BURO HAPPOLD

Wrexham FC Kop Stand

Drainage Strategy - Planning Addendum

WFC-BHE-KOP-ZZ-RP-C-00001

0065004

29 January 2025

Revision P01

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Revision	Description	Issued by	Date	Checked
P01	Planning Addendum	AD	29/01/2025	NH

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Glossary

Term	Definition
SuDS	Sustainable Urban Drainage Strategy
SAB	Sustainable Urban Drainage Approving Body
GA	General Arrangement

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1 Introduction

The new Kop stand at Wrexham Football Club was granted planning permission in January 2023 under application P/2022/0725.

A Section 73 application (P/2023/0776) was submitted in November 2023 for the removal of an initial restriction which limited the capacity to 4,900 (condition 3) due to a moratorium on development matters at the time in the County based on phosphates issues. The Section 73 application was approved in January 2024, which allowed the capacity to increase to the submitted 5,500 attendees.

The approved drainage strategy for the site was undertaken by Ramboll, document reference: WRX-RAM-XX-XX-RP-CD-00001, herewith referred to as The Original Strategy Document.

Changes to the scheme are to re-submitted for approval under a second Section 73 application. This document presents the required changes to the drainage strategy for the application and should be read in conjunction with The Original Strategy Document. Information within The Original Strategy Document remains valid if not updated within this report, for example existing site conditions and flood risk remain unchanged.

The overall Surface Water drainage strategy for the site retains the principles set in The Original Strategy Document. The amendments to the surface water drainage strategy are limited to revisions to accommodate the revised geometry and footprint of the Kop stand, alterations to the public realm layout and optimisation of the proposed soakaways. The surface water drainage strategy is discussed further in Section 2.1. A revised hydraulic model has been produced, the results from the hydraulic model can be found in Appendix B.

The overall foul water drainage strategy remains unchanged, with flows collected in pipe network below the new stand before being discharged under gravity to a Welsh Water foul sewer at the southern corner of the stand. The design flows from the site have increased slightly due to the greater number of facilities (toilets, concessions etc) being provided within the stand. The surface water drainage is discussed further in Section 2.2.

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2 Amendments to Surface Water Drainage Strategy

2.1 Surface Water

The overall proposed surface water drainage strategy remains consistent with the strategy presented in drawing WRX-RAM-ZZ-ZZ-DR-CD-00102, whereby there is no material change to the proposed surface water management train and SuDS strategy.

The key changes are presented below:

- Arrangement of catchment areas
- Replacement of green roof
- Permeable Paving
- Infiltration rate
- Soakaway design

The revised drainage strategy is presented on drawing WRS-BHE-XX-XX-DR-C-3000 in Appendix A.

2.1.1 Catchment Area

The total catchment area of the site remains unchanged at 6,400m^2, however due to revision of the general arrangement of the Kop stand, the area of the roof has increased to 4,100m^2 and the area of public realm has decreased to 2,300m^2. This can be seen in Figure 2—1. The changes to the catchment areas do not have a significant impact on the proposed surface water drainage strategy as both the public realm and stand area are hardscape and have the same runoff coefficient, therefore the total impermeable area is largely the same.

