

Built Development Ltd.

Bury Old Road, Heywood

Sustainable Drainage Strategy

July 2024



Revision Schedule

Bury Old Road, Heywood

Drainage Strategy

July 2024

Doc Ref: BDL-1763-01-DS-001

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-	28 th June 2024	First Issue	Calum Reford, BSc (Hons), MSc.	Lee Barnes, BSc (Hons), MCIHT	Lee Barnes, BSc (Hons), MCIHT
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P2	30 th August 2024	Second Revision	Calum Reford, BSc (Hons), MSc.	Lee Barnes, BSc (Hons), MCIHT	Lee Barnes, BSc (Hons), MCIHT

REVISION NOTES	
P1	Revised to include references to BDL-1763-01-FRA-001 – Flood Risk Assessment
P2	Revised to remove permeable paving and replacement with attenuation crates.

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CONTENTS

1.0	INTRODUCTION.....	3
2.0	SITE INFORMATION	4
3.0	FLOOD RISK	5
4.0	DRAINAGE STRATEGY	6
5.0	CONCLUSIONS.....	10

APPENDICES

APPENDIX A	LOCATION PLAN.....	11
APPENDIX B	SEWER RECORDS.....	12
APPENDIX C	DRAINAGE STRATEGY DRAWING.....	13
APPENDIX D	HYDRAULIC CALCULATIONS.....	14
APPENDIX E	SIMPLE INDEX APPROACH.....	15
APPENDIX F	FLOOD MAP FOR PLANNING	16

1.0 INTRODUCTION

1.1 Instructions

- 1.1.1 This Drainage Strategy report has been prepared in accordance with instructions from Bernard Taylor Partnership Architects, on behalf of Build Developments Ltd, to support a planning application to Rochdale Borough Council for a residential development of 28no. dwellings over two sites. Site 1 is located to the south of Bury Old Road, and to the east of Sutherland Road, Heywood. Site 2 is located to the north of Argyle Street, Heywood. Both sites are located within the curtilage of Our Lady's and St Paul's Roman Catholic Primary School, OL10 3PD.
- 1.1.2 The purpose of this report is to assess flood risk and determine a drainage strategy for the proposed development. It does not purport to be a detailed design for approval or construction purposes.

1.2 Planning History

- 1.2.1 Rochdale Borough Council have provided pre-application advice concerning flood risk as follows:

The site is within Flood Zone 1, having a less than a 1 in 1,000 annual probability of flooding, however, does fall in the Heywood Critical Drainage Area. Given the proposals would comprise of major development, a Flood Risk Assessment and a Sustainable Drainage Strategy will be required with any future application.

- 1.2.2 Inspire Design and Development have prepared a Site-Specific Flood Risk Assessment (doc ref: BDL-1763-01-FRA-001) which should be read in conjunction with this Sustainable Drainage Strategy.

2.0 SITE INFORMATION

2.1 Existing Site

- 2.1.1 The site comprises of two sites (Site 1 (0.5ha) and Site 2 (0.1ha)), with a total site area of 0.6ha. Both sites comprise of unused land which forms part of the curtilage to Our Lady's and St Paul's Roman Catholic Primary School, off Sutherland Road, Heywood, OL10 3PD. A Location Plan (BDL-1763-01-GA-001) is available within Appendix A of this report.
- 2.1.2 Site 1 is bound to the north by Old Bury Road, and to the west by Sutherland Road, and is relatively rectangular in shape. Levels on the site are generally sloping, with +135.7m AOD along the east boundary down to +132.2m AOD.
- 2.1.3 Site 2 is bound to the south by Argyle Street, and to the west and north by the curtilage of Our Lady's and St Paul's Roman Catholic Primary School. Levels on Site 2 is relatively flat, with +133.1m AOD in the north, and +132.5m AOD in the south.
- 2.1.4 The nearest watercourse in the River Roch, 660m to the northwest of the site. The River Roch is a main river, a tributary of the River Irwell, running east to west. The River Roch joins the River Irwell, 4.5km to the southwest of the site.
- 2.1.5 According to sewer records from United Utilities (Appendix B), there is a 225mm diameter public combined sewer located under Sutherland Road, and a 225mm diameter public combined sewer under Argyle Street.
- 2.1.6 According to BGS data, the site is located within the Pennine Lower Coal Measures formation comprising of mudstone, siltstone and sandstone. Superficial deposits of Glaciofluvial Deposits are also present with sand and gravel.

2.2 Development Proposals

- 2.2.1 The proposed development is to construct 28no. residential dwellings over two plots of land, complete with access, driveways, and associated landscaping. The total impermeable area of the development is considered to be approximately 60% of the total site area, with the remaining 40% to consist of public open space and private gardens.

3.0 FLOOD RISK

3.1.1 This section provides a brief overview of Flood Risk. However, full flood risk information is available within the Inspire Design & Development Report BDL-1763-01-FRA-001 *Flood Risk Assessment*, which has been submitted in support of this planning application.

3.2 Potential for Fluvial Flood Risk

3.2.1 The Environment Agency's *Flood Map for Planning* shows the site is located within Flood Zone 1 (low probability), see Appendix F. Consequently, there is no significant risk of fluvial flooding and therefore no need to consider the NPPF Sequential and Exception Tests.

3.2.2 As the site is located within Flood Zone 1, and has an area of less than 1ha, there is no requirements in the NPPF for a site-specific flood risk assessment to accompany a planning application.

3.3 Potential for Surface Water Flooding

3.3.1 According to the EA's *Flood Risk from Surface Water* shows a small area of low risk surface water flooding in the centre of Site 1. However, the remainder of Site 1, and all of Site 2, shows no risk of surface water flooding.

3.3.2 The proposed drainage system, described within Section 4, will utilise sustainable drainage techniques to attenuate runoff to a low discharge rate, thereby reducing any potential for surface water flooding at the site.

3.4 Potential for Reservoir Flooding

3.4.1 The EA's *Flood Risk from Reservoirs* map shows no risk of reservoir flooding at or in the vicinity of the site.

3.5 Potential for Groundwater Flooding

3.5.1 In view of the geological data from BGS, which identifies the site to be within coal measure geology, flood risk from groundwater is considered to be low.

4.0 DRAINAGE STRATEGY

4.1 Existing Drainage

4.1.1 There is no known positive drainage from the site at present.

4.2 Sustainable Urban Drainage Systems (SUDS)

4.2.1 The proposed drainage system will be based on SUDS principles for the attenuation and treatment of the surface water runoff, as shown on the drawing BDL-1763-01-DS-001 *Drainage Strategy Site 1* and BDL-1763-01-DR-002 *Drainage Strategy Site 2*, and described below.

4.2.2 The first consideration in the SUDS hierarchy is infiltration to ground. According to BGS data, there is relatively impermeable Coal Measure geology present at or near the surface of the site. There is also the possibility of Made Ground in some areas of the site. Although infiltration would be the preferred option if the ground conditions were favourable, in this case, it is considered unlikely that soakaways would prove feasible. For this reason, infiltration has not been pursued further within this Drainage Strategy.

4.2.3 The second consideration in the SUDS hierarchy is disposal to watercourse. As the nearest watercourse is approximately 650m to the northwest of the site, and crossing third-party land, discharge to watercourse is not considered to be a feasible option.

4.2.4 The third consideration in the SUDS hierarchy is disposal to the sewer. The nearest public sewer is the 225mm diameter public combined sewer which flows under Sutherland Road, adjacent to the site entrance. Discharge to the public sewer is therefore considered to be feasible, and the only option available based on current information. Consequently, this Drainage Strategy is based on discharge to the sewer.

4.3 Site 1 Proposed Drainage

Surface Water Drainage

4.3.1 The proposed surface water drainage system will collect future runoff from the site and discharge the attenuated flow to the 225mm diameter public combined sewer under Sutherland Road. A total surface water storage volume of 197m³ is provided by the

proposed 900mm pipes located under the access road and attenuation crates as shown on the drawing BDL-1763-01-DR-001 *Drainage Strategy*. Additional attenuation crates located under private driveways will provide additional attenuation capacity and provide appropriate treatment of surface water runoff.

- 4.3.2 The proposed attenuation will be sufficient to cater for the 1 in 100-year rainfall event with 40% climate change allowance in accordance with the EA Guidance *Flood Risk Assessments: Climate Change Allowances*, May 2022. Hydraulic calculations are available within Appendix D. Surface water will be discharged at the greenfield runoff rate of 5.1l/s.
- 4.3.3 The areas of open space and private gardens will be soft landscaped and offer a measure of bioretention through shallow infiltration into topsoil and the evapotranspiration of the vegetation.
- 4.3.4 The proposed drainage system will ensure that there will be no significant flooding caused either within the site, or in the surrounding area by future site surface water runoff.

Foul Sewerage

- 4.3.5 Foul sewerage for Site 1 will collect sewerage from various sanitary facilities and convey the sewerage via a new foul sewer under the proposed access road before discharging to the existing combined sewer under Sutherland Road, as shown on the drawing BDL-1763-01-DR-001 *Drainage Strategy*.

4.4 Site 2 Proposed Drainage

Surface Water Drainage

- 4.4.1 The proposed surface water drainage system will collect future runoff from the site and discharge the attenuated flow to the 225mm diameter public combined sewer under Argyle Street. A total surface water storage volume of 40m³ is provided by the attenuation crates located underneath each driveway of the 6no. plots as shown in the drawing BDL-1763-01-DR-001 *Drainage Strategy*.

