15 Winter	100	+40%				
S4.001	S21	15 Winter	100	+40%				
S4.002	S22	1440 Winter	100	+40%	100/1440 Winter			
S3.006	S19	1440 Winter	100	+40%	100/15 Summer			
S3.007	S20	1440 Winter	100	+40%	30/15 Summer			
S3.008	S26	1440 Winter	100	+40%	30/60 Winter			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.003	S16	39.685	0.129	0.000	0.05	0.8	SURCHARGED	
S3.004	S17	39.685	0.286	0.000	0.06	1.0	SURCHARGED	
S3.005	S18	39.685	0.399	0.000	0.02	1.1	SURCHARGED	
S4.000	S20	39.762	-0.088	0.000	0.36	5.4	OK	
S4.001	S21	39.732	-0.052	0.000	0.75	12.0	OK	
S4.002	S22	39.685	0.017	0.000	0.04	0.6	SURCHARGED	
S3.006	S19	39.685	0.600	0.000	0.03	1.9	SURCHARGED	
S3.007	S20	39.685	0.847	0.000	0.23	5.3	FLOOD RISK	
S3.008	S26	39.863	1.363	0.000	0.00	0.0	FLOOD RISK	

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Summer</td><td>38.559</td><td>0.359</td><td>0.2</td><td>34.1</td><td>O K</td></tr><tr><td>600 min Summer</td><td>38.565</td><td>0.365</td><td>0.2</td><td>34.7</td><td>O K</td></tr><tr><td>720 min Summer</td><td>38.568</td><td>0.368</td><td>0.2</td><td>35.0</td><td>O K</td></tr><tr><td>960 min Summer</td><td>38.568</td><td>0.368</td><td>0.2</td><td>34.9</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>38.557</td><td>0.357</td><td>0.2</td><td>33.9</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>38.539</td><td>0.339</td><td>0.2</td><td>32.2</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>38.520</td><td>0.320</td><td>0.2</td><td>30.4</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>38.485</td><td>0.285</td><td>0.2</td><td>27.1</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>38.452</td><td>0.252</td><td>0.2</td><td>24.0</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>38.422</td><td>0.222</td><td>0.2</td><td>21.1</td><td>O K</td></tr><tr><td>8640 min 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min Summer</td><td>5.278</td><td>0.0</td><td>614</td></tr><tr><td>720 min Summer</td><td>4.570</td><td>0.0</td><td>732</td></tr><tr><td>960 min Summer</td><td>3.639</td><td>0.0</td><td>966</td></tr><tr><td>1440 min Summer</td><td>2.637</td><td>0.0</td><td>1222</td></tr><tr><td>2160 min Summer</td><td>1.909</td><td>0.0</td><td>1584</td></tr><tr><td>2880 min Summer</td><td>1.517</td><td>0.0</td><td>1984</td></tr><tr><td>4320 min Summer</td><td>1.096</td><td>0.0</td><td>2796</td></tr><tr><td>5760 min Summer</td><td>0.870</td><td>0.0</td><td>3592</td></tr><tr><td>7200 min Summer</td><td>0.727</td><td>0.0</td><td>4400</td></tr><tr><td>8640 min Summer</td><td>0.628</td><td>0.0</td><td>5112</td></tr><tr><td>10080 min Summer</td><td>0.555</td><td>0.0</td><td>5856</td></tr><tr><td>15 min Winter</td><td>77.173</td><td>0.0</td><td>70</td></tr></tbody></table>					Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	38.348	0.148	0.2	14.1	O K	30 min Summer	38.394	0.194	0.2	18.5	O K	60 min Summer	38.441	0.241	0.2	22.9	O K	120 min Summer	38.487	0.287	0.2	27.3	O K	180 min Summer	38.512	0.312	0.2	29.7	O K	240 min Summer	38.528	0.328	0.2	31.2	O K	360 min Summer	38.548	0.348	0.2	33.0	O K	480 min Summer	38.559	0.359	0.2	34.1	O K	600 min Summer	38.565	0.365	0.2	34.7	O K	720 min Summer	38.568	0.368	0.2	35.0	O K	960 min Summer	38.568	0.368	0.2	34.9	O