VERSION 1.00

JUNE 2026

BDB Consulting

ENGINEERING SERVICES AND SURFACE WATER MANAGEMENT REPORT

STUDENT RESIDENCE

LADY'S LANE, LIMERICK CITY

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1.0 INTRODUCTION

BDB Consulting Ltd. were appointed by Ladys Lane PBSA to provide engineering consultancy services to support a planning application for the proposed development located at Lady's Lane, Limerick City. This Engineering Services Report outlines the surface water management, storm sewer design, SuDS strategy, foul drainage proposals and watermain connection.

This proposal is to construct a multi-storey student accommodation consisting of 350 no. bedrooms. The proposal will also include active outdoor amenity, quiet outdoor amenity, bicycle storage, ancillary utility rooms, bin storage room, connections to utilities and all associated engineering and site works.

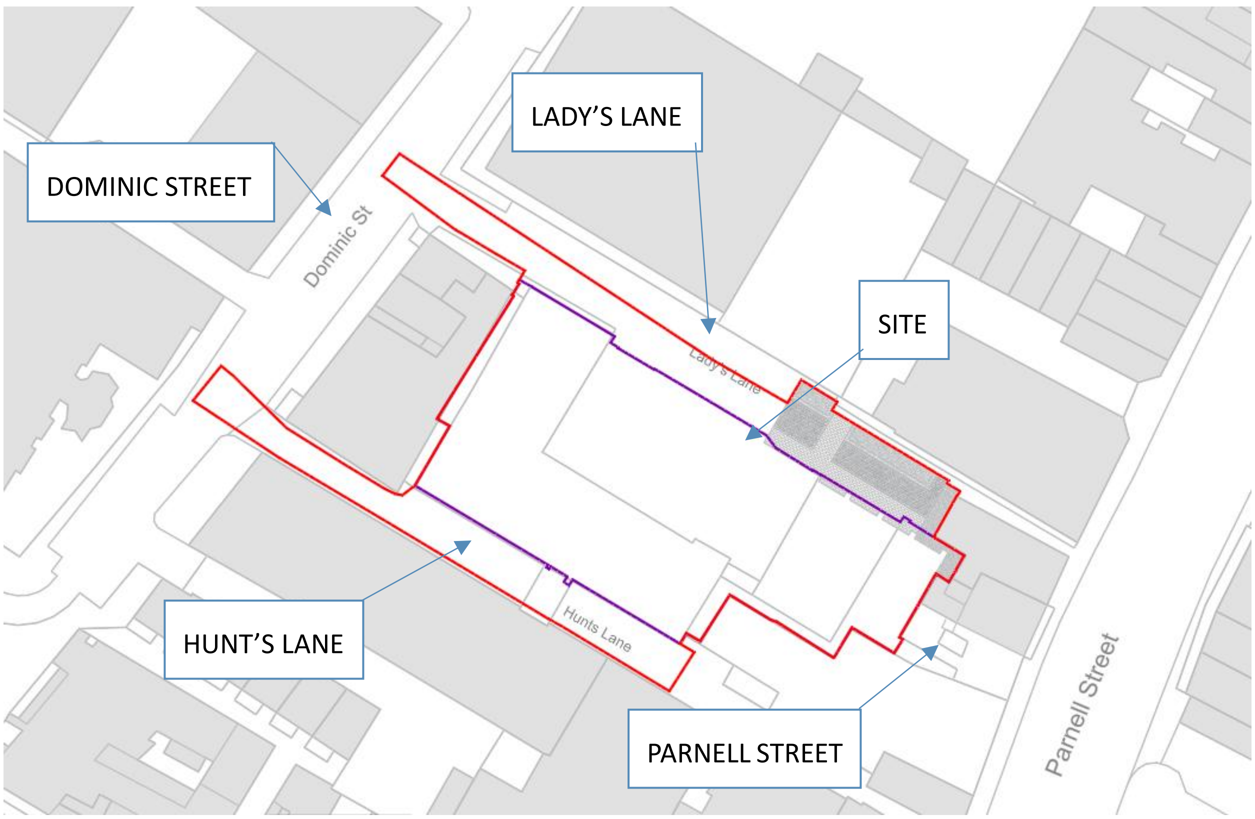

Fig 1. Site Location

2.0 EXISTING SERVICES AND PROPOSED CONNECTION POINTS

The existing site comprises predominantly impermeable brownfield hardstanding. Surface water runoff is currently collected and discharged via an existing connection to the adjacent public sewer.

Existing public services in the vicinity include a 300mm combined sewer in Dominic Street to the west of the site and a 150 mm combined sewer in Lady's Lane to the north. There is also a 100 mm water main within Lady's Lane and a 150 mm water main within Dominic Street.

The proposed design consists of separate storm and foul sewers running within Hunt's Lane, which will connect to a single combined sewer manhole prior to connecting to the existing 300mm combined sewer. As part of the redevelopment, the drainage design will incorporate a SuDS treatment train to deliver a measurable improvement in water quality relative to the existing situation.

A new 150 mm looped water main is proposed within Lady's Lane, connecting into the existing 150 mm water main in Dominic Street. All existing connections to foul or storm that may be affected are to be diverted to the proposed sewer network.

3.0 FOUL DRAINAGE

Regarding site specific drainage, separate wastewater sewer and storm sewer would be provided within the development, and systems will be connected together prior to the connection point to the existing combined sewer network. Internal drainage design by others.

The foul and surface water systems would be designed to comply with BS EN 752-4, BS 8301 (guidance only), Irish Water Code of Practice, and the Technical Guidance Document H Drainage and Wastewater Disposal ARNA FHOILSIÚ AG OIFIG AN TSOLÁTHAIR.

A Pre-Connection Enquiry was submitted to Uisce Éireann, which was assigned reference number CDS26001462.

The loadings for the scheme are as follows:

Average Daily Demand = Residents No. 350 x 150 L/Day x 1.1 (For 10%

infiltration (I)) = 57750 L / Day

= 2.7 l/s

Design Flow = (Pf x P x G) + I + E, where:

Pf = Peaking factor Domestic = 6 (for a population of 0 to 750)

P = Population = 350 residents

G = Water Consumption / Capita = 150 l/person/day x 1.1 for unit consumption

I = Infiltration – Negligible for new wastewater system

E = Trade Flow – Not Applicable

Therefore, Design Flow = 6 x 350 x 150 l/day x 1.1

= 346,500 l/day

= **4.01 l/s**

Please refer to BDB drawings for the foul drainage layout and longitudinal sections showing cover and invert levels. We enclose the design calculations in Appendix A.

4.0 STORMWATER DESIGN

4.1 PROPOSED STORM WATER REQUIREMENTS

The proposed surface water drainage system has been designed in accordance with I.S. EN 12056: 2000 'Gravity Drainage Systems inside Buildings', I.S. EN 752: 2017 'Drain & Sewer Systems outside Buildings', 'The Greater Dublin Region Code of Practice for Drainage Works', the recommendations of the 'Greater Dublin Strategic Drainage Study' (GDSDS), Limerick City and County Council Surface Water/SuDs Specification 2022 and the Building Regulations Technical Guidance Document Part H applying the following parameters.

The following specifications and requirements have been followed in respect to surface water sewers design:

Return Period	Return period of 5 years was used for hydraulic modelling
Flooding	Hydraulic modelling for the design of the network at a 1/30 year return period to include all pipelines so properties are protected against flooding.
Flooding	Hydraulic modelling design of the network 1/100 year return period +30% climate change The 10% urban creep allowance was omitted on the basis that hardstanding areas have been fully optimised within the site
Flooding	Checks made for adequate protection
Critical Results	Summary of Critical Results by Maximum Level (Rank l) for Storm Design for both the 1/30 & 1/100
Minimum depth	1.2m cover under highways 0.9m elsewhere 0.75m with use of Class Z Concrete surround
Maximum depth	Normally 5 meters
Runoff factors for pipe sizing	100% all paved/impermeable surfaces; hard surfaces inclusive of roofs, roads, footpaths, and other hard standing areas 20% green areas 30% Climate change allowance
Rainfall for initial pipe sizing	50mm/hr. rainfall intensity
Minimum velocity (pipe full)	1.0m/sec
Roughness	ks 0.6mm

4.2 ESTIMATION OF GREENFIELD RUNOFF RATE

The Greenfield runoff rate for the site has been estimated using the IH124 method, which is commonly applied for undeveloped sites of less than 50 hectares. This methodology is in line with Environment Agency guidance "Rainfall Runoff Management for Developments", the SuDS Manual C753 (CIRIA, 2015).

The stormwater management system, designed in accordance with SuDS principles, will effectively attenuate and control site runoff, preventing downstream flooding and improving water quality.

The Greenfield runoff estimation is based on the following site-specific parameters:

Parameter	Value
Positively Drained Area	0.188 ha
Standard Annual Average Rainfall (SAAR)	1011 mm
Soil Index (SPR)	0.3
Storm Return Period	100 years
Permissible Outflow per hectare	2.0 l/s/ha = **0.376 l/s**
Q_{BAR}	**1.4 l/s**

Hydro-Brakes will be utilised to control the flow leaving the site and entering the sewer within Hunt's Lane. They will restrict runoff to the greenfield rate of 0.4 l/s.

Accordingly, a 50 mm orifice (the minimum typically recommended to reduce blockage risk) will be provided for blue flow restriction. Calculations indicate that an orifice of this size will restrict runoff to approximately 1.5 l/s.

For detailed calculations please refer to Appendix B Storm Sewer Design Calculations.