- 4.4.2 The proposed attenuation will be sufficient to cater for the 1 in 100-year rainfall event with 40% climate change allowance in accordance with the EA Guidance *Flood Risk Assessments: Climate Change Allowances*, May 2022. Hydraulic calculations are available within Appendix D. Surface water will be discharged at the greenfield runoff rate of 2.43l/s.
- 4.4.3 The areas of open space and private gardens will be soft landscaped and offer a measure of bioretention through shallow infiltration into topsoil and the evapotranspiration of the vegetation.
- 4.4.4 The proposed drainage system will ensure that there will be no significant flooding caused either within the site, or in the surrounding area by future site surface water runoff.

Foul Sewerage

- 4.4.5 Foul sewerage for Site 2 will collect sewerage from various sanitary facilities and convey the sewerage via a new foul sewer under the proposed access road before discharging to the existing combined sewer under Argyle Street, as shown on the drawing BDL-1763-01-DR-001 *Drainage Strategy*.

4.5 Management and Maintenance

Treatment

- 4.5.1 Surface water will be collected via trapped gullies and conveyed to attenuation crates which will provide adequate treatment prior to discharge, together with roof water, to the combined sewer. Areas of soft landscaping will provide a significant degree of bioretention and amenity value.
- 4.5.2 To ensure the appropriate SUDS measures used to treat surface water and prevent the risk of pollution from the discharging runoff, the CIRIA SUDS Manual's *Simple Index Approach* has been used. A summary of the *Simple Index Approach Tool* by HR Wallingford is supplied within Appendix E of this report.

Surface Water Approvals

- 4.5.3 At the detailed design stage, an application will be made to United Utilities under Section 106 of the Water Industry Act 1991 for consent to discharge surface water from the site to the public sewer system.
- 4.5.4 All relevant authorities will be kept fully informed regarding the detailed design of the foul sewerage system. It is normal practice for detailed surface water drainage design to be subject to the approval of the Local Planning Authority subsequent to the granting of planning permission, and this will be sought from Rochdale Borough Council at the appropriate time.

Foul Sewerage Approvals

- 4.5.5 At the detailed design stage, an application will be made to United Utilities under Section 106 of the Water Industry Act 1991 for consent to discharge foul sewerage from the site to the public sewer system.
- 4.5.6 All relevant authorities will be kept fully informed regarding the detailed design of the foul sewerage system. It is normal practice for detailed foul water drainage design to be the subject of approval by the Local Planning Authority subsequent to the grant of planning permission. This will be sought from Rochdale Borough Council at the appropriate time.

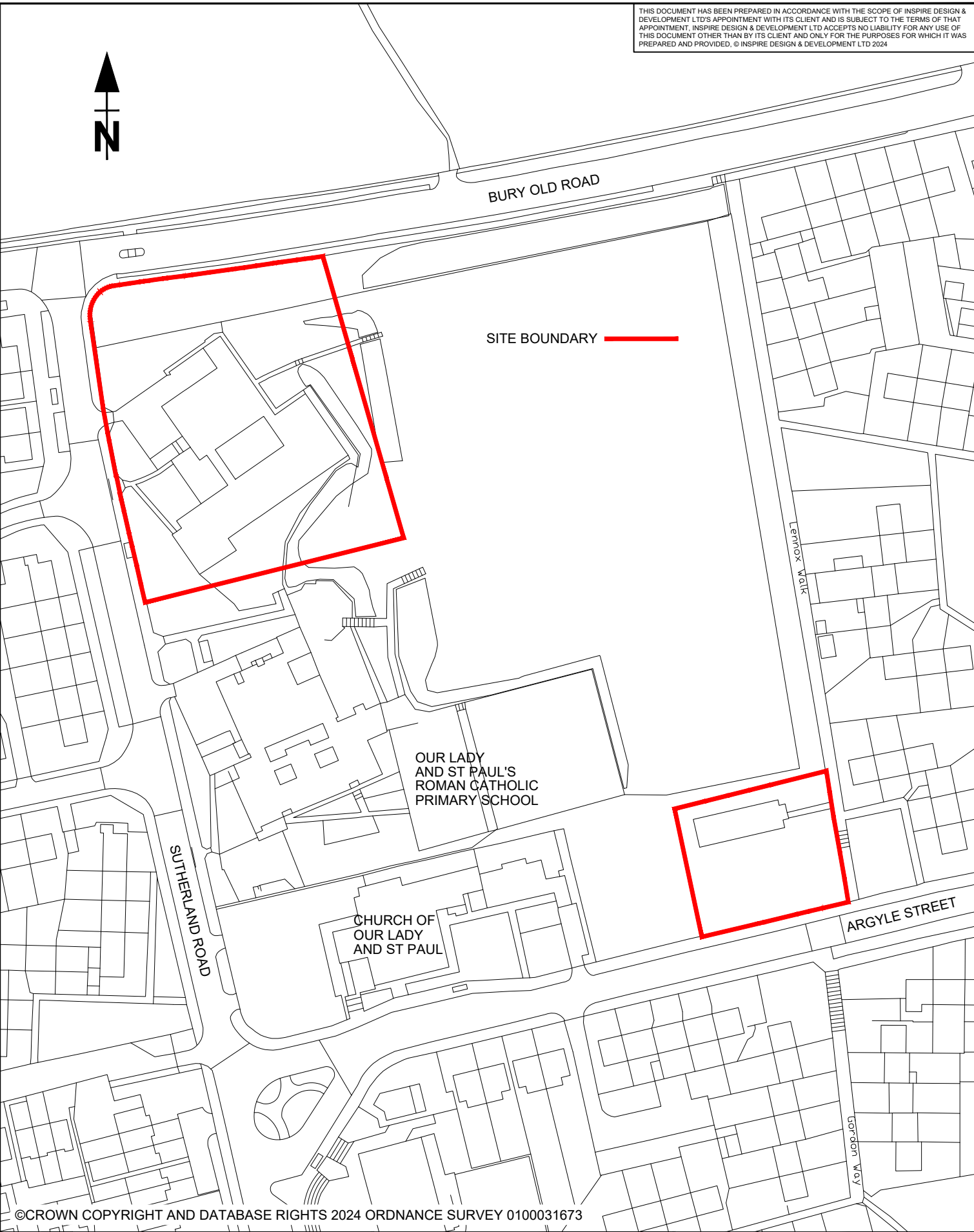
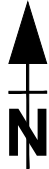
Maintenance

- 4.5.7 The completed development will be operated by the landowner, who may employ an operation and maintenance team to maintain the proposed drainage system to a standardised procedure and ensure that all features of the drainage system are regularly and adequately managed and maintained.
- 4.5.8 In the event that the properties are transferred to private ownership, the properties will be similarly managed and maintained by the owners.
- 4.5.9 A detailed Management and Maintenance Plan may be provided at the detailed design stage, as and when required.

5.0 CONCLUSIONS

- 5.1.1 The site is not at risk of flooding from any source and there is no need to consider the NPPF Sequential or Exception Tests.
- 5.1.2 The site will be drained via a new connection to the public sewer system using SUDS techniques, which will provide flow attenuation to a greenfield runoff rate and provide sufficient treatment of surface water runoff.
- 5.1.3 The proposed drainage system will be sufficient to cater for the 1 in 100-year rainfall event with 40% climate change allowance in accordance with the EA Guidance *Flood Risk Assessments: Climate Change Allowances*, May 2022.
- 5.1.4 Following implementation of the surface water drainage system, there will be no significant risk of surface water flooding at the site.
- 5.1.5 Foul sewerage will be disposed of the public combined sewer in Sutherland Road (Site 1), and Argyle Street (Site 2).
- 5.1.6 With regard to flood risk and drainage, therefore, the site is suitable for the proposed use. Subject to the implementation of this Drainage Strategy, the development may be occupied safely and adequately drained while reducing flood risk overall.

APPENDIX A LOCATION PLAN



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DATE: 26/06/2024	DRAWING TITLE: LOCATION PLAN		REV	DATE	NAME	CHK	NOTES
DRAWN: NGP			DRAWING STATUS: FOR APPROVAL				
CHECKED: CGR	PROJECT:	CLIENT:	DRAWING No:		REVISION No:		
APPROVED: CR	BURY OLD ROAD, HEYWOOD	BUILT DEVELOPMENTS LTD	BDL-1763-01-GA-001				
SCALE @ A4: 1:1250							

APPENDIX B SEWER RECORDS

Inspire Design And Development

Unit 2a, Church View Business Park
Coney Green Rd, Inspire Design And Development
Clay Cross, Chesterfield,
S45 9HA

FAO:

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Your Ref: 1763
Our Ref: UUPS-ORD-580703
Date: 24/06/2024

