CONSULTING ENGINEERS

The Bull Inn

Flood Risk, Drainage Strategy & Maintenance Report

V3

Client: Caldecotte Group

Our Ref: The Bull Inn

Date: 06/01/20245

Assessment of Flood Risk to Proposed Development

The site has been assessed to understand whether a Flood Risk Assessment is required to accommodate the planning application.

As per the Environment Agency Flood Map for Planning, it stated that an FRA will only be required in the event of:

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency.
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

The site area does not exceed 1 hectare with the site sitting within Flood Zone 1.

It is noted that there is some pluvial flooding as identified on the EA floodzone maps. >>

This is due to poor surface water drainage within the existing pub garden and as part of the proposed development this issue will be mitigated by way of a filter drain installed within the existing garden.

This has been identified on our proposed drainage strategy drawing.

On this basis, we would not deem the site subject to an FRA requirement, any risk of surface water flooding will be negated via the proposals of new drainage network in place.

Further clarity can be found within appendix:

- The Bull Inn – flood-map-planning-2024-11-05
- The Bull Inn-C-001-P03- Drainage Strategy

Assessment of Drainage Options

Surface Water

All surface water flows from the proposed development should drain in-line with the drainage hierarchy, as outlined in paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recognise the need to priorities the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable, below we have provided our possible surface water options based on information available to us at this stage, assumptions may be made however confirmation with associated evidence is to be provided at the full planning application stage.

This is outlined as follows, in order of priority:

1. Into the ground (infiltration)

In order to assess the permeability rates for the subsoil, a BRE365 soakaway test was undertaken. From this, calculations of the permeability rates were recorded which can confirm that the permeability rate of the subsoil is recorded as between $1.3x10^{-5}$ m/sec & $2.4x10^{-5}$ m/sec.

A soakaway solution has therefore been considered within the overall surface water drainage proposals against the lowest rate provided as per general BRE365 guidance.
Please see appendix: The Bull Inn – BRE365 Tests Results

Based on the above, the 3 following stages of the hierarchy have not been explored further.
However, whilst the ground conditions lend themselves to a soakaway solution, we believe an option for an overspill pipe, set above the top of the soakaway tank level is appropriate. This overspill pipe will discharge flows to the nearby public sewer in an extreme event greater than the 100-year event + climate change and would be beneficial to further reduce any risk of flooding.

Assessment of Surface Water Design Parameters.

The main sewerage for the development will remain private with surface water connections to the existing on-site private sewer network. This therefore ensures that the main sewerage infrastructure shall be owned and maintained by the client or management company.

As concluded within the assessment of the drainage options, a soakaway/infiltration discharge method has been proposed for the discharge of surface water, as per the The SuDS Manual C753 CIRIA guidance document, a soakaway solution is considered a surface water interception feature and there for no further SUDs features have been proposed for the scheme.

Cellular soakaway/attenuation tank has been sized to cater for the site impermeable area of 720m2.

The overall sites system is to be designed in accordance with Sewers for Adoption 6th Edition and will include the design for attenuation of flows for up to the 1 in 30 year + 40% & the 1 in 100 year + 45% as per the AEP plus climate change storm events without flooding with an infiltration rate set at 1.3x10-5 m/hour, which is the lesser of the 3 rates taken via the BRE365 infiltration tests.

A review was undertaken for Urban Creep against the Bristol SUDs design guide, with the scheme consisting of block apartments, no urban creep has been considered within the capacity of the surface water drainage network.

The tank has also been designed and checked to ensure the half drain down time is within a 24-hour period, the tank invert level has been set to ensure the 10-year storm event water level is less than the invert level of the lowest incoming pipe as per the BRE365 requirements.

An overall plan for the surface water drainage network can be found within Appendix:

- The Bull Inn–C–001–P03– Drainage Strategy

Details of the micro drainage calculations and infiltration rates have been designed and set out as per appendices below.

- The Bull Inn – Soakaway Design Calculations 14.11.2024
- The Bull Inn – SW Hydraulic Calcs – 14.11.2024

Proposed Maintenance (in accordance with best practice and CIRIA C753 – The SuDS Manual).

Pipework / manhole		
Regular maintenance	Inspect pipe work and clear blockages	Annually or after severe storms
	Inspect manholes and clear blockages	
Remedial Actions	Repair any defects in network	As required
Catchpit		
Regular maintenance	Inspect structure and remove any debris/litter on structure.	Annually or after severe storms
Remedial Actions	Replace malfunctioning parts or structures	As required
Gullies		
Regular maintenance	Inspect structure and remove any debris/litter on structure.	Annually or after severe storms
Remedial Actions	Replace malfunctioning parts or structures	As required
	Monitor inspection chambers	
Soakaways		
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	
	Trimming any roots that may be causing blockages	
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube of chamber and inside of concrete manhole rings	As required
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	
	Replacement of clogged geotextile (will require reconstruction of soakaway)	
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly
	Check soakaway to ensure emptying is occurring	Annually

Filter Drains		
Regular maintenance	Remove litter and debris from filter drain surface, access chambers and pre-treatment devices	Monthly
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	6 monthly
	Remove sediment from pre-treatment devices	
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods	As required / 5 yearly
	At locations with high pollution loads, remove surface geotextile and replace and wash or replace overlaying filter medium	
	Clear perforated pipework of blockages	

Assessment and Proposals for Foul Water Drainage

The site has been assessed for existing foul sewers to enable a proposed foul outfall solution from the new development site.

It has been found that due to the historical buildings on site, existing private sewers are available to be utilised, further clarification will be required by way of CCTV to confirm routings and depths.

In the case that the on-site sewers are not suitable for use, a direct connection to the existing surrounding public sewers will be proposed subject to agreement with Local water authority.

- Please see: The Bull Inn-C-001-P02- Drainage Strategy
- The Bull Inn – WW Sewer records

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**362904/172660**	**5 Nov 2024 7:55**

Your selected location is in flood zone 1, an area with a low probability of flooding.

