SIMPLE INDEX APPROACH: TOOL

HRW shall not be liable for any direct or indirect damage claim, loss, cost, expense or liability howsoever arising out of the use or impossibility to use the tools, even when HRW has been informed of the possibility of the same. The user hereby indemnifies HRW from and against any damage claim, loss, expense or liability resulting from any action taken against HRW that is related in any way to the use of the tool or any reliance made in respect of the output of such use by any person whatsoever. HRW does not guarantee that the tool's functions meet the requirements of any person, nor that the tool is free from errors.

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST	RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP
USER ENTRY	USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

Runoff Area Land Use Description	Hazard Level	Pollution Hazard Indices: Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): → Other	Enter User Defined Indices in row below			
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:				
Landuse Pollution Hazard Index		0	0	0

DESIGN CONDITIONS

1	2
Where indices are approved by the environmental regulator as part of the required risk assessment process, these should be entered in the 'User Defined Indices' row below. If indices are not considered appropriate, the risk assessment should use alternative measures of pollution hazard for the site.	In Scotland and Northern Ireland, the environmental regulator should be consulted as part of the licensing process required for High Risk sites. In England and Wales, the environmental regulator should be consulted prior to design (for pre-permitting advice) to determine the most appropriate design approach and requirements for risk assessment.

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

SuDS Component Description		Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: → Proprietary treatment system	Enter User Defined Indices in row below			
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: → None				
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: → None				
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows: TRAPPED GULLY	SuDS Component 1	1	1	1
Aggregated Surface Water Pollution Mitigation Index		>0.95	>0.95	>0.95

DESIGN CONDITIONS

1	2	3
Detailed assessment of performance of designed component in reducing inflow concentrations of each pollutant type required as evidence of adopted indices. Enter indices approved by the environmental regulator in appropriate 'User Defined Indices' row below	SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. WAT-RM-08 (SEPA, 2014) also provides a flow chart with a summary of checks on suitability of a proprietary system	See Chapter 15 Proprietary treatment systems for approaches to demonstrate product performance. Note: a British Water/Environment Agency assessment Code of Practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: http://www.britishwater.co.uk/Publications/codes-of-practise.aspx.

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

	Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: → None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:			
Groundwater Protection Pollution Mitigation Index	0	0	0

DESIGN CONDITIONS

1	2	3	4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	>0.95	>0.95	>0.95

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Sufficiency of Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Sufficient	Sufficient	Sufficient

DESIGN CONDITIONS

1
Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SCALE IN METRES
0 5 10 20 50

N

BENCH MARK INFORMATION

All levels relate to O.S (Newlyn) Datum, Established using network RTK, Survey plotted on a plane local grid, orientated to National Grid.

FALL ARROWS SHOWING DIRECTION OF WATER FLOW ALONG SITE ROAD/PROPERTY CURTILAGES DURING EXTREME WEATHER EVENTS OR POSSIBLE BLOCKAGES

THIS DRAWING IS BASED ON PLANNING LAYOUT PROVIDED BY CLIENT
DRAWING NUMBER:- KH006/A-100
REVISION:- L
CLIENT TO ENSURE THE ABOVE LAYOUT IS CURRENT BEFORE USING THIS DRAWING FOR CONSTRUCTION PURPOSES

PLEASE NOTE THAT THIS DRAWING IS ISSUED FOR INFORMATION/TENDER PURPOSES ONLY UNTIL TECHNICAL APPROVAL HAS BEEN GRANTED.
ANY WORK UNDERTAKEN PRIOR TO TECHNICAL APPROVAL BEING GRANTED IS AT THE CLIENTS RISK.

GENERAL

1. All adoptable sewers and associated works are to comply fully with "Design and Construction Guidance" & Local Practices
2. All highway works to be to adoptable standards and to to comply fully with the Local Authority specification.
3. All private drainage works are to comply fully with part H of the Building Regulations
4. All existing invert levels to be checked by the Contractor at the start of works and any discrepancies notified to REFA.
   All levels are based on topographical survey information provided by others.
5. All materials to bear the relevant B.S.Kitemark and comply fully with the specifications.
   All concrete & concrete products must use Sulphate resistant cement (unless the site investigation report proves that sulphate attack from soils and groundwater will not occur)
6. All opening notices etc. as required under highways acts etc. are to be obtained prior to commencement of works.
   All works are to be inspected by L.A., NHBC or Relevant Water Authority as applicable.

C.D.M. REGULATIONS 2015

In line with the above regulations we are obliged to inform the Client of their responsibilities under section CDM 15/1, and residual risks that may be encountered in the construction of these works.
All design work has been carried out with Health and Safety aspects given full consideration.
Wherever possible risks have been eliminated from the design, however due to the very nature of this type of work it is not possible to remove all the risks from the design.
We would also respectfully remind the Client of his obligations to take all reasonable steps in ensuring that only competent Contractors who have a valid safety policy are employed.
They should also provide satisfactory responses at tender stage as to the manner in which they will deal with the elements of risk involved in this type of work and in particular those highlighted by REFA below:–

1. Support / treatment for ALL excavation work.
2. Guarding to edges of excavations to prevent people,materials and vehicles falling into excavation.
3. Guarding of excavations outside working hours to prevent unauthorised access.
4. Undermining to adjacent roads or structures.
5. Confined space operations.
6. Dealing with existing services.
7. Traffic management on existing highways.
8. Procedure to be followed in event of accident or emergency.
9. Method of working where contaminated ground is present on site.
10. Confirmation will be required that all operatives are adequately trained, copies of relevant training certificates to be supplied.

The above list is by no means exhaustive but it does highlight operations that present a risk to contractors and the general public.
For clarification on any item please contact REFA.

rev	Revision details	RevBy	Date

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Drawing Stage			Drawing Status		
	Draft			Comments	● Tender
●	Issued			Information	Construction
		●	Approval		As Built

Client
KELLEN HOMES LIMITED

Job title
BENNETT STREET MANCHESTER

Drawing title
FLOOD WATER EXCEEDANCE PLAN

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GEOTECHNICAL • ENVIRONMENTAL

Date	Scale	Drawn
20.06.23	1:500	AS

DRAWING No 22122/101/2 Rev

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A1 SHEET

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

D AND CG Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
299	1200	599	1500	1199	2100
449	1350	899	1800	1800	2700

>1800 Link+900 mm

SW CIRCULAR Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

225	375	525	750	900	1200	1500
300	450	600	825	1050	1350	1800

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.099	5.00	45.245	1800	386307.537	396943.285	1.341
2	0.039	5.00	45.510	1800	386278.229	396976.911	1.719
3	0.122	5.00	45.258	1800	386289.289	396996.921	1.627
4	0.038	5.00	45.226	2400	386274.763	396995.269	2.082
5	0.000		45.645	2400	386235.364	396991.165	2.601
6	0.076	5.00	45.667	2400	386216.409	396985.060	2.673
7	0.079	5.00	45.198	2100	386261.638	396903.204	1.723
8	0.092	5.00	45.438	2100	386222.860	396946.458	2.260
9	0.019	5.00	45.620	2400	386199.992	396972.247	2.679
HB2	0.068	5.00	45.808	3000	386187.851	396986.724	2.915
CWC			45.782	3600	386174.081	397001.708	2.943

