Supplementary information

To address Condition 4 of 2019/5783/P

in relation to

2 Swain's Lane, London, N6 6QS

Prepared by

Dr Robin Saunders CEng

Innervision Design Ltd

September 2024

Contents

Appendix

List of Figures

Disclaimer

This document has been prepared solely as an addendum report providing supplementary details on behalf of the client. Innervision Design Ltd maintains that all reasonable care and skill have been used in the compilation of this report. However, Innervision Design Ltd shall not be under any liability for loss or damage (including consequential loss) whatsoever or howsoever arising as a result of the use of this report by the client or his agents. If any un-authorised third party comes into possession of this report they rely on it at their own risk and Innervision Design Ltd owes them no duty, care or skill whatsoever.

1 Planning Approval 2019/5783/P

1.1 Condition 4

"Prior to commencement of the development, full details of the following shall be submitted to and approved in writing by the local planning authority before the relevant part of the work is begun:

a) Measures to provide:

- internal water efficiency to target a consumption of no more than 105 litres per person per day)
- water recycling equipment
- sustainable drainage systems

; and

b) Demonstration that the proposal will provide:

-internal measures to ensure the development has been designed to cope with potential flooding

-external measures to reduce the risk of flooding"

Details to clear this condition were submitted under 2023/1143/P.

The details were refused:

"The details submitted in accordance with Condition 4 of planning permission 2019/5783/P dated 03/08/2022, are insufficient to demonstrate that the proposed development would not adversely impact on the need for further water infrastructure in an area of water stress or would not pose additional strain on adjoining sites or the existing drainage infrastructure in accordance with policies CC1 (Climate change mitigation), CC2 (Adapting to climate change), CC3 (Water and flooding) of the Camden Local Plan 2017."

1.2 Officer comments

"These details have been reviewed by Council's Sustainability Officer [CSO] who advised that whilst the proposed flood mitigation and water efficiency measure are largely acceptable, further details are required to meet the requirements of condition 4 (parts a and b).

Specifically, further details of the blue roof system, specifications of the proposed greywater harvesting system, location and specification of water butts and *further details and calculations regarding the runoff rates. These details were requested from the Applicant; however, they have not been provided at the date of this decision.*

Additionally, the Applicant was advised that the proposed flood barrier (drop down flood barrier) was not supported. These temporary barriers are not always effective during flash flooding events as there is not necessarily always time to deploy the flood barrier. The Applicant was advised that the Council encourages thresholds and other potential water ingress points (e.g. vents) to be raised 300mm above a maximum predicted flood level to protect the property in a permanent manner.

With regard to water efficiency, the Applicant has confirmed that the units would be fitted with water efficiency appliances to achieve a consumption of no more than 110 litres per person per day. However, it is noted that the condition requires a target a consumption of no more than 105 litres per person per day, therefore further clarity regarding water efficiency calculations is required.

In light of the comments above, insufficient details have been submitted to discharge parts (a) and (b) of condition 4."

which led to the following informative:

"You are advised that in order to enable the Council to discharge Condition 4 you need to provide further details of the blue roof system, specifications of the proposed greywater harvesting system, location and specification of water butts and further details and calculations regarding the runoff rates. Additionally, you need to reconsider the design of the proposed flood barrier so that it is raised at least 300mm above a maximum predicted flood level to protect the property in a permanent manner. you also need to ensure that the water consumption would not exceed 105 litres per person per day."

2 Responses

2.1 Scope

Innervison Design have been asked to assist with addressing the outstanding points such that Condition 4 can be cleared.

Therefore, in the order of the CSO's comments the following responses are provided:

2.2 SuDS - "further details"

The CSO states:

> *"Specifically, further details of the blue roof system, specifications of the proposed greywater harvesting system, location and specification of water butts and further details and calculations regarding the runoff rates."*

2.2.1 Blue roof

We are not sure what this refers to since the use of such a system is not mentioned in any of the approved documents under 2019/5783/P.

The D&A gives the construction as:

> *"Flat roof: reinforced concrete floor, 60mm Kingspan OPTIM – R insulation board to give .007w/m, 3 layer, hot rolled bituminous felt with solar reflective top layer"*

However, we note that part of the roofscape, as Approved, could indeed readily accommodate a blue/green roof without a significant change to the above specification. This is now the design intention.

Full details of this and calculations are provided at Appendix A.

2.2.2 Grey-water harvesting system

> *"specifications of the proposed greywater harvesting system"*

We are not sure what this refers to since the use of such a system is not mentioned in any part of the approved documents under 2019/5783/P.

Greywater re-use is not proposed on this development and is not required to meet the 105litre/person/day requirement of Condition 4.

This restricted use of potable water is far easier to achieve through careful selection of sanitary ware and fittings at detailed design stage for B Regs compliance.