4.3 SUDS STRATEGY OVERVIEW

The proposed SuDS strategy follows the sustainable drainage hierarchy, prioritizing source control, site control, and regional control measures to manage surface water effectively. The approach is designed to retain, treat, and attenuate stormwater at its source before controlled discharge into the drainage network. The hierarchy is applied as follows:

Source Control – Managing runoff at the point of rainfall through:

- Interception and temporary storage of runoff within Blue Roof with outflow released at reduced peak rates to the downstream system.
- Use of bioretention rain gardens with filter drains to provide initial capture, primary filtration and water quality treatment (removal of suspended solids and associated pollutants) at source.

Site Control – Routing and treating water within the development:

- Use of rain gardens with filter drains in series to convey, slow and treat surface water prior to entry into the drainage system, thereby reducing flow velocities, providing additional storage and enhancing pollutant removal.

Regional Control – Managing excess water at a larger scale:

- Provision of attenuation storage to accommodate the design storm events, providing temporary volume control and extending time of concentration prior to discharge.
- Flow control devices regulating discharge to the sewer network at a restricted rate, ensuring no increase in peak runoff relative to the existing (greenfield / pre-development) scenario.

By employing this multistage SuDS treatment train, the proposed drainage strategy reduces and delays peak runoff, provides water quality treatment and ensures that discharge to the existing network does not increase flood risk either on site or downstream.

4.3.1 STORM NETWORK DESIGN

The following design practice was employed for sewer design utilising Causeway Flow. A sewer layout was completed, and the pipes and manholes were named so that the upstream manhole (USMH) corresponds with its downstream pipe. For example, if a pipe was numbered 1.014 the USMH would be numbered 1.14. The cumulative impermeable area was then calculated by assigning the paved areas as 100% impervious and the public green spaces as 20% impermeable areas. This data was subsequently imported to Causeway Flow sewer design software. Causeway Flow modelling software was used to design the network to convey the flow associated with a 1:5 year return period and the previously listed requirement.

The site is a previously developed brownfield site with a significant proportion of existing hardstanding. The proposed development incorporates a permeable blue roof with integrated flow restriction devices, reducing the hardstanding area by approximately 306 m² compared with the existing land use. The foul and storm networks remain separate within the site and are combined at Manhole C1.0 prior to connecting to the existing network at Manhole EX CMH.

Attenuation has been designed to cater for the 1 in 100-year storm event. The Seasonal Return Period Wizard within Causeway Flow was used to assess the system across a range of storm durations and return periods, identifying the critical event at each manhole. The modelling confirms no flooding for events up to the 1 in 30-year return period and protection of properties for the 1 in 100-year return period.

Stormwater runoff will be attenuated primarily via the blue roof (approximately 16% of the total site area), with discharge restricted to 1.5 l/s. Secondary attenuation will be provided by a geocellular underground storage tank located beneath the Active Outdoor Amenity area, providing a storage volume of 100.32 m³. Additional minor storage and water quality treatment will be provided within the stone sub-base of the bioretention rain gardens. Refer to Figures 3 and 4 for the attenuation zone locations and the drainage schematic.

The proposed surface water drainage layout and longitudinal sections, including cover and invert levels, are shown on the BDB drawings.

We enclose the design calculations in Appendix B and Maintenance Plan and Schedule are included as a separate report.

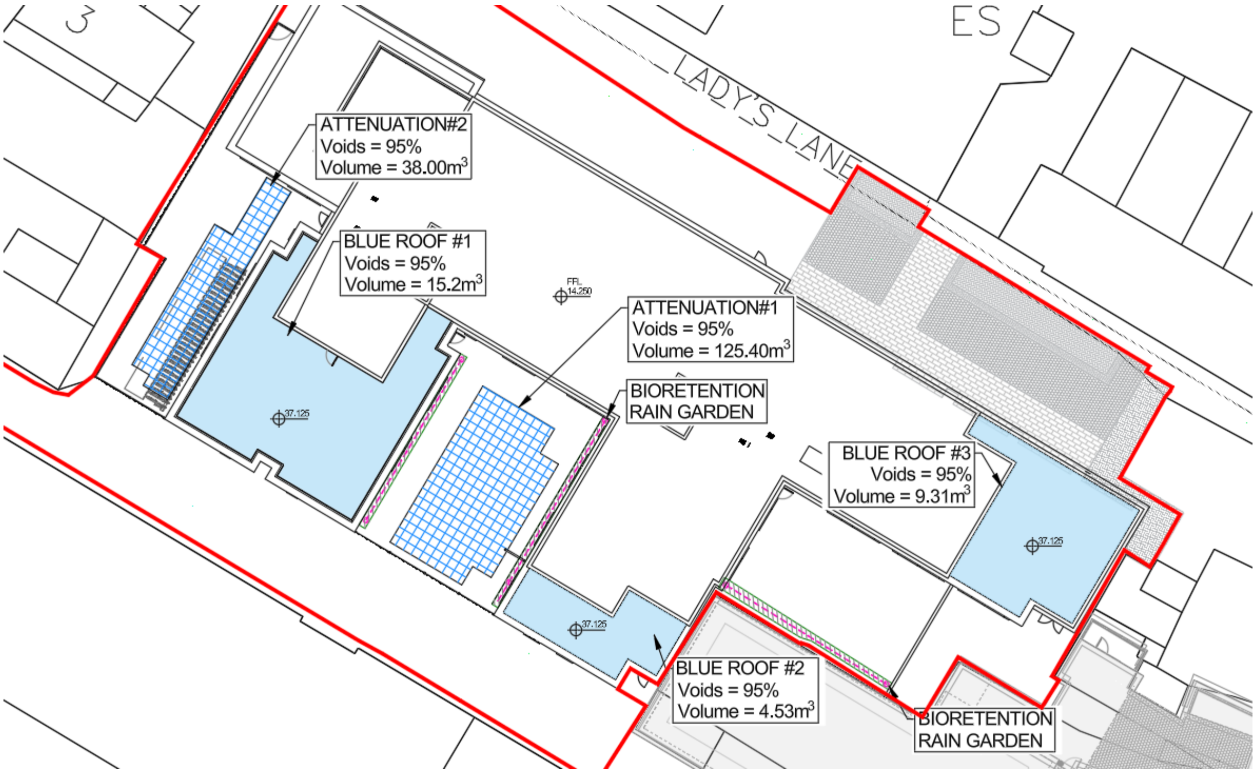

Fig 3. Attenuation Zones

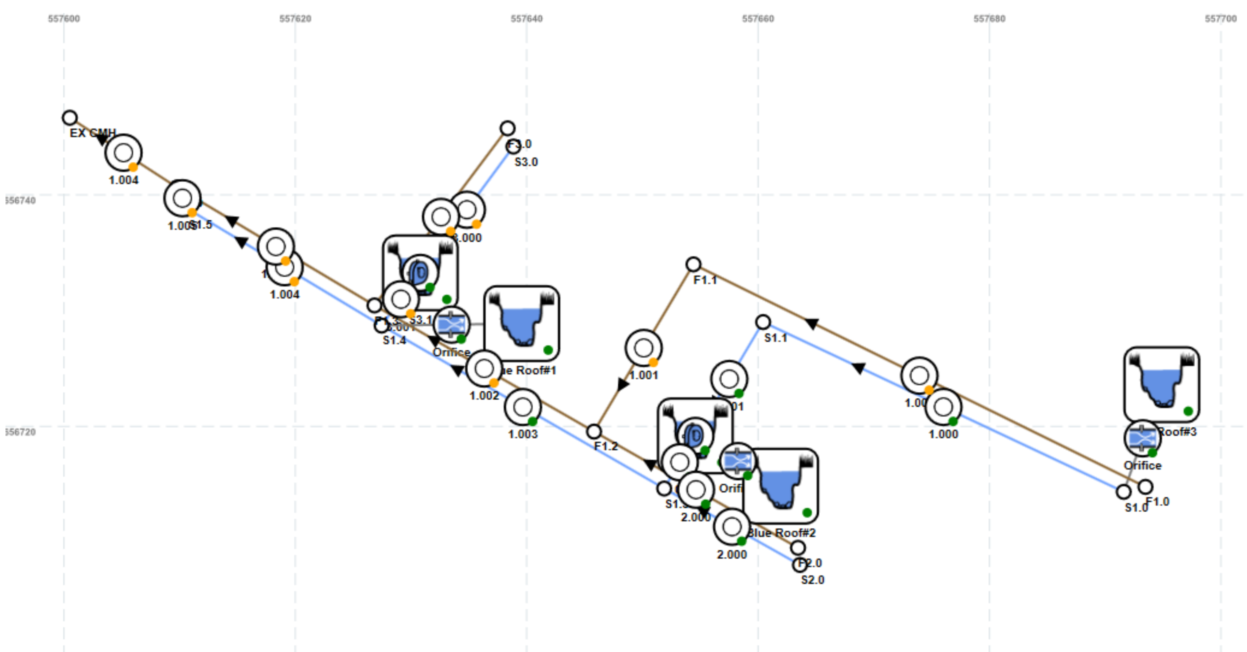

Fig 4. Schematic of attenuation model input to Causeway FLOW

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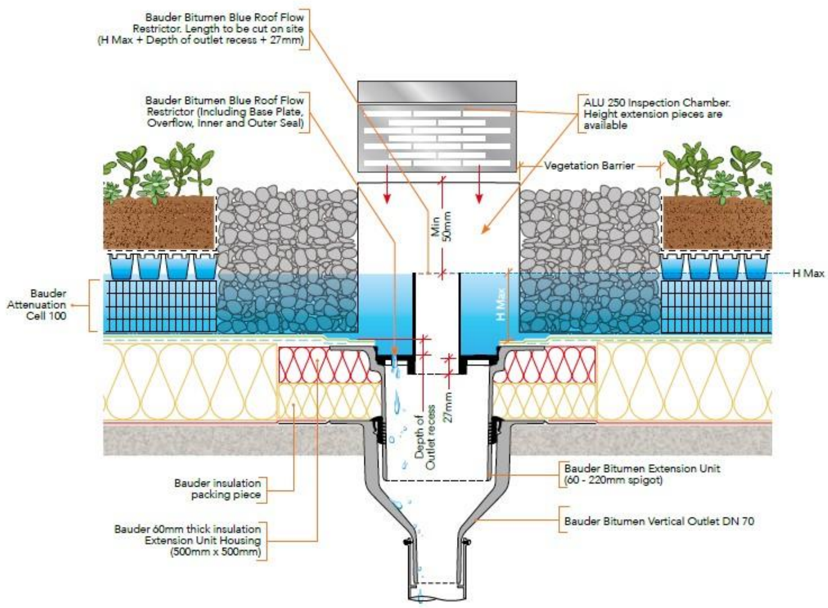
4.3.2 SUDS PROPOSALS

Blue Roof

Blue roofs aim to increase both the volume of water stored and control the amount of water released. They can be effectively used as a method of source control reducing run-off at its source.