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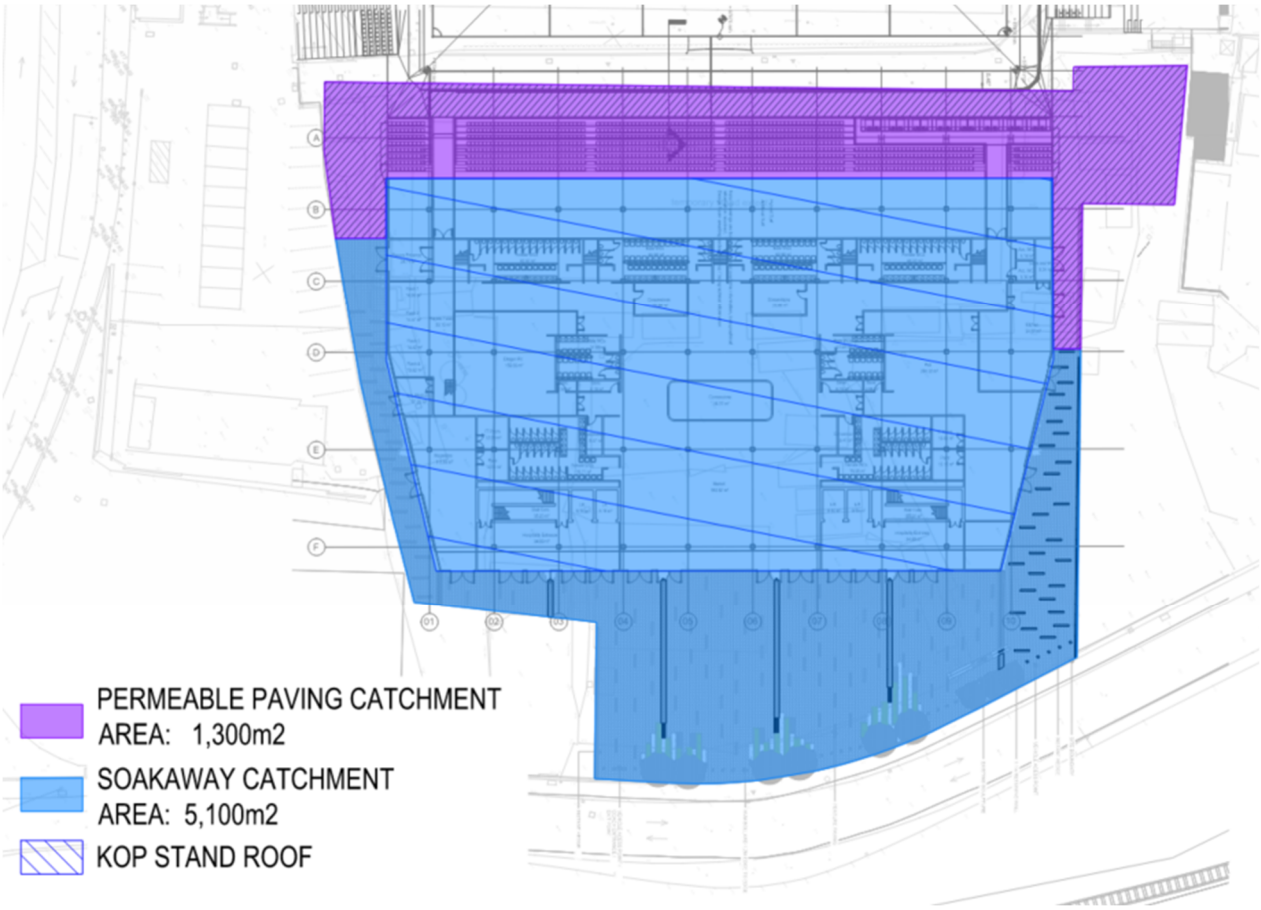


Figure 2—1 Catchment Areas Plan

2.1.2 Green Roof

The previous scheme included a standalone building to provide additional toilets. The need for this separate building has now been removed and the area is left as open space for deliveries to the new Kop stand. A green roof was previously proposed on the toilet block building; hence the removal of the building means the green roof is no longer part of the drainage strategy. The small soakaway that was previously provided for the toilet building roof run-off has also been omitted.

To manage the drainage for the affected area and mitigate the loss of the green roof in drainage terms, the footprint of the removed building is replaced by permeable paving at ground level. This solution will effectively handle surface water runoff at source, allowing infiltration through the paving directly to the ground below.

Additionally, to maintain the commitment to green infrastructure, rain gardens are incorporated into the public plaza area of the site. These rain gardens will enhance biodiversity, improve water quality and provide aesthetic and ecological benefits.

2.1.3 Permeable Paving

Based on the revision to the general arrangement of the Kop stand, the extent of permeable paving has changed. The permeable paving that was positioned adjacent to the southern and northern façades of the stand have been altered in shape to reflect the latest landscape plans.

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The area between the front of the stand and the pitch is to be permeable, as per The Original Strategy Document.

2.1.4 Infiltration Rate

Soakaway testing was completed at the site in July 2022 and results provided in Appendix C of the original strategy document.

An infiltration rate of 1.87 m/hr was previously used in calculations within the original strategy document, this was one of the higher results from the soakaway tests and is not a conservative approach to the design of the soakaway in accordance with BRE Digest 365. Using a high infiltration rate will overestimate the rate at which stormwater will discharge into surrounding ground and will not accurately simulate the conditions in a which a flood may occur.

The soak-away designs have been revised using an infiltration rate of 1.44 m/hr, being the lowest value obtained on the 3rd fill during the soak-away test, as required by BRE Digest 365. The lower infiltration rate still indicates the ground is a good infiltration media, according to the CIRIA SuDS Manual.