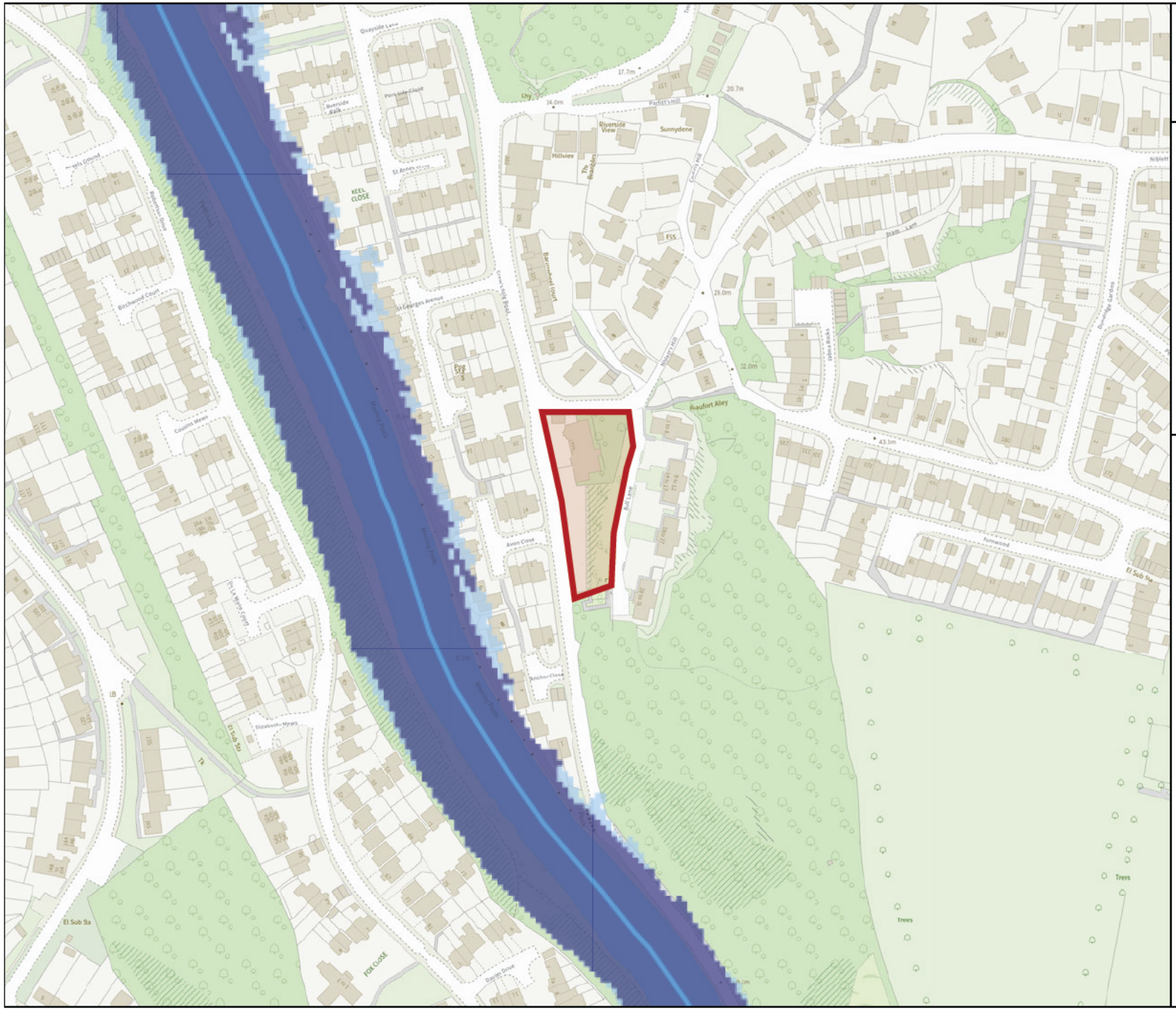
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
362904/172660

Scale
1:2500

Created
5 Nov 2024 7:55

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

PROPOSED FOUL WATER TO CONNECT TO ONSITE EXISTING FOUL WATER SEWER WITHIN SITE. FURTHER INVESTIGATIONS TO CHECK DEPTH AND ROUTING BY WAY OF CCTV SURVEY. DISCHARGE TO BE AGREED WITH WESSEX WATER BY WAY OF SECTION 106 BEFORE DRAWING CAN BE TAKEN TO CONSTRUCTION LEVEL.

EX WW MH
CL: 14.25
IL:

< EX WW 375Ø SW SEWER

< EX WW 300Ø FW SEWER

EX WW MH
CL: 18.63
IL:

F6
CL: 14.00
IL: 13.15

EX FW PR
CL: 13.97
IL: 12.733

S1 300Ø
CL: 14.00
IL: 13.40

S4 300Ø
CL: 14.00
IL: 13.40

F4
CL: 14.00
IL: 12.750

FFL 14.150

F3
CL: 14.00
IL: 13.010

F2
CL: 14.00
IL: 13.040

F1
CL: 14.00
IL: 13.15

S5
CL: 13.80
IL: 13.097

S2
CL: 14.00
IL: 13.073

S3
CL: 13.65
IL: 12.65

S7 CP 300Ø
CL: 13.584
IL: 11.800
SUMP: 11.40

< EX WW 600Ø SW SEWER >

< EX WW 750Ø FW SEWER

< EX WW 1350Ø FW SEWER

EX WW MH
CL: 13.45
IL:

CREWS HOLE ROAD

AVON CLOSE

BULL LANE

EXISTING WESSEX WATER MANHOLE INVERT LEVEL TO BE CONFIRMED PRIOR TO CONSTRUCTION OF PROPOSED OVERFLOW OUTLET PIPE. CONNECTION AGREEMENT TO BE GAINED BY WAY OF SECTION 106 VIA WESSEX WATER.

EX WW MH
CL: 13.086
IL: tbc

S10 CP 600Ø
CL: 13.382
IL: 11.80
SUMP: 11.40

< EX WW 600Ø SW SEWER

BRE365 TESTS HAVE CONFIRMED SUITABLE CONDITIONS FOR SURFACE WATER SOAKAWAY SOLUTION, HOWEVER, IN A STORM EVENT WHERE THE SOAKAWAY TANK MAY NOT PERFORM IN LINE WITH THE TEST RESULTS AND GROUND CONDITIONS, AN EMERGENCY OVERFLOW TO THE PUBLIC SEWER HAS BEEN PROPOSED AS AN OPTIONAL FEATURE.

INVERT LEVEL OF OVERFLOW PIPE HAS BEEN SET ABOVE THE TOP OF TANK LEVEL, THEREFORE WILL ONLY DISCHARGE FLOWS IN AN EXTREME EVENT GREATER THAN 100 YEAR EVENT + CLIMATE CHANGE

S9
CL: 13.080
IL: 12.030

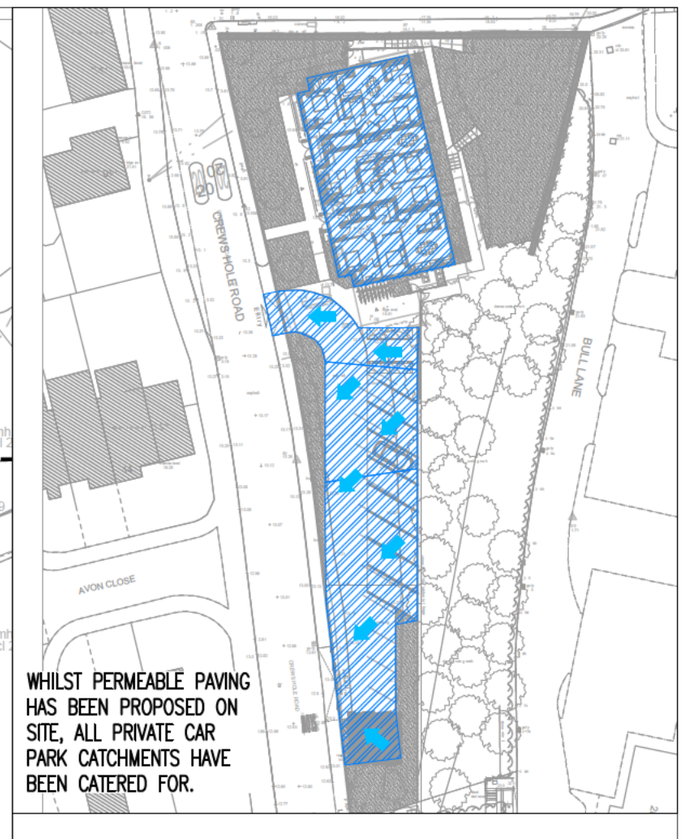
CELLULAR SOAKAWAY & ATTENUATION TANK

TOP OF TANK: 12.60m (700mm MINIMUM COVER)
INVERT: 11.40m
W: 3.50m
L: 17.0m
D: 0.8m
INFILTRATION RATE: 1.3x10-5 m/hour (worst rate of 3no. tests)

TANK SIZE TO CATER FOR 720m² IMPERMEABLE AREA, ANY OTHER AREAS ACROSS SITE TO BE SELF SATURATING SOFT LANDSCAPED AREA.

SOAKAWAY TANK HAS BEEN SIZED TO ACCOMMODATE THE 100 YEAR + 45% STORM EVENT WITH THE INFILTRATION RATE AS SPECIFIED ABOVE. THE TANK HAS ALSO BEEN DESIGNED AND CHECKED TO ENSURE THE HALF DRAIN DOWN TIME IS WITHIN A 24 HOUR PERIOD.