K	1440 min Summer	38.557	0.357	0.2	33.9	O K	2160 min Summer	38.539	0.339	0.2	32.2	O K	2880 min Summer	38.520	0.320	0.2	30.4	O K	4320 min Summer	38.485	0.285	0.2	27.1	O K	5760 min Summer	38.452	0.252	0.2	24.0	O K	7200 min Summer	38.422	0.222	0.2	21.1	O K	8640 min Summer	38.393	0.193	0.2	18.4	O K	10080 min Summer	38.368	0.168	0.2	15.9	O K	15 min Winter	38.367	0.167	0.2	15.9	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	77.173	0.0	69	30 min Summer	49.879	0.0	80	60 min Summer	30.811	0.0	104	120 min Summer	18.477	0.0	156	180 min Summer	13.560	0.0	210	240 min Summer	10.843	0.0	266	360 min Summer	7.888	0.0	382	480 min Summer	6.293	0.0	498	600 min Summer	5.278	0.0	614	720 min Summer	4.570	0.0	732	960 min Summer	3.639	0.0	966	1440 min Summer	2.637	0.0	1222	2160 min Summer	1.909	0.0	1584	2880 min Summer	1.517	0.0	1984	4320 min Summer	1.096	0.0	2796	5760 min Summer	0.870	0.0	3592	7200 min Summer	0.727	0.0	4400	8640 min Summer	0.628	0.0	5112	10080 min Summer	0.555	0.0	5856	15 min Winter	77.173	0.0	70
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11 Woodside Terrace Glasgow G3 7XQ		Battle of Britain Pub Gravesend South Soakaway 1:30 year			
Date 09/05/2022 14:44 File SOUTH SOAKAWAY 1 IN 30....		Designed by MDF Checked by MH			
Micro Drainage		Source Control 2019.1			
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	38.419	0.219	0.2	20.8	O K
60 min Winter	38.472	0.272	0.2	25.8	O K
120 min Winter	38.524	0.324	0.2	30.8	O K
180 min Winter	38.553	0.353	0.2	33.5	O K
240 min Winter	38.571	0.371	0.2	35.3	O K
360 min Winter	38.595	0.395	0.2	37.5	O K
480 min Winter	38.609	0.409	0.2	38.9	O K
600 min Winter	38.618	0.418	0.2	39.7	O K
720 min Winter	38.623	0.423	0.2	40.2	O K
960 min Winter	38.626	0.426	0.2	40.5	O K
1440 min Winter	38.617	0.417	0.2	39.7	O K
2160 min Winter	38.593	0.393	0.2	37.3	O K
2880 min Winter	38.568	0.368	0.2	35.0	O K
4320 min Winter	38.516	0.316	0.2	30.1	O K
5760 min Winter	38.466	0.266	0.2	25.3	O K
7200 min Winter	38.420	0.220	0.2	20.9	O K
8640 min Winter	38.377	0.177	0.2	16.8	O K
10080 min Winter	38.340	0.140	0.2	13.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	49.879	0.0	81		
60 min Winter	30.811	0.0	104		
120 min Winter	18.477	0.0	156		
180 min Winter	13.560	0.0	210		
240 min Winter	10.843	0.0	266		
360 min Winter	7.888	0.0	378		
480 min Winter	6.293	0.0	492		
600 min Winter	5.278	0.0	606		
720 min Winter	4.570	0.0	720		
960 min Winter	3.639	0.0	946		
1440 min Winter	2.637	0.0	1376		
2160 min Winter	1.909	0.0	1708		
2880 min Winter	1.517	0.0	2160		
4320 min Winter	1.096	0.0	3056		
5760 min Winter	0.870	0.0	3888		
7200 min Winter	0.727	0.0	4680		
8640 min Winter	0.628	0.0	5440		
10080 min Winter	0.555	0.0	6152		
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11 Woodside Terrace Glasgow G3 7XQ	Battle of Britain Pub Gravesend South Soakaway 1:30 year	
Date 09/05/2022 14:44 File SOUTH SOAKAWAY 1 IN 30....	Designed by MDF Checked by MH	
Micro Drainage Source Control 2019.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.418	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Pipe Network

Volume in Pipe Network (m³)	39	Dia of Outfall Pipe (m)	0.2
Slope of Outfall Pipe (1:X)	15	Roughness of Outfall Pipe (mm)	0.600