Benefits of a Blue Roof:

- Meets SuDS requirements when other systems are impractical or unable to be employed.
- Typically, a blue roof attenuates up to 120mm of stormwater and the outlets give predicted rainwater discharge rates.
- No moving parts, simple to install and easy to maintain.
- Attenuates stormwater to alleviate localized or downstream flooding.



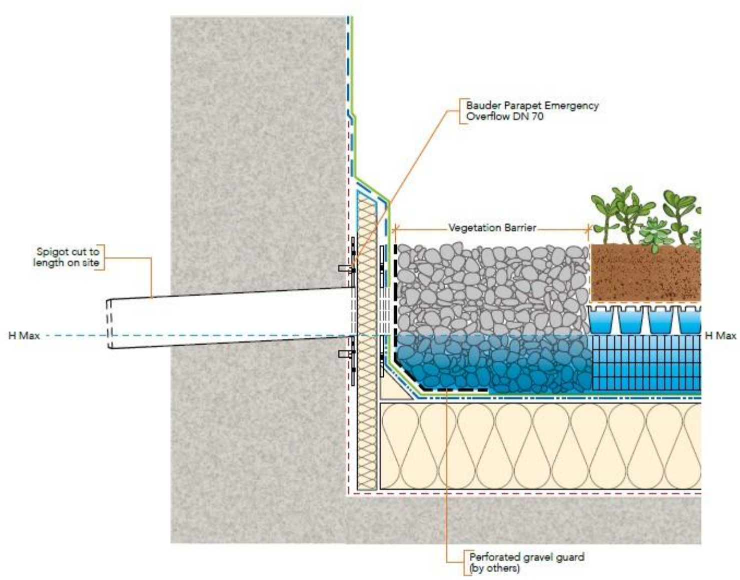


Fig 5. Typical Blue Roof Construction Detail

The inclusion of increased blue roof attenuation area coupled with the use of permeable surfaces and a 1.5 l/s flow restriction via an orifice ensures an efficient drainage system for the site. These measures prevent network surcharge, protecting the building against potential flooding from the sewer network.

Please refer to Appendix D for Bauder Blue Roof Brochure.

Bioretention Rain Garden with Underlying Filter Drain

The proposed rain gardens function as source control SuDS features, capturing runoff directly from adjacent hardstanding before it enters the piped network. Using a combination of stone, sand and organic mulch, these areas act as natural filters, removing pollutants and sediments from stormwater before it is conveyed to the drainage system. They help mitigate the impact of urbanisation on the local drainage regime, reduce peak runoff rates and provide green spaces that support biodiversity and improve visual amenity.

No infiltration to the ground is proposed and underlying filter drain will be wrapped in an impermeable membrane, operating as a lined storage and treatment trench rather than an infiltration feature. The filter drain will comprise a stone filled trench through which water can flow while trapping sediments and associated pollutants, with a high level overflow discharging to the proposed surface water network. This arrangement reduces flood risk and erosion potential while improving the quality of water discharged from the site.

Attenuation Tank

Secondary attenuation is provided by a geocellular underground storage tank located beneath the Active Outdoor Amenity area. The tank is designed to provide below ground storage volume while maintaining the usability of the overlying space, and to regulate runoff by temporarily storing stormwater and releasing it at the restricted discharge rate. The system will include access for inspection and maintenance, and a dedicated flow-through pipe will also be incorporated to act as a flush-out channel, facilitating future cleaning and maintenance of the tank.

4.3.3. POLLUTION HAZARDS INDICES BASED ON THE SIMPLE INDEX APPROACH

In accordance with the SUDS Manual CIRIA C753 the pollution prevention guidelines have been followed to ensure appropriate levels of treatment are provided before attenuated run-off from the site is discharged to an existing combined sewer within the public road southeast of the site. Regarding site-specific drainage, separate wastewater sewer and storm sewer would be provided within the development and systems will be connected prior to the connection point to the existing network. The Pollution Hazard Indices, shown in table below, for the different proposed land uses have been derived from Table 26.2 of CIRIA C753.

Step 1. Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS Scheme.

LAND USE HAZARD INDICES					
Land use characterization		**Pollution Hazard Level**	**Pollution Indices**		
LAND USE	**TYPE**		**Total Suspended Solids**	**Metals**	**Hydrocarbons**
ROOF	Residential roofing	Very low	0.2	0.2	0.05
OUTDOOR AMENITY	Active Space & Quiet Space	Low	0.3	0.2	0.05

Step 2. Determine the Pollution Mitigation Index for the proposed Ground Water Protection.

POLLUTION MITIGATION INDICES			
ELEMENT	**Pollution Indices**		
	Total Suspended Solids	**Metals**	**Hydrocarbons**
Blue Roof	0.4	0.3	0.3
Bioretention System	0.8	0.8	0.8
NOTE: SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual.			

Step 3. Determine sufficiency of Pollution Mitigation Indices for selected SuDS components.

	SUMMARY	
	Land Use Type	Residential Roof
	SuDS Mitigation Component	Blue Roof
Total SuDS Mitigation	**Pollution Hazard Level**	Very low
	TSS	0.2 – 0.4 = -0.2
	Metals	0.2 – 0.3 = -0.1
	Hydrocarbons	0.05 – 0.3 = -0.25
	Ground water protection	No Infiltration
	Acceptability of Pollution Mitigation	***Sufficient***

	SUMMARY	
	Land Use Type	Outdoor Amenities
	SuDS Mitigation Component	Bioretention System
Total SuDS Mitigation	**Pollution Hazard Level**	Low
	TSS	0.3 – 0.8 = -0.5
	Metals	0.2 – 0.8 = -0.6
	Hydrocarbons	0.05 – 0.8 = -0.75
	Ground water protection	No Infiltration
	Acceptability of Pollution Mitigation	***Sufficient***

5.0 WATER SUPPLY

A Pre-Connection Enquiry was submitted to Uisce Éireann, which was assigned reference number CDS26001462.

The proposed development will be served with a 100mm diameter watermain connected to the existing water supply in Dominic Street. An Irish Water approved water-meter shall be provided at the site boundary. All water mains shall be a minimum 100mm diameter HDPE as discussed with and agreed with Irish Water. All water service connections shall incorporate a water service control unit (round type).

The WSC unit shall be located in the footpath and shall include a stopcock in the unit. The stopcock shall be capable of being opened/closed without removal of the top of the WSC unit.

Hydrants shall be screw down type to BS 750 with 80mm diameter flanged inlet and 63 mm male thread outlet. The outlet from the hydrant shall not be greater than 200mm below adjoining ground level. Indicator plates conforming to BS 3251 shall be fixed to nearby walls or concrete marker posts.

Water Demand:

The average day/peak week demand should be taken as 1.25 times the average daily domestic demand.

Average Daily Domestic Demand = 350 x 150 l/person/day

= 52,500 l/day

= 0.6 l/s

Average Day / Peak Week Demand = 0.6l/s x 1.25

= 0.759 l/s

6.0 FINISHED FLOOR LEVELS AND FREEBOARD

The existing finished floor level 14.300m. The proposed finished floor level for the development is set at 14.250m.

Storm sewer calculations have been carried out for both the 1 in 30 year and 1 in 100 year storm events to determine the maximum surcharge levels within the drainage network serving the site. Comparing the proposed FFL against these surcharge levels confirms that adequate freeboard is achieved in all modelled scenarios.

Against the 1 in 30 year storm, a freeboard of 970 mm is provided between the maximum surcharge level and the proposed FFL. For the more severe 1 in 100 year event, this freeboard equals to 778 mm.

These figures demonstrate that the proposed Finished Floor Levels are set at a safe and appropriate elevation, providing a comfortable margin above the most severe storm event modelled. We are therefore satisfied that the development is fully protected against flood risk associated with sewer surcharge.

