RE-DEVELOPMENT OF EXISTING BUILDINGS AND LAND AT THE DOG & PARTRIDGE, CHIPPING, LANCS.

FRA & DRAINAGE STRATEGY

HAMILTON TECHNICAL SERVICES
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C-1050

Document Control Sheet

Re-development of Existing Buildings and land at the Dog & Partridge, Chipping, Preston, Lancs.

Flood Risk Assessment and Drainage Strategy Report

Job	Date	Issue	Copy
C1050	20th April 2023	1	
C1050	27th June 2023	2	
C1050	06th March 2024	3	
C1050	10th April 2024	4	

Originator……..G Hamilton

Checker……G Hamilton

Approver……G Hamilton

Contents

1. Introduction

1.1. Hamilton Technical Services have been commissioned by Homelife Developments Ltd., to prepare a Flood Risk Assessment and Drainage Strategy Report, in support of a re-development scheme, located on land at the former Dog & Partridge Inn, Hesketh Lane, Chipping, Preston.

1.2. The redevelopment is to convert the existing buildings to residential apartments and construct three new detached dwellings, along with access, parking and landscaping.

1.3. The site comprises an existing public house with residential facilities, car parking and additional out-buildings. The location of the site is illustrated in **Figure 1** appended to this report.

1.4. It is understood that permission is being sought to reconfigure the existing buildings, reconfigure the existing parking areas and construct four detached single storey dwellings, with associated access, driveways, landscaping and parking facilities.

2. Description of the existing site.

2.1. The site lies on the north side of Hesketh Lane, Chipping, opposite the junction with Judd Holmes Lane. The site is bounded to the west and east by a mix of commercial and residential properties.

2.2. To the north the site is bounded by agricultural land. To the south the boundary is to Hesketh Lane, Judd Holmes Lane and further agricultural properties. To the east and west the property is bounded by a mix of residential and agricultural properties.

2.3. The site is a former public house and was employed as such for many years. More recently the property has been partially used as a residence. The principal buildings are situated close to Hesketh Lane and the site is accessed at its southeast corner, from Hesketh Lane. The existing access is onto the car park area and leads to the garden areas to the rear of the main buildings. There are some small outbuildings and workshops adjacent to the eastern site boundary.

2.4. Presently the site is serviced by systems of foul and surface water drains. These systems are primarily separate with the foul effluent running to an existing sewage treatment facility located in the northwest corner of the site. Surface water run-off is directed to an existing surface water drain which passes through the northern portion of the site.

2.5. This drain runs from west to east through the site and towards Longridge Road (Back Lane) to a point behind The Bungalow. The drain then turns to run north northeast, downhill to an existing open watercourse which is a tributary of the River Loud. This watercourse flows west to east, passing under Longridge Road and flowing into the River Loud.

2.6. The surface water drain has been in existence for many decades and serves the drainage of several properties from Avondale on Hesketh Lane, east to The Bungalow on Hesketh Lane. The drain is in riparian ownership of each property through which it flows and each owner is responsible for the maintenance and repair of their portion of the drain. The drain is in good working and physical condition and has no record of exceedance flows.

2.7. There is a very small risk that in the unlikely event of a blockage in the surface water system or a very intense and prolonged rainstorm, over ground exceedance flows could occur and the excess water would flow in the same general direction as the surface water outfall drain, as illustrated by **Figure 11** of this report.

2.8. The route of the surface water drain is indicated in Blue on the location plan attached as **Figure 1** of this report. This drain is 300mm diameter and has good falls and capacity and is maintained in good condition by the property owners who make use of the drain. The treated effluent discharged from the treatment plant is discharged to this surface water drain along with treated effluent from the other serviced properties. The existing site layout and drainage is shown on **Figure 2** of this report.

2.9. Consultation of the British Geological Society maps shows the site to have a superficial Geology of “Till – Devensian, Diamicton clays” that overly bedrock of “Hodder Mudstone Formation – Mudstone”. Further consultation of the, Cranfield Institute, Soilscapes maps show the soils across the site to be “Slowly permeable, seasonally wet, acid, loamy and clayey soils” with impeded drainage.

2.10. These details are corroborated by site investigation works by others and confirm that infiltration methods will not be suitable for disposal of surface water run-off from the development. The re-developed site will continue to drain to the existing surface water drain as has been the case for several decades.

2.11. A series of storm flow calculations has been completed to determine the present rates of discharge from the site into the surface water drain. These calculations are contained in **Appendix 1** of this report. The rates of discharge are as follows; 17.4 l/s during a 1 Yr event; 22.5 l/s during a 2 Yr event; 47.7 l/s during a 30 Yr event and 61.5 l/s during a 100 Yr event. A plan showing the existing catchment zones is attached as **Figure 3** of this report.

2.12. The site is presently developed and occupied and can be classed as Brownfield. It is a requirement of redevelopment that surface water discharge rates from the site be reduced substantially, by approximately 50% and as close to Greenfield rates as is practical. The proposed re-developed site layout is illustrated on **Figure 4** of this report.

3. Proposals for Development

3.1. The development of the site will consist of the clearance of the existing out-buildings, rough grass, debris and some existing hardstanding areas. Followed by the diversion of the existing surface water drain to allow the construction of the three new detached dwellings. The conversion of the existing pub buildings to residential use along with associated access road, driveways and gardens.

3.2. In order to create space for the new detached dwellings it will be necessary to construct a short diversion of part of the existing surface water drain. It will also be necessary to remove the existing wastewater treatment facility as this is not of sufficient capacity or effectiveness to serve the re-developed site. The facility is also below the footprint of the proposed dwellings. Eventually, the majority of the existing foul drainage will be removed and replaced by new systems and a new treatment plant. A plan showing the extent of the diversion and removal of existing drainage is attached as **Figure 5** of this report.

3.3. As illustrated, the existing surface water drain crossing the site will be diverted around the new dwellings by means of two new manhole chambers containing slow bends. A slow 45^{o} bend will also be introduced between the new chambers to further relax the line of the new drain. Details of the internal layouts of the new chambers are included in **Figure 6** of this report.

3.4. The foul drainage for the re-development will be provided by a new system of drains that will outfall to a new waste water treatment plant. Treated clean run-off from this new plant will discharge into the new surface water drainage system, downstream of the new flow control chamber, before all flows discharge into the existing surface water drain and leave the site to eventually discharge to the local watercourse. A plan showing the proposed drainage layout is attached as **Figure 6** of this report.

3.5. The surface water run-off from the new and refurbished buildings, car park, access road, parking and driveway areas will be collected in a fully separate system of drains and will pass through a Hydro-brake control system before final discharge to the surface water drain. The new Hydro-brake unit will be set up to control flows from the site to much reduced rates compared to present day values. The Hydro-brake used in the flow simulation calculations will have a design head of 1.0m, a design flow of 20.0 l/s and an orifice diameter of 198mm.

3.6. As flow rates will be restricted, a surface water attenuation tank is included in the new drainage system, set just upstream of the Hydro-brake chamber. This tank will have a storage capacity of 18.24 CuM. A series of storm simulation calculations has been completed to illustrate the operation of the proposed system during storm events from 1 in 1 Yr up to 1 in 100 Yr events. These calculations are inclusive of a climate change allowance of 40% rainfall increase during the 1 in 30 Yr storm events and a 50% increase during the 1 in 100 Yr events. As virtually the whole of the site will be occupied by the new buildings, access and car parking there has been only a small allowance of 5% required for urban creep.

3.7. The series of simulation calculations cover storms up to the 1 in 100 Yr event of 600 minutes duration. The calculations show that no surface flooding or exceedance flows will be generated thus avoiding the occurrence of flooding on the site or to surrounding property. A plan showing the new surface water catchment zones is attached as **Figure** 7 of this report. Copies of a selection of the calculations are contained in **Appendix 2** of this report.

3.8. The calculations show that the maximum rate of discharge of surface water will be 8.0 l/s in a 1 in 1 Yr event; 10.5 l/s in a 1 in 2 Yr event; 19.8 l/s in a 1 in 30 Yr event and 19.8 l/s in a 1 in 100 Yr event. No surface flooding or exceedance flows will occur during the simulated storms.

3.9. These figures show that flows will be reduced in all storm events, with flows reduced from 17.4 to 8.0 l/s during a 1 Yr event **(54% reduced)**; from 22.5 to 11.5 l/s during a 2 Yr event **(49% reduced)**; from 47.7 to 19.8 l/s during a 30 Yr event **(58% reduced)** and from 61.5 to 19.8 l/s during a 100 Yr event **(68% reduced)**. These substantial reductions in discharge will provide relief against any risk of flooding to the downstream drainage system and watercourse network.

3.10. There will remain a very small risk that in the unlikely event of a blockage in the surface water system or a very intense and prolonged rainstorm, over ground exceedance flows could occur and the excess water would flow in the same general direction as the surface water outfall drain as the flows would today, as illustrated by **Figure 12** of this report.

4. Assessment of Flooding Risks

4.1. The **Flood Map for Planning.** The site, as illustrated in **Figure 8** of this report, an extract from the Gov.uk “Flood map for Planning”, falls wholly within Flood Zone 1.

4.2. **Flooding from Overland Flows.** The site falls gently from west to east. The development of the site will include the collection and conveyance of the rainfall off the new hard surfaces, through a flow control and attenuation system, to the existing outfall drainage system. The remainder of the site will be laid to grass and landscaped areas that will generate minimal overland flows. All new dwellings will be constructed at a minimum of 150mm above the surrounding ground to stop any possible inundation of the properties. The risk of flooding from this source can be considered to be low.

4.3. **Flooding from Ground Water.** Groundwater flooding occurs when water levels in the ground rise above the surface elevation. The land ls not in an n area indicated to be at risk of ground water emergence or flooding. The risk of flooding from this source can be considered to be low.