THE TANK INVERT LEVEL HAS BEEN SET TO ENSURE THE 10 YEAR STORM EVENT WATER LEVEL IS LESS THAN THE INVERT LEVEL OF THE LOWEST INCOMING PIPE AS PER BRE365 REQUIREMENTS.



WHILST PERMEABLE PAVING HAS BEEN PROPOSED ON SITE, ALL PRIVATE CAR PARK CATCHMENTS HAVE BEEN CATERED FOR.

PROPOSED IMPERMEABLE AREA 1 = 720m²

OVERLAND FLOW ROUTES

GENERAL NOTES

THIS DRAWING TO READ IN CONJUNCTION WITH ALL RELEVANT STRUCTURAL AND ARCHITECTURAL DRAWINGS AND SPECIFICATIONS.

ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR / FABRICATOR PRIOR TO COMMENCEMENT OF WORKS.

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.

ALL WORKS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH THE ENGINEER'S SPECIFICATIONS, RELEVANT BRITISH STANDARDS AND WHERE APPLICABLE LOCAL AUTHORITIES REQUIREMENTS.

DRAINAGE DETAILS NOTE:

FOR INFORMATION PURPOSES THE FOLLOWING SHOULD BE ASSUMED:

ALL MANHOLE AND SEWER TRENCH DEPTH SHOULD PROVIDE A MINIMUM COVER OF 0.6m (LANDSCAPING) & 1.2m (TRAFFIC AREAS) TO THE SOFFIT OF THE PIPE. FURTHER LEVEL INFORMATION WILL BE CALCULATED IN DUE COURSE.

ALL PPIC'S WITHIN PRIVATE SHARED DRIVE WAY TO HAVE C250 150 CONCRETE SURROUND LIDS

ALL MANHOLES WITHIN TRAFFICKED AREAS TO HAVE D400 COVER LID.

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ANY SERVICE/UTILITY APPARATUS IN THE VICINITY OF THE WORKS BEFORE DRAINAGE INSTALLATION HAS COMMENCED. ANY CONFLICTS IMPACTING DRAINAGE TO BE REPORTED TO ENGINEER TO RESOLVE ACCORDINGLY.

DRAINAGE CONSTRUCTION DETAILS INCLUDING PERMEABLE PAVING TO BE PROVIDED AT POST PLANNING DETAILED DESIGN.

DRAINAGE KEY

- EXISTING ANGLIAN WATER SURFACE WATER SEWER
- EXISTING ANGLIAN WATER FOUL WATER SEWER
- EXISTING PRIVATE FOUL WATER SEWER (ROUTE TBC)
- PROPOSED PRIVATE FOUL WATER PPIC (450Ø UNLESS OTHERWISE STATED).
- PROPOSED PRIVATE SURFACE WATER PPIC (450Ø UNLESS OTHERWISE STATED).
- PROPOSED PRIVATE FOUL WATER SEWER
- PROPOSED PRIVATE SURFACE WATER SEWER
- PROPOSED PRIVATE SW HYDROBRAKE CONTROL CHAMBER
- PROPOSED SW GULLY (LOCATIONS TBC)
- PROPOSED SW ACO CHANNEL
- PROPOSED SW FILTER DRAIN

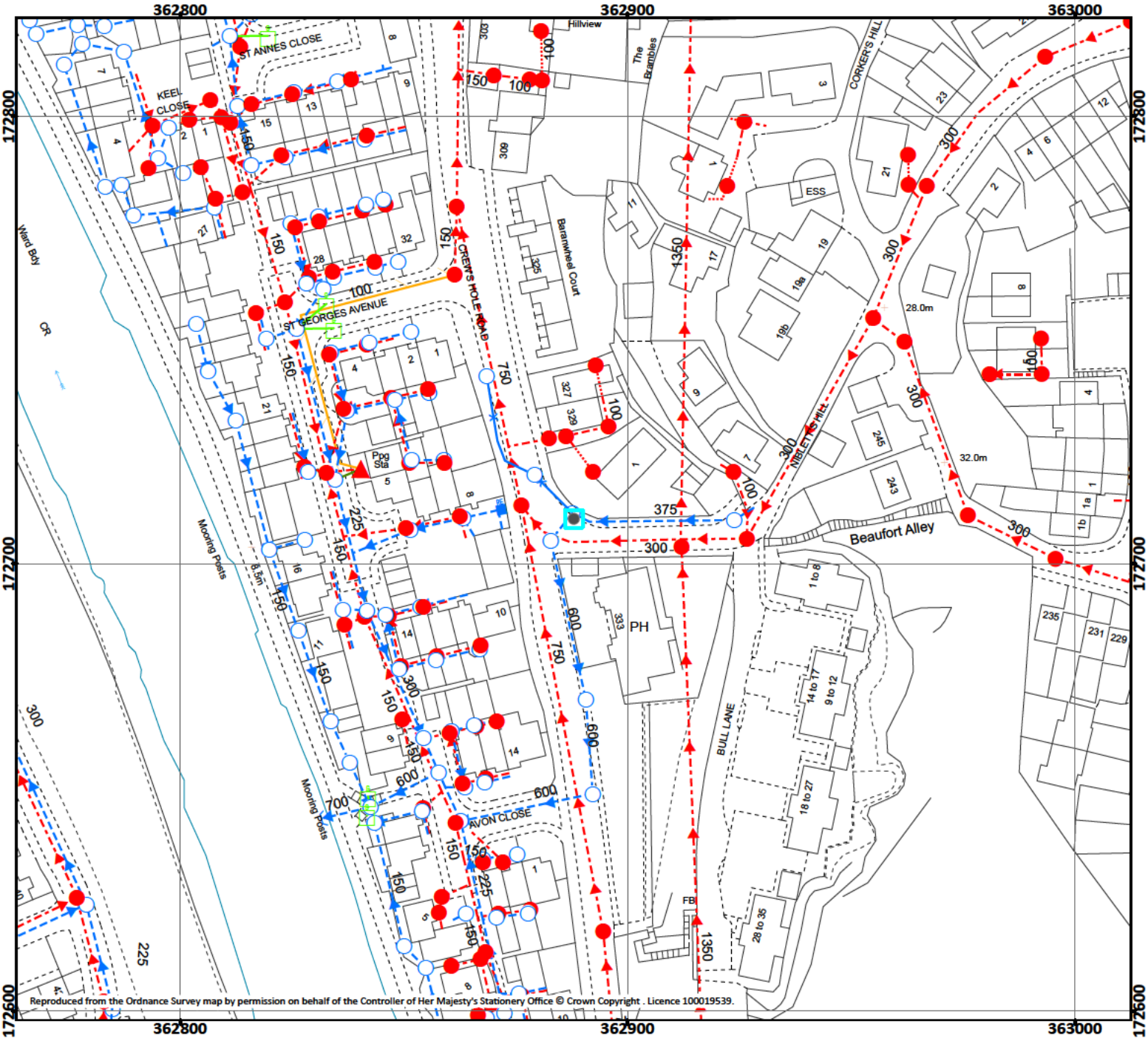
DGC CONSULTING ENGINEERS

PROJECT: The Bull Inn		TITLE: Drainage Strategy	
DATE: 14.11.2024	PROJECT ADDRESS: 333 Crews Hole Rd, Bristol BS5 8BQ	DESIGNED BY: SP	
SCALE (@ A2): 1:200	SHEET NO.: C-001	REV: P01	APPROVED BY: CE

Revision Schedule

Rev	By	Description	Date
P03	SP	Updated to Include Filter Drain.	06.01.25
P02	SP	Updated to Include Latest Site Plan Internal Arrangement	05.12.24
P01	SP	First Issue	14.11.24

PURPOSE OF ISSUE: Planning Submission



WASTE

PUBLIC SEWERS

- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Rising Main
- Standby Rising Main
- Syphon
- Overflow
- Use Unknown