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	44.606	0.600	43.904	43.791	0.113	394.7	450	5.73	50.0
1.001	2	4	18.682	0.600	43.791	43.744	0.047	397.5	450	6.04	50.0
2.000	3	4	14.620	0.600	43.631	43.594	0.037	395.1	600	5.20	50.0
1.002	4	5	39.612	0.600	43.144	43.044	0.100	396.1	1050	6.42	50.0
1.003	5	6	19.914	0.600	43.044	42.994	0.050	398.3	1050	6.61	50.0
1.004	6	9	20.825	0.600	42.994	42.941	0.053	392.9	1050	6.81	50.0
3.000	7	8	58.092	0.600	43.475	43.328	0.147	395.2	750	5.69	50.0
3.001	8	9	34.468	0.600	43.178	43.091	0.087	396.2	900	6.06	50.0
1.005	9	HB2	18.894	0.600	42.941	42.893	0.048	393.6	1050	7.00	50.0
1.006	HB2	CWC	20.350	0.600	42.893	42.839	0.054	380.0	450	7.32	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.017	161.7	13.4	0.891	1.269	0.099	0.0	87	0.623
1.001	1.013	161.2	18.7	1.269	1.032	0.138	0.0	102	0.683
2.000	1.219	344.6	16.5	1.027	1.032	0.122	0.0	88	0.640
1.002	1.725	1493.7	40.4	1.032	1.551	0.298	0.0	116	0.773
1.003	1.720	1489.5	40.4	1.551	1.623	0.298	0.0	116	0.771
1.004	1.732	1499.8	50.7	1.623	1.629	0.374	0.0	129	0.829
3.000	1.401	619.0	10.7	0.973	1.360	0.079	0.0	67	0.545
3.001	1.568	997.3	23.2	1.360	1.629	0.171	0.0	93	0.670
1.005	1.731	1498.4	76.4	1.629	1.865	0.564	0.0	158	0.932
1.006	1.037	164.9	85.7	2.465	2.493	0.632	0.0	230	1.046

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	44.606	394.7	450	SW CIRCULAR	45.245	43.904	0.891	45.510	43.791	1.269
1.001	18.682	397.5	450	SW CIRCULAR	45.510	43.791	1.269	45.226	43.744	1.032
2.000	14.620	395.1	600	SW CIRCULAR	45.258	43.631	1.027	45.226	43.594	1.032
1.002	39.612	396.1	1050	SW CIRCULAR	45.226	43.144	1.032	45.645	43.044	1.551
1.003	19.914	398.3	1050	SW CIRCULAR	45.645	43.044	1.551	45.667	42.994	1.623
1.004	20.825	392.9	1050	SW CIRCULAR	45.667	42.994	1.623	45.620	42.941	1.629
3.000	58.092	395.2	750	SW CIRCULAR	45.198	43.475	0.973	45.438	43.328	1.360
3.001	34.468	396.2	900	SW CIRCULAR	45.438	43.178	1.360	45.620	43.091	1.629
1.005	18.894	393.6	1050	SW CIRCULAR	45.620	42.941	1.629	45.808	42.893	1.865
1.006	20.350	380.0	450	SW CIRCULAR	45.808	42.893	2.465	45.782	42.839	2.493

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1800	Manhole	D AND CG	2	1800	Manhole	D AND CG
1.001	2	1800	Manhole	D AND CG	4	2400	Manhole	D AND CG
2.000	3	1800	Manhole	D AND CG	4	2400	Manhole	D AND CG
1.002	4	2400	Manhole	D AND CG	5	2400	Manhole	D AND CG
1.003	5	2400	Manhole	D AND CG	6	2400	Manhole	D AND CG
1.004	6	2400	Manhole	D AND CG	9	2400	Manhole	D AND CG
3.000	7	2100	Manhole	D AND CG	8	2100	Manhole	D AND CG
3.001	8	2100	Manhole	D AND CG	9	2400	Manhole	D AND CG
1.005	9	2400	Manhole	D AND CG	HB2	3000	Manhole	D AND CG
1.006	HB2	3000	Manhole	D AND CG	CWC	3600	Manhole	D AND CG

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Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	17.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	6.8
Summer CV	0.750	30 year (l/s)	15.2
Winter CV	0.840	100 year (l/s)	20.0
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	✓		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node HB2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	42.893	Product Number	CTL-SHE-0126-6800-0700-6800
Design Depth (m)	0.700	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.8	Min Node Diameter (mm)	1200

Node HB2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	43.550	Product Number	CTL-SHE-0125-7800-1360-7800
Design Depth (m)	1.360	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	7.8	Min Node Diameter (mm)	1200

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	92.521	26.180	1 year 60 minute winter	26.839	10.676
1 year 15 minute winter	64.927	26.180	1 year 120 minute summer	24.980	6.602
1 year 30 minute summer	60.022	16.984	1 year 120 minute winter	16.596	6.602
1 year 30 minute winter	42.121	16.984	1 year 180 minute summer	19.271	4.959
1 year 60 minute summer	40.398	10.676	1 year 180 minute winter	12.527	4.959

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 240 minute summer	15.301	4.043
1 year 240 minute winter	10.165	4.043
1 year 360 minute summer	11.775	3.030
1 year 360 minute winter	7.654	3.030
1 year 480 minute summer	9.342	2.469
1 year 480 minute winter	6.207	2.469
1 year 600 minute summer	7.682	2.101
1 year 600 minute winter	5.249	2.101
1 year 720 minute summer	6.859	1.838
1 year 720 minute winter	4.609	1.838
1 year 960 minute summer	5.653	1.489
1 year 960 minute winter	3.745	1.489
1 year 1440 minute summer	4.127	1.106
1 year 1440 minute winter	2.773	1.106
30 year 15 minute summer	226.195	64.005
30 year 15 minute winter	158.733	64.005
30 year 30 minute summer	147.452	41.724
30 year 30 minute winter	103.475	41.724
30 year 60 minute summer	98.615	26.061
30 year 60 minute winter	65.517	26.061
30 year 120 minute summer	59.946	15.842
30 year 120 minute winter	39.827	15.842
30 year 180 minute summer	45.598	11.734
30 year 180 minute winter	29.640	11.734
30 year 240 minute summer	35.759	9.450
30 year 240 minute winter	23.758	9.450
30 year 360 minute summer	26.939	6.932
30 year 360 minute winter	17.511	6.932
30 year 480 minute summer	20.981	5.545
30 year 480 minute winter	13.940	5.545
30 year 600 minute summer	17.039	4.661
30 year 600 minute winter	11.642	4.661
30 year 720 minute summer	15.093	4.045
30 year 720 minute winter	10.143	4.045
30 year 960 minute summer	12.278	3.233
30 year 960 minute winter	8.133	3.233
30 year 1440 minute summer	8.788	2.355
30 year 1440 minute winter	5.906	2.355
100 year +45% CC 15 minute summer	423.061	119.712
100 year +45% CC 15 minute winter	296.885	119.712
100 year +45% CC 30 minute summer	278.374	78.770
100 year +45% CC 30 minute winter	195.350	78.770
100 year +45% CC 60 minute summer	187.417	49.529
100 year +45% CC 60 minute winter	124.515	49.529
100 year +45% CC 120 minute summer	114.312	30.209
100 year +45% CC 120 minute winter	75.946	30.209
100 year +45% CC 180 minute summer	86.951	22.375
100 year +45% CC 180 minute winter	56.520	22.375
100 year +45% CC 240 minute summer	68.114	18.001
100 year +45% CC 240 minute winter	45.253	18.001
100 year +45% CC 360 minute summer	51.133	13.158
100 year +45% CC 360 minute winter	33.238	13.158
100 year +45% CC 480 minute summer	39.658	10.480
100 year +45% CC 480 minute winter	26.348	10.480
100 year +45% CC 600 minute summer	32.099	8.780
100 year +45% CC 600 minute winter	21.932	8.780
100 year +45% CC 720 minute summer	28.365	7.602
100 year +45% CC 720 minute winter	19.063	7.602
100 year +45% CC 960 minute summer	22.984	6.052
100 year +45% CC 960 minute winter	15.225	6.052
100 year +45% CC 1440 minute summer	16.353	4.383
100 year +45% CC 1440 minute winter	10.990	4.383