APPENDIX A

FOUL & COMBINED SEWER CALCULATIONS

Nodes

Name	Dwellings	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)	Invert Level (m)
F1.0	50		14.100	1200	0.975	13.125
F1.1	200		14.100	1200	1.265	12.835
F2.0			14.180	1200	1.330	12.850
F1.2			14.350	1200	1.627	12.723
F3.0	100		14.250	1200	0.975	13.275
F1.3			14.240	1200	1.663	12.577
C1.0		1.0	14.700	1200	2.868	11.832
EX CMH			14.750	1200	2.992	11.758

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	F1.0	F1.1	43.535	1.500	13.125	12.835	0.290	150.0	225
1.001	F1.1	F1.2	16.807	1.500	12.835	12.723	0.112	150.0	225
2.000	F2.0	F1.2	20.288	1.500	12.850	12.723	0.127	159.8	225
1.002	F1.2	F1.3	21.880	1.500	12.723	12.577	0.146	150.0	225
3.000	F3.0	F1.3	19.028	1.500	13.275	13.148	0.127	150.0	225
1.003	F1.3	C1.0	19.848	1.500	12.577	12.445	0.132	150.0	225
1.004	C1.0	EX CMH	11.080	1.500	11.832	11.758	0.074	150.0	225

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.936	37.2	1.5	0.750	1.040	0.000	50	0.0	0.0	31	0.455
1.001	0.936	37.2	7.7	1.040	1.402	0.000	250	0.0	0.0	70	0.740
2.000	0.907	36.1	0.0	1.105	1.402	0.000	0	0.0	0.0	0	0.000
1.002	0.936	37.2	7.7	1.402	1.438	0.000	250	0.0	0.0	70	0.740
3.000	0.936	37.2	3.1	0.750	0.867	0.000	100	0.0	0.0	44	0.568
1.003	0.936	37.2	10.8	1.438	2.030	0.000	350	0.0	0.0	83	0.811
1.004	0.936	37.2	11.8	2.643	2.767	0.000	350	0.0	1.0	87	0.833

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APPENDIX B

DESIGN STORM CALCULATIONS

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)	Invert Level (m)
S1.0	0.020	5.00	14.100	1200	1.350	12.750
S1.1	0.070	5.00	14.100	1200	1.769	12.331
S1.2	0.040	5.00	14.100	1200	1.883	12.217
S2.0		5.00	14.180	1200	1.680	12.500
S1.3			14.300	1200	2.136	12.164
S3.0	0.020	5.00	14.250	1200	1.050	13.200
S3.1			14.250	1200	1.184	13.066
S1.4	0.038	5.00	14.250	1200	2.274	11.976
S1.5			14.690	1200	2.844	11.846
C1.0			14.700	1200	2.868	11.832
Blue Roof#1			37.125		0.125	37.000
Blue Roof#2			37.125		0.125	37.000
Blue Roof#3			37.125		0.125	37.000

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	S1.0	S1.1	34.442	0.600	12.750	12.406	0.344	100.0	150	5.57	50.0
1.001	S1.1	S1.2	11.443	0.600	12.331	12.217	0.114	100.0	225	5.72	50.0
1.002	S1.2	S1.3	5.284	0.600	12.217	12.164	0.053	100.0	225	5.78	50.0
2.000	S2.0	S1.3	13.462	0.600	12.500	12.164	0.336	40.1	225	5.11	50.0
1.003	S1.3	S1.4	28.187	0.600	12.164	11.976	0.188	150.0	225	6.23	50.0
3.000	S3.0	S3.1	13.408	0.600	13.200	13.066	0.134	100.0	150	5.22	50.0
3.001	S3.1	S1.4	5.620	0.600	13.066	13.010	0.056	100.0	150	5.32	50.0
1.004	S1.4	S1.5	19.564	0.600	11.976	11.846	0.130	150.0	225	6.53	49.2
1.005	S1.5	C1.0	2.035	0.600	11.846	11.832	0.014	150.0	225	6.56	49.1

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	17.8	4.0	1.200	1.544	0.020	0.0	48	0.813
1.001	1.307	52.0	17.9	1.544	1.658	0.090	0.0	91	1.189
1.002	1.307	52.0	25.8	1.658	1.911	0.130	0.0	112	1.305
2.000	2.072	82.4	0.0	1.455	1.911	0.000	0.0	0	0.000
1.003	1.065	42.3	25.8	1.911	2.049	0.130	0.0	127	1.116
3.000	1.005	17.8	4.0	0.900	1.034	0.020	0.0	48	0.813
3.001	1.005	17.8	4.0	1.034	1.090	0.020	0.0	48	0.813
1.004	1.065	42.3	36.8	2.049	2.619	0.188	0.0	162	1.195
1.005	1.065	42.3	36.7	2.619	2.643	0.188	0.0	162	1.195

Simulation Settings

Rainfall Methodology	FSR
Rainfall Events	Singular
FSR Region	Scotland and Ireland
M5-60 (mm)	14.000
Ratio-R	0.300
Summer CV	1.000
Winter CV	1.000
Analysis Speed	Normal
Skip Steady State	x

Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
Starting Level (m)	
Check Discharge Rate(s)	✓
30 year (l/s)	2.8
100 year (l/s)	3.5
Check Discharge Volume	✓
100 year 360 minute (m³)	44

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 %)
30	30	10	0
100	30	10	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Growth Factor 1 year	0.85
Brownfield Method	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.188	Betterment (%)	0
SAAR (mm)	1011	QBar	1.4
Soil Index	4	Q 1 year (l/s)	
SPR	0.47	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	

Pre-development Discharge Volume

Site Makeup	Brownfield	Return Period (years)	100
Brownfield Method	Greenfield	Climate Change (%)	0
Greenfield Method	FSR/FEH	Storm Duration (mins)	360
Positively Drained Area (ha)	0.188	Betterment (%)	0
Soil Index	4	PR	0.490
SPR	0.47	Runoff Volume (m³)	44
CWI	125.028		

Node Blue Roof#1 Offline Orifice Control

Flap Valve	✓	Design Depth (m)	0.100	Discharge Coefficient	0.600
Loop to Node	S1.4	Design Flow (l/s)	1.5		
Invert Level (m)	37.000	Diameter (m)	0.051		

Node Blue Roof#2 Offline Orifice Control

Flap Valve	✓	Design Depth (m)	0.100	Discharge Coefficient	0.600
Loop to Node	S1.2	Design Flow (l/s)	1.5		
Invert Level (m)	37.000	Diameter (m)	0.051		

Node Blue Roof#3 Offline Orifice Control

Flap Valve	✓	Design Depth (m)	0.100	Discharge Coefficient	0.600
Loop to Node	S1.0	Design Flow (l/s)	1.5		
Invert Level (m)	37.000	Diameter (m)	0.051		

Node S1.2 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	12.217	Product Number	CTL-SHE-0025-4000-1800-4000
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.4	Min Node Diameter (mm)	1200

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Node S3.1 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	13.066	Product Number	CTL-SHE-0028-4000-1100-4000
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.4	Min Node Diameter (mm)	1200

Node S1.2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	12.217
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	88.0	0.0	1.500	88.0	0.0	1.501	0.0	0.0

Node Blue Roof#1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	160.0	0.0	0.100	160.0	0.0	0.101	0.0	0.0

Node Blue Roof#2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	48.0	0.0	0.100	48.0	0.0	0.101	0.0	0.0

Node Blue Roof#3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	98.0	0.0	0.100	98.0	0.0	0.101	0.0	0.0

Node S3.1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	13.066
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	50.0	0.0	0.800	50.0	0.0	0.801	0.0	0.0

Flow+ v17.0 Copyright © 1988-2026 Causeway Technologies Ltd

Results for 30 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
1440 minute winter	S1.0	1410	13.193	0.443	0.5	0.6449	0.0000	SURCHARGED
1440 minute winter	S1.1	1410	13.193	0.862	2.1	1.7250	0.0000	SURCHARGED
1440 minute winter	S1.2	1410	13.193	0.976	2.9	83.1239	0.0000	SURCHARGED
15 minute summer	S2.0	1	12.500	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	S1.3	1410	12.178	0.014	0.3	0.0155	0.0000	OK
15 minute summer	S3.0	9	13.280	0.080	7.9	0.1241	0.0000	OK
360 minute summer	S3.1	288	13.220	0.154	1.9	7.4686	0.0000	SURCHARGED
15 minute summer	S1.4	10	12.073	0.097	15.2	0.1451	0.0000	OK
15 minute summer	S1.5	11	11.951	0.105	14.9	0.1188	0.0000	OK
15 minute summer	C1.0	11	11.923	0.091	15.0	0.0000	0.0000	OK
15 minute summer	Blue Roof#1	1	37.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	Blue Roof#2	1	37.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	Blue Roof#3	1	37.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
1440 minute winter	S1.0	1.000	S1.1	0.5	0.334	0.028	0.6063	
1440 minute winter	S1.1	1.001	S1.2	2.0	0.480	0.038	0.4551	
1440 minute winter	S1.2	1.002	S1.3	0.3	0.333	0.006	0.0049	
15 minute summer	S2.0	2.000	S1.3	0.0	0.000	0.000	0.0044	
1440 minute winter	S1.3	1.003	S1.4	0.3	0.293	0.007	0.0518	
15 minute summer	S3.0	3.000	S3.1	8.0	1.408	0.448	0.0853	
360 minute summer	S3.1	3.001	S1.4	0.3	0.355	0.014	0.0040	
15 minute summer	S1.4	1.004	S1.5	14.9	0.871	0.352	0.3360	
15 minute summer	S1.5	1.005	C1.0	15.0	0.904	0.354	0.0338	11.1
15 minute summer	Blue Roof#1	Orifice	S1.4	0.0				0.0
15 minute summer	Blue Roof#2	Orifice	S1.2	0.0				0.0
15 minute summer	Blue Roof#3	Orifice	S1.0	0.0				0.0

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Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.60%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	S1.0	1410	13.472	0.722	0.6	1.0527	0.0000	SURCHARGED
1440 minute winter	S1.1	1410	13.472	1.141	2.6	2.2852	0.0000	SURCHARGED
1440 minute winter	S1.2	1410	13.472	1.255	3.8	106.9637	0.0000	SURCHARGED
15 minute summer	S2.0	1	12.500	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	S1.3	1410	12.178	0.014	0.3	0.0164	0.0000	OK
15 minute summer	S3.0	10	13.292	0.092	10.3	0.1422	0.0000	OK
480 minute summer	S3.1	384	13.274	0.208	2.0	10.1197	0.0000	SURCHARGED
15 minute summer	S1.4	10	12.089	0.113	19.7	0.1695	0.0000	OK
15 minute summer	S1.5	11	11.968	0.122	19.3	0.1379	0.0000	OK
15 minute summer	C1.0	11	11.937	0.105	19.4	0.0000	0.0000	OK
15 minute summer	Blue Roof#1	1	37.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	Blue Roof#2	1	37.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	Blue Roof#3	1	37.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	S1.0	1.000	S1.1	0.5	0.355	0.031	0.6063	
1440 minute winter	S1.1	1.001	S1.2	2.6	0.535	0.049	0.4551	
1440 minute winter	S1.2	1.002	S1.3	0.3	0.344	0.007	0.0053	
15 minute summer	S2.0	2.000	S1.3	0.0	0.000	0.000	0.0048	
1440 minute winter	S1.3	1.003	S1.4	0.3	0.282	0.008	0.0573	
15 minute summer	S3.0	3.000	S3.1	10.3	1.459	0.581	0.1080	
480 minute summer	S3.1	3.001	S1.4	0.3	0.355	0.014	0.0040	
15 minute summer	S1.4	1.004	S1.5	19.3	0.926	0.455	0.4078	
15 minute summer	S1.5	1.005	C1.0	19.4	0.967	0.457	0.0408	13.9
15 minute summer	Blue Roof#1	Orifice	S1.4	0.0				0.0
15 minute summer	Blue Roof#2	Orifice	S1.2	0.0				0.0
15 minute summer	Blue Roof#3	Orifice	S1.0	0.0				0.0

APPENDIX C

BAUDER – BLUE ROOF BROCHURE

BAUDER
making roofs secure.