Dear Sirs**Location: 105 SUTHERLAND ROAD, HEYWOOD, OL10 3PD**

I acknowledge with thanks your request dated 20/06/2024 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
2313	CO		122.94	225		VC	1.481851	100	
5204	VC		122.94	225		VC	6.047706	100	
5102	125.97	CO	122.94	225		VC	62.0867	1 in 93	
5201	130.73	SW	128.63	225		VC	84.43379	1 in 70	
3104	123.82	CO	122.14	450		CO	53.41125	1 in 281	
6401	140.25	VC	137.22	225		VC	83.55747	1 in 31	
3314	CO		150			VC	11.28187		
6214	CO		100			VC	9.225163		
4112	128.57	SW	127.22	225		UN	34.54596	1 in 24	
3304	128.52	CO	123.13	300		CO	38.62966	1 in 180	
5101	127.21	SW	124.63	225		VC	28.16026	1 in 83	
6311	FO		100			VC	22.84217		
6210	VC		225			VC	15.57762		
6106	CO		100			PF	18.53318		
7406	CO		150			VC	20.37769		
2304	125.48	CO	123.31	200		VC	57.47657		
3101	124.72	CO	122.44	450		CO	41.43546	1 in 206	
4202	132.38	SW	129.55	225		VC	52.88667	1 in 171	
6302	CO		0	225		VC	18.88154		
3202	125.09	CO	123.9	150		VC	12.20656	1 in 31	
4115	128.87	SW	0			UN	0.3689028		
6402	142.07	CO	140.21	225		VC	26.29477	1 in 166	
6407	CO		150			VC	39.8257		
6217	VC		150			VC	10.38363		
3103	123.67	CO	122.17	450		CO	8.494541	1 in 280	
5001	124.16	CO	121.04	600		CO	89.28686		
4107	128.89	CO	121.69	450		CO	12.707	1 in 254	
3304	129.71	CO	127.61	225		VC	49.65884	1 in 69	
7403	CO		150			VC	38.18105		
4105	128.83	CO	121.72	450		CO	9.035317	1 in 301	
4114	129.21	SW	127.02	525		UN	7.159987	1 in 720	
3311	125.22	CO	124.36	150		VC	30.91666	1 in 71	
8401	VC		150			VC	16.40287		
6001	CO		0	600		VC	50.9902		
7318	FO		100			VC	31.715		
3209	CO		100			VC	6.794676		
6501	142.59	CO	139.6	300		VC	49.47727	1 in 206	
3205	124.12	CO	122.71	375		VC	31.94403	1 in 246	
7316	CO		100			VC	19.77962		
3010	SW		150			UN	40.32331	1 in 9	
3404	122.66	CO	120.69	100		PVC	13.03947		
5003	123.62	CO	120.37	225		VC	34	1 in 179	
6111	VC		150			VC	8.358182		
3401	126.36	SW	125.63	300		VC	91.23595	1 in 30	
6213	CO		100			VC	20.47199		
7502	142.25	FO	141.12	150		PVC	33.25555	1 in 138	
6306	VC		150			VC	22.50286		
7405	CO		150			VC	12.42427		
4302	130.87	CO	125.86	225		VC	89.91656	1 in 71	
4402	132.04	SW	129.89	225		VC	28.15476	1 in 265	
3107	123.46	SW	122.22	300		UN	9.587879	1 in 137	
3307	126.45	CO	124.88	150		VC	8.468633	1 in 10	
4204	131.84	SW	127.15	525		UN	41.05666	1 in 513	
3106	123.57	SW	0			UN	0.2702629		
4304	CO		0	225		VC	69.2315		
4201	CO		127.62	300		CO	80.59266		
7314	CO		150			VC	12.20593		
6201	135.59	FO	133.25	225		VC	18.78289	1 in 18	
6202	135.63	CO	134.25	225		VC	10.44031	1 in 34	
7303	139.37	CO	133.93	450		CO	49.0408	1 in 175	
3405	CO		100			PVC	10.57144		
6105	VC		150			VC	8.113223		
3105	124.65	SW	122.39	600		VC	83.42997	1 in 521	
6230	CO		150			VC	7.166772		
4303	130.81	CO	129.11	150		VC	11.18034	1 in 36	
3305	129.09	CO	126.66	300		VC	17.02039	1 in 155	
2301	124.41	SW	121.02	300		VC	47.42362	1 in 30	
3201	126.32	CO	124.53	300		VC	23.5372	1 in 137	
4103	126.06	CO	121.95	450		CO	29.97428	1 in 300	
6104	CO		100			VC	22.12554		
6110	CO		150			VC	25.49229		
6204	134.57	CO	132.15	300		VC	77.12076	1 in 117	
4108	128.02	CO	121.49	300		CO	21.0302	1 in 191	
6219	CO		150			VC	11.40588		
6305	VC		150			VC	35.35233		
3302	131.13	CO	129.36	150		VC	6.703054		
4109	128.94	CO	0			UN	6.4013444		
6207	CO		100			VC	10.00156		
5111	VC		150			VC	8.261626		
7501	142.41	CO	139.31	300		VC	106.3203	1 in 226	
6103	CO		100			VC	17.11239		
7410	CO		150			VC	10.48514		
7401	142.79	CO	140.82	225		VC	60.40685	1 in 118	
6206	CO		100			VC	15.75202		
7306	CO		150			VC	20.83036		
3306	126.55	CO	125.05	150		VC	7.619773	1 in 19	
6301	141.02	CO	138.78	300		CO	113	1 in 231	
5011	CO		150			VC	23.67817		
7404	CO		150			VC	13.2453		
5401	136.02	SW	133.16	225		VC	72.43038	1 in 37	
6305	CO		100			VC	21.95093		
3310	126.73	CO	125.1	150		VC	14.14214		
4305	136.18	CO	128	150		VC	2.236066		
6218	CO		150			VC	15.589		
6228	CO		100			VC	11.57588		
7002	CO		0	225		VC	57.31462		
7302	140.03	CO	138.29	300		VC	17.72005	1 in 148	
7202	135.29	CO	130.08	450		CO	38.20995	1 in 212	
7301	141.02	SW	139.29	225		VC	35.12834	1 in 39	
7207	SW		150			VC	27.76678		
4101	131.11	CO	127.46	225		VC	2.236068		
3216	127.82	SW	128.47	150		UN	58.9927	1 in 25	
6309	CO		225			VC	21.72583		
6224	FO		100			VC	18.4165		
4113	131.32	SW	127.07	525		UN	40.85127	1 in 817	
5202	127.34	CO	125.27	225		VC	56.88895	1 in 55	
4110	126.44	SW	124.11	600		UN	20.27145	1 in 506	
3102	124.27	CO	122.3	450		VC	40.32373	1 in 310	
6403	140.67	CO	139.55	225		VC	30.35445	1 in 607	
6404	140.36	CO	139.61	225		VC	5.656854	1 in 94	
4401	132.52	SW	129.92	300		VC	106.3015	1 in 31	
6205	CO		150			VC	20.18107		
6204	133.19	SW	129.73	225		VC	57.48913	1 in 64	
7003	124.97	CO	120.13	600		CO	46.64346	1 in 177	
4301	131.88	CO	128.72	225		VC	26.83282		
6405	143.38	CO	139.39	225		VC	57.87054	1 in 113	
7305	CO		100			VC	9.379339		
4102	129.74	CO	126.69	300		CO	24.1921	1 in 5	
6007	CO		100			PF	7.220846		
6220	CO		150			VC	13.62927		
5103	126.77	CO	121.38	600		VC	71.67468	1 in 217	
6307	CO		225			VC	13.23467		
2003	124.67	CO	123.1	150		VC	4.123106		
5002	CO		0	225		VC	45.35416		
3208	126.82	CO	124.77	300		VC	35.1141	1 in 195	
5105	CO		225			VC	38.33984		
6203	132.16	CO	130.21	225		VC	34.78905	1 in 193	
4009	125.24	SW	123.89	150		UN	63.3173	1 in 19	
3309	126.2	CO	124.64	150		VC	4	1 in 33	
6303	CO		0	225		VC	13.18295		
4104	127.32	CO	121.85	450		CO	35.7648	1 in 275	
6205	127.46	CO	125.54	150		PF	4.123106	1 in 32	
6107	CO		100			VC	8.413028		
6101	124.96	SW	122.83	225		VC	43.41699		
3402	131.19	SW	129.69	150		UN	13.92839	1 in 66	
4111	127.11	SW	125.76	225		UN	87.73544	1 in 28	
6212	CO		225			VC	5.917274		
2303	125.47	CO	123.47	150		VC	4.472136		
3206	123.81	CO	122.58	450		CO	40.42694	1 in 289	
3301	131.16	CO	128.46	150		VC	3.162278	1 in 63	
6223	CO		100			VC	32.16652		
7402	142.85	CO	139.03	300		CO	39.21734	1 in 157	
7001	126.25	CO	124.64	225		VC	69.27216		
7203	131.39	SW	129.97	225		VC	35.05709	1 in 185	
7409	CO		150			VC	11.55051		
8504	CO		0			UN	6.843242	1 in	
7408	CO		150			VC	16.97377		
7201	134	CO	129.71	300		CO	61.0062	1 in 130	
5104	CO		150			VC	1.857179		

Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
2313	CO		122.94	225		VC	1.481851	100	
5204	VC		122.94	225		VC	6.047706	100	
5102	125.97	CO	122.94	225		VC	62.0867	1 in 93	
5201	130.73	SW	128.63	225		VC	84.43379	1 in 70	
3104	123.82	CO	122.14	450		CO	53.41125	1 in 281	

APPENDIX C DRAINAGE STRATEGY DRAWING

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NOTES:

- DO NOT SCALE FROM THIS DRAWING.
- ALL MEASUREMENTS ARE IN METERS UNLESS OTHERWISE STATED.
- DRAWING NOT ISSUED FOR CONSTRUCTION.
- SITE LAYOUT PROVIDED BY BTP ARCHITECTS DWG No. TG-BTP-00-SP-DR-A-4299-107
- LOCATION OF SVPs TO BE CONFIRMED BY THE ARCHITECT
- PROPOSED EXTERNAL WORKS LEVELS TO BE CONFIRMED AT DETAILED DESIGN
- OUTFALL INVERT LEVELS TO BE CONFIRMED & REPORTED BACK TO INSPIRE DESIGN & DEVELOPMENT

KEY:

- FFL 134.40 PROPOSED FINISH FLOOR LEVEL
132.06 + EXISTING SPOT LEVEL

EXISTING

- PUBLIC COMBINED DRAINAGE
— PUBLIC FOUL DRAINAGE
— PUBLIC SURFACE WATER DRAINAGE

PROPOSED

- PRIVATE SURFACE WATER DRAINAGE
— PRIVATE FOUL DRAINAGE
— PRIVATE FOUL RISING MAIN
— PRIVATE COMBINED DRAINAGE
— CHANNEL DRAIN
— GULLY
ATTENUATION CRATES

P1 28/08/24 CR CR CHANGED TO CRATES

REV	DATE	NAME	CHECK	NOTE
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DRAWING STATUS:

FOR APPROVAL

CLIENT

BUILT DEVELOPMENTS LTD



PROJECT

BURY OLD ROAD, HEYWOOD

DRAWING TITLE

DRAINAGE STRATEGY

DRAWN CHECKED APPROVED

NGP CGR CR

DATE SCALE @ A1
26/06/24 1:250

DRAWING No. REVISION No.