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	43.983	0.079	11.8	0.3190	0.0000	OK
15 minute winter	2	11	43.887	0.096	15.8	0.2877	0.0000	OK
15 minute winter	3	10	43.716	0.085	14.5	0.3422	0.0000	OK
60 minute winter	4	55	43.352	0.208	18.0	1.0167	0.0000	OK
60 minute winter	5	59	43.352	0.308	17.7	1.3931	0.0000	OK
60 minute winter	6	59	43.351	0.357	15.1	1.8197	0.0000	OK
15 minute winter	7	11	43.537	0.062	9.4	0.2723	0.0000	OK
60 minute winter	8	56	43.352	0.174	10.2	0.7450	0.0000	OK
60 minute winter	9	61	43.351	0.410	19.5	1.9127	0.0000	OK
60 minute winter	HB2	56	43.351	0.458	12.0	3.4543	0.0000	SURCHARGED
15 minute summer	CWC	1	42.839	0.000	6.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	11.3	0.537	0.070	0.9687	
15 minute winter	2	1.001	4	15.3	0.685	0.095	0.4186	
15 minute winter	3	2.000	4	14.1	0.647	0.041	0.3205	
60 minute winter	4	1.002	5	17.7	0.528	0.012	6.5618	
60 minute winter	5	1.003	6	10.9	0.396	0.007	4.6746	
60 minute winter	6	1.004	9	10.3	0.338	0.007	5.9296	
15 minute winter	7	3.000	8	8.3	0.552	0.013	0.8761	
60 minute winter	8	3.001	9	10.1	0.512	0.010	4.0783	
60 minute winter	9	1.005	HB2	8.8	0.242	0.006	6.3590	
60 minute winter	HB2	Hydro-Brake®	CWC	6.8				56.6
60 minute winter	HB2	Hydro-Brake®	CWC	0.0				0.0

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	44.030	0.126	28.8	0.5057	0.0000	OK
15 minute winter	2	11	43.946	0.155	39.4	0.4643	0.0000	OK
15 minute winter	3	10	43.764	0.133	35.5	0.5382	0.0000	OK
120 minute winter	4	92	43.724	0.580	27.4	2.8375	0.0000	OK
120 minute winter	5	92	43.724	0.680	22.2	3.0743	0.0000	OK
120 minute winter	6	92	43.723	0.729	21.0	3.7132	0.0000	OK
120 minute winter	7	90	43.727	0.252	10.4	1.1026	0.0000	OK
120 minute winter	8	94	43.723	0.545	15.8	2.3317	0.0000	OK
120 minute winter	9	92	43.723	0.782	18.1	3.6485	0.0000	OK
120 minute winter	HB2	92	43.723	0.830	16.3	6.2533	0.0000	SURCHARGED
15 minute summer	CWC	1	42.839	0.000	6.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	28.0	0.680	0.173	1.8685	
15 minute winter	2	1.001	4	38.9	0.884	0.241	0.8227	
15 minute winter	3	2.000	4	34.8	0.822	0.101	0.6207	
120 minute winter	4	1.002	5	22.2	0.430	0.015	21.3915	
120 minute winter	5	1.003	6	14.4	0.381	0.010	12.2511	
120 minute winter	6	1.004	9	15.2	0.335	0.010	13.8373	
120 minute winter	7	3.000	8	7.3	0.503	0.012	10.5610	
120 minute winter	8	3.001	9	9.8	0.455	0.010	15.1148	
120 minute winter	9	1.005	HB2	13.5	0.254	0.009	13.4243	
120 minute winter	HB2	Hydro-Brake®	CWC	7.4				137.4
120 minute winter	HB2	Hydro-Brake®	CWC	7.0				27.5

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	1	140	45.115	1.211	14.3	4.8680	0.0000	FLOOD RISK
180 minute winter	2	140	45.111	1.320	18.0	3.9564	0.0000	SURCHARGED
180 minute winter	3	140	45.108	1.477	15.9	5.9737	0.0000	FLOOD RISK
180 minute winter	4	140	45.109	1.965	36.3	9.6073	0.0000	FLOOD RISK
180 minute winter	5	140	45.110	2.066	28.4	9.3460	0.0000	SURCHARGED
180 minute winter	6	140	45.110	2.116	30.0	10.7782	0.0000	SURCHARGED
120 minute winter	7	100	45.109	1.634	20.8	7.1588	0.0000	FLOOD RISK
180 minute winter	8	140	45.110	1.932	18.5	8.2652	0.0000	SURCHARGED
180 minute winter	9	140	45.111	2.169	25.7	10.1229	0.0000	SURCHARGED
180 minute winter	HB2	140	45.111	2.218	26.4	16.7105	0.0000	SURCHARGED
15 minute summer	CWC	1	42.839	0.000	7.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	1	1.000	2	12.9	0.537	0.080	7.0675	
180 minute winter	2	1.001	4	17.7	0.714	0.110	2.9600	
180 minute winter	3	2.000	4	13.9	0.630	0.040	4.1181	
180 minute winter	4	1.002	5	28.4	0.453	0.019	34.1708	
180 minute winter	5	1.003	6	20.1	0.408	0.013	17.1785	
180 minute winter	6	1.004	9	23.2	0.358	0.015	17.9644	
120 minute winter	7	3.000	8	9.7	0.490	0.016	25.5675	
180 minute winter	8	3.001	9	11.9	0.453	0.012	21.8449	
180 minute winter	9	1.005	HB2	20.5	0.250	0.014	16.2987	
180 minute winter	HB2	Hydro-Brake®	CWC	11.7				197.2
180 minute winter	HB2	Hydro-Brake®	CWC	8.3				108.6

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

D AND CG Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
299	1200	599	1500	1199	2100
449	1350	899	1800	1800	2700

>1800 Link+900 mm

SW CIRCULAR Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

225	375	525	750	900	1200	1500
300	450	600	825	1050	1350	1800

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
20	0.116	5.00	45.525	2700	386291.920	397019.620	2.099
21	0.063	5.00	45.825	2700	386288.109	397047.731	2.471
22	0.032	5.00	46.106	2700	386286.291	397065.152	2.796
23	0.024	5.00	46.204	2700	386280.152	397069.619	2.913
24	0.099	5.00	46.308	2700	386258.553	397142.233	3.011
25	0.106	5.00	46.110	2700	386264.071	397097.333	2.928
26	0.130	5.00	46.272	2700	386267.003	397068.137	3.164
28	0.095	5.00	46.113	1800	386201.076	397131.262	1.955
29	0.093	5.00	45.587	1800	386205.349	397089.201	1.609
30	0.053	5.00	45.951	1800	386208.318	397066.317	2.071
HB3	0.075	5.00	46.028	3000	386208.414	397061.250	3.070
104			45.941	1800	386200.733	397060.329	3.003