2.1.5 Soakaway Sizing

A single soakaway is now proposed in the surface water drainage strategy, located under the public plaza area.

The soakaway is proposed to have a plan area of 76m^2 and a total depth of 4m. The invert level of the inlet pipe to the soakaway is at a depth of 2.1m, giving an effective depth available in the soakaway of 1.9m. This gives an attenuation volume of 137m^3 available within the soakaway.

These parameters have been modelled using hydraulic modelling software InfoDrainage, modelling results are contained in Appendix B. The soakaway does not result in any flooding for a 1 in 100-year rainfall event +40% climate change. This is compliant with the design criteria specified by Wrexham County Borough Council. The results for this hydraulic modelling can be found in Appendix B.

The previous scheme necessitated a second soakaway to serve the runoff from a green roof. The green roof has been removed from the scheme, and alternative drainage provisions have been proposed. Mitigating the requirement of an additional soakaway.

2.2 Foul Water Drainage

The overall foul water drainage strategy remains unchanged from The Original Strategy Document. Foul water flows are to be collected in a below ground drainage network and discharged to the adjacent Welsh Water sewer network.

A manhole has been constructed specifically for connection of the new Kop stand development as part of a sewer diversion recently completed through the car park of The Turf public house. The downstream sewer is 225mm in diameter at a gradient of approximately 1 in 150, giving a local capacity of approximately 37 l/sec.

Updated foul water drainage calculations are provided in Appendix C, which estimate the proposed flow peak flow as 19.2 l/sec. This is derived using the discharge unit methodology based on the number of sanitary fixings and fittings proposed in the new Kop stand. This is considered a conservative approach.

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Appendix A Surface Water Drainage Drawing

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HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION
COMPLETION OF GPR SURVEY TO IDENTIFY SERVICES. SURVEY IDENTIFIED EXISTING DRAINS, ELECTRIC CABLES, COMMUCBALES AND GAS PIPES. SERVICE NOT IDENTIFIED BY THE SURVEY ARE ANTICIPATED AND REQUIRE CONSIDERATION BY CONTRACTOR DURING CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION
NO UNUSUAL HAZARDS, TO BE REVIEWED AS DESIGN PROGRESSES.

DECOMMISSIONING/DEMOLITION
NO UNUSUAL HAZARDS, TO BE REVIEWED AS DESIGN PROGRESSES.

KEY
CD - CHANNEL DRAIN
RWP - RAINWATER DOWN PIPE

BLOCK PAVING

PERMEABLE PAVING

SOAKAWAY

1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL LEVELS ARE TO ORDNANCE SURVEY DATUM UNLESS STATED OTHERWISE.
3. FOR KNOWN EXISTING UTILITIES IDENTIFIED WITH GPR SURVEY REFER TO SUBSITE SURVEY 0223-GAT-001.
6. FOR KNOWN EXISTING TOPOGRAPHIC INFORMATION REFER TO SUBSITE SURVEY 1224-GAT-001.
7. FOR ARCHITECTURAL BACKGROUND REFER TO WRX-POP-KOP-L00-DR-AR-021020.
8. FOR LANDSCAPE ARCHITECTURAL PLAN REFER TO WRX-POP-KOP-L00-DR-LA-701000.
9. ALL RAINWATER DOWNPIPE POSITIONS ARE ASSUMED AND LIKELY TO CHANGE AS DESIGN PROGRESSES.
10. ALL PIPE CONNECTIONS FROM RAIN GARDENS AND CHANNEL DRAINS TO STORM WATER NETWORK ARE ASSUMED TO BE 100mm.

Rev	Description	Date	Iss'd	Rev'd	App'd
00	INFORMATION	29/01/2025	AD	NJH	NJH

PLANNING
Project Stage

INFORMATION
Status of Drawing

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Client: WREXHAM AFC
Architect: *POPULOUS*
Project: WREXHAM AFC KOP STAND
Drg Title: SURFACE WATER DRAINAGE STRATEGY GENERAL ARRANGEMENT

Job No.: 0065004
Scale@A1: 1:200
Drawn/Designed By.: AD
Checked By.: AD
Approved By.: NJH
Drawing No.: WRX-BHE-XX-XX-DR-C-3000
Revision: 00

Nick Hall C:\Users\nhall\Buro Happold\P65004 Wrexham FC Expansion - Civil Engineering\3_Drawings\3WIP\Sheets\WRX-BHE-XX-XX-DR-C-3000.dwg