Blue Roof Systems

Flat roof and podium level SuDS solutions

Blue roof finishes can comprise a variety of vegetation for green roofs, hard landscaping, and even incorporate a biosolar PV array.

Bauder is a leading European manufacturer of flat roof waterproofing membranes and insulation to make buildings watertight and thermally efficient; photovoltaic systems for renewable energy generation; green roofs to support the environment and create better living and working spaces for people; and blue roofs for stormwater attenuation and prevention of localised flooding.

Customers choose us because of the way in which we do business, for our robust advice on the right system, and our approach to delivering projects. We work alongside clients to deliver the best solution for a building from our broad portfolio of systems.

Blue Roofs
Rooftop sustainable urban drainage solutions (SuDS)

Designed to attenuate and slow the discharge of stormwater on a flat roof for up to a 48 hour period via a restrictive flow outlet to help prevent localised flooding.

A BauderBLUE roof controls rainwater where it lands, one of the core pillars of SuDS design.

The blue roof outlet restricts the discharge of stormwater to a calculated and defined flow rate to significantly slow down the volume of water leaving the site. As the storm passes, water continues to discharge from the roof at a controlled rate over a set period (typically up to 48 hrs).

This rooftop SuDS design has weight load implications and the project's structural engineer will need to be engaged at an early stage.

Specifying a blue roof

A BauderBLUE roof system can be constructed at either rooftop or podium level with a variety of landscape finishes including green roofs, biosolar PV array, or hard landscaping.

Usually required to meet planning when restrictions have been placed on the construction to limit the flow rate of rainwater leaving a site via the drainage system.

Outline of our BauderBLUE solutions

- Three different systems with stormwater flow restrictor outlet.
- Our specification service will confirm suitability of waterproofing system for each roof area.
- Warm, cold, and inverted roof design options.
- Single point guarantee to comply with client's insurance company requirement.

Achieving technical objectives

- Bespoke, project specific discharge rates to match drainage requirements for the site.
- Precise volume and weight of water storage with overflow to ensure the maximum water level (H-Max) is never exceeded.
- Design support to meet relevant British Standards and blue roof guidance criteria.

BauderBLUE ST adjustable blue roof outlet flow restrictor

BauderBLUE Roof Systems

Three methods for creating a blue roof with our solutions

There are different systems available to the construction designer to achieve a blue roof depending on the finish desired and the volume of water to be attenuated.

BauderBLUE STORMsub System

This hybrid system utilises the water storage capacity of a green roof build up. The additional SUB-RE UK substrate layer and RE 40 drainage and attenuation board act with the flow restrictor to carefully control the water discharge off the roof. The STORMsub system reduces the plastic content of the blue roof compared to a 100mm STORMcell system to enhance the environmental focus of the solution.

Finish options:

- Extensive and biodiverse vegetation

BauderBLUE STORMcell System

This high-volume system creates a void space between the waterproofing and the surface finish. The void is created by the BauderGREEN RWR 100 and enables water movement to the flow restrictor outlet. The STORMcell system gives the greatest capacity for water storage, three layers of RWR 100 will hold up to 285 litres/m^2.

Finish options:

- Extensive, biodiverse, and semi-intensive green roofs
- BauderSOLAR G LIGHT • Paving • Stone ballast

BauderBLUE STORMvoid System

This simple system creates a void space with Bauder pedestals and hard landscaping finish to an exact finish height to allow water movement to the flow restrictor outlet. Utilising Bauder pedestals ensures the entire system is covered by our guarantee.

Finish options:

- Paving • Metal decking

Plus points

- Our specification service will confirm suitability of the Bauder waterproofing system and type of blue roof for each roof area.
- We provide technical calculations for the required discharge rate of the blue roof and its geographical location.

Blue Roof Construction

Warm, inverted, or cold roof design to zero falls according to BS 6229:2018

Overview of the fundamental elements required for a blue roof that will generally be constructed with a concrete deck. Your area technical manager will assist in the highly developed points of design and construction.

Deck construction

The roof deck has to be built with zero falls (no back falls) to ensure the required water holding capacity is met and the blue roof is effective. When the construction is complete, a deck deflection survey will confirm the accuracy of construction, any back falls can then be corrected to ensure compliance to BS 6229:2018.

Waterproofing the building

An early and critical consideration for a blue roof is the waterproofing. There are two systems in our portfolio, reinforced bitumen membrane waterproofing and hot melt structural waterproofing that deliver the robust performance required. See page 12 for more information.

Warm roof construction

Insulation is between the layers of the waterproofing and the compressive strength of the insulation must exceed the maximum expected imposed loads for the blue roof, including the water within the blue roof components. Warm roofs normally allow for a shallower roof build-up.

Insulate with:

- BauderPIR
- BauderROCK
- BauderGLAS

Inverted roof construction

Insulation is above the waterproofing and will be subject to the force of buoyancy which causes floatation. The weight of the surface finish must exceed the force of buoyancy. Accurate calculation for thermal performance is not possible due to rainwater cooling around the insulation.

Inverted blue roofs are often preferred when a podium will be used as a site work space during construction.

Insulate with:

- BauderJFRI
- BauderXPS

Cold roof construction

The thermal effectiveness of the construction will have been included, where necessary, within the building rather than included in the blue roof solution.

Emergency overflow

An emergency overflow that is unconnected to the blue roof outlet will discharge the water should the maximum height of the blue roof design be exceeded.

Emergency overflow

Roof penetrations

The blue roof design must minimise or eliminate penetrations in the area where water is to be attenuated, other than the rainwater outlets or emergency overflows that are required for drainage functionality.

BauderBLUE STORMsub System

Creating a blue roof within a green roof where the substrate and water retention board attenuate stormwater

Extensive or biodiverse vegetation finishes can be coupled with a biosolar PV array for maximum environmental advantage.

Green roofs naturally, as part of their multi-layer design function, soak up water for the plants to use, retain it, and delay its run-off. Typically, a green roof will reduce annual run-off by 40-60% per annum*. However, simply using a green roof to attenuate water run-off has a major disadvantage, once saturated there is no control on the rate of water discharge so on its own it cannot be used to achieve a particular discharge rate.

The BauderBLUE STORMsub system utilises our BauderGREEN RE 40 drainage and attenuation board and BauderGREEN SUB-RE UK adapted lightweight substrate as the specific water attenuation components; all other components in the green roof are specified as normal to support the vegetation and safeguard the waterproofing.

Plus points

- Greater depth of substrate improves the vegetation cover and drought tolerance of the plants.
- Reduces the volume of plastics in the blue roof (84% reduction) compared to our STORMcell system with 100mm depth of BauderGREEN RWR 100.
- Suitable to use with our biosolar PV system.
- Can be used with Bauder's full range of vegetation options to suit visual preference or Biodiversity Action Plan.
- Comprehensive range of guarantee packages to fulfil cover requirements for the project (dependant on system/product selection). For more information contact our technical dept for a sample guarantee outlining cover level, terms and conditions.

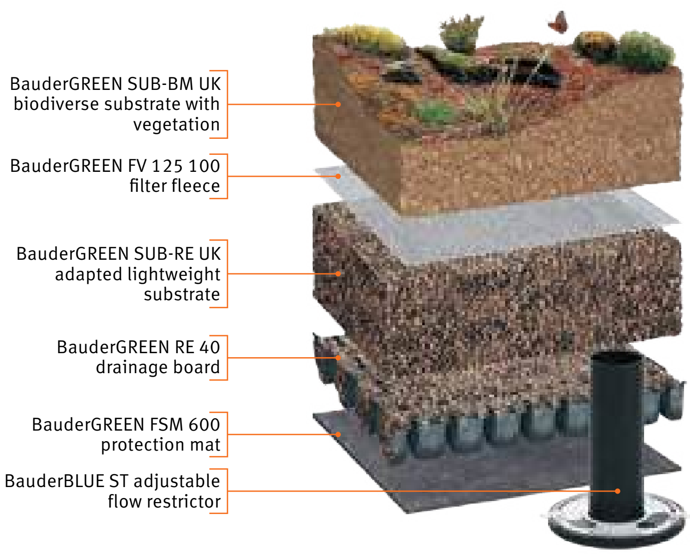
Roof finish options

- Extensive green roofs.
- BauderGREEN XF 301.
- BauderGREEN Flora 3 biosolar and shade tolerant seed mix.
- Intensive green roof.
- Pebble ballast.