NON-PUBLIC SEWERS & PIPELINES

- Private Sewer/Drain
- Highway Drain
- Culverted Watercourse
- Abandoned Sewer
- Status Unknown
- Section 104 - Foul
- Section 104 - Surface
- Section 104 - Combined
- Private Rising Main
- Effluent Disposal Main
- Cable

OTHER STRUCTURES

- Attenuation Tank
- Storage Tank
- Chamber
- Tunnel
- Interceptor
- Thrust Block
- Kiosk

STRUCTURES

- Manhole - Foul
- Manhole - Surface
- Manhole - Combined
- Outfall
- Inlet
- Lamphole
- Bifurcation - Foul
- Bifurcation - Surface
- Bifurcation - Combined
- Combined Sewage Overflow
- Pumping Station - Surface
- Pumping Stn - Foul/Combined
- Gully
- Vent Column
- Telemetry Point
- Rodding Eye
- Catchpit
- Flushing Chamber
- Soakaway
- Non Return Valve
- Air Valve
- Washout
- Hatch Box

Colours generally indicate the use of the sewer/drain (i.e Red - Foul, Dark Blue - Surface, Magenta - Combined/Dual Use, Light Green - Highway Drain, Mid Green - Overflow) styles of line are shown on the key in sample/typical colours.

SUPPLY

WATER MAINS

- Distribution Main
- Washout Main
- Raw Water Main
- Abandoned Main
- Private Main

FITTINGS

- Fire Hydrant
- Washout Hydrant
- Other Fitting

Wessex Water
YTL GROUP

Printed: 19/08/2024

Map Scale - 1:1,250

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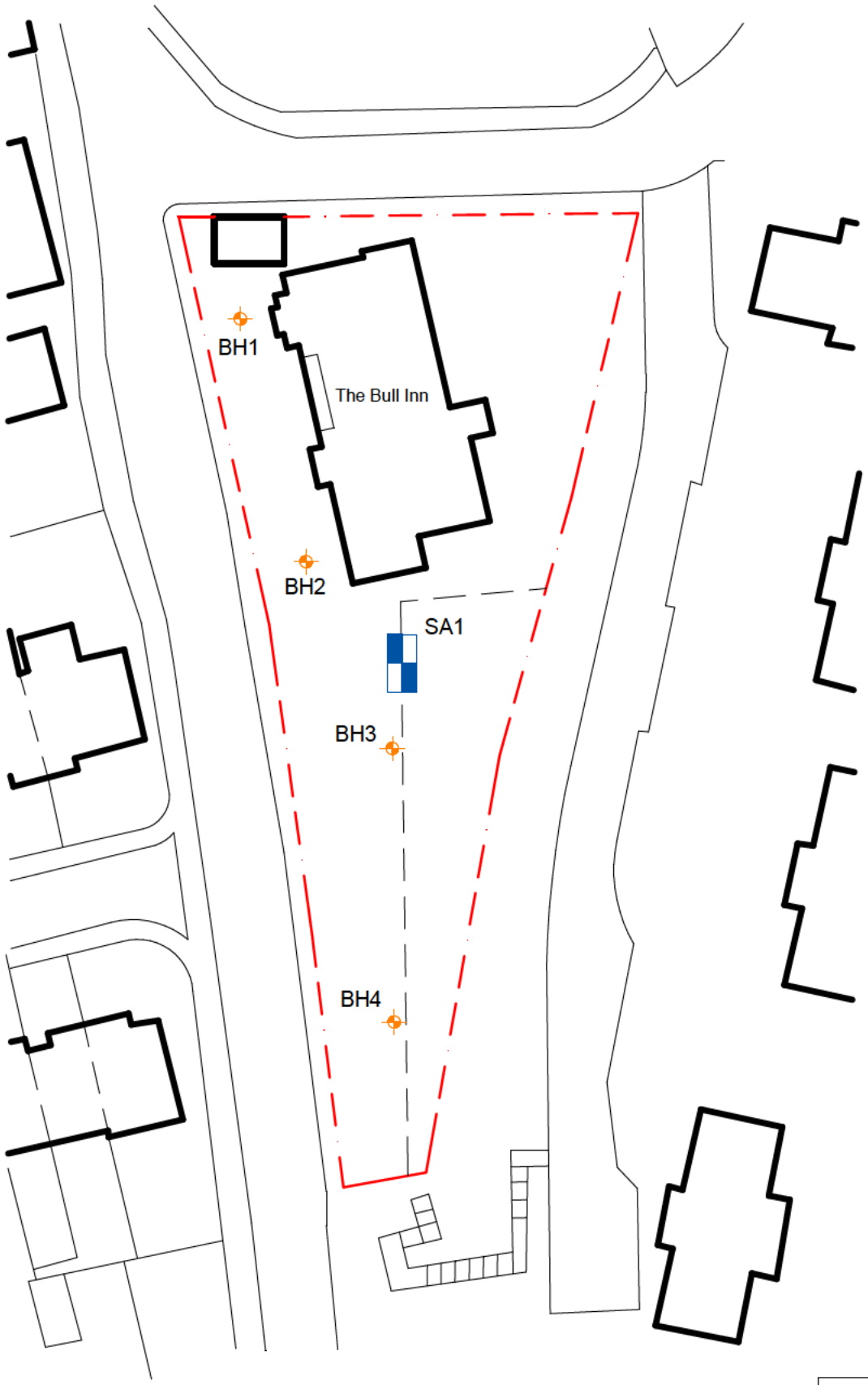
Appendix No	1
Sheet No	1
Job No	19180
Date	Oct 2024

The Bull Inn, 333 Crew's Hole Road, Bristol, BS5 8BQ

Site Plan



Not to Scale

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Appendix No. : 4
Sheet No. : 1
Job No. : 19180
Date : Oct-24

Soakaway No.: SA1 **Site Address:** The Bull Inn, 333 Crew's Hole Road, Bristol. BS5 8BQ **Fill No.:** One

B.R.E 365 - Soil Infiltration Rate

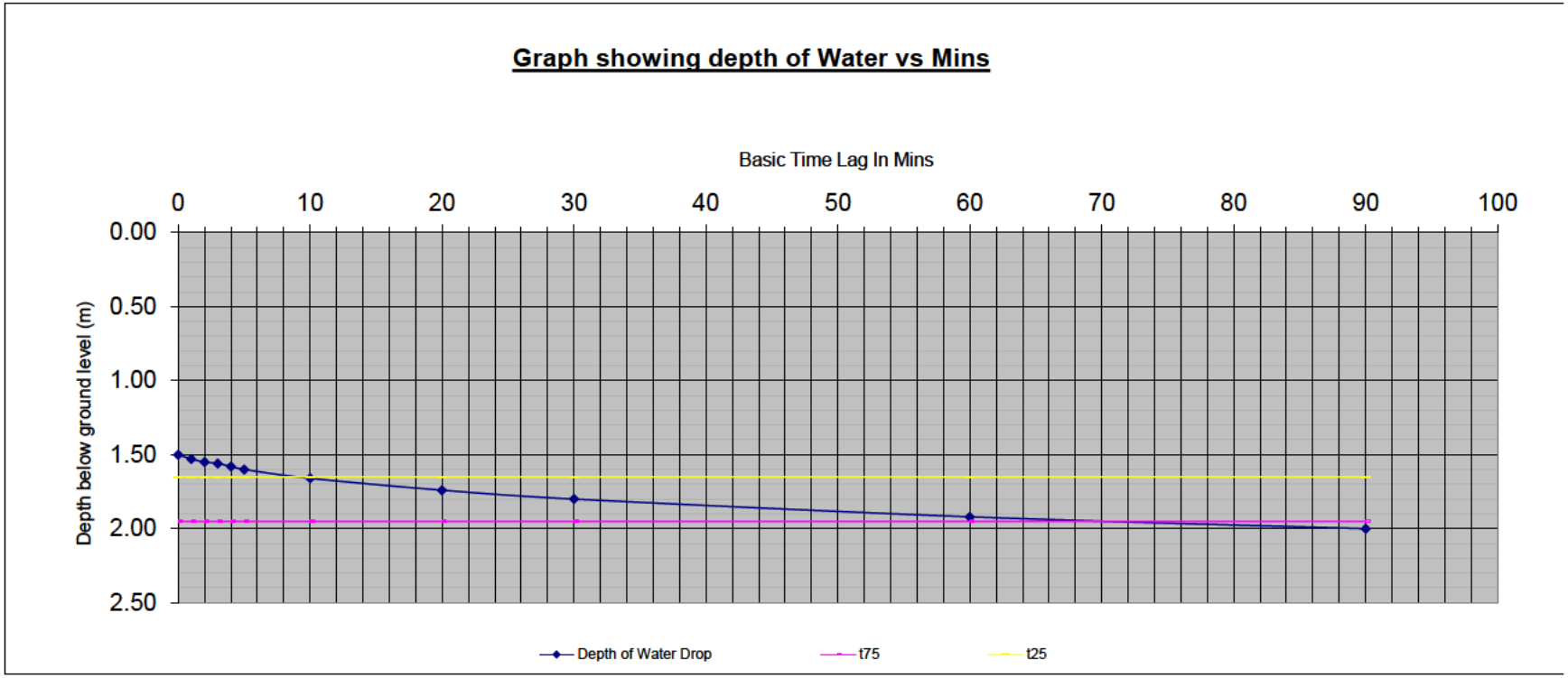
Depth of Test Hole		2.10 m
Dimensions of Test Hole	Width	0.60 m
	Length	1.60 m
Depth to Top of Water at Start of Test		1.50 m
Depth to discharge Drain		1.00 m