Time Area Diagram

Total Area (ha) 0.106

Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)
0	4 0.053	4	8 0.053

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11 Woodside Terrace Glasgow G3 7XQ	Battle of Britain Pub Gravesend South Soakaway 1:30 year																	
Date 09/05/2022 14:44 File SOUTH SOAKAWAY 1 IN 30....	Designed by MDF Checked by MH																	
Micro Drainage	Source Control 2019.1																	
<u>Model Details</u> Storage is Online Cover Level (m) 39.900 <u>Infiltration Blanket Structure</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.01692</td><td>Diameter/Width (m)</td><td>5.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Length (m)</td><td>20.0</td></tr><tr><td>Porosity</td><td>0.95</td><td>Cap Volume Depth (m)</td><td>0.800</td></tr><tr><td>Invert Level (m)</td><td>38.200</td><td></td><td></td></tr></table>			Infiltration Coefficient Base (m/hr)	0.01692	Diameter/Width (m)	5.0	Safety Factor	2.0	Length (m)	20.0	Porosity	0.95	Cap Volume Depth (m)	0.800	Invert Level (m)	38.200		
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<u>Summary of Results for 30 year Return Period</u> Half Drain Time : 1376 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>37.555</td><td>0.144</td><td>0.3</td><td>18.4</td><td>O K</td></tr><tr><td>30 min Summer</td><td>37.599</td><td>0.188</td><td>0.3</td><td>24.2</td><td>O K</td></tr><tr><td>60 min Summer</td><td>37.645</td><td>0.234</td><td>0.3</td><td>30.0</td><td>O K</td></tr><tr><td>120 min Summer</td><td>37.689</td><td>0.278</td><td>0.3</td><td>35.6</td><td>O K</td></tr><tr><td>180 min Summer</td><td>37.712</td><td>0.301</td><td>0.3</td><td>38.6</td><td>O K</td></tr><tr><td>240 min Summer</td><td>37.727</td><td>0.316</td><td>0.3</td><td>40.6</td><td>O K</td></tr><tr><td>360 min Summer</td><td>37.745</td><td>0.334</td><td>0.3</td><td>42.9</td><td>O K</td></tr><tr><td>480 min Summer</td><td>37.756</td><td>0.345</td><td>0.3</td><td>44.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>37.761</td><td>0.350</td><td>0.3</td><td>44.9</td><td>O K</td></tr><tr><td>720 min Summer</td><td>37.764</td><td>0.353</td><td>0.3</td><td>45.2</td><td>O K</td></tr><tr><td>960 min Summer</td><td>37.763</td><td>0.352</td><td>0.3</td><td>45.1</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>37.751</td><td>0.340</td><td>0.3</td><td>43.7</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>37.733</td><td>0.322</td><td>0.3</td><td>41.3</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>37.715</td><td>0.304</td><td>0.3</td><td>39.0</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>37.681</td><td>0.270</td><td>0.3</td><td>34.6</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>37.648</td><td>0.237</td><td>0.3</td><td>30.4</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>37.618</td><td>0.207</td><td>0.3</td><td>26.5</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>37.591</td><td>0.180</td><td>0.3</td><td>23.0</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>37.566</td><td>0.155</td><td>0.3</td><td>19.9</td><td>O K</td></tr><tr><td>15 min Winter</td><td>37.573</td><td>0.162</td><td>0.3</td><td>20.8</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>77.173</td><td>0.0</td><td>64</td></tr><tr><td>30 min Summer</td><td>49.879</td><td>0.0</td><td>75</td></tr><tr><td>60 min Summer</td><td>30.811</td><td>0.0</td><td>100</td></tr><tr><td>120 min Summer</td><td>18.477</td><td>0.0</td><td>152</td></tr><tr><td>180 min Summer</td><td>13.560</td><td>0.0</td><td>208</td></tr><tr><td>240 min Summer</td><td>10.843</td><td>0.0</td><td>264</td></tr><tr><td>360 min Summer</td><td>7.888</td><td>0.0</td><td>380</td></tr><tr><td>480 min Summer</td><td>6.293</td><td>0.0</td><td>496</td></tr><tr><td>600 min Summer</td><td>5.278</td><td>0.0</td><td>614</td></tr><tr><td>720 min Summer</td><td>4.570</td><td>0.0</td><td>730</td></tr><tr><td>960 min Summer</td><td>3.639</td><td>0.0</td><td>966</td></tr><tr><td>1440 min Summer</td><td>2.637</td><td>0.0</td><td>1212</td></tr><tr><td>2160 min