*(Source: Green roofs as a tool for solving the rainwater run-off problem in the urbanised 21st century? Mentens, J.; Raes, D.; Hermy, M. Revised 2005)

Biodiverse wildflower finish

BauderGREEN RE40

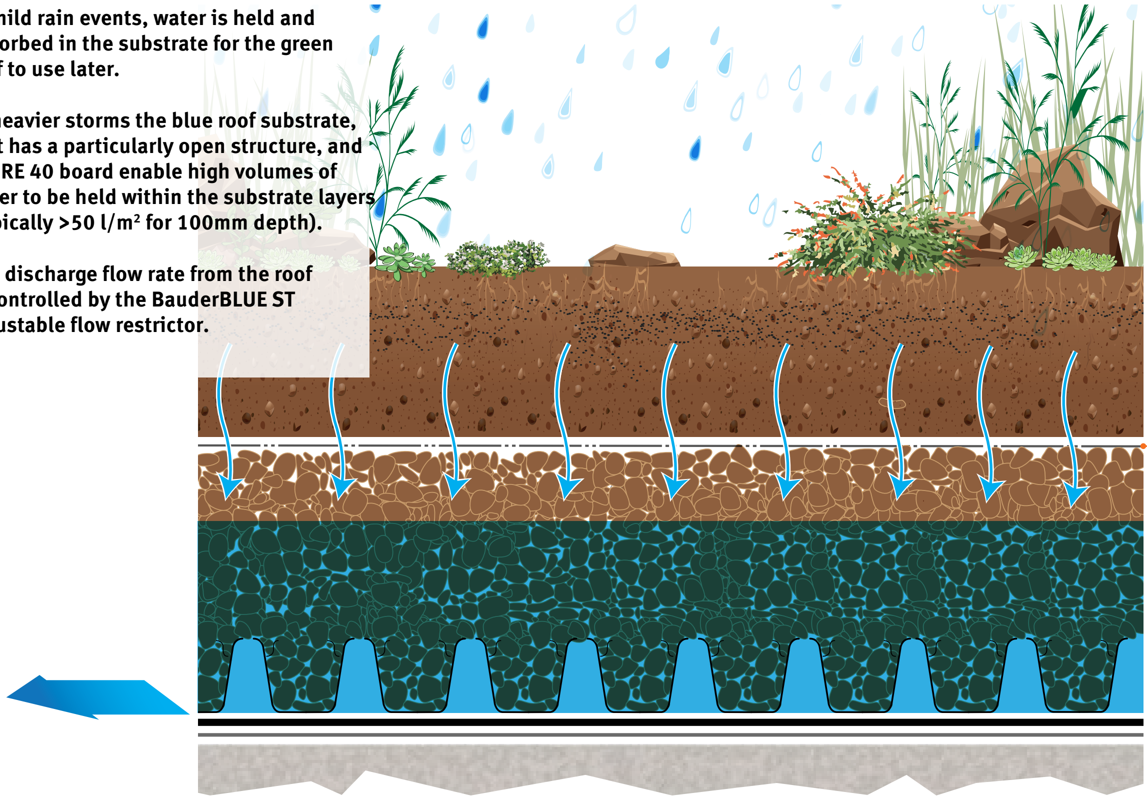


BauderBLUE STORMsub System

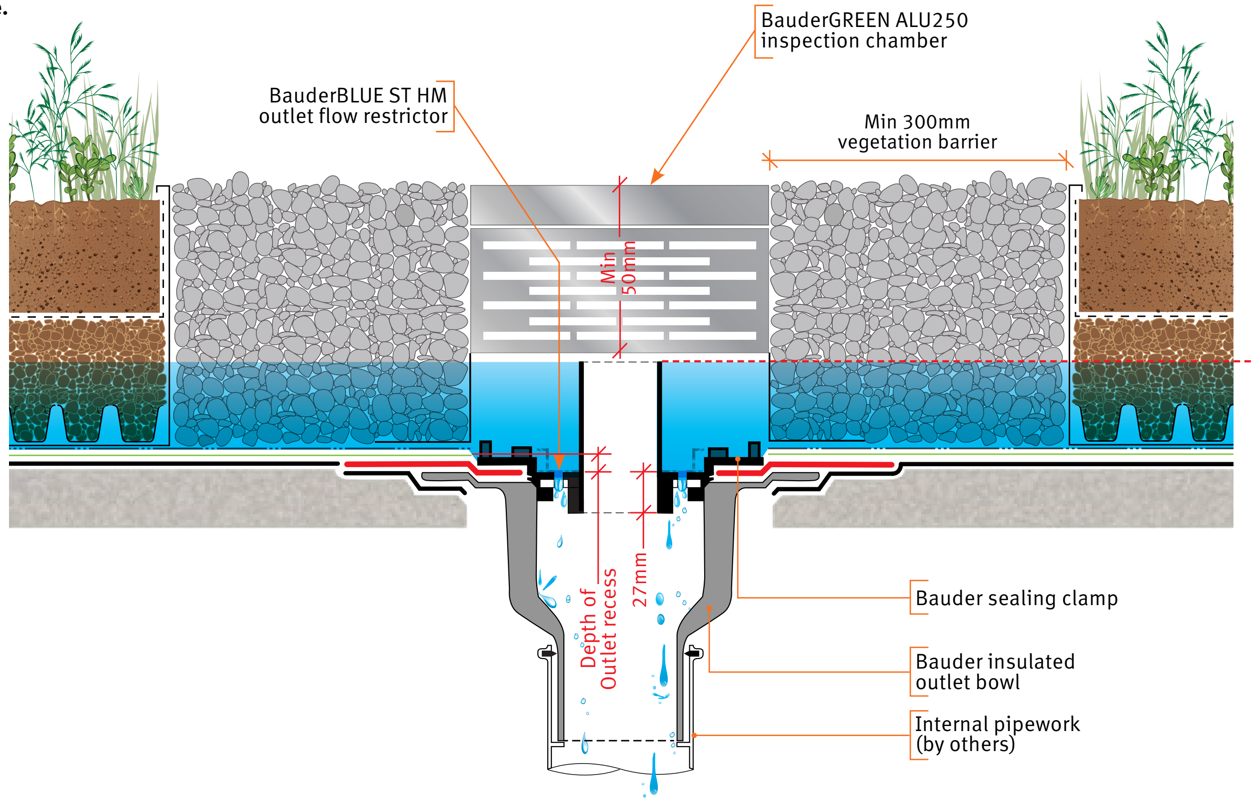
In mild rain events, water is held and absorbed in the substrate for the green roof to use later.

In heavier storms the blue roof substrate, that has a particularly open structure, and the RE 40 board enable high volumes of water to be held within the substrate layers (typically >50 l/m² for 100mm depth).

The discharge flow rate from the roof is controlled by the BauderBLUE ST adjustable flow restrictor.



Both illustrations show Bauder biodiverse green roof. All types of green roof finish are suitable.



BauderBLUE STORMcell System

Creating a blue roof beneath a green roof finish for high volumes of stormwater attenuation

The surface finish freely drains into the attenuating cavity forming layers that allow free-flowing movement of water to the flow restrictor outlets.

This solution is designed to hold high volumes of stormwater during severe rain events and reduce the flow rate from the roof to acceptable levels for the drainage system.

The BauderGREEN RWR 100 creates the void space beneath the roof finish and can be used in a multi-layer solution for increased levels of water attenuation. The product is >95% void and achieves compressive strength ≥400kN/m² for use under green roofs, roof mounted equipment, and hard landscaping surfaces.

Plus points

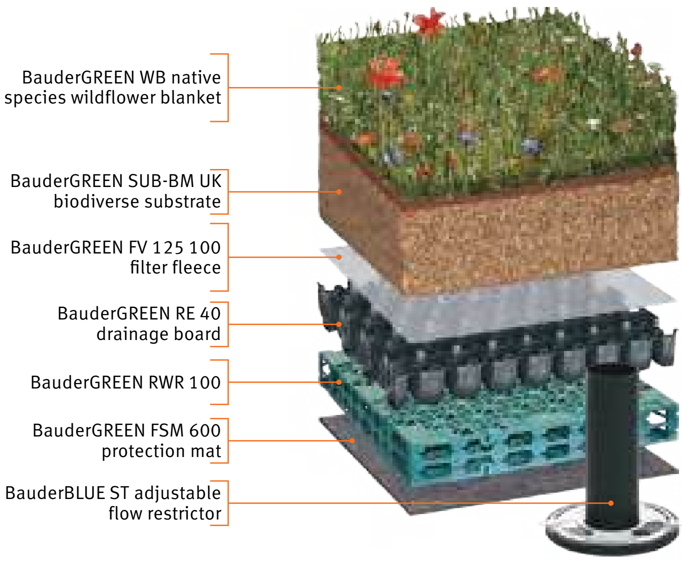
- Accommodates high volumes of water.
- Suitable as a base to build soft and hard landscaping including planters and paving details.
- BauderGREEN RWR 100 made from recycled plastic.
- High levels of compressive strength, suitable to mount plant equipment.
- Ideal as part of a comprehensive BREEAM solution.
- Specify with our BauderSOLAR G LIGHT biosolar PV array.
- Comprehensive range of guarantee packages to fulfil cover requirements for the project (dependant on system/product selection). For more information contact our technical dept for a sample guarantee outlining cover level, terms and conditions.

Roof finish options

- Extensive green roofs.
- BauderGREEN WB native species wildflower blanket.
- BauderGREEN Plugs.
- BauderGREEN Flora 3 biosolar and shade tolerant seed mix.
- Intensive green roof.
- Pebble ballast.