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	20	21	28.368	0.600	43.426	43.354	0.072	394.0	1050	5.27	50.0
1.001	21	22	17.516	0.600	43.354	43.310	0.044	398.1	1050	5.44	50.0
1.002	22	23	7.592	0.600	43.310	43.291	0.019	399.6	1050	5.52	50.0
1.003	23	26	13.232	0.600	43.291	43.258	0.033	401.0	1050	5.65	50.0
2.000	24	25	45.238	0.600	43.297	43.182	0.115	393.4	1200	5.40	50.0
2.001	25	26	29.343	0.600	43.182	43.108	0.074	396.5	1200	5.66	50.0
1.004	26	HB3	58.992	0.600	43.108	42.958	0.150	393.3	1200	6.19	50.0
3.000	28	29	42.277	0.600	44.158	43.978	0.180	234.9	300	5.69	50.0
3.001	29	30	23.076	0.600	43.978	43.880	0.098	235.5	300	6.07	50.0
3.002	30	HB3	5.068	0.600	43.880	43.858	0.022	230.4	300	6.15	50.0
1.005	HB3	104	7.736	0.600	42.958	42.938	0.020	386.8	600	6.29	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.730	1497.7	15.7	1.049	1.421	0.116	0.0	74	0.586
1.001	1.721	1489.9	24.3	1.421	1.746	0.179	0.0	91	0.664
1.002	1.717	1487.1	28.6	1.746	1.863	0.211	0.0	99	0.696
1.003	1.714	1484.5	31.8	1.863	1.964	0.235	0.0	104	0.717
2.000	1.880	2126.0	13.4	1.811	1.728	0.099	0.0	67	0.549
2.001	1.872	2117.4	27.8	1.728	1.964	0.205	0.0	93	0.678
1.004	1.880	2126.2	77.2	1.964	1.870	0.570	0.0	153	0.921
3.000	1.021	72.2	12.9	1.655	1.309	0.095	0.0	85	0.776
3.001	1.020	72.1	25.5	1.309	1.771	0.188	0.0	123	0.934
3.002	1.031	72.9	32.7	1.771	1.870	0.241	0.0	141	1.005
1.005	1.232	348.3	120.1	2.470	2.403	0.886	0.0	242	1.123

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	28.368	394.0	1050	SW CIRCULAR	45.525	43.426	1.049	45.825	43.354	1.421
1.001	17.516	398.1	1050	SW CIRCULAR	45.825	43.354	1.421	46.106	43.310	1.746
1.002	7.592	399.6	1050	SW CIRCULAR	46.106	43.310	1.746	46.204	43.291	1.863
1.003	13.232	401.0	1050	SW CIRCULAR	46.204	43.291	1.863	46.272	43.258	1.964
2.000	45.238	393.4	1200	SW CIRCULAR	46.308	43.297	1.811	46.110	43.182	1.728
2.001	29.343	396.5	1200	SW CIRCULAR	46.110	43.182	1.728	46.272	43.108	1.964
1.004	58.992	393.3	1200	SW CIRCULAR	46.272	43.108	1.964	46.028	42.958	1.870
3.000	42.277	234.9	300	SW CIRCULAR	46.113	44.158	1.655	45.587	43.978	1.309
3.001	23.076	235.5	300	SW CIRCULAR	45.587	43.978	1.309	45.951	43.880	1.771

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	20	2700	Manhole	D AND CG	21	2700	Manhole	D AND CG
1.001	21	2700	Manhole	D AND CG	22	2700	Manhole	D AND CG
1.002	22	2700	Manhole	D AND CG	23	2700	Manhole	D AND CG
1.003	23	2700	Manhole	D AND CG	26	2700	Manhole	D AND CG
2.000	24	2700	Manhole	D AND CG	25	2700	Manhole	D AND CG
2.001	25	2700	Manhole	D AND CG	26	2700	Manhole	D AND CG
1.004	26	2700	Manhole	D AND CG	HB3	3000	Manhole	D AND CG
3.000	28	1800	Manhole	D AND CG	29	1800	Manhole	D AND CG
3.001	29	1800	Manhole	D AND CG	30	1800	Manhole	D AND CG

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.002	5.068	230.4	300	SW CIRCULAR	45.951	43.880	1.771	46.028	43.858	1.870
1.005	7.736	386.8	600	SW CIRCULAR	46.028	42.958	2.470	45.941	42.938	2.403

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.002	30	1800	Manhole	D AND CG	HB3	3000	Manhole	D AND CG
1.005	HB3	3000	Manhole	D AND CG	104	1800	Manhole	D AND CG

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	17.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	8.6
Summer CV	0.750	30 year (l/s)	19.1
Winter CV	0.840	100 year (l/s)	25.0
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	✓		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node HB3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	42.958	Product Number	CTL-SHE-0140-8600-0700-8600
Design Depth (m)	0.700	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	8.6	Min Node Diameter (mm)	1200

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Node HB3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	43.550	Product Number	CTL-SHE-0129-8500-1450-8500
Design Depth (m)	1.450	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	8.5	Min Node Diameter (mm)	1200

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	92.521	26.180	30 year 360 minute summer	26.939	6.932
1 year 15 minute winter	64.927	26.180	30 year 360 minute winter	17.511	6.932
1 year 30 minute summer	60.022	16.984	30 year 480 minute summer	20.981	5.545
1 year 30 minute winter	42.121	16.984	30 year 480 minute winter	13.940	5.545
1 year 60 minute summer	40.398	10.676	30 year 600 minute summer	17.039	4.661
1 year 60 minute winter	26.839	10.676	30 year 600 minute winter	11.642	4.661
1 year 120 minute summer	24.980	6.602	30 year 720 minute summer	15.093	4.045
1 year 120 minute winter	16.596	6.602	30 year 720 minute winter	10.143	4.045
1 year 180 minute summer	19.271	4.959	30 year 960 minute summer	12.278	3.233
1 year 180 minute winter	12.527	4.959	30 year 960 minute winter	8.133	3.233
1 year 240 minute summer	15.301	4.043	30 year 1440 minute summer	8.788	2.355
1 year 240 minute winter	10.165	4.043	30 year 1440 minute winter	5.906	2.355
1 year 360 minute summer	11.775	3.030	100 year +45% CC 15 minute summer	423.061	119.712
1 year 360 minute winter	7.654	3.030	100 year +45% CC 15 minute winter	296.885	119.712
1 year 480 minute summer	9.342	2.469	100 year +45% CC 30 minute summer	278.374	78.770
1 year 480 minute winter	6.207	2.469	100 year +45% CC 30 minute winter	195.350	78.770
1 year 600 minute summer	7.682	2.101	100 year +45% CC 60 minute summer	187.417	49.529
1 year 600 minute winter	5.249	2.101	100 year +45% CC 60 minute winter	124.515	49.529
1 year 720 minute summer	6.859	1.838	100 year +45% CC 120 minute summer	114.312	30.209
1 year 720 minute winter	4.609	1.838	100 year +45% CC 120 minute winter	75.946	30.209
1 year 960 minute summer	5.653	1.489	100 year +45% CC 180 minute summer	86.951	22.375
1 year 960 minute winter	3.745	1.489	100 year +45% CC 180 minute winter	56.520	22.375
1 year 1440 minute summer	4.127	1.106	100 year +45% CC 240 minute summer	68.114	18.001
1 year 1440 minute winter	2.773	1.106	100 year +45% CC 240 minute winter	45.253	18.001
30 year 15 minute summer	226.195	64.005	100 year +45% CC 360 minute summer	51.133	13.158
30 year 15 minute winter	158.733	64.005	100 year +45% CC 360 minute winter	33.238	13.158
30 year 30 minute summer	147.452	41.724	100 year +45% CC 480 minute summer	39.658	10.480
30 year 30 minute winter	103.475	41.724	100 year +45% CC 480 minute winter	26.348	10.480
30 year 60 minute summer	98.615	26.061	100 year +45% CC 600 minute summer	32.099	8.780
30 year 60 minute winter	65.517	26.061	100 year +45% CC 600 minute winter	21.932	8.780
30 year 120 minute summer	59.946	15.842	100 year +45% CC 720 minute summer	28.365	7.602
30 year 120 minute winter	39.827	15.842	100 year +45% CC 720 minute winter	19.063	7.602
30 year 180 minute summer	45.598	11.734	100 year +45% CC 960 minute summer	22.984	6.052
30 year 180 minute winter	29.640	11.734	100 year +45% CC 960 minute winter	15.225	6.052
30 year 240 minute summer	35.759	9.450	100 year +45% CC 1440 minute summer	16.353	4.383
30 year 240 minute winter	23.758	9.450	100 year +45% CC 1440 minute winter	10.990	4.383