4.4. **Flooding from Sewers.** There are no foul or surface water sewers crossing through the site or near the vicinity of the site. The risk of flooding from this source can be considered to be very low.

4.5. **Flooding from Reservoirs, Canals or other Infrastructure.** Consultation of the Environment Agency flood mapping systems show that there are no reservoirs, canals or infrastructure close to the site and the risk of flooding from such sources can be considered to be very low. A copy of the relevant map extract is attached as **Figure 9** of this report.

4.6. **Flooding from Rivers or the Sea.** The site, as noted in 4.1 above, is located in Flood Zone 1 as shown on an extract taken from the plans provided on the Gov.UK website flooding information pages and attached as **Figure 8** of this report.

4.7. **Flooding from Surface Water.** Further consultation of the Gov.uk flood information mapping shows that the site is not considered to be in an area at risk of flooding due to surface water. A copy of the map extract is attached as **Figure 10** of this report. This plan shows a slight possibility that highway run-off may pass along Hesketh Lane from west to east and a small amount of these flows could run onto the site through the access way. To counteract this risk, a new channel drain will be introduced at the site entrance to cut off such flows and avoid water entering the site. The risk of flooding from this source can be considered to be very low.

4.8. **Flood Mitigation Measures.** Taking into account the lack of any residual risk of flooding occurring during a major storm event, mitigation measures will not be necessary on this development.

5. Maintenance

The developed site will remain in private ownership and will be the responsibility of the owners/occupiers of the new buildings.

On completion of the development a suitably qualified Management Company will be contracted to carry out all necessary inspections, repairs and maintenance of the communal areas and facilities on the development.

All new owners and tenants will be required to enter into a legal agreement with the Management Company. Annual fees charged to the owners and occupants will fund the works carried out by the Management Company.

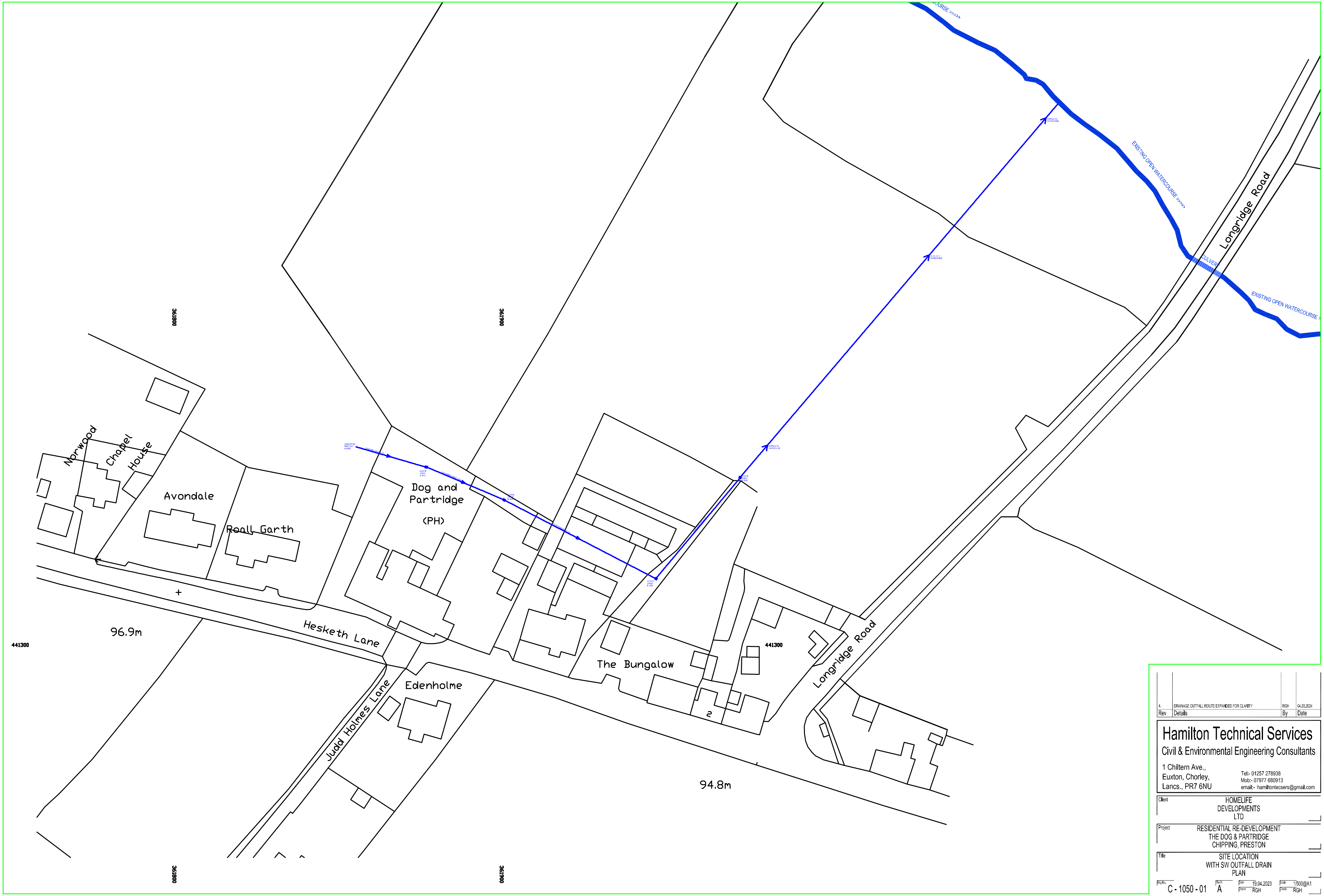
The drains, channels, attenuation tank, Hydro-brake and chambers will be inspected at six monthly intervals and will be cleaned and repaired as necessary to maintain a fully operational system of drainage and roadways.

The sewage treatment plant will be inspected, cleaned and desludged at regular intervals as dictated by the manufacturer's guidance. Work will be carried out through the Management Company by the manufacturer or suitably qualified maintenance engineers.

Figures;

Figure 1 – Site Location Plan
Figure 2 – Existing Site and Drainage Plan
Figure 3 – Existing Catchment Layout
Figure 4 – Proposed Development Layout
Figure 5 – SW Diversion and Drain Removal Plan
Figure 6 – Proposed drainage Layout
Figure 7 – Proposed SW Catchment Plan
Figure 8 – Extract from Flood Map for Planning
Figure 9 – Extract of Flood Map for Reservoir Failure
Figure 10 – Extract of Flood Map for Surface Water
Figure 11 – Existing Exceedance Routes Plan
Figure 12 _ Future Exceedance Routes Plan

Appendix 1 – Existing SW Run-off Simulation Calcs
Appendix 2 – Proposed Surface Water Run-off Calculations



Rev	Details	By	Date
A	DRAINAGE OUTFALL ROUTE EXPANDED FOR CLARITY	RGH	04.03.2024

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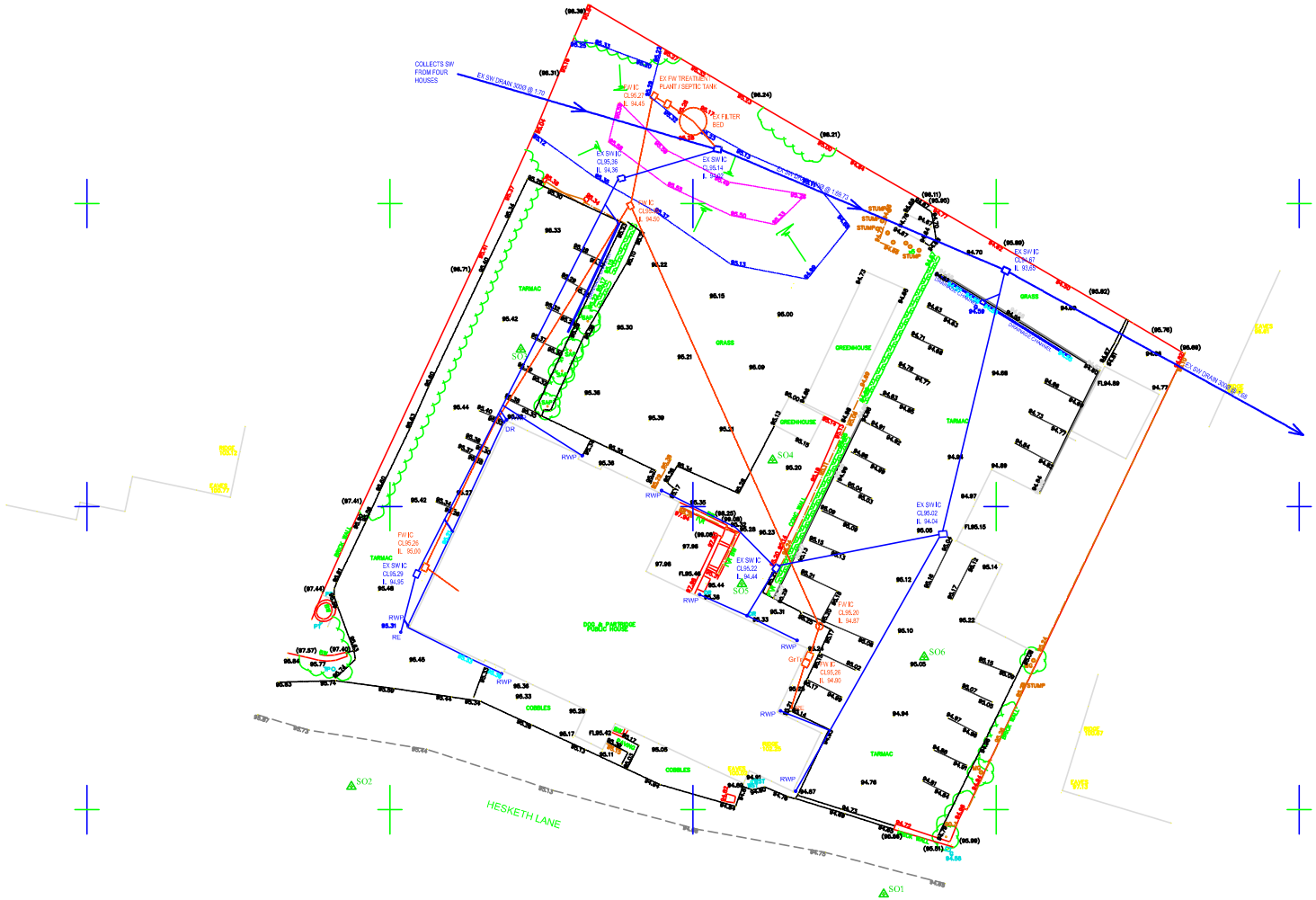
Project: RESIDENTIAL RE-DEVELOPMENT THE DOG & PARTRIDGE CHIPPING, PRESTON