Biosolar PV with wildflower finish

BauderGREEN RWR 100

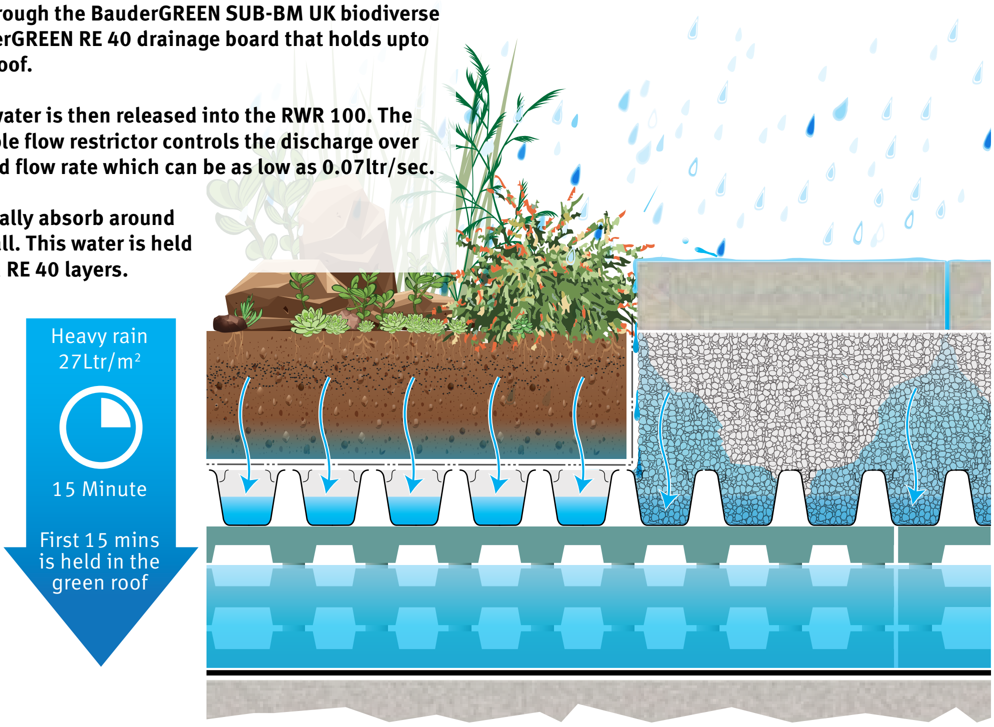


BauderBLUE STORMcell System

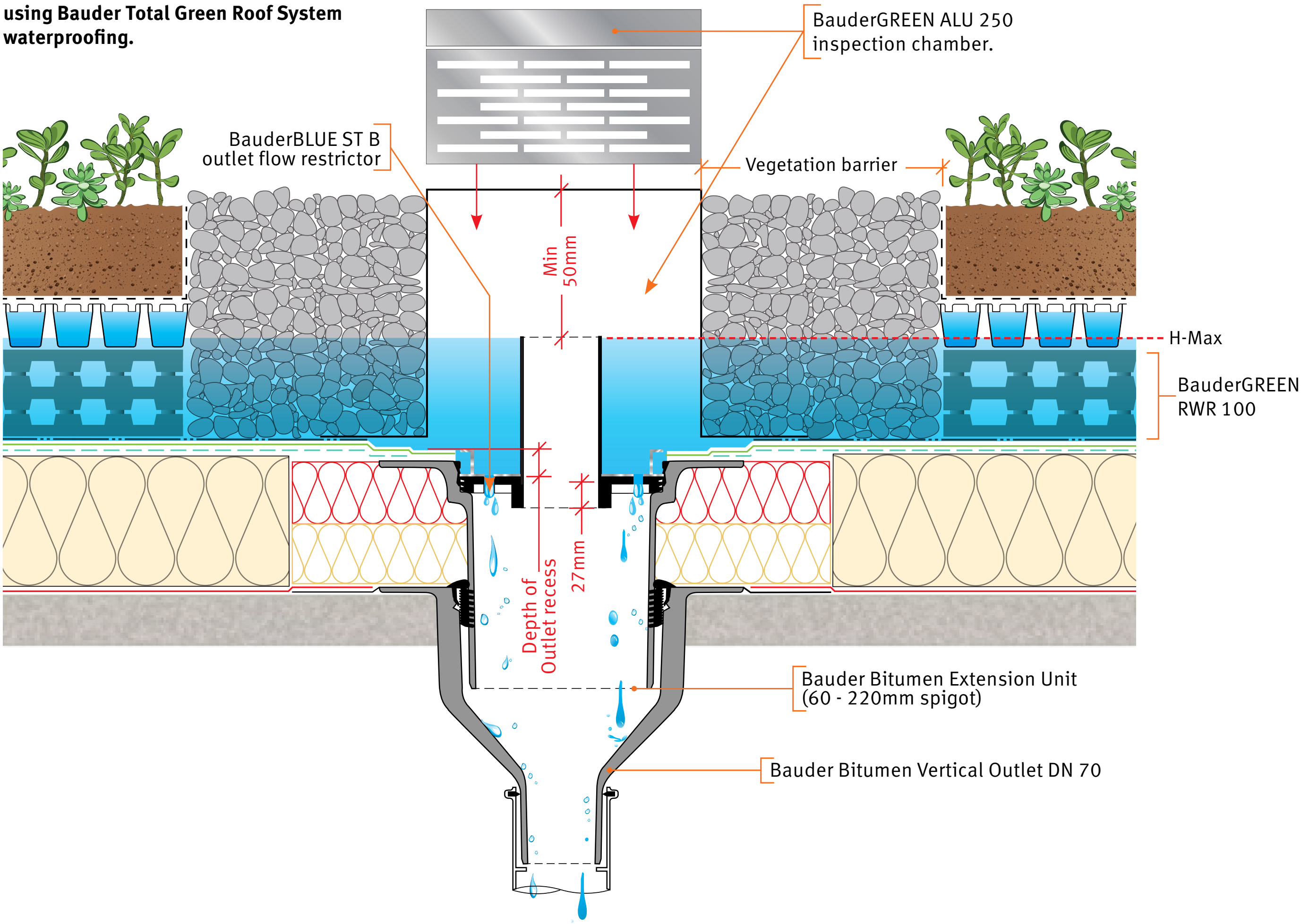
Rainwater perculates through the BauderGREEN SUB-BM UK biodiverse substrate into the BauderGREEN RE 40 drainage board that holds upto 13.5 l/m² for the green roof.

During a storm, excess water is then released into the RWR 100. The BauderBLUE ST adjustable flow restrictor controls the discharge over <48 hours at the required flow rate which can be as low as 0.07ltr/sec.

The green roof will naturally absorb around 50% of the annual rainfall. This water is held within the substrate and RE 40 layers.



Illustrated here as a warm roof construction using Bauder Total Green Roof System waterproofing.



BauderBLUE STORMvoid System

Simplest blue roof solution beneath hard landscaping on a pedestal support system

Courtyard podiums or terraces are ideal locations for this blue roof solution with a completely paved finish above the void space created by the pedestal system.

This blue roof solution incorporates open-jointed paving on a Bauder pedestal support system that covers the height of the H-Max. The weight loading of the paving must exceed any buoyancy forces that will be exerted on the pedestals. The STORMvoid system is likely to require additional ballast to prevent floatation if used on inverted blue roofs.

The Bauder pedestal range is used in the STORMvoid system with hard landscaping. Selection will depend on the performance required.
Options include:

Bauder Adjustable Pedestal System
Simple, high strength, low-cost pedestal units that achieve depths from 18mm to 955mm. The pedestals feature a 197mm diameter base to negate the need for additional load spreader.

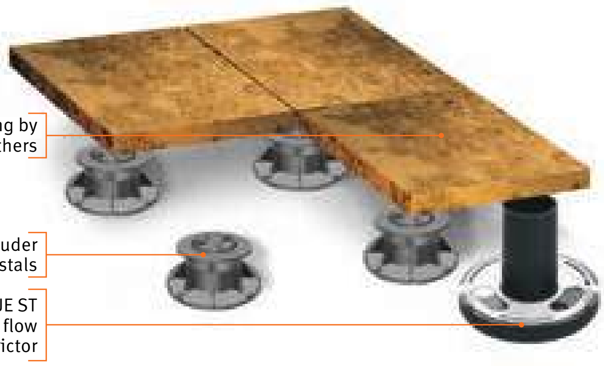
Bauder Non-Combustible Pedestal System
An all metal, non-combustible pedestal with a 170mm diameter base plate to spread load across the roof surface. The pedestal system can achieve a variety of heights from 42mm to 282mm.


Permeable paving on pedestals finish


Bauder pedestals

Plus points

- Accommodates high volumes of water.
- Hard landscape finish.
- Often an ideal finish for simple roof areas.
- Ideal as part of a comprehensive BREEAM solution.
- Comprehensive range of guarantee packages to fulfil cover requirements for the project (dependant on system/product selection). For more information contact our technical dept for a sample guarantee outlining cover level, terms and conditions.