75%	0.15
25%	0.45
V75%-25%	0.29
ap50	3.38
tp75-25	61

Soil Infiltration Rate is ***2.3E-05 m/s***

Start Time (Mins)	Depth of Water Drop (m)	Depth of Water (m)
0	0.000	0.600
1	0.030	0.570
2	0.050	0.550
3	0.060	0.540
4	0.080	0.520
5	0.100	0.500
10	0.160	0.440
20	0.240	0.360
30	0.300	0.300
60	0.420	0.180
90	0.500	0.100

Value to Note time at (m)	Time Equals (Mins)		
1.95	70	=	t75
1.65	9	=	t25



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Appendix No. : 4
Sheet No. : 2
Job No. : 19180
Date : Oct-24

Soakaway No.: SA1 **Site Address:** The Bull Inn, 333 Crew's Hole Road, Bristol. BS5 8BQ **Fill No.:** Two

B.R.E 365 - Soil Infiltration Rate

Depth of Test Hole		2.10 m
Dimensions of Test Hole	Width	0.60 m
	Length	1.60 m
Depth to Top of Water at Start of Test		1.50 m
Depth to discharge Drain		1.00 m

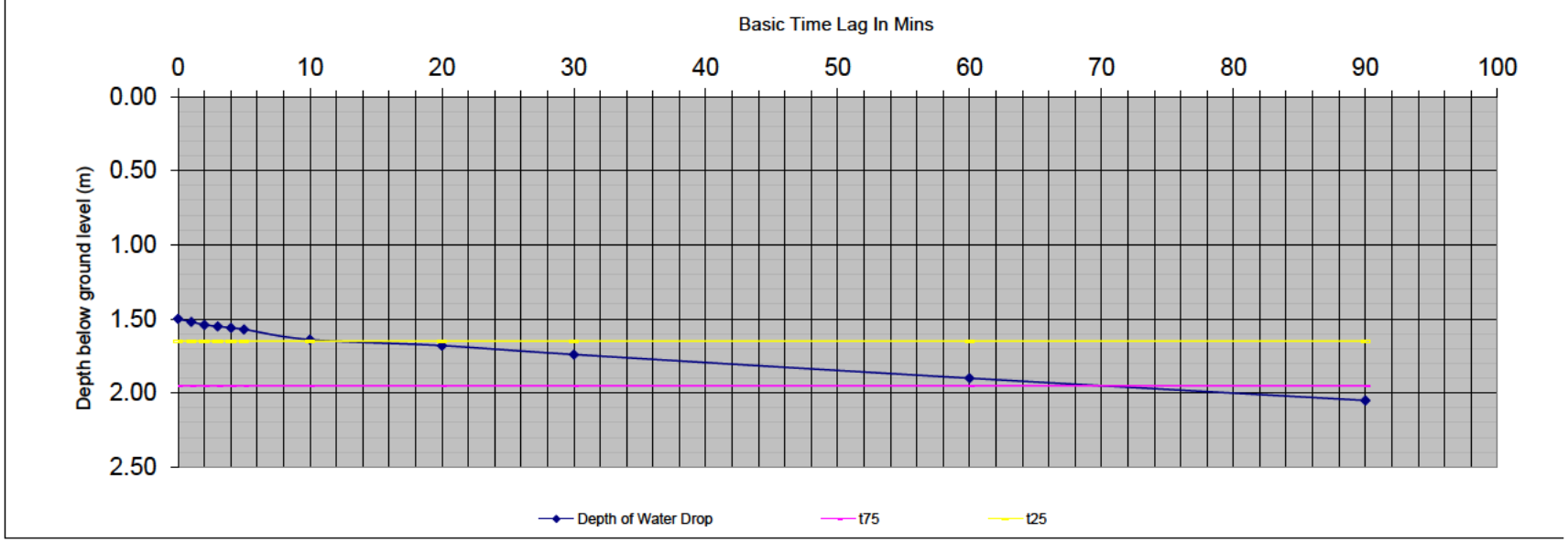
75%	0.15
25%	0.45
V75%-25%	0.29
ap50	3.38
tp75-25	59

Soil Infiltration Rate is ***2.4E-05 m/s***

Start Time (Mins)	Depth of Water Drop (m)	Depth of Water (m)
0	0.000	0.600
1	0.020	0.580
2	0.040	0.560
3	0.050	0.550
4	0.060	0.540
5	0.070	0.530
10	0.140	0.460
20	0.180	0.420
30	0.240	0.360
60	0.400	0.200
90	0.550	0.050

Value to Note time at (m)	Time Equals (Mins)		
1.95	70	=	t75
1.65	11	=	t25

Graph showing depth of Water vs Mins



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Appendix No. : 4
Sheet No. : 3
Job No. : 19180
Date : Oct-24

Soakaway No.: SA1 **Site Address:** The Bull Inn, 333 Crew's Hole Road, Bristol. BS5 8BQ **Fill No.:** Three

B.R.E 365 - Soil Infiltration Rate

Depth of Test Hole		2.10 m
Dimensions of Test Hole	Width	0.60 m
	Length	1.60 m
Depth to Top of Water at Start of Test		1.40 m
Depth to discharge Drain		1.00 m