Summer</td><td>1.909</td><td>0.0</td><td>1576</td></tr><tr><td>2880 min Summer</td><td>1.517</td><td>0.0</td><td>1980</td></tr><tr><td>4320 min Summer</td><td>1.096</td><td>0.0</td><td>2788</td></tr><tr><td>5760 min Summer</td><td>0.870</td><td>0.0</td><td>3584</td></tr><tr><td>7200 min Summer</td><td>0.727</td><td>0.0</td><td>4376</td></tr><tr><td>8640 min Summer</td><td>0.628</td><td>0.0</td><td>5104</td></tr><tr><td>10080 min Summer</td><td>0.555</td><td>0.0</td><td>5856</td></tr><tr><td>15 min Winter</td><td>77.173</td><td>0.0</td><td>65</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	37.555	0.144	0.3	18.4	O K	30 min Summer	37.599	0.188	0.3	24.2	O K	60 min Summer	37.645	0.234	0.3	30.0	O K	120 min Summer	37.689	0.278	0.3	35.6	O K	180 min Summer	37.712	0.301	0.3	38.6	O K	240 min Summer	37.727	0.316	0.3	40.6	O K	360 min Summer	37.745	0.334	0.3	42.9	O K	480 min Summer	37.756	0.345	0.3	44.2	O K	600 min Summer	37.761	0.350	0.3	44.9	O K	720 min Summer	37.764	0.353	0.3	45.2	O K	960 min Summer	37.763	0.352	0.3	45.1	O K	1440 min Summer	37.751	0.340	0.3	43.7	O K	2160 min Summer	37.733	0.322	0.3	41.3	O K	2880 min Summer	37.715	0.304	0.3	39.0	O K	4320 min Summer	37.681	0.270	0.3	34.6	O K	5760 min Summer	37.648	0.237	0.3	30.4	O K	7200 min Summer	37.618	0.207	0.3	26.5	O K	8640 min Summer	37.591	0.180	0.3	23.0	O K	10080 min Summer	37.566	0.155	0.3	19.9	O K	15 min Winter	37.573	0.162	0.3	20.8	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	77.173	0.0	64	30 min Summer	49.879	0.0	75	60 min Summer	30.811	0.0	100	120 min Summer	18.477	0.0	152	180 min Summer	13.560	0.0	208	240 min Summer	10.843	0.0	264	360 min Summer	7.888	0.0	380	480 min Summer	6.293	0.0	496	600 min Summer	5.278	0.0	614	720 min Summer	4.570	0.0	730	960 min Summer	3.639	0.0	966	1440 min Summer	2.637	0.0	1212	2160 min Summer	1.909	0.0	1576	2880 min Summer	1.517	0.0	1980	4320 min Summer	1.096	0.0	2788	5760 min Summer	0.870	0.0	3584	7200 min Summer	0.727	0.0	4376	8640 min Summer	0.628	0.0	5104	10080 min Summer	0.555	0.0	5856	15 min Winter	77.173	0.0	65
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W A Fairhurst & Partners				Page 2	
11 Woodside Terrace Glasgow G3 7XQ		Battle of Britain Pub Gravesend North Soakaway 1:30 year			
Date 09/05/2022 14:50 File SOUTH SOAKAWAY 1 IN 30....		Designed by MDF Checked by MH			
Micro Drainage		Source Control 2019.1			
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	37.623	0.212	0.3	27.2	O K
60 min Winter	37.674	0.263	0.3	33.7	O K
120 min Winter	37.724	0.313	0.3	40.1	O K
180 min Winter	37.751	0.340	0.3	43.6	O K
240 min Winter	37.769	0.358	0.3	45.9	O K
360 min Winter	37.791	0.380	0.3	48.7	O K
480 min Winter	37.804	0.393	0.3	50.4	O K
600 min Winter	37.812	0.401	0.3	51.4	O K
720 min Winter	37.817	0.406	0.3	52.0	O K
960 min Winter	37.819	0.408	0.3	52.3	O K
1440 min Winter	37.809	0.398	0.3	51.0	O K
2160 min Winter	37.784	0.373	0.3	47.9	O K
2880 min Winter	37.760	0.349	0.3	44.7	O K
4320 min Winter	37.708	0.297	0.3	38.1	O K
5760 min Winter	37.659	0.248	0.3	31.8	O K
7200 min Winter	37.613	0.202	0.3	25.9	O K
8640 min Winter	37.572	0.161	0.3	20.7	O K
10080 min Winter	37.536	0.125	0.3	16.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	49.879	0.0	76		
60 min Winter	30.811	0.0	100		
120 min Winter	18.477	0.0	152		
180 min Winter	13.560	0.0	206		
240 min Winter	10.843	0.0	262		
360 min Winter	7.888	0.0	376		
480 min Winter	6.293	0.0	490		
600 min Winter	5.278	0.0	604		
720 min Winter	4.570	0.0	720		
960 min Winter	3.639	0.0	944		
1440 min Winter	2.637	0.0	1370		
2160 min Winter	1.909	0.0	1708		
2880 min Winter	1.517	0.0	2152		
4320 min Winter	1.096	0.0	3036		
5760 min Winter	0.870	0.0	3872		
7200 min Winter	0.727	0.0	4672		
8640 min Winter	0.628	0.0	5432		
10080 min Winter	0.555	0.0	6152		
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11 Woodside Terrace Glasgow G3 7XQ	Battle of Britain Pub Gravesend North Soakaway 1:30 year	
Date 09/05/2022 14:50 File SOUTH SOAKAWAY 1 IN 30....	Designed by MDF Checked by MH	
Micro Drainage Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 39.410