BDL-1763-01-DR-001 P1



APPENDIX D HYDRAULIC CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	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)	20.000	Minimum Backdrop Height (m)	2.000
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
9	0.008	5.00	131.750	450	383449.287	410366.189	0.750
P17	0.000	5.00	131.300		383445.565	410365.190	0.610
10	0.005	5.00	131.750	600	383443.984	410376.437	1.260
C1	0.000		131.700	450	383442.525	410376.804	1.240

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	9	P17	3.854	0.600	131.000	130.690	0.310	12.4	100	5.06	50.0
1.001	P17	10	11.358	0.600	130.690	130.490	0.200	56.8	100	5.25	50.0
1.002	10	C1	1.504	0.600	130.490	130.460	0.030	50.1	100	5.28	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	2.203	17.3	1.4	0.650	0.510	0.008	0.0	20	1.348
1.001	1.024	8.0	1.4	0.510	1.160	0.008	0.0	29	0.772
1.002	1.091	8.6	2.3	1.160	1.140	0.013	0.0	36	0.927

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	3.854	12.4	100	Circular	131.750	131.000	0.650	131.300	130.690	0.510
1.001	11.358	56.8	100	Circular	131.300	130.690	0.510	131.750	130.490	1.160
1.002	1.504	50.1	100	Circular	131.750	130.490	1.160	131.700	130.460	1.140

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	9	450	Manhole	Adoptable	P17		Junction	
1.001	P17		Junction		10	600	Manhole	Adoptable
1.002	10	600	Manhole	Adoptable	C1	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
9	383449.287	410366.189	131.750	0.750	450		0	1.000	131.000	100
P17	383445.565	410365.190	131.300	0.610			1	1.000	130.690	100
							0	1.001	130.690	100
10	383443.984	410376.437	131.750	1.260	600		1	1.001	130.490	100
							0	1.002	130.490	100
C1	383442.525	410376.804	131.700	1.240	450		1	1.002	130.460	100

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node 10 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	130.490	Diameter (m)	0.024		

Node P17 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	130.690
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	78

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	8.8	0.0	0.450	8.8	0.0	0.451	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	9	9	131.020	0.020	1.4	0.0032	0.0000	OK
30 minute summer	P17	24	130.737	0.047	1.5	0.4103	0.0000	OK
30 minute summer	10	23	130.738	0.248	1.8	0.0703	0.0000	SURCHARGED
15 minute summer	C1	1	130.460	0.000	0.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	9	1.000	P17	1.4	1.409	0.081	0.0065	
15 minute summer	P17	1.001	10	1.1	0.192	0.134	0.0609	
30 minute summer	10	Orifice	C1	0.6				1.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	9	10	131.031	0.031	3.5	0.0049	0.0000	OK
60 minute summer	P17	45	130.893	0.203	2.9	1.7836	0.0000	SURCHARGED
60 minute summer	10	45	130.892	0.402	1.5	0.1138	0.0000	SURCHARGED
15 minute summer	C1	1	130.460	0.000	0.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	9	1.000	P17	3.5	1.564	0.201	0.0188	
15 minute summer	P17	1.001	10	-1.9	-0.292	-0.234	0.0889	
60 minute summer	10	Orifice	C1	0.8				4.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	9	51	131.161	0.161	4.3	0.0255	0.0000	SURCHARGED
60 minute summer	P17	51	131.160	0.470	5.6	3.9644	0.0000	FLOOD RISK
60 minute summer	10	51	131.159	0.669	2.7	0.1893	0.0000	SURCHARGED
15 minute summer	C1	1	130.460	0.000	0.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	9	1.000	P17	6.3	1.660	0.363	0.0221	
15 minute summer	P17	1.001	10	-2.3	-0.296	-0.283	0.0889	
60 minute summer	10	Orifice	C1	1.0				7.4

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	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)	20.000	Minimum Backdrop Height (m)	2.000
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
P18	0.009	5.00	133.800	450	383622.218	410284.373	0.560
P19	0.007	5.00	133.400	450	383616.659	410284.403	0.760
P20	0.007	5.00	133.200	450	383609.013	410282.708	0.760
P21	0.008	5.00	132.890	450	383606.049	410281.717	0.760
P22	0.009	5.00	132.500	450	383596.473	410279.450	0.660
P23	0.009	5.00	132.200	450	383590.826	410278.369	0.910
6	0.000		133.500	450	383617.044	410283.090	1.000
7	0.000		133.000	450	383606.345	410280.486	1.350
8	0.000		132.300	1200	383592.246	410277.056	1.600
OUTFALL			132.000		383595.540	410262.640	2.506

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	P18	6	5.331	0.600	133.240	132.500	0.740	7.2	100	5.09	50.0
2.000	P19	6	1.368	0.600	132.640	132.500	0.140	9.8	100	5.01	50.0
3.000	P20	7	3.472	0.600	132.440	132.000	0.440	7.9	100	5.03	50.0
4.000	P21	7	1.266	0.600	132.130	132.000	0.130	9.7	100	5.01	50.0
5.000	P22	8	4.858	0.600	131.840	131.050	0.790	6.1	100	5.03	50.0
6.000	P23	8	1.934	0.600	131.290	131.050	0.240	8.1	100	5.01	50.0
1.001	6	7	11.011	0.600	132.500	132.000	0.500	22.0	100	5.27	50.0
1.002	7	8	14.510	0.600	131.650	130.750	0.900	16.1	450	5.51	50.0
1.003	8	OUTFALL	14.788	0.600	130.700	129.494	1.206	12.3	150	5.76	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	2.898	22.8	1.6	0.460	0.900	0.009	0.0	18	1.689
2.000	2.487	19.5	1.3	0.660	0.900	0.007	0.0	18	1.410
3.000	2.769	21.7	1.3	0.660	0.900	0.007	0.0	16	1.481
4.000	2.491	19.6	1.4	0.660	0.900	0.008	0.0	18	1.451
5.000	3.138	24.6	1.6	0.560	1.150	0.009	0.0	18	1.780
6.000	2.740	21.5	1.6	0.810	1.150	0.009	0.0	18	1.596
1.001	1.652	13.0	2.9	0.900	0.900	0.016	0.0	32	1.338
1.002	5.082	808.2	5.6	0.900	1.100	0.031	0.0	26	1.485
1.003	2.892	51.1	8.9	1.450	2.356	0.049	0.0	42	2.169

Pipeline Schedule

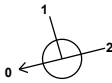
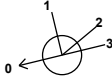
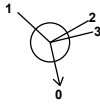
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.331	7.2	100	Circular	133.800	133.240	0.460	133.500	132.500	0.900
2.000	1.368	9.8	100	Circular	133.400	132.640	0.660	133.500	132.500	0.900
3.000	3.472	7.9	100	Circular	133.200	132.440	0.660	133.000	132.000	0.900
4.000	1.266	9.7	100	Circular	132.890	132.130	0.660	133.000	132.000	0.900
5.000	4.858	6.1	100	Circular	132.500	131.840	0.560	132.300	131.050	1.150
6.000	1.934	8.1	100	Circular	132.200	131.290	0.810	132.300	131.050	1.150
1.001	11.011	22.0	100	Circular	133.500	132.500	0.900	133.000	132.000	0.900
1.002	14.510	16.1	450	Circular	133.000	131.650	0.900	132.300	130.750	1.100
1.003	14.788	12.3	150	Circular	132.300	130.700	1.450	132.000	129.494	2.356

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	P18	450	Manhole	Adoptable	6	450	Manhole	Adoptable
2.000	P19	450	Manhole	Adoptable	6	450	Manhole	Adoptable
3.000	P20	450	Manhole	Adoptable	7	450	Manhole	Adoptable
4.000	P21	450	Manhole	Adoptable	7	450	Manhole	Adoptable
5.000	P22	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
6.000	P23	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.001	6	450	Manhole	Adoptable	7	450	Manhole	Adoptable
1.002	7	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.003	8	1200	Manhole	Adoptable	OUTFALL		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
P18	383622.218	410284.373	133.800	0.560	450				
						0	1.000	133.240	100
P19	383616.659	410284.403	133.400	0.760	450				
						0	2.000	132.640	100
P20	383609.013	410282.708	133.200	0.760	450				
						0	3.000	132.440	100
P21	383606.049	410281.717	132.890	0.760	450				
						0	4.000	132.130	100
P22	383596.473	410279.450	132.500	0.660	450				
						0	5.000	131.840	100
P23	383590.826	410278.369	132.200	0.910	450				
						0	6.000	131.290	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
6	383617.044	410283.090	133.500	1.000	450		1	2.000	132.500	100
							2	1.000	132.500	100
							0	1.001	132.500	100
7	383606.345	410280.486	133.000	1.350	450		1	4.000	132.000	100
							2	3.000	132.000	100
							3	1.001	132.000	100
							0	1.002	131.650	450
8	383592.246	410277.056	132.300	1.600	1200		1	6.000	131.050	100
							2	5.000	131.050	100
							3	1.002	130.750	450
							0	1.003	130.700	150
OUTFALL	383595.540	410262.640	132.000	2.506			1	1.003	129.494	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