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.20%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	20	11	43.495	0.069	13.8	0.4696	0.0000	OK
60 minute winter	21	59	43.488	0.134	11.0	0.8354	0.0000	OK
60 minute winter	22	59	43.489	0.179	12.8	1.0640	0.0000	OK
60 minute winter	23	59	43.488	0.197	14.1	1.1595	0.0000	OK
60 minute winter	24	59	43.490	0.193	11.1	1.2313	0.0000	OK
60 minute winter	25	60	43.489	0.307	19.6	1.9794	0.0000	OK
60 minute winter	26	58	43.487	0.379	30.7	2.4815	0.0000	OK
15 minute winter	28	11	44.236	0.078	11.3	0.2740	0.0000	OK
15 minute winter	29	11	44.094	0.116	21.9	0.4283	0.0000	OK
15 minute winter	30	11	44.021	0.141	27.4	0.4319	0.0000	OK
60 minute winter	HB3	57	43.487	0.529	31.3	4.0006	0.0000	OK
15 minute summer	104	1	42.938	0.000	8.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	20	1.000	21	13.3	0.466	0.009	0.8224	
60 minute winter	21	1.001	22	10.9	0.459	0.007	1.4100	
60 minute winter	22	1.002	23	12.6	0.480	0.008	0.7927	
60 minute winter	23	1.003	26	13.6	0.587	0.009	1.6517	
60 minute winter	24	2.000	25	-7.6	0.303	-0.004	7.7398	
60 minute winter	25	2.001	26	10.5	0.301	0.005	7.8040	
60 minute winter	26	1.004	HB3	15.5	0.220	0.007	23.0869	
15 minute winter	28	3.000	29	10.9	0.563	0.151	0.8361	
15 minute winter	29	3.001	30	21.5	0.746	0.298	0.6652	
15 minute winter	30	3.002	HB3	27.2	0.901	0.373	0.1532	
60 minute winter	HB3	Hydro-Brake®	104	8.6				79.5
60 minute winter	HB3	Hydro-Brake®	104	0.0				0.0

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.20%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	20	98	43.860	0.434	10.7	2.9625	0.0000	OK
120 minute winter	21	94	43.859	0.505	14.7	3.1516	0.0000	OK
120 minute winter	22	98	43.858	0.548	12.8	3.2624	0.0000	OK
120 minute winter	23	98	43.858	0.567	13.6	3.3374	0.0000	OK
120 minute winter	24	96	43.859	0.562	11.2	3.5860	0.0000	OK
120 minute winter	25	96	43.858	0.676	17.1	4.3595	0.0000	OK
120 minute winter	26	96	43.858	0.750	27.0	4.9096	0.0000	OK
15 minute winter	28	10	44.283	0.125	27.7	0.4401	0.0000	OK
15 minute winter	29	11	44.194	0.216	54.0	0.8012	0.0000	OK
15 minute winter	30	11	44.124	0.244	66.9	0.7470	0.0000	OK
120 minute winter	HB3	96	43.859	0.901	29.1	6.8096	0.0000	SURCHARGED
15 minute summer	104	1	42.938	0.000	8.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	20	1.000	21	8.9	0.388	0.006	10.5879	
120 minute winter	21	1.001	22	9.9	0.430	0.007	7.5820	
120 minute winter	22	1.002	23	12.7	0.439	0.009	3.5314	
120 minute winter	23	1.003	26	15.6	0.512	0.010	6.5095	
120 minute winter	24	2.000	25	8.0	0.242	0.004	26.5027	
120 minute winter	25	2.001	26	13.7	0.263	0.006	20.4649	
120 minute winter	26	1.004	HB3	18.4	0.223	0.009	48.6386	
15 minute winter	28	3.000	29	26.9	0.671	0.372	1.7334	
15 minute winter	29	3.001	30	52.4	0.903	0.727	1.3371	
15 minute winter	30	3.002	HB3	66.9	1.192	0.918	0.2835	
120 minute winter	HB3	Hydro-Brake®	104	9.7				176.3
120 minute winter	HB3	Hydro-Brake®	104	8.3				55.2

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.20%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	20	144	45.395	1.969	15.1	13.4529	0.0000	FLOOD RISK
180 minute winter	21	144	45.395	2.041	19.6	12.7257	0.0000	SURCHARGED
180 minute winter	22	144	45.395	2.085	14.3	12.4123	0.0000	SURCHARGED
180 minute winter	23	144	45.395	2.104	10.6	12.3902	0.0000	SURCHARGED
180 minute winter	24	144	45.393	2.096	16.7	13.3805	0.0000	SURCHARGED
180 minute winter	25	144	45.394	2.212	19.8	14.2688	0.0000	SURCHARGED
180 minute winter	26	144	45.394	2.286	32.0	14.9696	0.0000	SURCHARGED
180 minute winter	28	144	45.396	1.238	12.4	4.3525	0.0000	SURCHARGED
180 minute winter	29	144	45.396	1.418	24.5	5.2489	0.0000	FLOOD RISK
180 minute winter	30	144	45.395	1.515	31.5	4.6312	0.0000	SURCHARGED
180 minute winter	HB3	144	45.394	2.436	40.8	18.4111	0.0000	SURCHARGED
15 minute summer	104	1	42.938	0.000	10.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	20	1.000	21	11.4	0.343	0.008	24.4713	
180 minute winter	21	1.001	22	11.2	0.376	0.008	15.1099	
180 minute winter	22	1.002	23	7.7	0.387	0.005	6.5491	
180 minute winter	23	1.003	26	9.9	0.510	0.007	11.4144	
180 minute winter	24	2.000	25	-6.1	0.245	-0.003	50.9701	
180 minute winter	25	2.001	26	11.1	0.272	0.005	33.0610	
180 minute winter	26	1.004	HB3	16.7	0.228	0.008	66.4668	
180 minute winter	28	3.000	29	12.4	0.577	0.172	2.9771	
180 minute winter	29	3.001	30	24.6	0.762	0.341	1.6250	
180 minute winter	30	3.002	HB3	31.0	0.931	0.425	0.3569	
180 minute winter	HB3	Hydro-Brake®	104	15.5				265.3
180 minute winter	HB3	Hydro-Brake®	104	9.5				157.5

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

D AND CG Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
299	1200	599	1500	1199	2100
449	1350	899	1800	1800	2700

>1800 Link+900 mm

SW CIRCULAR Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

225	375	525	750	900	1200	1500
300	450	600	825	1050	1350	1800

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
40	0.112	5.00	45.631	1800	386165.986	397010.930	1.456
41	0.040	5.00	45.641	1800	386150.617	397028.850	1.366
42	0.019	5.00	45.560	1800	386156.749	397021.508	1.920
43	0.180	5.00	45.941	2700	386207.917	396902.917	3.035
44	0.128	5.00	45.761	2700	386165.172	396947.786	3.011
45	0.051	5.00	45.761	2700	386141.909	396972.921	3.097
46	0.110	5.00	45.615	2700	386123.560	396988.035	3.011
HB4	0.076	5.00	45.927	3000	386136.315	397004.506	3.375
107			45.630	2000	386129.161	397012.817	3.140