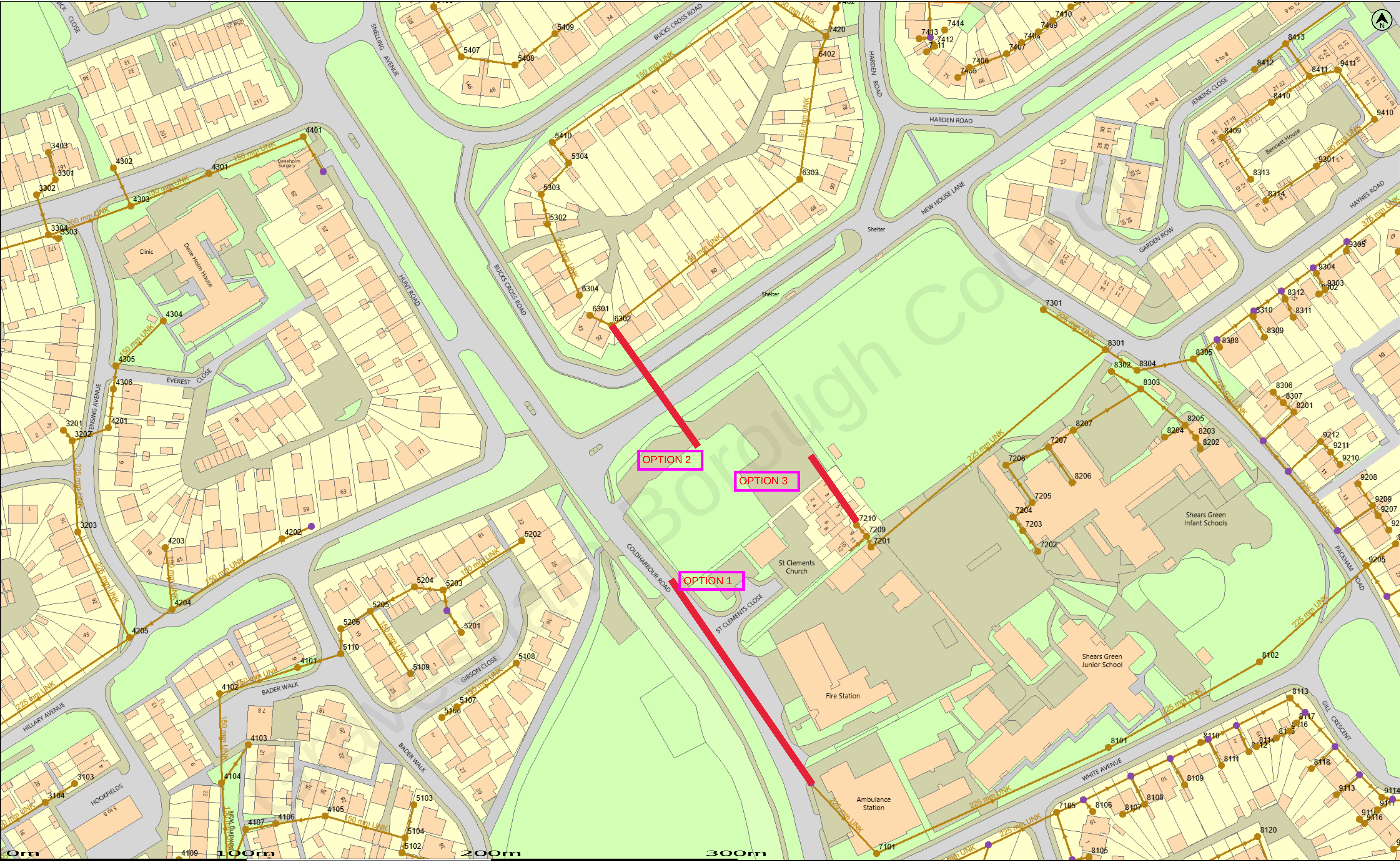
Infiltration Blanket Structure

Infiltration Coefficient Base (m/hr)	0.01692	Diameter/Width (m)	5.0
Safety Factor	2.0	Length (m)	27.0
Porosity	0.95	Cap Volume Depth (m)	0.800
Invert Level (m)	37.411		

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Appendix H

Potential Foul Discharge Locations



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Date: 22/07/21

Scale: 1:1000

Map Centre: 563650,172289

Data updated: 19/07/21

Our Ref: 604393 - 1

Wastewater Plan A2

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 2021 Ordnance Survey 100031673. 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.

mark.hayward@fairhurst.co.uk

B



Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
3103	F	31.98	30.94	
3104	F	32.01	30.68	
3201	F	31.90	30.61	
3202	F	0.00	0.00	
3203	F	32.25	30.13	
3301	F	33.88	32.63	
3302	F	33.85	32.43	
3303	F	33.50	32.41	
3304	F	33.89	0.00	
3403	F	33.81	32.79	
4101	F	35.51	34.32	
4102	F	34.49	33.71	
4103	F	35.16	34.07	
4104	F	34.81	0.00	
4105	F	0.00	0.00	
4106	F	35.71	33.44	
4107	F	35.33	32.85	
4109	F	33.47	32.00	
4201	F	32.33	30.74	
4202	F	34.28	0.00	
4203	F	32.72	31.13	
4204	F	32.55	29.99	
4205	F	32.54	0.00	
4301	F	35.80	33.98	
4302	F	0.00	0.00	
4303	F	0.00	0.00	
4304	F	33.24	31.70	
4305	F	32.66	31.01	
4306	F	32.56	30.94	
4401	F	36.71	0.00	
5102	F	40.63	0.00	
5103	F	0.00	0.00	
5104	F	40.56	0.00	
5106	F	40.45	39.20	
5107	F	40.45	38.93	
5108	F	40.07	0.00	
5109	F	39.32	37.63	
5110	F	35.84	34.64	
5201	F	39.46	37.70	
5202	F	40.47	39.64	
5203	F	0.00	0.00	
5204	F	37.56	35.85	
5205	F	36.81	0.00	
5206	F	36.25	0.00	
5302	F	39.00	37.91	
5303	F	37.98	37.27	
5304	F	37.05	36.65	
5406	F	37.15	35.91	
5407	F	0.00	0.00	
5408	F	36.72	35.16	
5409	F	0.00	0.00	
5410	F	0.00	0.00	
6301	F	0.00	0.00	