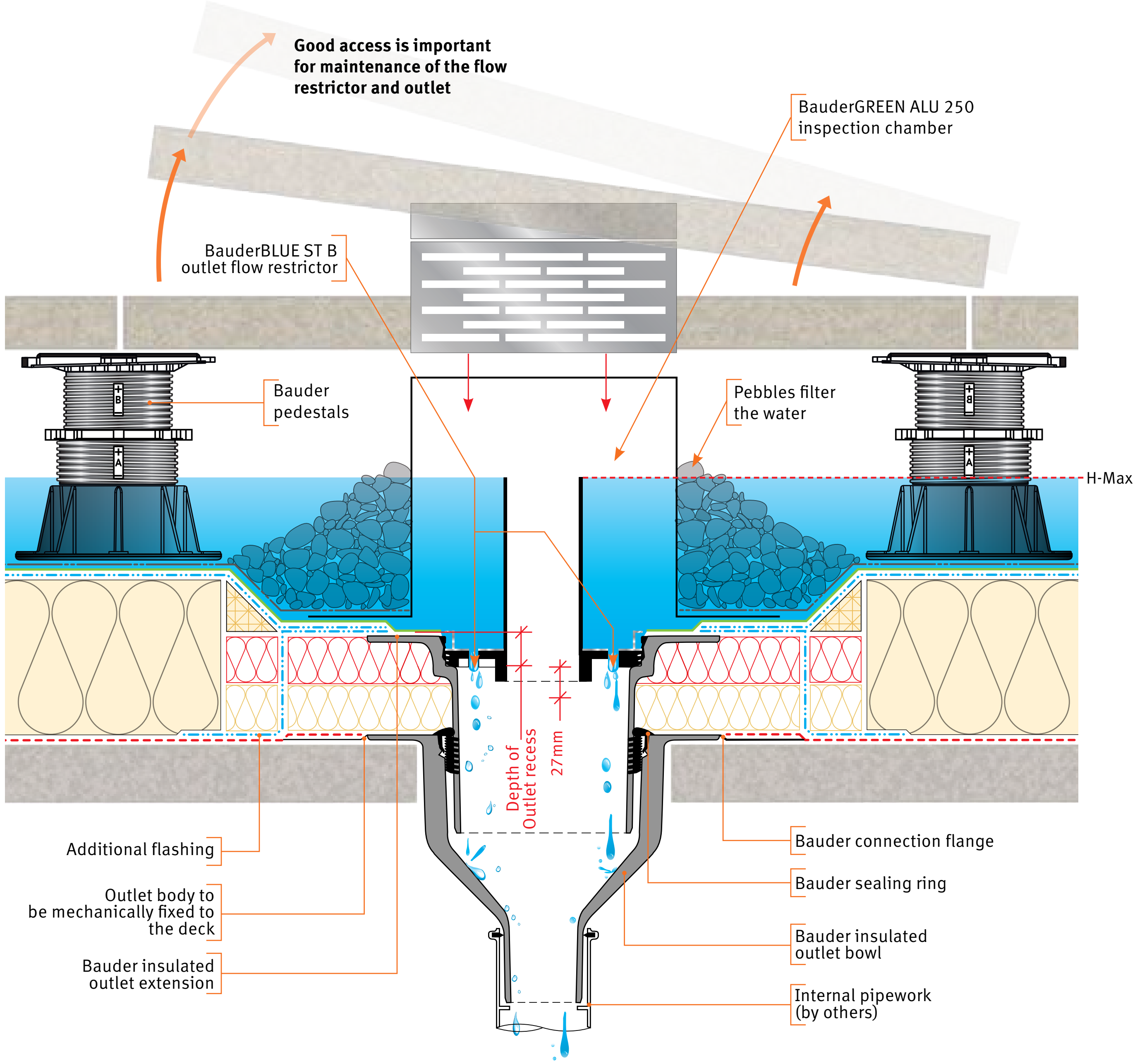


Roof finish options

- Paving.
- Metal decking.

BauderBLUE STORMvoid System

The STORMvoid system uses the Bauder range of pedestals to form the blue roof void. Rainwater landing on the decking or paving drains through the open joints between them into the void below. Here the water is held via the BauderBLUE ST adjustable blue roof flow restrictor and discharged at the required rate for the roof. The system is ideal for simple hard landscaped blue roofs.



The discharge flow rate is controlled by the adjustable flow Restrictor. The pebble margin filters the rainwater to prevent debris being washed into the restrictor.

Sumping of the outlet increases efficiency of the flow restrictor.

Waterproofing a Blue Roof

Ensuring the construction remains watertight throughout the service life of the structure

It is critical to ensure the waterproofing system is able to meet the demands placed on it by the blue roof. Additionally, the design should minimise the risk of water ingress by eliminating penetrations within the blue roof areas.

Reinforced bitumen membrane systems for warm roof construction

Our reinforced bitumen membrane systems are used when a warm roof needs to be constructed on the building.

BTRS PLUS and BTRS are suitable for STORMcell and STORMvoid hard landscaping. For green roof systems over STORMcell or STORMsub system BTGRS PLUS and BTGRS are used with their root resistant cap sheets.

In a warm roof all penetrations are isolated. This is achieved by forming a secondary seal between the vapour control layer and the underlay or the underside of the waterproofing, set 250mm back from the penetration.

See our Reinforced Bitumen Membrane brochure for more details on these systems.

Reinforced bitumen membrane systems for warm roof construction

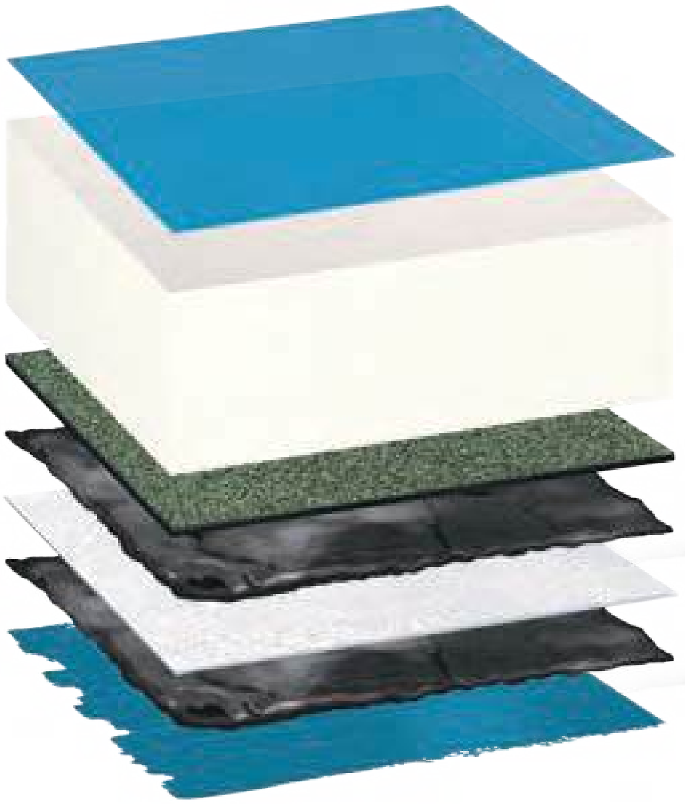
Hot melt structural waterproofing system for inverted roof construction

A seamless monolithic liquid waterproofing that is hot applied to the deck. The durability of this system matches the expected service life of the structure, as stated in BBA certificate 06/4350. Also specified as a cold roof construction.

See our Hot Melt Structural Waterproofing brochure for further information.

Incorporating a green roof

A root resistant membrane is specified to prevent plant roots and rhizomes damaging the waterproofing.



Hot melt waterproofing for inverted roof construction

Technical Support Service for Blue Roof Projects

Supporting you in the design of a blue roof to meet the needs of the building and its construction

Our technical managers are based nationwide and play a vital role in the success of every blue roof project from initial concept through to installation and sign-off of the Bauder solution.

We assist you with the design of the detailing, writing the specification for the blue roof solution, and recommend suitable approved contractors to tender for the project. Our service is without charge, and we work with you to ensure your roof specification meets all your needs.

Working with you to understand

- Building type and usage.
- Drivers for the blue roof.
- The SuDS requirements for blue roof, i.e. target flow rates.
- Zero falls necessity.
- Requirements for waterproofing system design life.
- Opportunity for adding a green roof or biosolar PV array to meet sustainability targets.
- Budget.
- Insulation responsibility to meet building regulations and negate risk of floatation for inverted roofs.
- Guarantee requirements.

Our service to you delivers

- Flow rate calculations for roof, site, and geographical location to meet planning obligations.
- Drainage calculations for the overflow requirements.
- Calculation for the total imposed load of the waterproofing and blue roof system and volume of water held in a 1:100 yr storm.
- Recommended waterproofing system for the structure.
- Wind load and restraint calculations for buoyancy forces on inverted insulation and roof finish.
- Full design service for green roof and biosolar PV with yield analysis.
- NBS Chorus, comprehensive Bauder detailed specification.
- Roof detail drawings.
- Comprehensive range of guarantee packages to suit project and cover requirements.
- Recommended approved contractors.

Project Study
Department of Engineering, Cambridge University

BauderBLUE STORMcell System with BauderSOLAR G LIGHT.

Synposis
A new build construction with sustainability as a key driver in the design with the solution to be delivered by a single source supplier that could provide a guarantee for products and workmanship for the waterproofing, blue roof, extensive green roof, and biosolar PV array.

The roof deck was constructed using large span pretensioned concrete plank with consequential restricted dead load weight to the roof. Considerate specification of the blue roof with green landscaping and biosolar PV array was essential to ensure weight loads were heeded and followed the defined calculations. Additionally, the pretensioned deck did not provide a completely flat finish. When installing a blue roof, a flat deck with no falls is essential, as detailed in BS 6229:2018. To overcome this onsite challenge, the final deflection of the fully loaded roof was calculated and the concrete deck was screeded to give zero falls.

Highlights
- Warm roof solution with sustainability central to the design incorporating blue roof, green roof, and biosolar PV array.
- Concrete deck screeded to ensure zero falls to meet BS 6229:2018.
- Designed flow rate less than 0.7 litres/second.

System summary

Blue Roof	BauderBLUE STORMcell
Waterproofing	Bauder Total Green Roof System
Green Roof	Bauder extensive wildflower with Bauder Flora 3 seed mix
PV Array	BauderSOLAR G LIGHT

Department of Engineering, Cambridge University

BUILDING BOARD

Roof Size:	1,610m²
PV Scheme:	40 modules; 9.91MWh
Specifier:	RH Partnership Architects
Approved Contractor:	Voland Roofing
Main Contractor:	SDC Limited
PV Installer:	Voland Limited

making roofs secure.

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