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	40	42	14.043	0.600	44.175	43.640	0.535	26.2	375	5.07	50.0
2.000	41	42	9.566	0.600	44.275	43.640	0.635	15.1	375	5.03	50.0
1.001	42	HB4	26.582	0.600	43.640	43.527	0.113	235.2	375	5.44	50.0
3.000	43	44	61.971	0.600	42.906	42.750	0.156	397.3	1350	5.51	50.0
3.001	44	45	34.248	0.600	42.750	42.664	0.086	398.2	1350	5.80	50.0
3.002	45	46	23.772	0.600	42.664	42.604	0.060	396.2	1350	5.99	50.0
3.003	46	HB4	20.832	0.600	42.604	42.552	0.052	400.6	1350	6.17	50.0
1.002	HB4	107	10.966	0.600	42.552	42.490	0.062	176.9	450	6.29	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.548	391.9	15.2	1.081	1.545	0.112	0.0	49	1.739
2.000	4.688	517.8	5.4	0.991	1.545	0.040	0.0	27	1.561
1.001	1.177	130.0	23.2	1.545	2.025	0.171	0.0	107	0.896
3.000	2.011	2878.8	24.4	1.685	1.661	0.180	0.0	85	0.642
3.001	2.009	2875.2	41.7	1.661	1.747	0.308	0.0	110	0.753
3.002	2.014	2882.6	48.7	1.747	1.661	0.359	0.0	119	0.790
3.003	2.003	2866.6	63.6	1.661	2.025	0.469	0.0	135	0.851
1.002	1.525	242.6	97.0	2.925	2.690	0.716	0.0	197	1.443

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	14.043	26.2	375	SW CIRCULAR	45.631	44.175	1.081	45.560	43.640	1.545
2.000	9.566	15.1	375	SW CIRCULAR	45.641	44.275	0.991	45.560	43.640	1.545
1.001	26.582	235.2	375	SW CIRCULAR	45.560	43.640	1.545	45.927	43.527	2.025
3.000	61.971	397.3	1350	SW CIRCULAR	45.941	42.906	1.685	45.761	42.750	1.661
3.001	34.248	398.2	1350	SW CIRCULAR	45.761	42.750	1.661	45.761	42.664	1.747
3.002	23.772	396.2	1350	SW CIRCULAR	45.761	42.664	1.747	45.615	42.604	1.661
3.003	20.832	400.6	1350	SW CIRCULAR	45.615	42.604	1.661	45.927	42.552	2.025
1.002	10.966	176.9	450	SW CIRCULAR	45.927	42.552	2.925	45.630	42.490	2.690

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	40	1800	Manhole	D AND CG	42	1800	Manhole	D AND CG
2.000	41	1800	Manhole	D AND CG	42	1800	Manhole	D AND CG
1.001	42	1800	Manhole	D AND CG	HB4	3000	Manhole	D AND CG
3.000	43	2700	Manhole	D AND CG	44	2700	Manhole	D AND CG
3.001	44	2700	Manhole	D AND CG	45	2700	Manhole	D AND CG
3.002	45	2700	Manhole	D AND CG	46	2700	Manhole	D AND CG
3.003	46	2700	Manhole	D AND CG	HB4	3000	Manhole	D AND CG
1.002	HB4	3000	Manhole	D AND CG	107	2000	Manhole	D AND CG

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	✓
M5-60 (mm)	17.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	✓
Winter CV	0.840	1 year (l/s)	5.2

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Simulation Settings

30 year (l/s)	11.5	Check Discharge Volume	x
100 year (l/s)	15.1		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node HB4 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	42.552	Product Number	CTL-SHE-0108-5200-1000-5200
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.2	Min Node Diameter (mm)	1200

Node HB4 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	43.100	Product Number	CTL-SHE-0107-6600-1900-6600
Design Depth (m)	1.900	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.6	Min Node Diameter (mm)	1200

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	92.521	26.180	1 year 240 minute winter	10.165	4.043
1 year 15 minute winter	64.927	26.180	1 year 360 minute summer	11.775	3.030
1 year 30 minute summer	60.022	16.984	1 year 360 minute winter	7.654	3.030
1 year 30 minute winter	42.121	16.984	1 year 480 minute summer	9.342	2.469
1 year 60 minute summer	40.398	10.676	1 year 480 minute winter	6.207	2.469
1 year 60 minute winter	26.839	10.676	1 year 600 minute summer	7.682	2.101
1 year 120 minute summer	24.980	6.602	1 year 600 minute winter	5.249	2.101
1 year 120 minute winter	16.596	6.602	1 year 720 minute summer	6.859	1.838
1 year 180 minute summer	19.271	4.959	1 year 720 minute winter	4.609	1.838
1 year 180 minute winter	12.527	4.959	1 year 960 minute summer	5.653	1.489
1 year 240 minute summer	15.301	4.043	1 year 960 minute winter	3.745	1.489

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 1440 minute summer	4.127	1.106	30 year 1440 minute winter	5.906	2.355
1 year 1440 minute winter	2.773	1.106	100 year +45% CC 15 minute summer	423.061	119.712
30 year 15 minute summer	226.195	64.005	100 year +45% CC 15 minute winter	296.885	119.712
30 year 15 minute winter	158.733	64.005	100 year +45% CC 30 minute summer	278.374	78.770
30 year 30 minute summer	147.452	41.724	100 year +45% CC 30 minute winter	195.350	78.770
30 year 30 minute winter	103.475	41.724	100 year +45% CC 60 minute summer	187.417	49.529
30 year 60 minute summer	98.615	26.061	100 year +45% CC 60 minute winter	124.515	49.529
30 year 60 minute winter	65.517	26.061	100 year +45% CC 120 minute summer	114.312	30.209
30 year 120 minute summer	59.946	15.842	100 year +45% CC 120 minute winter	75.946	30.209
30 year 120 minute winter	39.827	15.842	100 year +45% CC 180 minute summer	86.951	22.375
30 year 180 minute summer	45.598	11.734	100 year +45% CC 180 minute winter	56.520	22.375
30 year 180 minute winter	29.640	11.734	100 year +45% CC 240 minute summer	68.114	18.001
30 year 240 minute summer	35.759	9.450	100 year +45% CC 240 minute winter	45.253	18.001
30 year 240 minute winter	23.758	9.450	100 year +45% CC 360 minute summer	51.133	13.158
30 year 360 minute summer	26.939	6.932	100 year +45% CC 360 minute winter	33.238	13.158
30 year 360 minute winter	17.511	6.932	100 year +45% CC 480 minute summer	39.658	10.480
30 year 480 minute summer	20.981	5.545	100 year +45% CC 480 minute winter	26.348	10.480
30 year 480 minute winter	13.940	5.545	100 year +45% CC 600 minute summer	32.099	8.780
30 year 600 minute summer	17.039	4.661	100 year +45% CC 600 minute winter	21.932	8.780
30 year 600 minute winter	11.642	4.661	100 year +45% CC 720 minute summer	28.365	7.602
30 year 720 minute summer	15.093	4.045	100 year +45% CC 720 minute winter	19.063	7.602
30 year 720 minute winter	10.143	4.045	100 year +45% CC 960 minute summer	22.984	6.052
30 year 960 minute summer	12.278	3.233	100 year +45% CC 960 minute winter	15.225	6.052
30 year 960 minute winter	8.133	3.233	100 year +45% CC 1440 minute summer	16.353	4.383
30 year 1440 minute summer	8.788	2.355	100 year +45% CC 1440 minute winter	10.990	4.383