6302	F	39.71	0.00	
6303	F	36.39	35.35	
6304	F	39.67	38.84	
6402	F	34.54	32.80	
7101	F	0.00	0.00	
7105	F	44.67	41.34	
7201	F	0.00	0.00	
7202	F	0.00	0.00	
7203	F	0.00	0.00	
7204	F	0.00	0.00	
7205	F	0.00	0.00	
7206	F	0.00	0.00	
7207	F	0.00	0.00	
7209	F	0.00	0.00	
7210	F	0.00	0.00	
7301	F	37.33	35.61	
7402	F	33.68	31.84	
7405	F	0.00	0.00	
7406	F	34.23	33.55	
7407	F	34.06	33.17	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
7408	F	0.00	0.00	
7409	F	0.00	0.00	
7410	F	0.00	0.00	
7411	F	0.00	0.00	
7412	F	34.05	33.21	
7413	F	0.00	0.00	
7414	F	33.71	0.00	
7420	F	33.86	0.00	
8101	F	0.00	0.00	
8102	F	0.00	0.00	
8105	F	0.00	0.00	
8106	F	0.00	0.00	
8107	F	0.00	0.00	
8108	F	43.32	0.00	
8109	F	42.67	42.08	
8110	F	42.40	0.00	
8111	F	42.05	41.54	
8112	F	42.04	41.48	
8113	F	40.41	38.45	
8114	F	0.00	0.00	
8115	F	0.00	0.00	
8116	F	0.00	0.00	
8117	F	0.00	0.00	
8118	F	41.08	40.49	
8120	F	42.89	0.00	
8201	F	37.99	0.00	
8202	F	0.00	0.00	
8203	F	0.00	0.00	
8204	F	0.00	0.00	
8205	F	0.00	0.00	
8206	F	0.00	0.00	
8207	F	0.00	0.00	
8301	F	37.85	35.21	
8302	F	0.00	0.00	
8303	F	0.00	0.00	
8304	F	38.22	35.04	
8305	F	37.71	34.84	
8306	F	0.00	0.00	
8307	F	0.00	0.00	
8308	F	0.00	0.00	
8309	F	0.00	0.00	
8310	F	37.30	0.00	
8311	F	0.00	0.00	
8312	F	37.29	0.00	
8313	F	36.31	35.61	
8314	F	36.69	35.97	
8401	F	33.68	32.68	
8409	F	35.70	34.96	
8410	F	35.49	34.67	
8411	F	35.25	34.26	
8412	F	0.00	0.00	
8413	F	0.00	0.00	
9113	F	41.08	40.53	
9114	F	40.70	0.00	
9115	F	0.00	0.00	
9116	F	0.00	0.00	
9117	F	40.94	0.00	
9118	F	41.00	40.11	
9204	F	38.74	38.17	
9205	F	0.00	0.00	
9206	F	0.00	0.00	
9207	F	0.00	0.00	
9208	F	0.00	0.00	
9209	F	38.67	0.00	
9210	F	0.00	0.00	
9211	F	0.00	0.00	
9212	F	38.19	0.00	
9301	F	36.45	35.66	
9302	F	0.00	0.00	
9303	F	0.00	0.00	
9304	F	37.14	0.00	
9305	F	37.12	36.17	
9315	F	0.00	0.00	