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	40	0	0

Node 8 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.500	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	2.4		
Invert Level (m)	130.700	Diameter (m)	0.030		

Node P18 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.600	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	0.5		
Invert Level (m)	133.240	Diameter (m)	0.017		

Node P19 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	132.640	Diameter (m)	0.024		

Node P20 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	132.440	Diameter (m)	0.024		

Node P21 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.2		
Invert Level (m)	132.130	Diameter (m)	0.026		

Node P22 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.600	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	131.840	Diameter (m)	0.025		

Node P18 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	133.240
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	182

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	11.0	0.0	0.450	11.0	0.0	0.451	0.0	0.0

Node P19 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	132.640
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	45

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	5.2	0.0	0.450	5.2	0.0	0.451	0.0	0.0

Node P20 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	132.440
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	45

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	5.2	0.0	0.450	5.2	0.0	0.451	0.0	0.0

Node P21 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	132.130
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	47

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	5.2	0.0	0.450	5.2	0.0	0.451	0.0	0.0

Node P22 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	131.840
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	64

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	7.1	0.0	0.450	7.1	0.0	0.451	0.0	0.0

Node P23 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	131.290
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	164

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	15.5	0.0	0.450	15.5	0.0	0.451	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute summer	P18	84	133.322	0.082	0.7	0.9119	0.0000	OK
30 minute summer	P19	23	132.721	0.080	1.1	0.4313	0.0000	OK
30 minute summer	P20	23	132.521	0.080	1.1	0.4313	0.0000	OK
30 minute summer	P21	23	132.222	0.092	1.3	0.4922	0.0000	OK
60 minute summer	P22	40	131.926	0.086	1.1	0.6249	0.0000	OK
15 minute summer	P23	12	131.308	0.018	1.6	0.2798	0.0000	OK
60 minute summer	6	42	132.513	0.013	0.5	0.0021	0.0000	OK
60 minute summer	7	41	131.663	0.013	1.2	0.0021	0.0000	OK
120 minute summer	8	92	131.181	0.481	2.0	0.5438	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	129.494	0.000	1.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute summer	P18	Orifice	6	0.2				
30 minute summer	P19	Orifice	6	0.3				
30 minute summer	P20	Orifice	7	0.3				
30 minute summer	P21	Orifice	7	0.4				
60 minute summer	P22	Orifice	8	0.4				
15 minute summer	P23	6.000	8	1.3	1.431	0.060	0.0017	
60 minute summer	6	1.001	7	0.5	0.774	0.036	0.0066	
30 minute summer	7	1.002	8	1.2	0.646	0.001	0.9884	
120 minute summer	8	Orifice	OUTFALL	1.3				8.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	P18	96	133.445	0.205	1.2	2.2833	0.0000	SURCHARGED
60 minute summer	P19	42	132.865	0.225	2.0	1.2076	0.0000	SURCHARGED
60 minute summer	P20	42	132.665	0.225	2.0	1.2076	0.0000	SURCHARGED
60 minute summer	P21	41	132.375	0.245	2.3	1.3147	0.0000	SURCHARGED
60 minute summer	P22	43	132.070	0.230	2.6	1.6717	0.0000	SURCHARGED
120 minute winter	P23	124	131.510	0.220	1.6	3.4461	0.0000	SURCHARGED
60 minute summer	6	44	132.517	0.017	0.8	0.0027	0.0000	OK
60 minute summer	7	43	131.667	0.017	2.0	0.0027	0.0000	OK
120 minute winter	8	124	131.510	0.810	3.1	0.9162	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	129.494	0.000	1.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	P18	Orifice	6	0.3				
60 minute summer	P19	Orifice	6	0.6				
60 minute summer	P20	Orifice	7	0.6				
60 minute summer	P21	Orifice	7	0.7				
60 minute summer	P22	Orifice	8	0.6				
30 minute summer	P23	6.000	8	3.5	1.799	0.163	0.0151	
60 minute summer	6	1.001	7	0.8	0.910	0.062	0.0098	
60 minute summer	7	1.002	8	2.0	0.630	0.003	1.1630	
120 minute winter	8	Orifice	OUTFALL	1.7				18.2

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	P18	112	133.646	0.406	2.1	4.5259	0.0000	FLOOD RISK
60 minute summer	P19	44	133.119	0.479	3.7	2.4188	0.0000	FLOOD RISK
60 minute summer	P20	44	132.919	0.479	3.7	2.4188	0.0000	FLOOD RISK
60 minute summer	P21	42	132.837	0.706	4.3	2.4549	0.0000	FLOOD RISK
60 minute summer	P22	45	132.339	0.499	4.8	3.2779	0.0000	FLOOD RISK
180 minute winter	P23	176	132.119	0.829	2.4	7.1145	0.0000	FLOOD RISK
60 minute summer	6	44	132.521	0.021	1.2	0.0033	0.0000	OK
180 minute winter	7	176	132.119	0.469	2.6	0.0745	0.0000	SURCHARGED
180 minute winter	8	176	132.120	1.420	3.4	1.6056	0.0000	FLOOD RISK
15 minute summer	OUTFALL	1	129.494	0.000	1.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	P18	Orifice	6	0.4				
60 minute summer	P19	Orifice	6	0.8				
60 minute summer	P20	Orifice	7	0.8				
60 minute summer	P21	Orifice	7	1.2				
60 minute summer	P22	Orifice	8	0.9				
15 minute summer	P23	6.000	8	7.3	2.091	0.339	0.0151	
60 minute summer	6	1.001	7	1.2	1.015	0.091	0.0128	
60 minute summer	7	1.002	8	3.2	0.639	0.004	1.7669	
180 minute winter	8	Orifice	OUTFALL	2.2				36.0

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	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)	20.000	Minimum Backdrop Height (m)	2.000
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
P1	0.045	5.00	133.000		383474.884	410394.195	0.610
P2	0.006	5.00	133.000		383477.677	410398.950	0.610
P3	0.007	5.00	133.000		383477.403	410400.635	0.610
P4	0.008	5.00	133.300	450	383487.190	410417.810	0.560
P5	0.005	5.00	133.300	450	383482.676	410420.869	0.560
P6	0.006	5.00	133.300	450	383480.944	410420.625	0.560
P7	0.018	5.00	133.000	450	383471.267	410419.265	0.560
P8	0.008	5.00	132.850	450	383457.237	410407.700	0.560
P9	0.006	5.00	132.850	450	383458.236	410417.434	0.560
P10	0.006	5.00	132.850	450	383462.559	410418.042	0.560
P11	0.007	5.00	132.850	450	383452.331	410407.010	0.560
P12	0.007	5.00	132.850	450	383449.998	410406.683	0.560
P13	0.008	5.00	132.850	450	383449.216	410416.166	0.560
P14	0.006	5.00	132.600	450	383444.681	410415.529	0.560
P15	0.008	5.00	132.600		383438.358	410414.640	0.710
P16	0.008	5.00	132.600		383441.019	410404.659	0.510
1	0.000		132.800	1350	383473.964	410400.069	2.285
2	0.000		133.100	1350	383481.453	410417.004	2.600
3	0.011	5.00	132.800	1350	383471.776	410415.644	2.324
4	0.026	5.00	132.600	450	383439.438	410404.879	0.950
5	0.029	5.00	132.300	1500	383438.711	410410.997	1.958
C2	0.000		132.100	450	383436.289	410408.114	2.000
JUNCTION 1			132.650		383449.132	410412.462	2.230
JUNCTION 2			132.700		383458.691	410413.805	2.257

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)
5.000	P1	1	5.946	0.600	132.390	130.865	1.525	3.9	100	5.09	50.0
6.000	P2	1	3.878	0.600	132.390	130.865	1.525	2.5	100	5.06	50.0
7.000	P3	1	3.485	0.600	132.390	130.865	1.525	2.3	100	5.05	50.0
8.000	P4	2	5.793	0.600	132.740	130.850	1.890	3.1	100	5.10	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)
5.000	3.944	31.0	8.1	0.510	1.835	0.045	0.0	35	3.318
6.000	4.887	38.4	1.1	0.510	1.835	0.006	0.0	11	2.096
7.000	5.156	40.5	1.3	0.510	1.835	0.007	0.0	12	2.311
8.000	4.450	35.0	1.4	0.460	2.150	0.008	0.0	14	2.157