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.39%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	40	10	44.222	0.047	13.3	0.1908	0.0000	OK
15 minute winter	41	10	44.301	0.026	4.8	0.0799	0.0000	OK
15 minute winter	42	11	43.741	0.101	20.2	0.2779	0.0000	OK
120 minute winter	43	96	43.052	0.146	6.9	1.0120	0.0000	OK
60 minute winter	44	61	43.051	0.301	21.5	1.9780	0.0000	OK
120 minute winter	45	114	43.051	0.387	9.4	2.3417	0.0000	OK
120 minute winter	46	98	43.052	0.448	7.5	2.8903	0.0000	OK
120 minute winter	HB4	98	43.052	0.500	9.8	3.7611	0.0000	SURCHARGED
15 minute summer	107	1	42.490	0.000	5.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	40	1.000	42	13.2	0.886	0.034	0.2223	
15 minute winter	41	2.000	42	4.8	0.399	0.009	0.1295	
15 minute winter	42	1.001	HB4	19.8	0.849	0.152	0.6206	
120 minute winter	43	3.000	44	6.9	0.333	0.002	9.8669	
60 minute winter	44	3.001	45	13.5	0.391	0.005	9.7118	
120 minute winter	45	3.002	46	7.3	0.283	0.003	8.9119	
120 minute winter	46	3.003	HB4	6.0	0.148	0.002	9.3049	
120 minute winter	HB4	Hydro-Brake®	107	5.2				79.3
120 minute winter	HB4	Hydro-Brake®	107	0.0				0.0

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.39%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	40	10	44.247	0.072	32.6	0.2946	0.0000	OK
15 minute winter	41	10	44.313	0.038	11.6	0.1204	0.0000	OK
15 minute winter	42	10	43.805	0.165	49.4	0.4536	0.0000	OK
120 minute winter	43	116	43.471	0.565	20.6	3.9065	0.0000	OK
120 minute winter	44	108	43.468	0.718	24.6	4.7244	0.0000	OK
120 minute winter	45	106	43.469	0.805	21.8	4.8731	0.0000	OK
120 minute winter	46	106	43.470	0.866	25.3	5.5887	0.0000	OK
120 minute winter	HB4	112	43.470	0.918	22.7	6.9008	0.0000	SURCHARGED
15 minute summer	107	1	42.490	0.000	5.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	40	1.000	42	32.4	1.093	0.083	0.4325	
15 minute winter	41	2.000	42	11.5	0.659	0.022	0.2521	
15 minute winter	42	1.001	HB4	48.5	1.077	0.373	1.1975	
120 minute winter	43	3.000	44	14.8	0.306	0.005	41.3888	
120 minute winter	44	3.001	45	15.4	0.384	0.005	28.3607	
120 minute winter	45	3.002	46	-17.1	0.318	-0.006	22.0256	
120 minute winter	46	3.003	HB4	-15.8	0.167	-0.006	20.8202	
120 minute winter	HB4	Hydro-Brake®	107	5.2				100.1
120 minute winter	HB4	Hydro-Brake®	107	6.0				56.2

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.39%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	40	172	45.178	1.003	14.6	4.0955	0.0000	SURCHARGED
180 minute winter	41	172	45.178	0.903	5.2	2.8272	0.0000	SURCHARGED
180 minute winter	42	172	45.178	1.538	22.3	4.2176	0.0000	SURCHARGED
180 minute winter	43	172	45.176	2.270	24.6	15.6932	0.0000	SURCHARGED
180 minute winter	44	172	45.179	2.429	36.4	15.9746	0.0000	SURCHARGED
180 minute winter	45	172	45.179	2.515	23.7	15.2264	0.0000	SURCHARGED
180 minute winter	46	172	45.177	2.573	29.8	16.6130	0.0000	SURCHARGED
180 minute winter	HB4	168	45.176	2.624	32.6	19.7322	0.0000	SURCHARGED
15 minute summer	107	1	42.490	0.000	5.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	40	1.000	42	14.6	0.888	0.037	1.5489	
180 minute winter	41	2.000	42	5.2	0.398	0.010	1.0551	
180 minute winter	42	1.001	HB4	22.7	0.873	0.175	2.9319	
180 minute winter	43	3.000	44	11.4	0.313	0.004	88.3701	
180 minute winter	44	3.001	45	-19.7	0.400	-0.007	48.8373	
180 minute winter	45	3.002	46	18.6	0.289	0.006	33.8987	
180 minute winter	46	3.003	HB4	21.4	0.172	0.007	29.7062	
180 minute winter	HB4	Hydro-Brake®	107	8.2				149.0
180 minute winter	HB4	Hydro-Brake®	107	6.9				123.9

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

D AND CG Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
299	1200	599	1500	1199	2100
449	1350	899	1800	1800	2700

>1800 Link+900 mm

SW CIRCULAR Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

225	375	525	750	900	1200	1500
300	450	600	825	1050	1350	1800

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
50	0.135	5.00	45.966	2700	386062.047	397067.350	2.685
51	0.099	5.00	46.511	2400	386077.024	397090.643	3.069
52	0.078	5.00	46.333	2700	386079.268	397068.873	3.096
54	0.157	5.00	46.306	2700	386140.409	397075.875	3.225
HB5	0.079	5.00	46.077	3000	386142.576	397058.256	3.041
105			45.973	1200	386146.558	397053.237	2.976

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	50	52	17.288	0.600	43.281	43.237	0.044	392.9	1200	5.15	50.0
2.000	51	52	21.885	0.600	43.442	43.387	0.055	397.9	1050	5.21	50.0
1.001	52	54	61.541	0.600	43.237	43.081	0.156	394.5	1200	5.76	50.0
1.002	54	HB5	17.752	0.600	43.081	43.036	0.045	394.5	1200	5.92	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.881	2127.3	18.3	1.485	1.896	0.135	0.0	76	0.601
2.000	1.721	1490.3	13.4	2.019	1.896	0.099	0.0	69	0.558
1.001	1.877	2122.9	42.3	1.896	2.025	0.312	0.0	115	0.771
1.002	1.877	2122.9	63.6	2.025	1.841	0.469	0.0	139	0.868

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.003	HB5	105	6.407	0.600	43.036	42.997	0.039	165.0	225	6.02	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.003	1.015	40.4	74.3	2.816	2.751	0.548	0.0	225	1.034

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	17.288	392.9	1200	SW CIRCULAR	45.966	43.281	1.485	46.333	43.237	1.896
2.000	21.885	397.9	1050	SW CIRCULAR	46.511	43.442	2.019	46.333	43.387	1.896
1.001	61.541	394.5	1200	SW CIRCULAR	46.333	43.237	1.896	46.306	43.081	2.025
1.002	17.752	394.5	1200	SW CIRCULAR	46.306	43.081	2.025	46.077	43.036	1.841
1.003	6.407	165.0	225	SW CIRCULAR	46.077	43.036	2.816	45.973	42.997	2.751

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	50	2700	Manhole	D AND CG	52	2700	Manhole	D AND CG
2.000	51	2400	Manhole	D AND CG	52	2700	Manhole	D AND CG
1.001	52	2700	Manhole	D AND CG	54	2700	Manhole	D AND CG
1.002	54	2700	Manhole	D AND CG	HB5	3000	Manhole	D AND CG
1.003	HB5	3000	Manhole	D AND CG	105	1200	Manhole	D AND CG