Title: SITE LOCATION WITH SW OUTFALL DRAIN PLAN

Dwg.No. C - 1050 - 01 | Rev. A | Date 19.04.2023 | Drawn RGH | Scale 1/500@A1 | Check RGH



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Title: EXISTING SITE DRAINAGE LAYOUT

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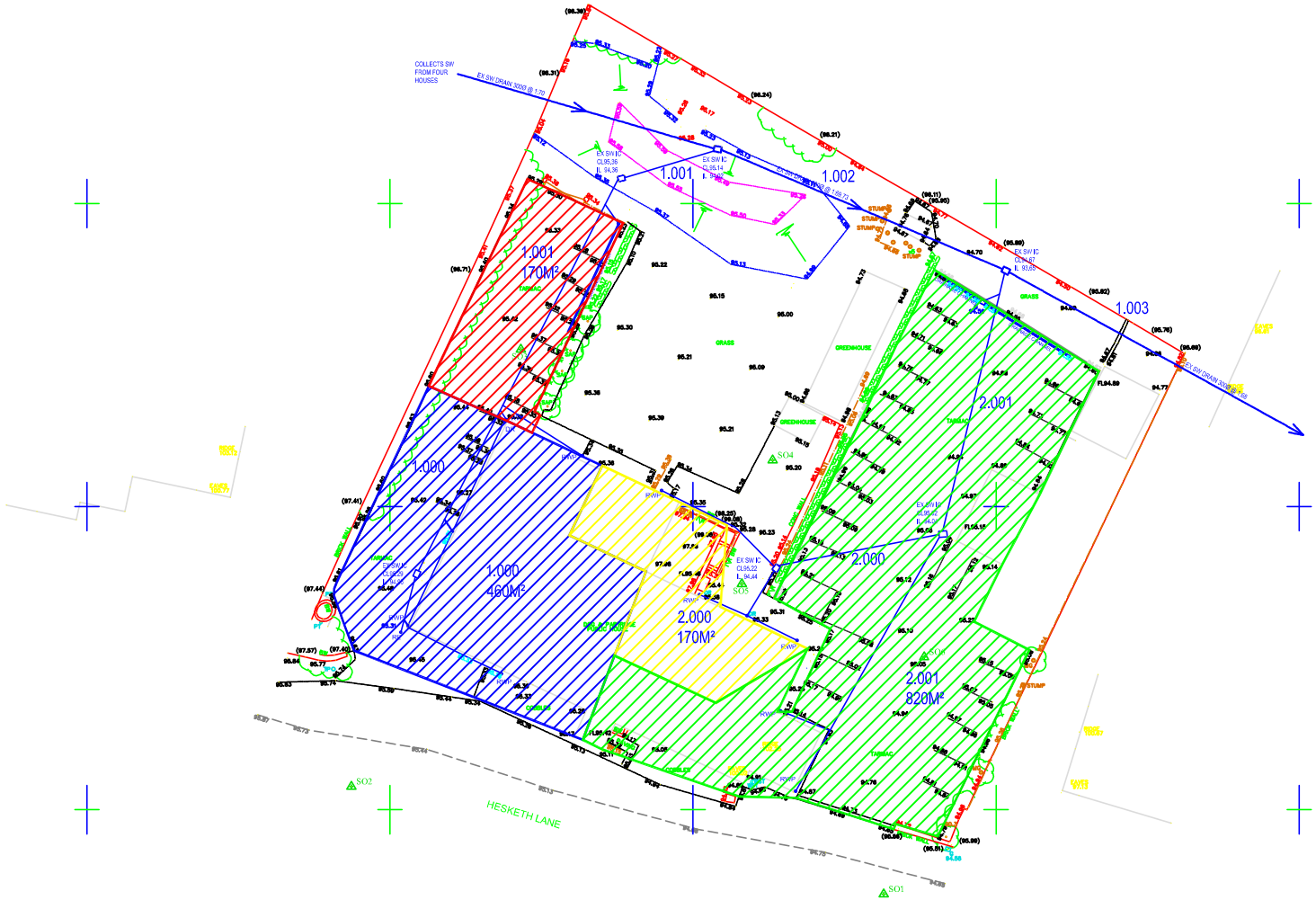

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Title: EXISTING
SW CATCHMENTS
LAYOUT

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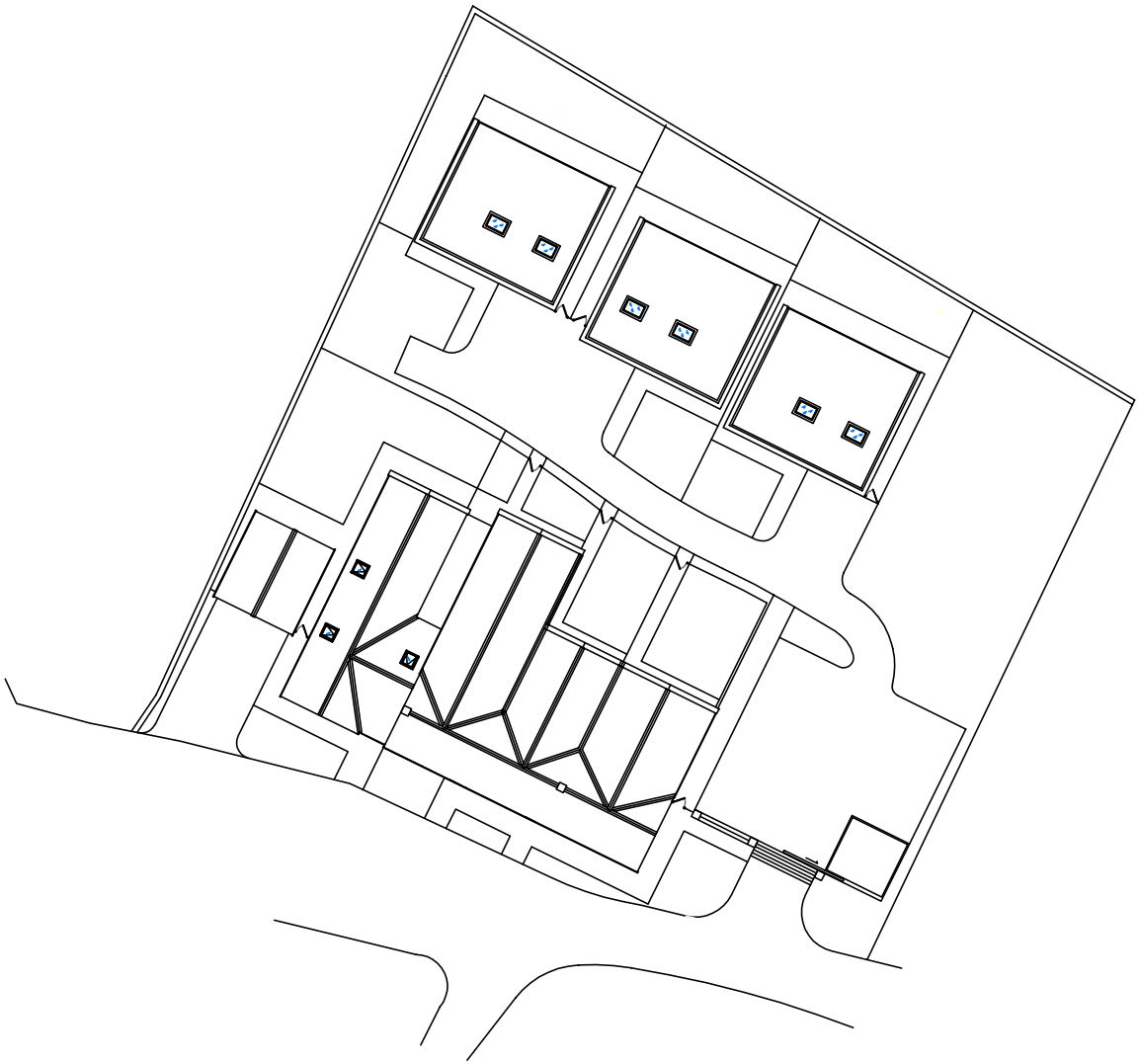

Rev	Details	By	Date
A	PLOT LAYOUT REVISED	RGH	10.04.2024

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Title: PROPOSED SITE LAYOUT

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Rev	Details	By	Date
B	PLOT LAYOUT REVISED	RGH	10.04.2024
A	DIVERSION ROUTE REVISED	RGH	20.26.2023

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Title: DIVERSION OF SW DRAIN AND ABANDONMENT OF EXISTING FW DRAINS