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)
9.000	P5	2	4.054	0.600	132.740	130.850	1.890	2.1	100	5.06	50.0
10.000	P6	2	3.657	0.600	132.740	130.850	1.890	1.9	100	5.05	50.0
11.000	P7	3	3.657	0.600	132.440	130.826	1.614	2.3	100	5.03	50.0
12.000	P8	JUNCTION 2	6.276	0.600	132.290	130.793	1.497	4.2	100	5.08	50.0
14.000	P9	JUNCTION 2	3.657	0.600	132.290	130.793	1.497	2.4	100	5.04	50.0
13.000	P10	JUNCTION 2	5.737	0.600	132.290	130.793	1.497	3.8	100	5.08	50.0
2.000	P11	JUNCTION 1	14.192	0.600	132.290	130.770	1.520	9.3	100	5.07	50.0
3.000	P12	JUNCTION 1	12.083	0.600	132.290	130.770	1.520	7.9	100	5.07	50.0
4.000	P13	JUNCTION 1	11.708	0.600	132.290	130.770	1.520	7.7	100	5.03	50.0
15.000	P14	5	5.405	0.600	132.040	130.742	1.298	4.2	100	5.12	50.0
16.000	P15	5	10.992	0.600	131.890	130.742	1.148	9.6	100	5.04	50.0
17.000	P16	4	11.256	0.600	132.090	131.700	0.390	28.9	100	5.03	50.0
5.001	1	3	15.728	0.600	130.515	130.476	0.039	403.3	450	5.36	50.0
8.001	2	3	9.772	0.600	130.500	130.476	0.024	407.2	450	5.20	50.0
5.002	3	JUNCTION 2	13.214	0.600	130.476	130.443	0.033	400.4	450	5.57	50.0
5.003	JUNCTION 2	JUNCTION 1	9.653	0.600	130.443	130.420	0.023	419.7	450	5.72	50.0
1.004	JUNCTION 1	5	10.523	0.600	130.420	130.392	0.028	375.8	450	5.89	50.0
1.000	4	5	6.161	0.600	131.650	130.692	0.958	6.4	450	5.73	50.0
1.001	5	C2	3.765	0.600	130.342	130.100	0.242	15.6	150	5.84	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)
9.000	5.322	41.8	0.9	0.460	2.150	0.005	0.0	11	2.179
10.000	5.605	44.0	1.1	0.460	2.150	0.006	0.0	11	2.294
11.000	5.178	40.7	3.3	0.460	1.874	0.018	0.0	19	3.099
12.000	3.803	29.9	1.4	0.460	1.807	0.008	0.0	15	1.974
14.000	4.987	39.2	1.1	0.460	1.807	0.006	0.0	11	2.139
13.000	3.979	31.2	1.1	0.460	1.807	0.006	0.0	13	1.855
2.000	2.544	20.0	1.3	0.460	1.780	0.007	0.0	17	1.402
3.000	2.758	21.7	1.3	0.460	1.780	0.007	0.0	17	1.521
4.000	2.802	22.0	1.4	0.460	1.780	0.008	0.0	18	1.589
15.000	3.816	30.0	1.1	0.460	1.458	0.006	0.0	13	1.779
16.000	2.512	19.7	1.4	0.610	1.458	0.008	0.0	18	1.463
17.000	1.442	11.3	1.4	0.410	0.800	0.008	0.0	24	0.981
5.001	1.006	160.0	10.5	1.835	1.874	0.058	0.0	77	0.574
8.001	1.001	159.2	3.4	2.150	1.874	0.019	0.0	45	0.412
5.002	1.010	160.6	19.2	1.874	1.807	0.106	0.0	104	0.687
5.003	0.986	156.8	22.8	1.807	1.780	0.126	0.0	115	0.708
1.004	1.042	165.8	26.7	1.780	1.458	0.148	0.0	122	0.774
1.000	8.054	1280.9	6.1	0.500	1.158	0.034	0.0	22	2.144
1.001	2.566	45.4	40.7	1.808	1.850	0.225	0.0	111	2.893

Pipeline Schedule

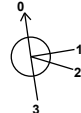
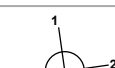
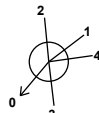
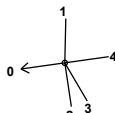
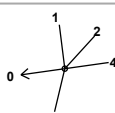
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	5.946	3.9	100	Circular	133.000	132.390	0.510	132.800	130.865	1.835
6.000	3.878	2.5	100	Circular	133.000	132.390	0.510	132.800	130.865	1.835
7.000	3.485	2.3	100	Circular	133.000	132.390	0.510	132.800	130.865	1.835
8.000	5.793	3.1	100	Circular	133.300	132.740	0.460	133.100	130.850	2.150
9.000	4.054	2.1	100	Circular	133.300	132.740	0.460	133.100	130.850	2.150
10.000	3.657	1.9	100	Circular	133.300	132.740	0.460	133.100	130.850	2.150
11.000	3.657	2.3	100	Circular	133.000	132.440	0.460	132.800	130.826	1.874
12.000	6.276	4.2	100	Circular	132.850	132.290	0.460	132.700	130.793	1.807
14.000	3.657	2.4	100	Circular	132.850	132.290	0.460	132.700	130.793	1.807
13.000	5.737	3.8	100	Circular	132.850	132.290	0.460	132.700	130.793	1.807
2.000	14.192	9.3	100	Circular	132.850	132.290	0.460	132.650	130.770	1.780
3.000	12.083	7.9	100	Circular	132.850	132.290	0.460	132.650	130.770	1.780
4.000	11.708	7.7	100	Circular	132.850	132.290	0.460	132.650	130.770	1.780
15.000	5.405	4.2	100	Circular	132.600	132.040	0.460	132.300	130.742	1.458
16.000	10.992	9.6	100	Circular	132.600	131.890	0.610	132.300	130.742	1.458
17.000	11.256	28.9	100	Circular	132.600	132.090	0.410	132.600	131.700	0.800
5.001	15.728	403.3	450	Circular	132.800	130.515	1.835	132.800	130.476	1.874
8.001	9.772	407.2	450	Circular	133.100	130.500	2.150	132.800	130.476	1.874
5.002	13.214	400.4	450	Circular	132.800	130.476	1.874	132.700	130.443	1.807
5.003	9.653	419.7	450	Circular	132.700	130.443	1.807	132.650	130.420	1.780
1.004	10.523	375.8	450	Circular	132.650	130.420	1.780	132.300	130.392	1.458
1.000	6.161	6.4	450	Circular	132.600	131.650	0.500	132.300	130.692	1.158
1.001	3.765	15.6	150	Circular	132.300	130.342	1.808	132.100	130.100	1.850

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	P1		Junction		1	1350	Manhole	Adoptable
6.000	P2		Junction		1	1350	Manhole	Adoptable
7.000	P3		Junction		1	1350	Manhole	Adoptable
8.000	P4	450	Manhole	Adoptable	2	1350	Manhole	Adoptable
9.000	P5	450	Manhole	Adoptable	2	1350	Manhole	Adoptable
10.000	P6	450	Manhole	Adoptable	2	1350	Manhole	Adoptable
11.000	P7	450	Manhole	Adoptable	3	1350	Manhole	Adoptable
12.000	P8	450	Manhole	Adoptable	JUNCTION 2		Junction	
14.000	P9	450	Manhole	Adoptable	JUNCTION 2		Junction	
13.000	P10	450	Manhole	Adoptable	JUNCTION 2		Junction	
2.000	P11	450	Manhole	Adoptable	JUNCTION 1		Junction	
3.000	P12	450	Manhole	Adoptable	JUNCTION 1		Junction	
4.000	P13	450	Manhole	Adoptable	JUNCTION 1		Junction	
15.000	P14	450	Manhole	Adoptable	5	1500	Manhole	Adoptable
16.000	P15		Junction		5	1500	Manhole	Adoptable
17.000	P16		Junction		4	450	Manhole	Adoptable
5.001	1	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
8.001	2	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
5.002	3	1350	Manhole	Adoptable	JUNCTION 2		Junction	
5.003	JUNCTION 2		Junction		JUNCTION 1		Junction	
1.004	JUNCTION 1		Junction		5	1500	Manhole	Adoptable
1.000	4	450	Manhole	Adoptable	5	1500	Manhole	Adoptable
1.001	5	1500	Manhole	Adoptable	C2	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
P1	383474.884	410394.195	133.000	0.610					
						0	5.000	132.390	100
P2	383477.677	410398.950	133.000	0.610					
						0	6.000	132.390	100
P3	383477.403	410400.635	133.000	0.610					
						0	7.000	132.390	100
P4	383487.190	410417.810	133.300	0.560	450				
						0	8.000	132.740	100
P5	383482.676	410420.869	133.300	0.560	450				
						0	9.000	132.740	100
P6	383480.944	410420.625	133.300	0.560	450				
						0	10.000	132.740	100
P7	383471.267	410419.265	133.000	0.560	450				
						0	11.000	132.440	100
P8	383457.237	410407.700	132.850	0.560	450				
						0	12.000	132.290	100
P9	383458.236	410417.434	132.850	0.560	450				
						0	14.000	132.290	100
P10	383462.559	410418.042	132.850	0.560	450				
						0	13.000	132.290	100
P11	383452.331	410407.010	132.850	0.560	450				
						0	2.000	132.290	100
P12	383449.998	410406.683	132.850	0.560	450				
						0	3.000	132.290	100
P13	383449.216	410416.166	132.850	0.560	450				
						0	4.000	132.290	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
P14	383444.681	410415.529	132.600	0.560	450		0	15.000	132.040	100
P15	383438.358	410414.640	132.600	0.710			0	16.000	131.890	100
P16	383441.019	410404.659	132.600	0.510			0	17.000	132.090	100
1	383473.964	410400.069	132.800	2.285	1350		1 2 3 0	7.000 6.000 5.000 5.001	130.865 130.865 130.865 130.515	100 100 100 450
2	383481.453	410417.004	133.100	2.600	1350		1 2 3 0	10.000 9.000 8.000 8.001	130.850 130.850 130.850 130.500	100 100 100 450
3	383471.776	410415.644	132.800	2.324	1350		1 2 3 0	11.000 8.001 5.001 5.002	130.826 130.476 130.476 130.476	100 450 450 450
4	383439.438	410404.879	132.600	0.950	450		1 0	17.000 1.000	131.700 131.650	100 450
5	383438.711	410410.997	132.300	1.958	1500		1 2 3 4 0	15.000 16.000 1.000 1.004 1.001	130.742 130.742 130.692 130.392 130.342	100 100 450 450 150
C2	383436.289	410408.114	132.100	2.000	450		1	1.001	130.100	150
JUNCTION 1	383449.132	410412.462	132.650	2.230			1 2 3 4 0	4.000 3.000 2.000 5.003 1.004	130.770 130.770 130.770 130.420 130.420	100 100 100 450 450
JUNCTION 2	383458.691	410413.805	132.700	2.257			1 2 3 4 0	14.000 13.000 12.000 5.002 5.003	130.793 130.793 130.793 130.443 130.443	100 100 100 450 450