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	17.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	5.2
Summer CV	0.750	30 year (l/s)	11.5
Winter CV	0.840	100 year (l/s)	15.1
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	✓		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	1
Greenfield Method	IH124	Growth Factor 1 year	0.85
Positively Drained Area (ha)		Growth Factor 30 year	1.95
SAAR (mm)		Growth Factor 100 year	2.48
Soil Index	1	Betterment (%)	0
SPR	0.10	QBar	

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Pre-development Discharge Rate

Q 1 year (l/s)	Q 100 year (l/s)
Q 30 year (l/s)	

Node HB5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	43.036	Product Number	CTL-SHE-0108-5000-0850-5000
Design Depth (m)	0.850	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node HB5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	43.600	Product Number	CTL-SHE-0100-5000-1400-5000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	92.521	26.180	30 year 120 minute winter	39.827	15.842
1 year 15 minute winter	64.927	26.180	30 year 180 minute summer	45.598	11.734
1 year 30 minute summer	60.022	16.984	30 year 180 minute winter	29.640	11.734
1 year 30 minute winter	42.121	16.984	30 year 240 minute summer	35.759	9.450
1 year 60 minute summer	40.398	10.676	30 year 240 minute winter	23.758	9.450
1 year 60 minute winter	26.839	10.676	30 year 360 minute summer	26.939	6.932
1 year 120 minute summer	24.980	6.602	30 year 360 minute winter	17.511	6.932
1 year 120 minute winter	16.596	6.602	30 year 480 minute summer	20.981	5.545
1 year 180 minute summer	19.271	4.959	30 year 480 minute winter	13.940	5.545
1 year 180 minute winter	12.527	4.959	30 year 600 minute summer	17.039	4.661
1 year 240 minute summer	15.301	4.043	30 year 600 minute winter	11.642	4.661
1 year 240 minute winter	10.165	4.043	30 year 720 minute summer	15.093	4.045
1 year 360 minute summer	11.775	3.030	30 year 720 minute winter	10.143	4.045
1 year 360 minute winter	7.654	3.030	30 year 960 minute summer	12.278	3.233
1 year 480 minute summer	9.342	2.469	30 year 960 minute winter	8.133	3.233
1 year 480 minute winter	6.207	2.469	30 year 1440 minute summer	8.788	2.355
1 year 600 minute summer	7.682	2.101	30 year 1440 minute winter	5.906	2.355
1 year 600 minute winter	5.249	2.101	100 year +45% CC 15 minute summer	423.061	119.712
1 year 720 minute summer	6.859	1.838	100 year +45% CC 15 minute winter	296.885	119.712
1 year 720 minute winter	4.609	1.838	100 year +45% CC 30 minute summer	278.374	78.770
1 year 960 minute summer	5.653	1.489	100 year +45% CC 30 minute winter	195.350	78.770
1 year 960 minute winter	3.745	1.489	100 year +45% CC 60 minute summer	187.417	49.529
1 year 1440 minute summer	4.127	1.106	100 year +45% CC 60 minute winter	124.515	49.529
1 year 1440 minute winter	2.773	1.106	100 year +45% CC 120 minute summer	114.312	30.209
30 year 15 minute summer	226.195	64.005	100 year +45% CC 120 minute winter	75.946	30.209
30 year 15 minute winter	158.733	64.005	100 year +45% CC 180 minute summer	86.951	22.375
30 year 30 minute summer	147.452	41.724	100 year +45% CC 180 minute winter	56.520	22.375
30 year 30 minute winter	103.475	41.724	100 year +45% CC 240 minute summer	68.114	18.001
30 year 60 minute summer	98.615	26.061	100 year +45% CC 240 minute winter	45.253	18.001
30 year 60 minute winter	65.517	26.061	100 year +45% CC 360 minute summer	51.133	13.158
30 year 120 minute summer	59.946	15.842	100 year +45% CC 360 minute winter	33.238	13.158

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 480 minute summer	39.658	10.480	100 year +45% CC 720 minute winter	19.063	7.602
100 year +45% CC 480 minute winter	26.348	10.480	100 year +45% CC 960 minute summer	22.984	6.052
100 year +45% CC 600 minute summer	32.099	8.780	100 year +45% CC 960 minute winter	15.225	6.052
100 year +45% CC 600 minute winter	21.932	8.780	100 year +45% CC 1440 minute summer	16.353	4.383
100 year +45% CC 720 minute summer	28.365	7.602	100 year +45% CC 1440 minute winter	10.990	4.383

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.15%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	50	60	43.496	0.215	8.4	1.4472	0.0000	OK
15 minute winter	51	11	43.508	0.066	11.8	0.3413	0.0000	OK
60 minute winter	52	59	43.494	0.257	21.2	1.5986	0.0000	OK
60 minute winter	54	58	43.494	0.413	23.7	2.7667	0.0000	OK
60 minute winter	HB5	58	43.494	0.458	11.8	3.4777	0.0000	SURCHARGED
15 minute summer	105	1	42.997	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	50	1.000	52	10.4	0.341	0.005	2.6991	
15 minute winter	51	2.000	52	11.4	0.576	0.008	0.4337	
60 minute winter	52	1.001	54	15.1	0.322	0.007	15.9628	
60 minute winter	54	1.002	HB5	7.5	0.238	0.004	6.5577	
60 minute winter	HB5	Hydro-Brake®	105	5.0				49.2
60 minute winter	HB5	Hydro-Brake®	105	0.0				0.0

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.15%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	50	102	43.892	0.611	12.4	4.1146	0.0000	OK
120 minute winter	51	96	43.893	0.451	9.1	2.3330	0.0000	OK
120 minute winter	52	102	43.892	0.655	22.4	4.0792	0.0000	OK
120 minute winter	54	98	43.892	0.811	19.9	5.4341	0.0000	OK
120 minute winter	HB5	98	43.893	0.857	13.9	6.5007	0.0000	SURCHARGED
15 minute summer	105	1	42.997	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	50	1.000	52	8.3	0.287	0.004	10.4242	
120 minute winter	51	2.000	52	7.6	0.503	0.005	8.3637	
120 minute winter	52	1.001	54	8.2	0.338	0.004	44.2950	
120 minute winter	54	1.002	HB5	9.8	0.233	0.005	14.8398	
120 minute winter	HB5	Hydro-Brake®	105	5.0				97.8
120 minute winter	HB5	Hydro-Brake®	105	4.9				34.1

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.15%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	50	144	45.866	2.585	17.6	17.4002	0.0000	FLOOD RISK
180 minute winter	51	144	45.865	2.423	12.9	12.5246	0.0000	SURCHARGED
180 minute winter	52	144	45.866	2.629	28.8	16.3742	0.0000	SURCHARGED
180 minute winter	54	144	45.866	2.785	25.1	18.6548	0.0000	SURCHARGED
180 minute winter	HB5	144	45.866	2.830	21.9	21.4722	0.0000	FLOOD RISK
15 minute summer	105	1	42.997	0.000	5.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	50	1.000	52	11.8	0.262	0.006	19.4785	
180 minute winter	51	2.000	52	8.5	0.502	0.006	18.8788	
180 minute winter	52	1.001	54	9.3	0.331	0.004	69.3388	
180 minute winter	54	1.002	HB5	15.2	0.241	0.007	20.0013	
180 minute winter	HB5	Hydro-Brake®	105	8.8				147.0
180 minute winter	HB5	Hydro-Brake®	105	6.3				101.2

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