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Date: 19.04.2023
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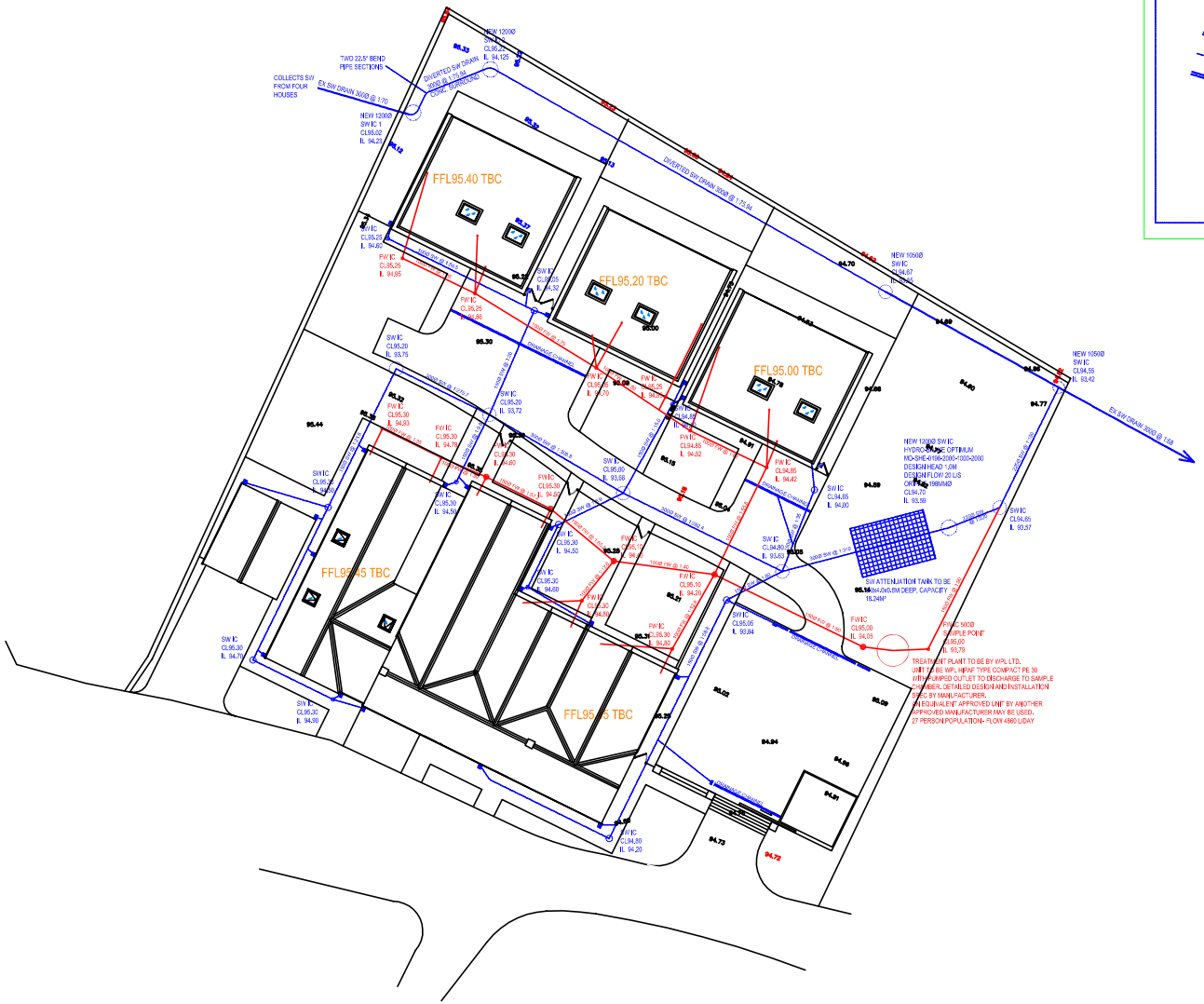

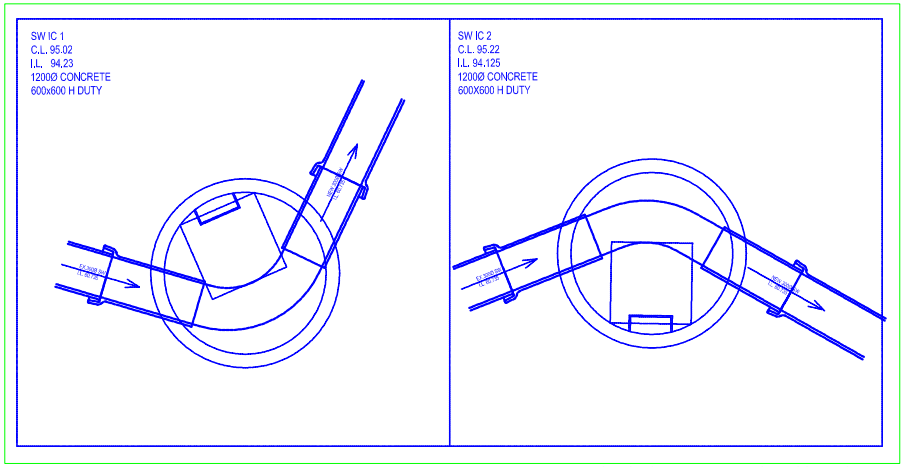

SW IC 1 & 2 INTERNAL LAYOUT - SCALE 1/20

Rev	Details	By	Date
C	PLOT LAYOUT REVISED	RGH	10.04.2024
B	FOUL AND SURFACE WATER SCRIPT UPDATED	RGH	01.03.2024
A	DIMENSION CHAMBERS REVISED AND LAYOUTS ADDED	RGH	05.06.2023

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Title: PROPOSED DRAINAGE LAYOUT

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B	PLOT LAYOUT REVISED	RGH	10.04.2024
A	DIVERSION ROUTE UPDATED	RGH	29.06.2023

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Title: PROPOSED
SW CATCHMENTS
LAYOUT

Proj. No.: C - 1050 - 06
Rev: B
Date: 19.04.2023
Drawn: RGH
File: 1200@A1
Check: RGH

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**361883/441332**	**20 Apr 2023 11:58**

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)
361883/441332

Scale
1:2500

Created
20 Apr 2023 11:58

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

0 20 40 60m

Learn more about this area's flood risk

Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

Enter a place or postcode

Maximum extent of flooding from reservoirs:

when river levels are normal | when there is also flooding from rivers | Location you selected

View the flood risk information for another location (/postcode)

Learn more about this area's flood risk

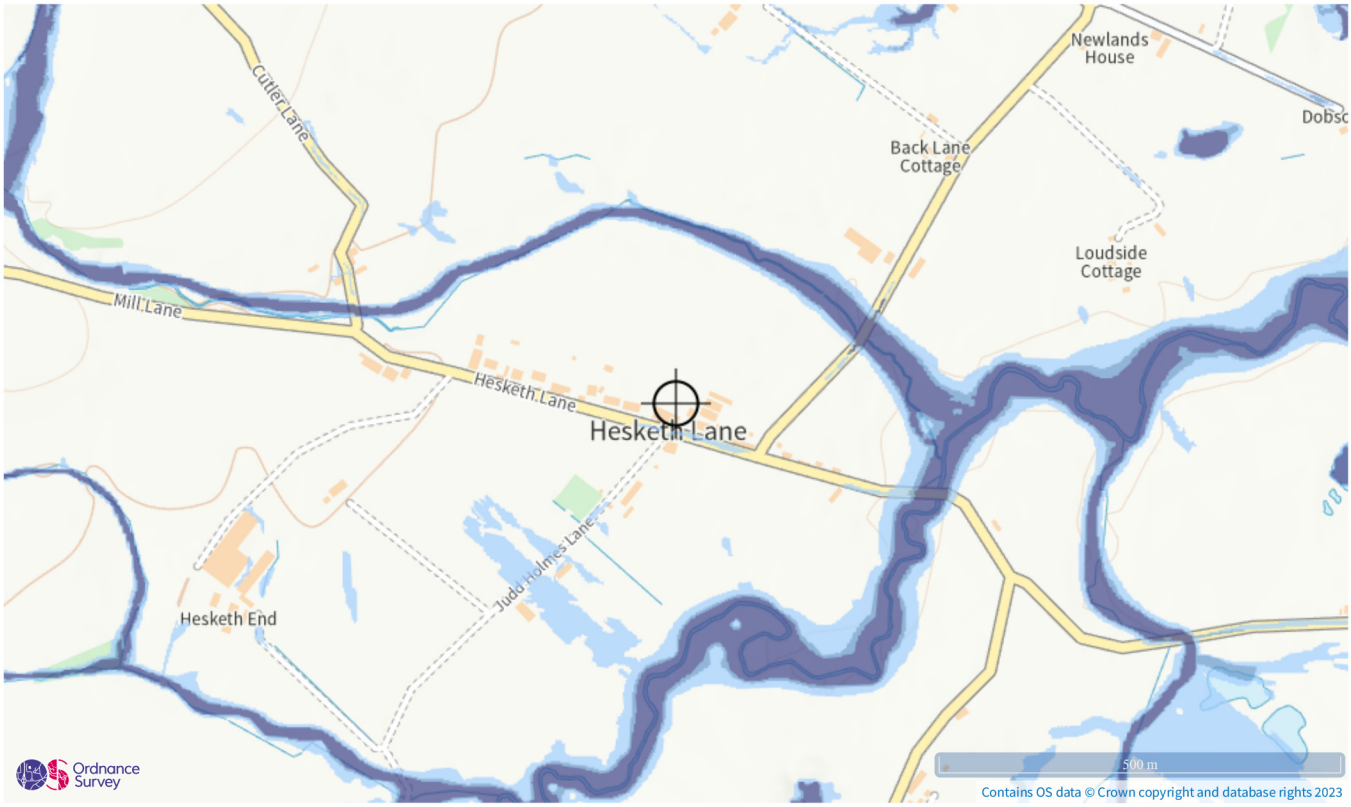
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