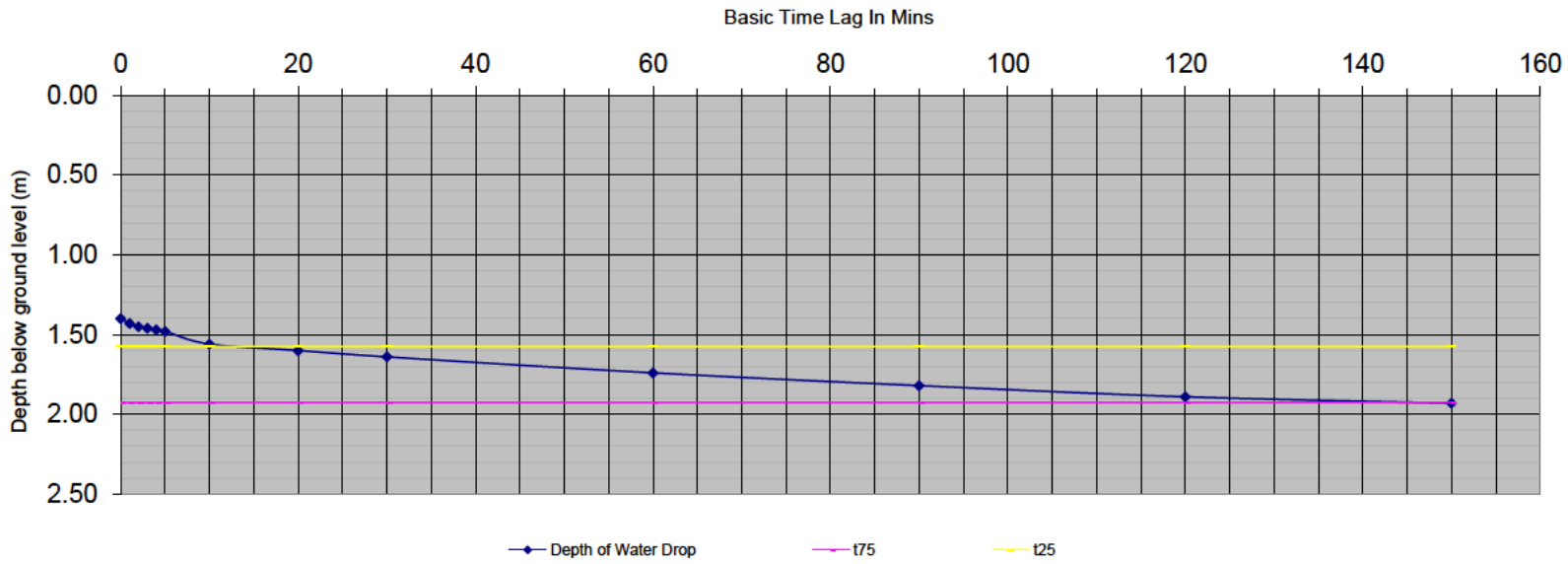
75%	0.18
25%	0.53
V75%-25%	0.34
ap50	3.38
tp75-25	132

Soil Infiltration Rate is *1.3E-05 m/s*

Start Time (Mins)	Depth of Water Drop (m)	Depth of Water (m)
0	0.000	0.700
1	0.030	0.670
2	0.050	0.650
3	0.060	0.640
4	0.070	0.630
5	0.080	0.620
10	0.160	0.540
20	0.200	0.500
30	0.240	0.460
60	0.340	0.360
90	0.420	0.280
120	0.490	0.210
150	0.530	0.170

Value to Note time at (m)	Time Equals (Mins)		
1.93	145	=	t75
1.58	13	=	t25

Graph showing depth of Water vs Mins



SOAKAWAY DESIGN

BRE 365

Project: The Bull

Made By: JC

Job No: 505
Date: 14/11/2024
Sheet No: 1 of 1
Checked By: DP

DGC CONSULTING ENGINEERS

Key:
- User Input
- Calculated
- Fixed

Assumptions:
- Internal surface area excludes area of base
- No allowance is made for time taken for run-off to reach soakaway
- Percentage run-off taken as 100%

Notes: Worst case inifltration rate has been used for this design. Please refer to microdrainage calculations for further modelling information.

Inflow			
Catchment Area	A	m²	720
M5-60	R	mm	20.3
Ratio	r	-	0.35

Outflow			
Infiltration rate	f	m/s	1.30E-05
Tank Length	L	m	17.0
Tank Width	W	m	5.0
Total Depth	d	m	1.8
Effective Depth	de	m	0.8
Internal surface area	a50	m²	35.2

Storage design			
Maximum storage required	Smax	m³	29.9
Ring diameter	Dmh	m³	0.0
Fill Porosity	p	-	0.3
Storage within soakaway	Ss	m³	20.40
Additional storage	Sadd	m³	9.5

Half Drain Down Time			
Storage (50%)	S50	m³	14.9
1/2 drain down time	ts50	hrs	9.1
Acceptable drain down time			YES

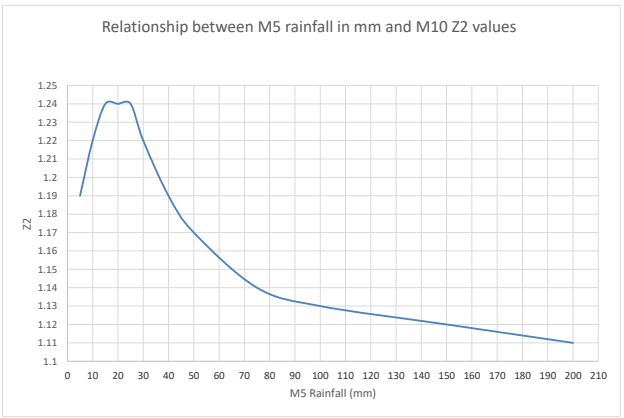
10 Year Storm Inflow Rainfall

D (mins)	Z1	M5 Rainfall (mm)	Z2	M10 Rainfall (mm)	M10 Rainfall + CC% (mm)	Inflow (m³)	Outflow (m³)	Storage (m³)
5	0.37	7.5	1.215	9.1	12.8	9.2	0.1	9.1
10	0.52	10.6	1.220	12.9	18.0	13.0	0.3	12.7
15	0.63	12.8	1.225	15.7	21.9	15.8	0.4	15.4
30	0.8	16.2	1.241	20.2	28.2	20.3	0.8	19.5
60	1	20.3	1.240	25.2	35.2	25.4	1.6	23.7
120	1.21	24.6	1.241	30.5	42.7	30.7	3.3	27.4
240	1.45	29.4	1.225	36.1	50.5	36.3	6.6	29.8
360	1.6	32.5	1.214	39.4	55.2	39.7	9.9	29.9
600	1.79	36.3	1.190	43.2	60.5	43.6	16.5	27.1
1,440	2.24	45.5	1.168	53.1	74.4	53.5	39.5	14.0
2,880	3.25	66.0	1.150	75.9	106.2	76.5	79.1	-2.6

REFERENCES

Rainfall
1) Read off M5-60min rainfall depth for site on M5-60 tab.
2) Read off r for site on "r" tab.

3) Read off Z1 value corresponding to duration (D) wanted for relevant "r" on Z1 & Z2 tab.
4) Calculate M5-D by M5-60 x Z1.
5) Using table (or graph offisite) read off Z2 value using M10 (column) and M5-D rainfall depth (row). Note rows correspond to rainfall depth.
6) Calculate MT-D rainfall depth by M5-D x Z2
7) Calculate MT-D intensity by Rainfall Depth / ((D (mins) / 60mins)



Infiltration rates - SuDS Manual CIRIA C753

Soil Type	*ISO 14688-1 description*	*Typical coefficient (m/s)*
Gravel	Sandy gravel	3 x 10^-4 to 3 x 10^-2
Sand	Slightly silty slightly clayey sand	1 x 10^-5 to 5 x 10^-5
Loamy sand	Silty slightly clayey sand	1 x 10^-4 to 3 x 10^-5
Sandy loam	Silty clayey sand	1 x 10^-7 to 1 x 10^-5
Loam	Very silty clayey sand	1 x 10^-7 to 5 x 10^-6
Silt loam	Very sandy clayey silt	1 x 10^-7 to 1 x 10^-5
Chalk (structureless)	N/A	3 x 10^-8 to 3 x 10^-6
Sandy clay loam	Very clayey silty sand	3 x 10^-10 to 3 x 1^0-7
Silty clay loam	-	1 x 10^-8 to 1 x 10^-6
Clay	-	< 3 x 10^-8
Till	Can be any texture	3 x 10^-9 to 3 x 10^-6
Rock	N/A	3 x 10^-9 to 3 x 10^-5

Values of Z1 for rainfall duration D and ratio r (Taken from BRE Digest 365 guidance)