Appendix B Surface Water Drainage Calculations

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0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Junctions Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)	Invert Level (m)	Chamber Shape	Diameter (m)
STMH 1	Manhole	332909.608	350910.285	87.916	1.300	86.616	Circular	1.200
STMH 2	Manhole	332920.649	350909.572	87.513	1.400	86.113	Circular	1.200
STMH 3	Manhole	332924.727	350916.174	87.439	1.528	85.911	Circular	1.200
STMH 4	Manhole	332930.829	350927.023	87.440	1.662	85.778	Circular	1.200
STMH 7	Manhole	332927.080	350929.788	87.673	1.911	85.762	Circular	1.200
STMH 8	Manhole	332929.315	350933.244	87.667	1.919	85.748	Circular	1.200
STMH 5	Manhole	332937.374	350948.147	87.763	1.350	86.413	Circular	1.200
STMH 6	Manhole	332935.644	350937.773	87.542	1.725	85.817	Circular	1.200
STMH 10	Manhole	332891.802	350894.860	88.187	1.702	86.485	Circular	1.350
STMH 11	Manhole	332909.991	350920.199	88.124	1.717	86.407	Circular	1.350
STMH 12	Manhole	332926.370	350945.650	88.118	1.787	86.331	Circular	1.350
STMH 15	Manhole	332928.700	350944.416	87.986	1.661	86.324	Circular	1.350
STMH 13	Manhole	332910.063	350973.181	88.212	1.500	86.712	Circular	1.200
STMH 14	Manhole	332931.432	350952.735	88.067	1.454	86.613	Circular	1.200
STMH 9	Manhole	332865.364	350905.806	88.207	1.650	86.557	Circular	1.350

Name	Lock
STMH 1	None
STMH 2	None
STMH 3	None
STMH 4	None
STMH 7	None
STMH 8	None
STMH 5	None
STMH 6	None
STMH 10	None
STMH 11	None
STMH 12	None
STMH 15	None
STMH 13	None
STMH 14	None
STMH 9	None



Soakaway

Type : Soakaway

Dimensions

Exceedance Level (m)	87.850
Depth (m)	4.000
Base Level (m)	83.850
Freeboard (mm)	0
Soakaway Shape	Rectangular
Diameter / Width (m)	8.000
Length (m)	9.500
Porosity (%)	95
Ineffective Storage Depth (m)	2.102
Number of Soakaways	1
Base Infiltration Rate (m/hr)	1.44
Side Infiltration Rate (m/hr)	1.44
Safety Factor	2.0
Total Volume (m^3)	137.036

Inlets

Inlet (1)

Incoming Item(s)	No Delay
Bypass Destination	(None)
Capacity Type	No Restriction

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Connections Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Name	Length (m)	Connection Type	Slope (1:X)	Manning's n	Diameter / Base Width (mm)	Upstream Cover Level (m)	Upstream Invert Level (m)	Downstream Cover Level (m)
1.000	11.063	Pipe	24.430	0.013	100	87.916	86.616	87.513
1.001	7.760	Pipe	150.000	0.013	150	87.513	86.113	87.439
1.002	12.447	Pipe	93.587	0.013	300	87.439	85.911	87.440
1.003	4.658	Pipe	300.000	0.013	300	87.440	85.778	87.673
1.004	4.116	Pipe	300.000	0.013	300	87.673	85.762	87.667
2.000	10.517	Pipe	23.605	0.013	150	87.763	86.413	87.542
2.001	11.779	Pipe	300.000	0.013	300	87.542	85.817	87.440
No Delay	15.898	No Delay						
3.001	31.191	Pipe	399.886	0.013	450	88.187	86.485	88.124
3.002	30.266	Pipe	398.237	0.013	450	88.124	86.407	88.118
3.003	2.637	Pipe	400.000	0.013	450	88.118	86.331	87.986
No Delay (1)	11.189	No Delay						
4.000	29.575	Pipe	298.738	0.013	300	88.212	86.712	88.067
4.001	8.708	Pipe	65.972	0.013	300	88.067	86.613	88.118
3.000	28.614	Pipe	400.000	0.013	450	88.207	86.557	88.187