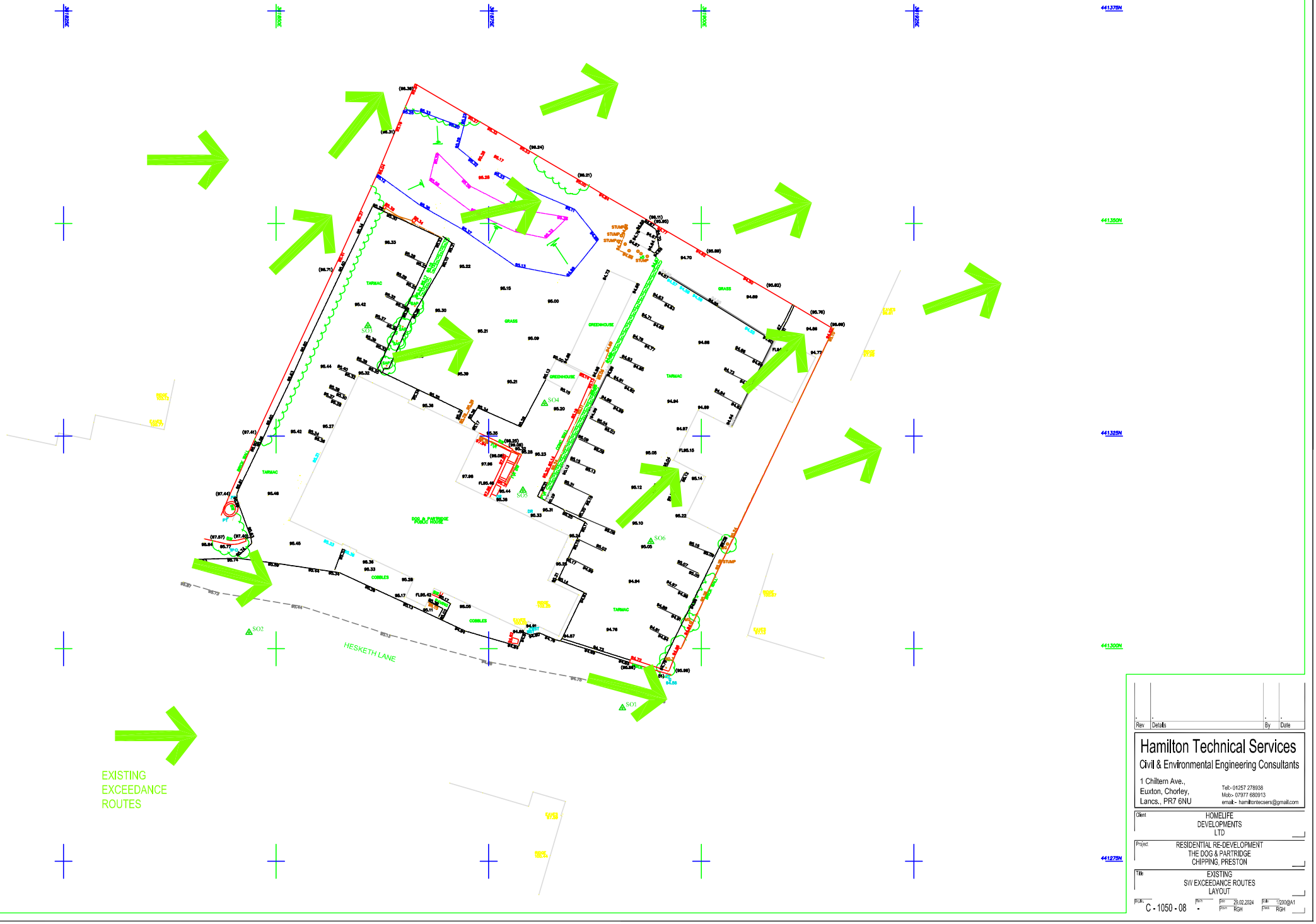
Enter a place or postcode



Extent of flooding from surface water

High Medium Low Very low Location you selected

View the flood risk information for another location (/postcode)



Rev	Details	By	Date
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Title: EXISTING
SW EXCEEDANCE ROUTES
LAYOUT

Proj. No.	Rev	Date	Scale
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FUTURE
EXCEEDANCE
ROUTES

Rev	Details	By	Date
A	PLOT LAYOUT REVISED	RGH	12.04.2024

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Title: PROPOSED
SW EXCEEDANCE ROUTES
LAYOUT

Proj. No. C - 1050 - 09 | Rev. A | Date 29.02.2024 | Drawn RGH | Scale 1:200@A1 | Check RGH

Land at former Dog & Partridge, Hesketh Lane, Chipping, Preston.

Appendix 1

Existing SW Run-off Simulation Calculations

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	36.800	0.590	62.4	0.046	5.00	0.0	0.600	o	150
1.001	8.200	0.190	43.2	0.017	0.00	0.0	0.600	o	150
1.002	25.810	0.370	69.8	0.000	0.00	0.0	0.600	o	300
2.000	14.080	0.320	44.0	0.017	5.00	0.0	0.600	o	150
2.001	22.340	0.310	72.1	0.082	0.00	0.0	0.600	o	225
1.003	20.000	0.294	68.0	0.000	0.00	0.0	0.600	o	300

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	0.00	5.48	94.950	0.046	0.0	0.0	0.0	1.28	22.5	0.0
1.001	0.00	5.57	94.360	0.063	0.0	0.0	0.0	1.54	27.1	0.0
1.002	0.00	5.80	94.020	0.063	0.0	0.0	0.0	1.89	133.2	0.0
2.000	0.00	5.15	94.440	0.017	0.0	0.0	0.0	1.52	26.9	0.0
2.001	0.00	5.40	94.040	0.099	0.0	0.0	0.0	1.54	61.3	0.0
1.003	0.00	5.97	93.650	0.162	0.0	0.0	0.0	1.91	135.0	0.0

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)
1.003	EXSWDRAIN	94.800	93.356	93.356	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model FSR Return Period (years) 1

Synthetic Rainfall Details

Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840
Ratio R	0.300	Storm Duration (mins)	15
Profile Type	Winter		

Summary of Results for 15 minute 1 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	95.001	-0.099	0.000	0.25	0.0	5.4	OK
1.001	2	94.416	-0.094	0.000	0.30	0.0	7.1	OK
1.002	3	94.067	-0.253	0.000	0.06	0.0	7.1	OK
2.000	4	94.469	-0.121	0.000	0.08	0.0	2.0	OK
2.001	5	94.106	-0.159	0.000	0.18	0.0	10.3	OK
1.003	6	93.727	-0.223	0.000	0.15	0.0	17.4	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.128	4-8	0.034

Total Area Contributing (ha) = 0.162

Total Pipe Volume (m³) = 5.170

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	36.800	0.590	62.4	0.046	5.00	0.0	0.600	o	150
1.001	8.200	0.190	43.2	0.017	0.00	0.0	0.600	o	150
1.002	25.810	0.370	69.8	0.000	0.00	0.0	0.600	o	300
2.000	14.080	0.320	44.0	0.017	5.00	0.0	0.600	o	150
2.001	22.340	0.310	72.1	0.082	0.00	0.0	0.600	o	225
1.003	20.000	0.294	68.0	0.000	0.00	0.0	0.600	o	300

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	0.00	5.48	94.950	0.046	0.0	0.0	0.0	1.28	22.5	0.0
1.001	0.00	5.57	94.360	0.063	0.0	0.0	0.0	1.54	27.1	0.0
1.002	0.00	5.80	94.020	0.063	0.0	0.0	0.0	1.89	133.2	0.0
2.000	0.00	5.15	94.440	0.017	0.0	0.0	0.0	1.52	26.9	0.0
2.001	0.00	5.40	94.040	0.099	0.0	0.0	0.0	1.54	61.3	0.0
1.003	0.00	5.97	93.650	0.162	0.0	0.0	0.0	1.91	135.0	0.0

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)
1.003	EXSWDRAIN	94.800	93.356	93.356	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model FSR Return Period (years) 2

Synthetic Rainfall Details

Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840
Ratio R	0.300	Storm Duration (mins)	15
Profile Type	Winter		

Summary of Results for 15 minute 2 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	95.009	-0.091	0.000	0.32	0.0	7.0	OK
1.001	2	94.425	-0.085	0.000	0.39	0.0	9.2	OK
1.002	3	94.075	-0.245	0.000	0.08	0.0	9.2	OK
2.000	4	94.473	-0.117	0.000	0.11	0.0	2.6	OK
2.001	5	94.115	-0.150	0.000	0.24	0.0	13.3	OK
1.003	6	93.739	-0.211	0.000	0.19	0.0	22.5	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.128	4-8	0.034

Total Area Contributing (ha) = 0.162

Total Pipe Volume (m³) = 5.170

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	36.800	0.590	62.4	0.046	5.00	0.0	0.600	o	150
1.001	8.200	0.190	43.2	0.017	0.00	0.0	0.600	o	150
1.002	25.810	0.370	69.8	0.000	0.00	0.0	0.600	o	300
2.000	14.080	0.320	44.0	0.017	5.00	0.0	0.600	o	150
2.001	22.340	0.310	72.1	0.082	0.00	0.0	0.600	o	225
1.003	20.000	0.294	68.0	0.000	0.00	0.0	0.600	o	300