	Minutes				*Hours*					
r	*5.00*	*10.00*	*15.00*	*30.00*	*1.00*	*2.00*	*4.00*	*6.00*	*10.00*	*24.00*
0.12	0.22	0.34	0.45	0.67	1.00	1.48	2.17	2.75	3.70	6.00
0.15	0.25	0.38	0.48	0.69	1.00	1.42	2.02	2.46	3.23	4.90
0.18	0.27	0.41	0.51	0.71	1.00	1.36	1.86	2.25	2.86	4.30
0.21	0.29	0.43	0.54	0.73	1.00	1.33	1.77	2.12	2.62	3.60
0.24	0.31	0.46	0.56	0.75	1.00	1.30	1.71	2.00	2.40	3.35
0.27	0.33	0.48	0.58	0.76	1.00	1.27	1.64	1.88	2.24	3.10
0.30	0.34	0.49	0.59	0.77	1.00	1.25	1.57	1.78	2.12	2.84
0.33	0.35	0.50	0.61	0.78	1.00	1.23	1.53	1.73	2.04	2.60
0.36	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
0.39	0.37	0.52	0.63	0.80	1.00	1.21	1.46	1.62	1.82	2.28
0.40	0.37	0.52	0.63	0.80	1.00	1.22	1.48	1.65	1.86	2.34
0.42	0.38	0.53	0.64	0.81	1.00	1.20	1.42	1.57	1.74	2.16
0.45	0.39	0.54	0.65	0.82	1.00	1.19	1.38	1.51	1.68	2.03

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Date 14/11/2024 09:22	Designed by JC
File BULL INN - DRAINAGE CALCS -...	Checked by
Innovyze	Network 2019.1

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)	1	PIMP (%)	100
M5-60 (mm)	20.300	Add Flow / Climate Change (%)	0
Ratio R	0.350	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

Time Area Diagram for Surface Network 1

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.017	4-8	0.007	8-12	0.000	12-16	0.026	16-20	0.021

Total Area Contributing (ha) = 0.072

Total Pipe Volume (m³) = 1.917

Network Design Table for Surface Network 1

« - 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	22.192	0.277	80.1	0.007	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	13.086	0.423	30.9	0.007	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	20.213	0.253	79.9	0.007	5.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	3.162	0.447	7.1	0.007	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	4.236	0.775	5.5	0.019	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	19.284	0.000	192836.0	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)
1.000	50.00	5.43	13.400	0.007	0.0	0.0	0.0	0.86	6.8	0.9
1.001	49.65	5.55	13.073	0.014	0.0	0.0	0.0	1.82	32.1	1.9
2.000	50.00	5.39	13.400	0.007	0.0	0.0	0.0	0.86	6.8	0.9
2.001	50.00	5.40	13.097	0.014	0.0	0.0	0.0	3.81	67.4	1.9
1.002	49.58	5.57	12.650	0.047	0.0	0.0	0.0	4.34	76.7	6.3
1.003	26.39	18.92	11.800	0.047	0.0	0.0	0.0	0.02	1.0«	6.3

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Date 14/11/2024 09:22 File BULL INN - DRAINAGE CALCS -...	Designed by JC Checked by	
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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	19.062	0.155	122.7	0.025	5.00	0.0	0.600	o	150	Pipe/Conduit	🔒
1.004	6.696	0.045	148.8	0.000	0.00	0.0	0.600	o	150	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	5.35	12.030	0.025	0.0	0.0	0.0	0.91	16.0	3.3
1.004	26.28	19.05	11.400	0.072	0.0	0.0	0.0	0.82	14.5	6.3

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Soakaway

Date 14/11/2024 09:22 | Designed by JC
File BULL INN - DRAINAGE CALCS -... | Checked by
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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)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	14.000	0.600	Open Manhole	300	1.000	13.400	100				
S2	14.000	0.927	Open Manhole	450	1.001	13.073	150	1.000	13.123	100	
S4	14.000	0.600	Open Manhole	300	2.000	13.400	100				
S5	13.800	0.703	Open Manhole	450	2.001	13.097	150	2.000	13.147	100	
S3	13.650	1.000	Open Manhole	450	1.002	12.650	150	1.001	12.650	150	
								2.001	12.650	150	
S7	13.584	1.784	Open Manhole	600	1.003	11.800	225	1.002	11.875	150	
S9	13.080	1.050	Open Manhole	450	3.000	12.030	150				
S10	13.382	1.982	Open Manhole	600	1.004	11.400	150	1.003	11.800	225	475
								3.000	11.875	150	475
Existing MH	13.086	1.731	Open Manhole	1800		OUTFALL		1.004	11.355	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	362905.664	172698.034	362905.664	172698.034	Required	
S2	362910.436	172676.361	362910.436	172676.361	Required	
S4	362890.997	172695.290	362890.997	172695.290	Required	
S5	362895.495	172675.584	362895.495	172675.584	Required	
S3	362897.707	172673.324	362897.707	172673.324	Required	
S7	362898.770	172669.224	362898.770	172669.224	Required	
S9	362899.068	172630.879	362899.068	172630.879	Required	
S10	362898.895	172649.940	362898.895	172649.940	Required	
Existing MH	362892.203	172649.691			No Entry	

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Date 14/11/2024 09:22 File BULL INN - DRAINAGE CALCS -...	Designed by JC Checked by	
Innovyze	Network 2019.1	

PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

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	100	S1	14.000	13.400	0.500	Open Manhole	300
1.001	o	150	S2	14.000	13.073	0.777	Open Manhole	450
2.000	o	100	S4	14.000	13.400	0.500	Open Manhole	300
2.001	o	150	S5	13.800	13.097	0.553	Open Manhole	450
1.002	o	150	S3	13.650	12.650	0.850	Open Manhole	450
1.003	o	225	S7	13.584	11.800	1.559	Open Manhole	600
3.000	o	150	S9	13.080	12.030	0.900	Open Manhole	450
1.004	o	150	S10	13.382	11.400	1.832	Open Manhole	600

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	22.192	80.1	S2	14.000	13.123	0.777	Open Manhole	450
1.001	13.086	30.9	S3	13.650	12.650	0.850	Open Manhole	450
2.000	20.213	79.9	S5	13.800	13.147	0.553	Open Manhole	450
2.001	3.162	7.1	S3	13.650	12.650	0.850	Open Manhole	450
1.002	4.236	5.5	S7	13.584	11.875	1.559	Open Manhole	600
1.003	19.284	192836.0	S10	13.382	11.800	1.357	Open Manhole	600
3.000	19.062	122.7	S10	13.382	11.875	1.357	Open Manhole	600
1.004	6.696	148.8	Existing MH	13.086	11.355	1.581	Open Manhole	1800

	The Bull SW Hydraulic Calcs Soakaway
Date 14/11/2024 09:22	Designed by JC
File BULL INN - DRAINAGE CALCS -...	Checked by
Innovyze	Network 2019.1

Network Classifications for Surface Network 1

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	S1	100	0.500	0.777	Unclassified	300	0	0.500	Unclassified
1.001	S2	150	0.777	0.850	Unclassified	450	0	0.777	Unclassified
2.000	S4	100	0.500	0.553	Unclassified	300	0	0.500	Unclassified
2.001	S5	150	0.553	0.850	Unclassified	450	0	0.553	Unclassified
1.002	S3	150	0.850	1.559	Unclassified	450	0	0.850	Unclassified
1.003	S7	225	1.357	1.559	Unclassified	600	0	1.559	Unclassified
3.000	S9	150	0.900	1.357	Unclassified	450	0	0.900	Unclassified
1.004	S10	150	1.581	1.832	Unclassified	600	0	1.832	Unclassified

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)
1.004	Existing MH	13.086	11.355	0.000	1800	0

Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	0.750	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.300	Storm Duration (mins)	30
Ratio R	0.350		