Appendix I

Maintenance Strategy

Cellular attenuation Soakaway (Management Company)

Maintenance Frequency	Action Required	Maintenance Frequency
Regular Maintenance	Inspect/identify areas not operating correctly and take remedial action	3 months initially, every 6 months for next year, than as required.
	Inspect structure as specified by manufacturer	Monthly or as required
	Inspect and remove debris from inlet structure (catchpit)	Monthly or as required
	Check inlets and outlets	Annually or as required
Occasional Maintenance	Jetting and suction where silt has settled in structure	As required
Remedial Works	Full replacement of the structure if permanently silted or structural failure	As required
Following all significant event	Inspect and carry out essential recovery works to return feature to full working order	As required

Permeable Paving (Independent Management Company)

Maintenance Frequency	Action Required	Maintenance Frequency
Regular Maintenance	Refer to manufacturer specification for details of specific maintenance requirements	Defined by manufacturer
	Inspect permeable paving outfalls to ensure functioning correctly	3 months as required
	Brush surface regularly remove sweepings away from paving blocks	3 months or as required
Occasional Maintenance	Vacuum surface and brush and re-grit where necessary to prevent silt blockage and enhance design life	6 month or as required
	Remove weeds and plant growth in gaps between paving	As required
Remedial Works	Monitor effectiveness i.e. note if water fails to infiltrate immediately upon contact as the reinstatement of pavement if jet washing and suction cleaning does not restore it	As required
Following all significant events	Inspect and carry out essential maintenance works as required to return feature to full working order	As required

Underground Drainage and Chambers (Management Company)

Maintenance Frequency	Action Required	Maintenance Frequency
Regular Maintenance	Cleaning gutters and any filters on downpipe	Every 6 months or as required
	Remove sediment, debris etc. from manhole chambers, catchpits and inspection chambers	Annually or as required
Occasional Maintenance	CCTV Survey to check pipe alignment, cracks, joint displacements and root ingress for repair	Every 10 years
Remedial Works	Full replacement of the structure if permanently silted or structural failure	As required
Ad-hoc	If blockage/flooding reported utilise jetting/rodding practices to remove obstruction within 24 hours of report.	As required
Following all significant events	Inspect and carry out essential maintenance works to return feature to full working order	As required

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