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	0.00	5.48	94.950	0.046	0.0	0.0	0.0	1.28	22.5	0.0
1.001	0.00	5.57	94.360	0.063	0.0	0.0	0.0	1.54	27.1	0.0
1.002	0.00	5.80	94.020	0.063	0.0	0.0	0.0	1.89	133.2	0.0
2.000	0.00	5.15	94.440	0.017	0.0	0.0	0.0	1.52	26.9	0.0
2.001	0.00	5.40	94.040	0.099	0.0	0.0	0.0	1.54	61.3	0.0
1.003	0.00	5.97	93.650	0.162	0.0	0.0	0.0	1.91	135.0	0.0

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)
1.003	EXSWDRAIN	94.800	93.356	93.356	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model FSR Return Period (years) 30

Synthetic Rainfall Details

Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840
Ratio R	0.300	Storm Duration (mins)	15
Profile Type	Winter		

Summary of Results for 15 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	95.036	-0.064	0.000	0.61	0.0	13.3	OK
1.001	2	94.461	-0.049	0.000	0.77	0.0	18.1	OK
1.002	3	94.099	-0.221	0.000	0.15	0.0	18.2	OK
2.000	4	94.486	-0.104	0.000	0.20	0.0	5.0	OK
2.001	5	94.159	-0.106	0.000	0.55	0.0	30.7	OK
1.003	6	93.785	-0.165	0.000	0.41	0.0	47.7	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.128	4-8	0.034

Total Area Contributing (ha) = 0.162

Total Pipe Volume (m³) = 5.170

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	36.800	0.590	62.4	0.046	5.00	0.0	0.600	o	150
1.001	8.200	0.190	43.2	0.017	0.00	0.0	0.600	o	150
1.002	25.810	0.370	69.8	0.000	0.00	0.0	0.600	o	300
2.000	14.080	0.320	44.0	0.017	5.00	0.0	0.600	o	150
2.001	22.340	0.310	72.1	0.082	0.00	0.0	0.600	o	225
1.003	20.000	0.294	68.0	0.000	0.00	0.0	0.600	o	300

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	0.00	5.48	94.950	0.046	0.0	0.0	0.0	1.28	22.5	0.0
1.001	0.00	5.57	94.360	0.063	0.0	0.0	0.0	1.54	27.1	0.0
1.002	0.00	5.80	94.020	0.063	0.0	0.0	0.0	1.89	133.2	0.0
2.000	0.00	5.15	94.440	0.017	0.0	0.0	0.0	1.52	26.9	0.0
2.001	0.00	5.40	94.040	0.099	0.0	0.0	0.0	1.54	61.3	0.0
1.003	0.00	5.97	93.650	0.162	0.0	0.0	0.0	1.91	135.0	0.0

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)
1.003	EXSWDRAIN	94.800	93.356	93.356	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model FSR Return Period (years) 100

Synthetic Rainfall Details

Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840
Ratio R	0.300	Storm Duration (mins)	15
Profile Type	Winter		

Summary of Results for 15 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	95.053	-0.047	0.000	0.79	0.0	17.1	OK
1.001	2	94.484	-0.026	0.000	0.99	0.0	23.4	OK
1.002	3	94.110	-0.210	0.000	0.20	0.0	23.5	OK
2.000	4	94.492	-0.098	0.000	0.26	0.0	6.4	OK
2.001	5	94.181	-0.084	0.000	0.71	0.0	39.6	OK
1.003	6	93.807	-0.143	0.000	0.52	0.0	61.5	OK

Land at former Dog & Partridge, Hesketh Lane, Chipping, Preston.

Appendix 2

Proposed SW Run-off Simulation Calculations

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m^3) = 5.334

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	12.290	0.570	21.6	0.018	5.00	0.0	0.600	o	150
1.001	8.270	0.030	275.7	0.000	0.00	0.0	0.600	o	300
2.000	9.030	0.452	20.0	0.031	5.00	0.0	0.600	o	150
3.000	5.960	0.600	9.9	0.011	5.00	0.0	0.600	o	150
1.002	12.350	0.040	308.8	0.000	0.00	0.0	0.600	o	300
4.000	8.090	0.540	15.0	0.012	5.00	0.0	0.600	o	150
5.000	5.720	0.640	8.9	0.015	5.00	0.0	0.600	o	150
1.003	14.120	0.050	282.4	0.005	0.00	0.0	0.600	o	300
6.000	21.170	0.360	58.8	0.016	5.00	0.0	0.600	o	150
6.001	4.980	0.062	80.3	0.019	0.00	0.0	0.600	o	150
7.000	6.980	0.190	36.7	0.015	5.00	0.0	0.600	o	150
1.004	13.730	0.040	343.3	0.000	0.00	0.0	0.600	o	300

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	0.00	5.09	94.500	0.018	0.0	0.0	0.0	2.18	38.5	0.0
1.001	0.00	5.24	93.750	0.018	0.0	0.0	0.0	0.94	66.6	0.0
2.000	0.00	5.07	94.600	0.031	0.0	0.0	0.0	2.26	40.0	0.0
3.000	0.00	5.03	94.500	0.011	0.0	0.0	0.0	3.22	56.8	0.0
1.002	0.00	5.47	93.720	0.060	0.0	0.0	0.0	0.89	62.9	0.0
4.000	0.00	5.05	94.400	0.012	0.0	0.0	0.0	2.62	46.2	0.0
5.000	0.00	5.03	94.500	0.015	0.0	0.0	0.0	3.39	59.9	0.0
1.003	0.00	5.72	93.680	0.092	0.0	0.0	0.0	0.93	65.8	0.0
6.000	0.00	5.27	94.200	0.016	0.0	0.0	0.0	1.31	23.2	0.0
6.001	0.00	5.34	93.840	0.035	0.0	0.0	0.0	1.12	19.8	0.0
7.000	0.00	5.07	94.000	0.015	0.0	0.0	0.0	1.67	29.4	0.0
1.004	0.00	6.00	93.628	0.142	0.0	0.0	0.0	0.84	59.6	0.0

STORM SEWER DESIGN by the Modified Rational Method

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)
1.005	4.330	0.020	216.5	0.000	0.00	0.0	0.600	o	225
1.006	10.670	0.071	150.0	0.000	0.00	0.0	0.600	o	225

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)
1.005	0.00	6.08	93.588	0.142	0.0	0.0	0.0	0.88	35.2	0.0
1.006	0.00	6.24	93.568	0.142	0.0	0.0	0.0	1.07	42.4	0.0