	The Bull SW Hydraulic Calcs Soakaway	
Date 14/11/2024 09:22	Designed by JC	
File BULL INN - DRAINAGE CALCS -...	Checked by	
Innovyze	Network 2019.1	

Online Controls for Surface Network 1

Pump Manhole: S10, DS/PN: 1.004, Volume (m³): 1.6

Invert Level (m) 11.400

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.900	0.0000	1.700	0.0000	2.500	0.0000
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000
0.300	0.0000	1.100	0.0000	1.900	0.0000	2.700	0.0000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000
0.500	0.0000	1.300	0.0000	2.100	0.0000	2.900	0.0000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.0000
0.700	0.0000	1.500	0.0000	2.300	0.0000		
0.800	0.0000	1.600	0.0000	2.400	0.0000		

	The Bull SW Hydraulic Calcs Soakaway
Date 14/11/2024 09:22	Designed by JC
File BULL INN - DRAINAGE CALCS -...	Checked by
Innovyze	Network 2019.1

Storage Structures for Surface Network 1

Cellular Storage Manhole: S10, DS/PN: 1.004

Invert Level (m) 11.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.04680 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.04680

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	59.5	59.5	0.900	0.0	92.3
0.800	59.5	92.3			

Manhole Headloss for Surface Network 1

PN	US/MH Name	US/MH Headloss
1.000	S1	0.500
1.001	S2	0.500
2.000	S4	0.500
2.001	S5	0.500
1.002	S3	0.500
1.003	S7	0.500
3.000	S9	0.500
1.004	S10	0.500

	The Bull SW Hydraulic Calcs Soakaway
Date 14/11/2024 09:22	Designed by JC
File BULL INN - DRAINAGE CALCS -...	Checked by
Innovyze	Network 2019.1

1 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR M5-60 (mm) 20.300	Cv (Summer) 0.750
Region England and Wales		Ratio R 0.350	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S1	15 Winter	1	+0%					13.425	-0.075
1.001	S2	15 Winter	1	+0%					13.097	-0.126
2.000	S4	15 Winter	1	+0%					13.425	-0.075
2.001	S5	15 Winter	1	+0%					13.117	-0.130
1.002	S3	15 Winter	1	+0%					12.682	-0.118
1.003	S7	15 Winter	1	+0%	10/15 Summer				11.924	-0.101
3.000	S9	15 Winter	1	+0%	100/15 Winter				12.078	-0.102
1.004	S10	360 Winter	1	+0%	2/60 Winter				11.550	0.000

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.000	0.14		0.9	OK	
1.001	S2	0.000	0.06		1.7	OK	
2.000	S4	0.000	0.14		0.9	OK	
2.001	S5	0.000	0.04		1.7	OK	
1.002	S3	0.000	0.10		5.6	OK	
1.003	S7	0.000	0.59		5.7	OK	
3.000	S9	0.000	0.22		3.3	OK	
1.004	S10	0.000	0.00		0.0	OK	

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Date 14/11/2024 09:22	Designed by JC
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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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 20.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.350	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S1	15 Winter	2	+0%					13.429	-0.071
1.001	S2	15 Winter	2	+0%					13.101	-0.122
2.000	S4	15 Winter	2	+0%					13.429	-0.071
2.001	S5	15 Winter	2	+0%					13.120	-0.127
1.002	S3	15 Winter	2	+0%					12.686	-0.114
1.003	S7	15 Winter	2	+0%	10/15 Summer				11.947	-0.078
3.000	S9	15 Winter	2	+0%	100/15 Winter				12.085	-0.095
1.004	S10	360 Winter	2	+0%	2/60 Winter				11.593	0.043

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.000	0.18		1.2	OK	
1.001	S2	0.000	0.08		2.2	OK	
2.000	S4	0.000	0.18		1.2	OK	
2.001	S5	0.000	0.05		2.2	OK	
1.002	S3	0.000	0.13		7.3	OK	
1.003	S7	0.000	0.76		7.3	OK	
3.000	S9	0.000	0.28		4.3	OK	
1.004	S10	0.000	0.00		0.0	SURCHARGED	

	The Bull SW Hydraulic Calcs Soakaway
Date 14/11/2024 09:22	Designed by JC
File BULL INN - DRAINAGE CALCS -...	Checked by
Innovyze	Network 2019.1

10 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	20.300
Region	England and Wales	Ratio R	0.350
Cv (Summer)	0.750		
Cv (Winter)	0.840		

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S1	15 Winter	10	+0%					13.436	-0.064
1.001	S2	15 Winter	10	+0%					13.109	-0.114
2.000	S4	15 Winter	10	+0%					13.436	-0.064
2.001	S5	15 Winter	10	+0%					13.127	-0.120
1.002	S3	15 Winter	10	+0%					12.699	-0.101
1.003	S7	15 Winter	10	+0%	10/15 Summer				12.040	0.015
3.000	S9	15 Winter	10	+0%	100/15 Winter				12.099	-0.081
1.004	S10	360 Winter	10	+0%	2/60 Winter				11.702	0.152

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.000	0.28		1.8	OK	
1.001	S2	0.000	0.13		3.7	OK	
2.000	S4	0.000	0.28		1.8	OK	
2.001	S5	0.000	0.09		3.7	OK	
1.002	S3	0.000	0.23		12.8	OK	
1.003	S7	0.000	1.30		12.6	SURCHARGED	
3.000	S9	0.000	0.42		6.4	OK	
1.004	S10	0.000	0.00		0.0	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	20.300
Region	England and Wales	Ratio R	0.350
Cv (Summer)	0.750		
Cv (Winter)	0.840		

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S1	15 Winter	30	+40%					13.450	-0.050
1.001	S2	15 Winter	30	+40%					13.122	-0.101
2.000	S4	15 Winter	30	+40%					13.450	-0.050
2.001	S5	15 Winter	30	+40%					13.137	-0.110
1.002	S3	15 Winter	30	+40%					12.717	-0.083
1.003	S7	15 Winter	30	+40%	10/15 Summer				12.062	0.036
3.000	S9	15 Winter	30	+40%	100/15 Winter				12.130	-0.051
1.004	S10	480 Winter	30	+40%	2/60 Winter				12.000	0.450

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.000	0.49		3.2	OK	
1.001	S2	0.000	0.23		6.6	OK	
2.000	S4	0.000	0.49		3.2	OK	
2.001	S5	0.000	0.16		6.7	OK	
1.002	S3	0.000	0.41		22.7	OK	
1.003	S7	0.000	2.31		22.4	SURCHARGED	
3.000	S9	0.000	0.75		11.3	OK	
1.004	S10	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 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	20.300
Region	England and Wales	Ratio R	0.350
Cv (Summer)	0.750		
Cv (Winter)	0.840		

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S1	15 Winter	100	+45%					13.460	-0.040
1.001	S2	15 Winter	100	+45%					13.130	-0.093
2.000	S4	15 Winter	100	+45%					13.460	-0.040
2.001	S5	15 Winter	100	+45%					13.144	-0.103
1.002	S3	15 Winter	100	+45%					12.730	-0.070
1.003	S7	480 Winter	100	+45%	10/15 Summer				12.577	0.552
3.000	S9	480 Winter	100	+45%	100/15 Winter				12.577	0.397
1.004	S10	480 Winter	100	+45%	2/60 Winter				12.576	1.026

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.000	0.66		4.3	OK	
1.001	S2	0.000	0.30		8.9	OK	
2.000	S4	0.000	0.66		4.3	OK	
2.001	S5	0.000	0.21		8.9	OK	
1.002	S3	0.000	0.55		30.4	OK	
1.003	S7	0.000	0.37		3.6	SURCHARGED	
3.000	S9	0.000	0.13		1.9	SURCHARGED	
1.004	S10	0.000	0.00		0.0	SURCHARGED	