Name	Downstream Invert Level (m)	Lock	Flow Restriction (L/s)
1.000	86.163	All	
1.001	86.061	All	
1.002	85.778	All	
1.003	85.762	All	
1.004	85.748	All	
2.000	85.967	All	
2.001	85.778	All	
No Delay			
3.001	86.407	All	
3.002	86.331	All	
3.003	86.324	All	
No Delay (1)			
4.000	86.613	All	
4.001	86.481	All	
3.000	86.485	All	

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Inflow Summary Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
BioRetention Area 01	STMH 2		Time of Concentration	0.002	30	0	30	0.001
BioRetention Area 02	STMH 4		Time of Concentration	0.002	30	0	30	0.001
BioRetention Area 03	STMH 4		Time of Concentration	0.003	30	0	30	0.001
BioRetention Area 04	STMH 6		Time of Concentration	0.002	30	0	30	0.001
Catchment Area	STMH 1		Time of Concentration	0.035	95	0	95	0.033
Catchment Area (1)	STMH 2		Time of Concentration	0.015	95	0	95	0.015
Catchment Area (2)	STMH 3		Time of Concentration	0.030	95	0	95	0.029
Catchment Area (3)	STMH 4		Time of Concentration	0.028	95	0	95	0.026
Catchment Area (4)	STMH 6		Time of Concentration	0.019	95	0	95	0.018
Catchment Area (5)	STMH 5		Time of Concentration	0.036	95	0	95	0.034
Catchment Area (6)	STMH 9		Time of Concentration	0.106	95	0	95	0.101
RWP01	STMH 13		Time of Concentration	0.058	95	0	95	0.055
RWP02	STMH 10		Time of Concentration	0.045	95	0	95	0.043
RWP03	STMH 11		Time of Concentration	0.079	95	0	95	0.075
RWP04	STMH 12		Time of Concentration	0.065	95	0	95	0.062
TOTAL		**0.0**		**0.525**				**0.493**

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Title: Rainfall Analysis Criteria	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Shortest
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform First Flush Analysis	☐

Rainfall

Wrexham FC FSR

Type: FSR

Region	England And Wales
M5-60 (mm)	18.0
Ratio R	0.327
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	40.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Junctions Summary Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Wrexham FC FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
STMH 1	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.916	86.616	87.581	0.965	17.2	1.092	0.000	10.7	7.925	Surcharged
STMH 2	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.513	86.113	87.348	1.235	18.7	1.397	0.000	14.3	11.604	Flood Risk
STMH 3	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.439	85.911	87.298	1.387	29.4	1.569	0.000	25.2	18.627	Flood Risk
STMH 4	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.440	85.778	87.292	1.514	58.2	1.713	0.000	53.9	37.705	Flood Risk
STMH 7	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.673	85.762	87.280	1.518	53.9	1.716	0.000	49.3	37.600	Surcharged
STMH 8	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.667	85.748	87.266	1.518	122.8	1.717	0.000	125.3	117.835	OK
STMH 5	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.763	86.413	87.312	0.900	17.6	1.017	0.000	13.2	8.101	Surcharged
STMH 6	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.542	85.817	87.295	1.478	22.8	1.671	0.000	18.6	12.536	Flood Risk
STMH 10	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.187	86.485	87.984	1.499	62.2	2.145	0.000	46.9	34.537	Flood Risk
STMH 11	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.124	86.407	87.964	1.557	86.1	2.228	0.000	61.2	52.486	Flood Risk
STMH 12	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.118	86.331	87.924	1.593	93.4	2.280	0.000	79.7	80.506	Flood Risk
STMH 15	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.986	86.324	87.910	1.585	79.7	2.268	0.000	84.8	80.340	Flood Risk
STMH 13	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.212	86.712	87.985	1.273	28.5	1.440	0.000	10.6	13.252	Flood Risk
STMH 14	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.067	86.613	87.944	1.331	14.7	1.505	0.000	24.2	13.293	Flood Risk
STMH 9	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.207	86.557	87.985	1.428	52.5	2.043	0.000	40.0	24.345	Flood Risk

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Stormwater Controls Summary Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Wrexham FC FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Resident Volume

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Soakaway	Wrexham FC FSR: 100 years: +40 %: 60 mins: Winter	85.724	85.724	1.874	1.874	108.0	135.292	0.000	156.163	0.0	0.000	1.272	OK