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	15
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 15 minute 1 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.524	-0.126	0.000	0.06	0.0	2.2	OK
1.001	2	93.810	-0.240	0.000	0.04	0.0	2.1	OK
2.000	3	94.633	-0.117	0.000	0.11	0.0	3.7	OK
3.000	4	94.517	-0.133	0.000	0.03	0.0	1.3	OK
1.002	5	93.804	-0.216	0.000	0.14	0.0	7.0	OK
4.000	6	94.418	-0.132	0.000	0.04	0.0	1.4	OK
5.000	7	94.518	-0.132	0.000	0.04	0.0	1.8	OK
1.003	8	93.780	-0.200	0.000	0.19	0.0	10.5	OK
6.000	9	94.230	-0.120	0.000	0.09	0.0	1.9	OK
6.001	10	93.891	-0.099	0.000	0.25	0.0	3.8	OK
7.000	11	94.027	-0.123	0.000	0.07	0.0	1.8	OK
1.004	12	93.752	-0.176	0.000	0.34	0.0	15.7	OK
1.005	13	93.742	-0.071	0.000	0.30	0.0	7.3	OK
1.006	14	93.637	-0.156	0.000	0.21	0.0	7.4	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 30 minute 1 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.521	-0.129	0.000	0.05	0.0	1.8	OK
1.001	2	93.802	-0.248	0.000	0.03	0.0	1.7	OK
2.000	3	94.629	-0.121	0.000	0.09	0.0	3.0	OK
3.000	4	94.515	-0.135	0.000	0.02	0.0	1.1	OK
1.002	5	93.796	-0.224	0.000	0.11	0.0	5.7	OK
4.000	6	94.417	-0.133	0.000	0.03	0.0	1.2	OK
5.000	7	94.517	-0.133	0.000	0.03	0.0	1.5	OK
1.003	8	93.774	-0.206	0.000	0.16	0.0	8.6	OK
6.000	9	94.226	-0.124	0.000	0.07	0.0	1.6	OK
6.001	10	93.886	-0.104	0.000	0.21	0.0	3.3	OK
7.000	11	94.023	-0.127	0.000	0.06	0.0	1.5	OK
1.004	12	93.759	-0.169	0.000	0.27	0.0	12.7	OK
1.005	13	93.750	-0.063	0.000	0.32	0.0	8.0	OK
1.006	14	93.640	-0.153	0.000	0.22	0.0	8.0	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	60
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 60 minute 1 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.518	-0.132	0.000	0.04	0.0	1.2	OK
1.001	2	93.792	-0.258	0.000	0.02	0.0	1.2	OK
2.000	3	94.624	-0.126	0.000	0.06	0.0	2.1	OK
3.000	4	94.511	-0.139	0.000	0.02	0.0	0.8	OK
1.002	5	93.785	-0.235	0.000	0.08	0.0	4.1	OK
4.000	6	94.415	-0.135	0.000	0.02	0.0	0.8	OK
5.000	7	94.515	-0.135	0.000	0.02	0.0	1.0	OK
1.003	8	93.763	-0.217	0.000	0.11	0.0	6.2	OK
6.000	9	94.222	-0.128	0.000	0.05	0.0	1.1	OK
6.001	10	93.879	-0.111	0.000	0.15	0.0	2.4	OK
7.000	11	94.020	-0.130	0.000	0.04	0.0	1.0	OK
1.004	12	93.748	-0.180	0.000	0.20	0.0	9.3	OK
1.005	13	93.738	-0.075	0.000	0.29	0.0	7.1	OK
1.006	14	93.636	-0.157	0.000	0.20	0.0	7.1	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	15
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 15 minute 2 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.528	-0.122	0.000	0.08	0.0	2.8	OK
1.001	2	93.823	-0.227	0.000	0.05	0.0	2.7	OK
2.000	3	94.637	-0.113	0.000	0.14	0.0	4.8	OK
3.000	4	94.518	-0.132	0.000	0.04	0.0	1.7	OK
1.002	5	93.819	-0.201	0.000	0.18	0.0	9.1	OK
4.000	6	94.421	-0.129	0.000	0.05	0.0	1.9	OK
5.000	7	94.521	-0.129	0.000	0.05	0.0	2.3	OK
1.003	8	93.797	-0.183	0.000	0.25	0.0	13.5	OK
6.000	9	94.234	-0.116	0.000	0.11	0.0	2.5	OK
6.001	10	93.899	-0.091	0.000	0.32	0.0	5.0	OK
7.000	11	94.031	-0.119	0.000	0.09	0.0	2.3	OK
1.004	12	93.784	-0.144	0.000	0.43	0.0	20.0	OK
1.005	13	93.776	-0.037	0.000	0.40	0.0	9.9	OK
1.006	14	93.649	-0.144	0.000	0.28	0.0	10.0	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 30 minute 2 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.525	-0.125	0.000	0.06	0.0	2.3	OK
1.001	2	93.816	-0.234	0.000	0.04	0.0	2.2	OK
2.000	3	94.633	-0.117	0.000	0.11	0.0	3.9	OK
3.000	4	94.517	-0.133	0.000	0.03	0.0	1.4	OK
1.002	5	93.812	-0.208	0.000	0.15	0.0	7.3	OK
4.000	6	94.419	-0.131	0.000	0.04	0.0	1.5	OK
5.000	7	94.519	-0.131	0.000	0.04	0.0	1.9	OK
1.003	8	93.799	-0.181	0.000	0.20	0.0	10.9	OK
6.000	9	94.230	-0.120	0.000	0.09	0.0	2.0	OK
6.001	10	93.893	-0.097	0.000	0.27	0.0	4.2	OK
7.000	11	94.027	-0.123	0.000	0.08	0.0	1.9	OK
1.004	12	93.792	-0.136	0.000	0.35	0.0	15.9	OK
1.005	13	93.783	-0.030	0.000	0.43	0.0	10.5	OK
1.006	14	93.651	-0.142	0.000	0.30	0.0	10.5	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	60
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 60 minute 2 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.520	-0.130	0.000	0.05	0.0	1.6	OK
1.001	2	93.803	-0.247	0.000	0.03	0.0	1.5	OK
2.000	3	94.628	-0.122	0.000	0.08	0.0	2.7	OK
3.000	4	94.514	-0.136	0.000	0.02	0.0	1.0	OK
1.002	5	93.799	-0.221	0.000	0.10	0.0	5.1	OK
4.000	6	94.416	-0.134	0.000	0.03	0.0	1.1	OK
5.000	7	94.516	-0.134	0.000	0.03	0.0	1.3	OK
1.003	8	93.785	-0.195	0.000	0.14	0.0	7.7	OK
6.000	9	94.225	-0.125	0.000	0.06	0.0	1.4	OK
6.001	10	93.885	-0.105	0.000	0.19	0.0	3.0	OK
7.000	11	94.022	-0.128	0.000	0.05	0.0	1.3	OK
1.004	12	93.776	-0.152	0.000	0.25	0.0	11.5	OK
1.005	13	93.768	-0.045	0.000	0.38	0.0	9.4	OK
1.006	14	93.646	-0.147	0.000	0.26	0.0	9.4	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	15
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 15 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.547	-0.103	0.000	0.21	0.0	7.4	OK
1.001	2	94.073	0.023	0.000	0.12	0.0	6.0	SURCHARGED
2.000	3	94.663	-0.087	0.000	0.36	0.0	12.7	OK
3.000	4	94.531	-0.119	0.000	0.10	0.0	4.5	OK
1.002	5	94.072	0.052	0.000	0.41	0.0	20.5	SURCHARGED
4.000	6	94.435	-0.115	0.000	0.12	0.0	4.9	OK
5.000	7	94.535	-0.115	0.000	0.12	0.0	6.2	OK
1.003	8	94.065	0.085	0.000	0.55	0.0	30.1	SURCHARGED
6.000	9	94.256	-0.094	0.000	0.30	0.0	6.5	OK
6.001	10	94.061	0.071	0.000	0.94	0.0	14.6	SURCHARGED
7.000	11	94.058	-0.092	0.000	0.25	0.0	6.2	OK
1.004	12	94.052	0.124	0.000	1.00	0.0	46.2	SURCHARGED
1.005	13	94.036	0.223	0.000	0.80	0.0	19.8	SURCHARGED
1.006	14	93.688	-0.105	0.000	0.56	0.0	19.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m^3) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * $10m^3$/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 30 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.542	-0.108	0.000	0.17	0.0	6.0	OK
1.001	2	94.118	0.068	0.000	0.09	0.0	4.7	SURCHARGED
2.000	3	94.655	-0.095	0.000	0.30	0.0	10.4	OK
3.000	4	94.528	-0.122	0.000	0.08	0.0	3.7	OK
1.002	5	94.117	0.097	0.000	0.33	0.0	16.4	SURCHARGED
4.000	6	94.432	-0.118	0.000	0.10	0.0	4.0	OK
5.000	7	94.532	-0.118	0.000	0.10	0.0	5.0	OK
1.003	8	94.109	0.129	0.000	0.44	0.0	24.2	SURCHARGED
6.000	9	94.250	-0.100	0.000	0.24	0.0	5.4	OK
6.001	10	94.107	0.117	0.000	0.73	0.0	11.4	SURCHARGED
7.000	11	94.103	-0.047	0.000	0.20	0.0	5.0	OK
1.004	12	94.097	0.169	0.000	0.80	0.0	36.8	SURCHARGED
1.005	13	94.081	0.268	0.000	0.80	0.0	19.8	SURCHARGED
1.006	14	93.688	-0.105	0.000	0.56	0.0	19.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	60
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 60 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.534	-0.116	0.000	0.12	0.0	4.2	OK
1.001	2	94.062	0.012	0.000	0.07	0.0	3.6	SURCHARGED
2.000	3	94.646	-0.104	0.000	0.21	0.0	7.3	OK
3.000	4	94.522	-0.128	0.000	0.05	0.0	2.6	OK
1.002	5	94.060	0.040	0.000	0.24	0.0	12.2	SURCHARGED
4.000	6	94.426	-0.124	0.000	0.07	0.0	2.8	OK
5.000	7	94.526	-0.124	0.000	0.07	0.0	3.5	OK
1.003	8	94.053	0.073	0.000	0.33	0.0	18.0	SURCHARGED
6.000	9	94.241	-0.109	0.000	0.17	0.0	3.7	OK
6.001	10	94.051	0.061	0.000	0.51	0.0	7.9	SURCHARGED
7.000	11	94.047	-0.103	0.000	0.14	0.0	3.5	OK
1.004	12	94.042	0.114	0.000	0.60	0.0	27.8	SURCHARGED
1.005	13	94.025	0.212	0.000	0.80	0.0	19.8	SURCHARGED
1.006	14	93.688	-0.105	0.000	0.56	0.0	19.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	15
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 15 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.556	-0.094	0.000	0.29	0.0	10.2	OK
1.001	2	94.310	0.260	0.000	0.15	0.0	7.7	SURCHARGED
2.000	3	94.676	-0.074	0.000	0.50	0.0	17.6	OK
3.000	4	94.536	-0.114	0.000	0.13	0.0	6.3	OK
1.002	5	94.309	0.289	0.000	0.56	0.0	28.2	SURCHARGED
4.000	6	94.442	-0.108	0.000	0.17	0.0	6.8	OK
5.000	7	94.542	-0.108	0.000	0.17	0.0	8.5	OK
1.003	8	94.302	0.322	0.000	0.77	0.0	41.8	SURCHARGED
6.000	9	94.310	-0.040	0.000	0.41	0.0	9.0	OK
6.001	10	94.299	0.309	0.000	1.18	0.0	18.4	SURCHARGED
7.000	11	94.296	0.146	0.000	0.34	0.0	8.5	SURCHARGED
1.004	12	94.290	0.362	0.000	1.36	0.0	62.8	SURCHARGED
1.005	13	94.273	0.460	0.000	0.80	0.0	19.8	SURCHARGED
1.006	14	93.688	-0.105	0.000	0.56	0.0	19.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m^3) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m^3/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 30 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.550	-0.100	0.000	0.24	0.0	8.4	OK
1.001	2	94.429	0.379	0.000	0.12	0.0	5.8	SURCHARGED
2.000	3	94.667	-0.083	0.000	0.41	0.0	14.5	OK
3.000	4	94.533	-0.117	0.000	0.11	0.0	5.2	OK
1.002	5	94.429	0.409	0.000	0.45	0.0	22.9	SURCHARGED
4.000	6	94.437	-0.113	0.000	0.14	0.0	5.6	OK
5.000	7	94.537	-0.113	0.000	0.14	0.0	7.0	OK
1.003	8	94.424	0.444	0.000	0.64	0.0	34.8	SURCHARGED
6.000	9	94.428	0.078	0.000	0.34	0.0	7.5	SURCHARGED
6.001	10	94.421	0.431	0.000	0.88	0.0	13.7	SURCHARGED
7.000	11	94.417	0.267	0.000	0.27	0.0	6.8	SURCHARGED
1.004	12	94.415	0.487	0.000	1.11	0.0	51.1	SURCHARGED
1.005	13	94.401	0.588	0.000	0.80	0.0	19.8	SURCHARGED
1.006	14	93.688	-0.105	0.000	0.56	0.0	19.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	60
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 60 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.541	-0.109	0.000	0.17	0.0	5.9	OK
1.001	2	94.406	0.356	0.000	0.09	0.0	4.4	SURCHARGED
2.000	3	94.655	-0.095	0.000	0.29	0.0	10.2	OK
3.000	4	94.527	-0.123	0.000	0.08	0.0	3.6	OK
1.002	5	94.405	0.385	0.000	0.33	0.0	16.7	SURCHARGED
4.000	6	94.431	-0.119	0.000	0.10	0.0	4.0	OK
5.000	7	94.532	-0.118	0.000	0.10	0.0	4.9	OK
1.003	8	94.399	0.419	0.000	0.47	0.0	25.6	SURCHARGED
6.000	9	94.407	0.057	0.000	0.24	0.0	5.3	SURCHARGED
6.001	10	94.397	0.407	0.000	0.64	0.0	9.9	SURCHARGED
7.000	11	94.393	0.243	0.000	0.19	0.0	4.7	SURCHARGED
1.004	12	94.388	0.460	0.000	0.82	0.0	37.9	SURCHARGED
1.005	13	94.372	0.559	0.000	0.80	0.0	19.8	SURCHARGED
1.006	14	93.688	-0.105	0.000	0.56	0.0	19.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m^3) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m^3/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	120
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 120 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.533	-0.117	0.000	0.11	0.0	3.9	OK
1.001	2	94.177	0.127	0.000	0.07	0.0	3.3	SURCHARGED
2.000	3	94.644	-0.106	0.000	0.19	0.0	6.6	OK
3.000	4	94.521	-0.129	0.000	0.05	0.0	2.4	OK
1.002	5	94.176	0.156	0.000	0.23	0.0	11.6	SURCHARGED
4.000	6	94.425	-0.125	0.000	0.06	0.0	2.6	OK
5.000	7	94.525	-0.125	0.000	0.06	0.0	3.2	OK
1.003	8	94.169	0.189	0.000	0.32	0.0	17.7	SURCHARGED
6.000	9	94.239	-0.111	0.000	0.16	0.0	3.4	OK
6.001	10	94.167	0.177	0.000	0.44	0.0	6.9	SURCHARGED
7.000	11	94.163	0.013	0.000	0.13	0.0	3.2	SURCHARGED
1.004	12	94.158	0.230	0.000	0.58	0.0	26.9	SURCHARGED
1.005	13	94.140	0.327	0.000	0.80	0.0	19.8	SURCHARGED
1.006	14	93.688	-0.105	0.000	0.56	0.0	19.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	180
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 180 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.529	-0.121	0.000	0.08	0.0	2.9	OK
1.001	2	93.990	-0.060	0.000	0.05	0.0	2.7	OK
2.000	3	94.638	-0.112	0.000	0.14	0.0	5.0	OK
3.000	4	94.519	-0.131	0.000	0.04	0.0	1.8	OK
1.002	5	93.989	-0.031	0.000	0.18	0.0	9.2	OK
4.000	6	94.421	-0.129	0.000	0.05	0.0	1.9	OK
5.000	7	94.521	-0.129	0.000	0.05	0.0	2.4	OK
1.003	8	93.982	0.002	0.000	0.25	0.0	13.9	SURCHARGED
6.000	9	94.234	-0.116	0.000	0.12	0.0	2.6	OK
6.001	10	93.980	-0.010	0.000	0.35	0.0	5.5	OK
7.000	11	94.031	-0.119	0.000	0.10	0.0	2.4	OK
1.004	12	93.971	0.043	0.000	0.47	0.0	21.4	SURCHARGED
1.005	13	93.954	0.141	0.000	0.78	0.0	19.4	SURCHARGED
1.006	14	93.686	-0.107	0.000	0.54	0.0	19.4	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m^3) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m^3/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	240
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 240 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.525	-0.125	0.000	0.07	0.0	2.4	OK
1.001	2	93.908	-0.142	0.000	0.05	0.0	2.3	OK
2.000	3	94.634	-0.116	0.000	0.12	0.0	4.1	OK
3.000	4	94.517	-0.133	0.000	0.03	0.0	1.5	OK
1.002	5	93.906	-0.114	0.000	0.15	0.0	7.7	OK
4.000	6	94.419	-0.131	0.000	0.04	0.0	1.6	OK
5.000	7	94.519	-0.131	0.000	0.04	0.0	2.0	OK
1.003	8	93.900	-0.080	0.000	0.22	0.0	11.8	OK
6.000	9	94.231	-0.119	0.000	0.10	0.0	2.1	OK
6.001	10	93.901	-0.089	0.000	0.30	0.0	4.6	OK
7.000	11	94.028	-0.122	0.000	0.08	0.0	2.0	OK
1.004	12	93.890	-0.038	0.000	0.39	0.0	18.2	OK
1.005	13	93.875	0.062	0.000	0.72	0.0	17.8	SURCHARGED
1.006	14	93.680	-0.113	0.000	0.50	0.0	17.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m^3) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m^3/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	360
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 360 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.522	-0.128	0.000	0.05	0.0	1.8	OK
1.001	2	93.848	-0.202	0.000	0.03	0.0	1.8	OK
2.000	3	94.630	-0.120	0.000	0.09	0.0	3.1	OK
3.000	4	94.515	-0.135	0.000	0.02	0.0	1.1	OK
1.002	5	93.847	-0.173	0.000	0.12	0.0	5.8	OK
4.000	6	94.417	-0.133	0.000	0.03	0.0	1.2	OK
5.000	7	94.517	-0.133	0.000	0.03	0.0	1.5	OK
1.003	8	93.842	-0.138	0.000	0.16	0.0	8.9	OK
6.000	9	94.226	-0.124	0.000	0.07	0.0	1.6	OK
6.001	10	93.888	-0.102	0.000	0.22	0.0	3.5	OK
7.000	11	94.023	-0.127	0.000	0.06	0.0	1.5	OK
1.004	12	93.834	-0.094	0.000	0.30	0.0	13.8	OK
1.005	13	93.823	0.010	0.000	0.55	0.0	13.6	SURCHARGED
1.006	14	93.664	-0.129	0.000	0.38	0.0	13.6	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m³) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	480
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 480 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.519	-0.131	0.000	0.04	0.0	1.4	OK
1.001	2	93.817	-0.233	0.000	0.03	0.0	1.4	OK
2.000	3	94.626	-0.124	0.000	0.07	0.0	2.5	OK
3.000	4	94.513	-0.137	0.000	0.02	0.0	0.9	OK
1.002	5	93.815	-0.205	0.000	0.09	0.0	4.8	OK
4.000	6	94.416	-0.134	0.000	0.02	0.0	1.0	OK
5.000	7	94.516	-0.134	0.000	0.02	0.0	1.2	OK
1.003	8	93.808	-0.172	0.000	0.13	0.0	7.3	OK
6.000	9	94.223	-0.127	0.000	0.06	0.0	1.3	OK
6.001	10	93.883	-0.107	0.000	0.18	0.0	2.8	OK
7.000	11	94.021	-0.129	0.000	0.05	0.0	1.2	OK
1.004	12	93.801	-0.127	0.000	0.24	0.0	11.3	OK
1.005	13	93.792	-0.021	0.000	0.45	0.0	11.2	OK
1.006	14	93.654	-0.139	0.000	0.31	0.0	11.2	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.050