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node 1 Online Orifice Control

Flap Valve	x	Design Depth (m)	2.200	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	2.0		
Invert Level (m)	130.515	Diameter (m)	0.025		

Node 5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	130.342	Product Number	CTL-SHE-0085-4000-1700-4000
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	4.0	Min Node Diameter (mm)	1200

Node P1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	132.390
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	160

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	91.0	0.0	0.450	91.0	0.0	0.451	0.0	0.0

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	130.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	75.0	0.0	1.200	75.0	0.0	1.201	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	P1	21	132.415	0.025	7.2	2.2962	0.0000	OK
15 minute summer	P2	10	132.402	0.012	1.1	0.0000	0.0000	OK
15 minute summer	P3	10	132.403	0.013	1.3	0.0000	0.0000	OK
15 minute summer	P4	10	132.754	0.014	1.4	0.0022	0.0000	OK
15 minute summer	P5	10	132.751	0.011	0.9	0.0017	0.0000	OK
15 minute summer	P6	10	132.751	0.011	1.1	0.0018	0.0000	OK
15 minute summer	P7	10	132.460	0.020	3.2	0.0032	0.0000	OK
15 minute summer	P8	10	132.305	0.015	1.4	0.0024	0.0000	OK
15 minute summer	P9	10	132.302	0.012	1.1	0.0019	0.0000	OK
15 minute summer	P10	10	132.303	0.013	1.1	0.0021	0.0000	OK
15 minute summer	P11	10	132.307	0.017	1.3	0.0028	0.0000	OK
15 minute summer	P12	10	132.307	0.017	1.3	0.0027	0.0000	OK
15 minute summer	P13	11	132.307	0.017	1.4	0.0028	0.0000	OK
15 minute summer	P14	10	132.053	0.013	1.1	0.0021	0.0000	OK
15 minute summer	P15	11	131.908	0.018	1.4	0.0000	0.0000	OK
15 minute summer	P16	11	132.114	0.024	1.4	0.0000	0.0000	OK
60 minute summer	1	50	132.396	1.881	5.2	2.6921	0.0000	SURCHARGED
120 minute summer	2	102	130.641	0.141	10.5	10.7677	0.0000	OK
120 minute summer	3	104	130.641	0.165	9.2	0.2360	0.0000	OK
15 minute summer	4	10	131.673	0.023	6.1	0.0037	0.0000	OK
15 minute summer	5	11	130.652	0.310	13.8	0.5476	0.0000	SURCHARGED
15 minute summer	C2	1	130.100	0.000	3.4	0.0000	0.0000	OK
15 minute summer	JUNCTION 1	11	130.649	0.229	13.8	0.0000	0.0000	OK
15 minute summer	JUNCTION 2	11	130.649	0.206	18.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	P1	5.000	1	4.3	2.044	0.140	0.0279	
15 minute summer	P2	6.000	1	1.1	2.144	0.028	0.0161	
15 minute summer	P3	7.000	1	1.3	2.346	0.032	0.0145	
15 minute summer	P4	8.000	2	1.4	2.150	0.040	0.0038	
15 minute summer	P5	9.000	2	0.9	2.148	0.022	0.0017	
15 minute summer	P6	10.000	2	1.1	2.366	0.025	0.0017	
15 minute summer	P7	11.000	3	3.2	3.020	0.079	0.0039	
15 minute summer	P8	12.000	JUNCTION 2	1.4	1.933	0.047	0.0045	
15 minute summer	P9	14.000	JUNCTION 2	1.1	2.177	0.028	0.0018	
15 minute summer	P10	13.000	JUNCTION 2	1.1	1.850	0.035	0.0034	
15 minute summer	P11	2.000	JUNCTION 1	1.3	1.417	0.064	0.0128	
15 minute summer	P12	3.000	JUNCTION 1	1.3	1.501	0.059	0.0103	
15 minute summer	P13	4.000	JUNCTION 1	1.4	1.559	0.064	0.0105	
15 minute summer	P14	15.000	5	1.1	1.784	0.036	0.0033	
15 minute summer	P15	16.000	5	1.4	1.442	0.071	0.0107	
15 minute summer	P16	17.000	4	1.4	0.975	0.124	0.0162	
60 minute summer	1	Orifice	3	1.7				
15 minute summer	2	8.001	3	-24.9	-0.922	-0.156	0.2971	
15 minute summer	3	5.002	JUNCTION 2	-18.9	-0.328	-0.118	0.8065	
15 minute summer	4	1.000	5	6.1	2.048	0.005	0.0183	
15 minute summer	5	Hydro-Brake®	C2	3.4				16.8
15 minute winter	JUNCTION 1	1.004	5	-10.4	0.326	-0.063	0.8898	
15 minute summer	JUNCTION 2	5.003	JUNCTION 1	-14.9	0.288	-0.095	0.7320	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute summer	P1	94	132.500	0.110	9.3	10.0252	0.0000	SURCHARGED
120 minute summer	P2	94	132.497	0.107	1.1	0.0000	0.0000	SURCHARGED
120 minute summer	P3	94	132.497	0.107	1.3	0.0000	0.0000	SURCHARGED
15 minute summer	P4	10	132.762	0.022	3.5	0.0035	0.0000	OK
15 minute summer	P5	10	132.756	0.016	2.2	0.0026	0.0000	OK
15 minute summer	P6	10	132.757	0.017	2.6	0.0028	0.0000	OK
15 minute summer	P7	10	132.473	0.033	7.9	0.0052	0.0000	OK
15 minute summer	P8	10	132.314	0.024	3.5	0.0038	0.0000	OK
15 minute summer	P9	10	132.308	0.018	2.6	0.0029	0.0000	OK
15 minute summer	P10	10	132.310	0.020	2.6	0.0032	0.0000	OK
15 minute summer	P11	10	132.317	0.027	3.1	0.0043	0.0000	OK
15 minute summer	P12	10	132.316	0.026	3.1	0.0041	0.0000	OK
15 minute summer	P13	10	132.317	0.027	3.5	0.0043	0.0000	OK
15 minute summer	P14	10	132.061	0.021	2.6	0.0033	0.0000	OK
15 minute summer	P15	10	131.919	0.029	3.5	0.0000	0.0000	OK
15 minute summer	P16	10	132.129	0.039	3.5	0.0000	0.0000	OK
120 minute summer	1	94	132.497	1.982	5.7	2.8366	0.0000	SURCHARGED
180 minute winter	2	180	131.003	0.503	11.4	38.4397	0.0000	SURCHARGED
180 minute winter	3	180	131.003	0.527	10.5	0.7540	0.0000	SURCHARGED
15 minute summer	4	10	131.686	0.036	14.9	0.0057	0.0000	OK
180 minute winter	5	180	131.003	0.661	7.5	1.1678	0.0000	SURCHARGED
15 minute summer	C2	1	130.100	0.000	3.4	0.0000	0.0000	OK
180 minute winter	JUNCTION 1	180	131.003	0.583	5.6	0.0000	0.0000	SURCHARGED
180 minute winter	JUNCTION 2	180	131.003	0.560	6.9	0.0000	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	P1	5.000	1	9.0	1.875	0.291	0.0408	
120 minute winter	P2	6.000	1	2.7	1.283	0.069	0.0303	
15 minute summer	P3	7.000	1	3.1	2.426	0.076	0.0252	
15 minute summer	P4	8.000	2	3.5	2.790	0.100	0.0072	
15 minute summer	P5	9.000	2	2.2	2.785	0.052	0.0032	
15 minute summer	P6	10.000	2	2.6	3.033	0.059	0.0031	
15 minute summer	P7	11.000	3	7.9	3.835	0.194	0.0075	
15 minute summer	P8	12.000	JUNCTION 2	3.5	2.515	0.117	0.0087	
15 minute summer	P9	14.000	JUNCTION 2	2.6	2.809	0.066	0.0034	
15 minute summer	P10	13.000	JUNCTION 2	2.6	2.387	0.083	0.0062	
15 minute summer	P11	2.000	JUNCTION 1	3.1	1.827	0.153	0.0238	
15 minute summer	P12	3.000	JUNCTION 1	3.1	1.935	0.142	0.0192	
15 minute summer	P13	4.000	JUNCTION 1	3.5	2.026	0.158	0.0201	
15 minute summer	P14	15.000	5	2.6	2.288	0.086	0.0094	
15 minute summer	P15	16.000	5	3.5	1.872	0.176	0.0204	
15 minute summer	P16	17.000	4	3.5	1.252	0.305	0.0311	
180 minute summer	1	Orifice	3	1.7				
15 minute summer	2	8.001	3	-63.7	-1.239	-0.400	1.0893	
15 minute summer	3	5.002	JUNCTION 2	-49.4	-0.548	-0.307	1.6296	
15 minute summer	4	1.000	5	14.8	2.618	0.012	0.0758	
15 minute summer	5	Hydro-Brake®	C2	3.4				41.8
15 minute summer	JUNCTION 1	1.004	5	-30.1	0.317	-0.181	1.5043	
15 minute summer	JUNCTION 2	5.003	JUNCTION 1	-40.5	-0.375	-0.258	1.2956	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	P1	120	132.683	0.293	11.8	26.6507	0.0000	SURCHARGED
120 minute winter	P2	118	132.681	0.291	1.4	0.0000	0.0000	SURCHARGED
120 minute winter	P3	118	132.681	0.291	1.7	0.0000	0.0000	SURCHARGED
15 minute summer	P4	10	132.771	0.031	6.4	0.0049	0.0000	OK
15 minute summer	P5	10	132.762	0.022	4.0	0.0035	0.0000	OK
15 minute summer	P6	10	132.764	0.024	4.8	0.0038	0.0000	OK
15 minute summer	P7	10	132.487	0.047	14.4	0.0074	0.0000	OK
15 minute summer	P8	10	132.322	0.032	6.4	0.0051	0.0000	OK
15 minute summer	P9	10	132.314	0.024	4.8	0.0039	0.0000	OK
15 minute summer	P10	10	132.317	0.027	4.8	0.0043	0.0000	OK
15 minute summer	P11	10	132.326	0.036	5.6	0.0058	0.0000	OK
15 minute summer	P12	10	132.325	0.035	5.6	0.0055	0.0000	OK
15 minute summer	P13	10	132.327	0.037	6.4	0.0059	0.0000	OK
15 minute summer	P14	10	132.067	0.027	4.8	0.0043	0.0000	OK
15 minute summer	P15	10	131.929	0.039	6.4	0.0000	0.0000	OK
15 minute summer	P16	10	132.145	0.055	6.4	0.0000	0.0000	OK
120 minute winter	1	118	132.681	2.166	5.7	3.0996	0.0000	FLOOD RISK
240 minute winter	2	236	131.674	1.174	19.7	89.6993	0.0000	SURCHARGED
240 minute winter	3	236	131.674	1.198	17.5	1.7137	0.0000	SURCHARGED
15 minute summer	4	10	131.695	0.045	27.0	0.0071	0.0000	OK
240 minute winter	5	236	131.674	1.331	10.7	2.3527	0.0000	SURCHARGED
15 minute summer	C2	1	130.100	0.000	3.4	0.0000	0.0000	OK
240 minute winter	JUNCTION 1	236	131.674	1.254	10.1	0.0000	0.0000	SURCHARGED
240 minute winter	JUNCTION 2	236	131.674	1.231	12.3	0.0000	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	P1	5.000	1	9.8	2.066	0.318	0.0465	
15 minute summer	P2	6.000	1	4.5	2.297	0.116	0.0303	
15 minute summer	P3	7.000	1	5.0	2.526	0.124	0.0273	
15 minute summer	P4	8.000	2	6.4	3.288	0.183	0.0260	
15 minute summer	P5	9.000	2	4.0	3.291	0.095	0.0173	
15 minute summer	P6	10.000	2	4.8	3.592	0.109	0.0157	
15 minute summer	P7	11.000	3	14.4	4.425	0.353	0.0186	
15 minute summer	P8	12.000	JUNCTION 2	6.4	2.976	0.214	0.0301	
15 minute summer	P9	14.000	JUNCTION 2	4.9	3.292	0.126	0.0164	
15 minute summer	P10	13.000	JUNCTION 2	4.8	2.795	0.154	0.0264	
15 minute summer	P11	2.000	JUNCTION 1	5.6	2.112	0.279	0.0731	
15 minute summer	P12	3.000	JUNCTION 1	5.6	2.238	0.257	0.0613	
15 minute summer	P13	4.000	JUNCTION 1	6.4	2.352	0.290	0.0607	
15 minute summer	P14	15.000	5	4.8	2.497	0.160	0.0256	
15 minute summer	P15	16.000	5	6.4	2.035	0.323	0.0582	
15 minute summer	P16	17.000	4	6.3	1.458	0.560	0.0490	
60 minute summer	1	Orifice	3	1.7				
15 minute summer	2	8.001	3	-99.9	-1.340	-0.627	1.5483	
15 minute summer	3	5.002	JUNCTION 2	-79.6	-0.690	-0.496	2.0937	
15 minute summer	4	1.000	5	27.0	2.516	0.021	0.4459	
240 minute winter	5	Hydro-Brake®	C2	3.6				93.5
15 minute summer	JUNCTION 1	1.004	5	-53.4	-0.364	-0.322	1.6673	
15 minute summer	JUNCTION 2	5.003	JUNCTION 1	-67.6	-0.504	-0.431	1.5295	