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
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Report Details: Type: Connections Summary Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Wrexham FC FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.000	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 1	STMH 2	87.916	87.581	0.100	7.925	1.4	1.02	10.7	Surcharged
1.001	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 2	STMH 3	87.513	87.348	0.150	11.604	0.8	1.15	14.3	Flood Risk
1.002	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 3	STMH 4	87.439	87.298	0.300	18.627	0.4	0.25	25.2	Flood Risk
1.003	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 4	STMH 7	87.440	87.292	0.300	37.705	0.8	0.96	53.9	Flood Risk
1.004	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 7	STMH 8	87.673	87.280	0.300	37.600	0.7	0.88	49.3	Surcharged
2.000	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 5	STMH 6	87.763	87.312	0.150	8.101	1.2	0.42	13.2	Surcharged
2.001	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 6	STMH 4	87.542	87.295	0.300	12.536	0.3	0.33	18.6	Flood Risk
No Delay	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	No Delay	STMH 8	Soakaway		87.266	0.088	117.829	0.0		125.4	
3.001	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 10	STMH 11	88.187	87.984	0.450	34.537	0.5	0.33	46.9	Flood Risk
3.002	Wrexham FC FSR: 100 years: +40 %: 30 mins: Winter	Pipe	STMH 11	STMH 12	88.124	87.858	0.450	71.725	0.4	0.44	63.2	Flood Risk
3.003	Wrexham FC FSR: 100 years: +40 %: 30 mins: Winter	Pipe	STMH 12	STMH 15	88.118	87.840	0.450	109.902	0.6	0.64	90.8	Flood Risk

No Delay (1)	Wrexham FC FSR: 100 years: +40 %: 30 mins: Winter	No Delay	STMH 15	STMH 8		87.830	0.087	109.923	0.0		85.8	
4.000	Wrexham FC FSR: 100 years: +40 %: 30 mins: Winter	Pipe	STMH 13	STMH 14	88.212	87.847	0.300	17.996	0.7	0.33	18.6	Surcharged
4.001	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 14	STMH 12	88.067	87.944	0.300	13.168	0.9	0.2	24.2	Flood Risk
3.000	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 9	STMH 10	88.207	87.985	0.450	24.345	0.5	0.28	40.0	Flood Risk

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Stormwater Controls Storm Phase: ST_02	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		



Porous Paving

Type : Porous Paving

Dimensions

Exceedance Level (m)	88.230
Depth (m)	0.500
Base Level (m)	87.730
Paving Layer Depth (mm)	100
Membrane Percolation (m/hr)	0.2
Porosity (%)	30
Length (m)	113.000
Long. Slope (1:X)	10000.00
Width (m)	10.000
Total Volume (m^3)	135.600

Inlets

PP Catchment

Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

Advanced

Base Infiltration Rate (m/hr)	1.44
Side Infiltration Rate (m/hr)	1.44
Safety Factor	10.0
Conductivity (m/hr)	36.0

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Inflow Summary Storm Phase: ST_02	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	Porous Paving		Time of Concentration	0.113	95	0	95	0.107
TOTAL		**0.0**		**0.113**				**0.107**

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Title: Rainfall Analysis Criteria	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Shortest
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform First Flush Analysis	☐

Rainfall

Wrexham FC FSR

Type: FSR

Region	England And Wales
M5-60 (mm)	18.0
Ratio R	0.327
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	40.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Stormwater Controls Summary Storm Phase: ST_02	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Wrexham FC FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Resident Volume

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Porous Paving	Wrexham FC FSR: 100 years: +40 %: 60 mins: Winter	88.025	87.730	0.284	0.000	29.5	19.223	0.000	45.857	0.0	0.000	85.824	OK

Appendix C Foul Water Drainage Calculations

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29th January 2025
Revision 01

Wrexham FC Expansion
Foul Water Flow Calculations

Sanitary Fittings	Ground Floor				First Floor		Second Floor		Third Floor		Forth Floor	
	Washroom	Kitchen	Concessions	Pub	Washroom and Changing Rooms		Washroom	Concessions	Washroom	Concessions	Washroom	Concessions
WC	54				27		23		21		14	
Urinal	54				10		8		17		5	
Basins	52				27		17		16		12	
Sinks		8	5	4				4		3		3
Dishwasher		4		2				2				
Showers					12							

Probability Methodology

Sanitary Fittings	TOTAL	DU	Total DUs
WC	139	1.8	250.2
Urinal	94	0.5	47
Basins	124	0.3	37.2
Sinks	27	0.8	21.6
Dishwasher	8	0.8	6.4
Showers	12	0.6	7.2
		Total DUs	369.6

Frequency Factor 1

Peak Flow 19.2 L/s

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