Total Area Contributing (ha) = 0.142

Total Pipe Volume (m^3) = 5.334

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)
1.006	SW DRAIN	94.550	93.497	93.500	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	50.000
Hot Start (mins)	0	MADD Factor * 10m^3/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	600
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference	MD-SHE-0198-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	198
Invert Level (m)	93.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	19.9
Flush-Flo™	0.339	19.9
Kick-Flo®	0.720	17.0
Mean Flow over Head Range	-	16.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	1.200	21.7	3.000	33.6	7.000	50.6
0.200	18.6	1.400	23.3	3.500	36.2	7.500	52.4
0.300	19.8	1.600	24.9	4.000	38.6	8.000	54.0
0.400	19.8	1.800	26.3	4.500	40.9	8.500	55.6
0.500	19.4	2.000	27.7	5.000	43.0	9.000	57.2
0.600	18.8	2.200	29.0	5.500	45.1	9.500	58.7
0.800	17.9	2.400	30.2	6.000	47.0		
1.000	19.9	2.600	31.4	6.500	48.9		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.005

Invert Level (m) 93.588 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 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	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Summary of Results for 600 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	94.518	-0.132	0.000	0.04	0.0	1.2	OK
1.001	2	93.801	-0.249	0.000	0.02	0.0	1.2	OK
2.000	3	94.624	-0.126	0.000	0.06	0.0	2.1	OK
3.000	4	94.511	-0.139	0.000	0.02	0.0	0.7	OK
1.002	5	93.798	-0.222	0.000	0.08	0.0	4.1	OK
4.000	6	94.414	-0.136	0.000	0.02	0.0	0.8	OK
5.000	7	94.515	-0.135	0.000	0.02	0.0	1.0	OK
1.003	8	93.787	-0.193	0.000	0.11	0.0	6.2	OK
6.000	9	94.221	-0.129	0.000	0.05	0.0	1.1	OK
6.001	10	93.879	-0.111	0.000	0.15	0.0	2.4	OK
7.000	11	94.019	-0.131	0.000	0.04	0.0	1.0	OK
1.004	12	93.779	-0.149	0.000	0.21	0.0	9.6	OK
1.005	13	93.770	-0.043	0.000	0.39	0.0	9.6	OK
1.006	14	93.647	-0.146	0.000	0.27	0.0	9.6	OK