APPENDIX E SIMPLE INDEX APPROACH

SIMPLE INDEX APPROACH: TOOL



HRW shall not be liable for any direct or indirect damage claims, loss, cost, expense or liability whatsoever arising out of the use or impossibility to use the tool, even when HRW has been informed of the possibility of this claim. 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.

- 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).
- The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.
- Relevant design examples are included in the SuDS Manual Appendix C.
- 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	1 use suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable):				
Residential parking	Low	0.5	0.4	0.4
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	Low	0.5	0.4	0.4

DESIGN CONDITIONS	
1	2

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	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:			
Aggregated Surface Water Pollution Mitigation Index	0.8	0.6	0.7

DESIGN CONDITIONS		
1	2	3
Detailed assessment of performance of designed component in reducing flow concentrations of each pollutant type required as evidence of design indices. Error 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-RMA-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/code-of-practice.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

Groundwater Protection Description	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	0.8	0.6	0.7

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 near 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	Sufficient

DESIGN CONDITIONS

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.

APPENDIX F FLOOD MAP FOR PLANNING

Flood map for planning

Your reference
Site 1

Location (easting/northing)
383475/410403

Created
1 Jul 2024 15:01

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 than 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)

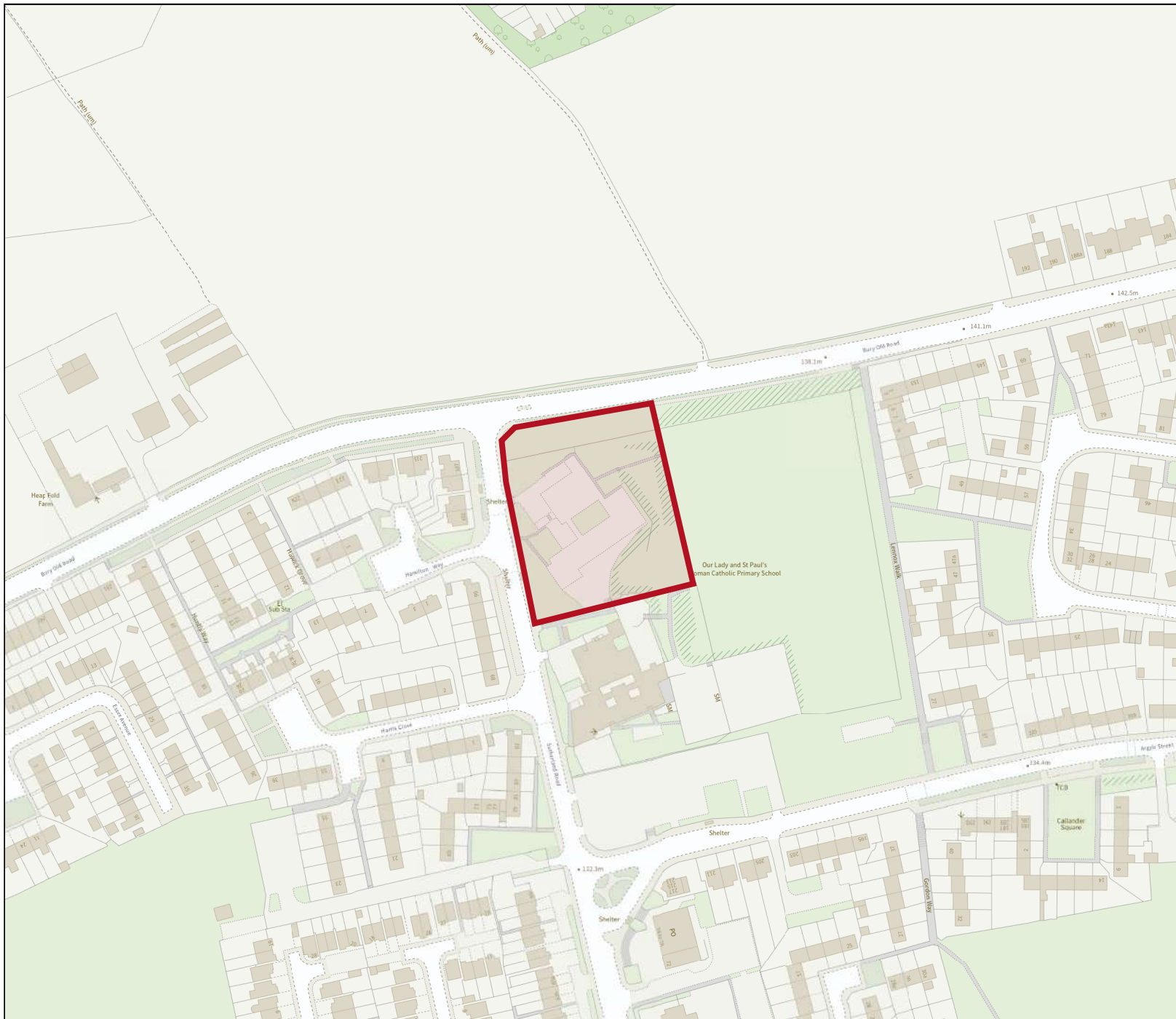
Notes

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.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

Site 1

Location (easting/northing)

383475/410403

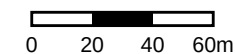
Scale

1:2500

Created

1 Jul 2024 15:01

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



Flood map for planning

Your reference
Site 2

Location (easting/northing)
383599/410296

Created
1 Jul 2024 15:02

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 than 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.

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Flood map for planning

Your reference

Site 2

Location (easting/northing)

383599/410296

Scale

1:2500

Created

1 Jul 2024 15:02

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