2.2.3 Water butts

> *"...location and specification of water butts"*

We are not sure what this refers to since these are not shown in any part of the approved documents under 2019/5783/P.

However, so as to reduce potable water demand, two 100 litre water butts are to be installed on standard rainwater diverters (e.g. Web link: Standard diverter example, as per Figure 1).

Figure 1: Standard rainwater diverter

2.2.4 Run-off rates

Refer to Appendix C for the calculations.

Site specific FEH22 point rainfall data is used.

In summary:

Existing outfall rates

1 in 1yr = 2.85 ls^{-1}

1 in 30yr = 3.07 ls^{-1}

1 in 100yr + CC = 4.01 ls^{-1}

Proposed outfall rates

Blue roof area:

1 in 1yr = 0.12 ls^{-1}

1 in 30yr = 0.16 ls^{-1}

1 in 100yr + CC = 0.19 ls^{-1}

Remaining roof area:

1 in 1yr = 1.18 ls^{-1}

1 in 30yr = 1.27 ls^{-1}

1 in 100yr + CC = 1.66 ls^{-1}

Total outfall rates as proposed:

1 in 1yr = 1.37 ls^{-1} which represents a 52% betterment

1 in 30yr = 1.34 ls^{-1}which represents a 53% betterment

1 in 100yr + CC = 1.78 ls^{-1}which represents a 56% betterment

2.3 Flood mitigation measures

2.3.1 Understanding the risk

The site is in close proximity to an area at risk from surface water flooding with predicted flood depths for the 1 in 100yr event between 0 and 150mm in depth within the highway to the front of the site as indicated in Figure 2. It is also shown that under design period flooding, safe pedestrian access and egress is immediately available.

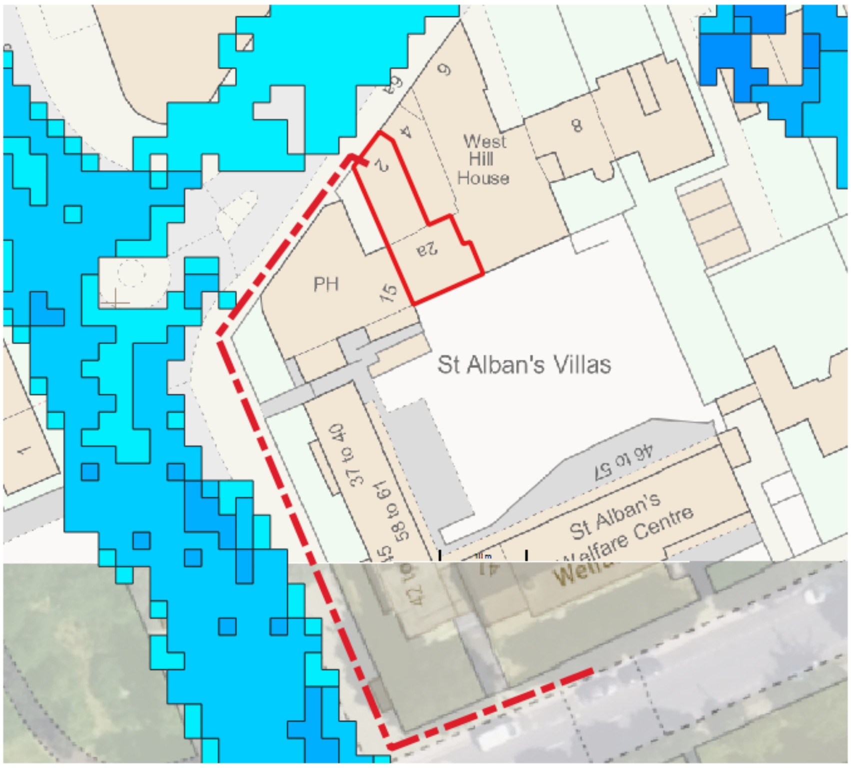


Figure 2: 1 in 100yr SW flood depths and safe pedestrian access/egress route from the proposal

2.3.2 Flood barrier

The CSO states:

> *"Additionally, the Applicant was advised that the proposed flood barrier (drop down flood barrier) was not supported. These temporary barriers are not always effective during flash flooding events as there is not necessarily always time to deploy the flood barrier."*

Clarity on this point

Primarily, Camden's SFRA promotes the use of such measures, as shown in Figure 3, under Section 6.5; "Property Level Resilience Measures".

URS London Borough of Camden — Strategic Flood Risk Assessment

Figure 6.3: Examples of property level flood barriers, air bricks, non-return valves (Floodguards)

6.5.2 Temporary flood barriers (Figure 6.3) are moveable flood defences that can be fitted to doorways or windows. On a smaller scale, temporary clip-on covers for airbricks and air vents can also be fitted to prevent water entry.

Figure 3: Promotion of flood barriers in SFRA

We trust the guidance from the SFRA (which forms part of the local plan's evidence base) is, and remains valid.

Furthermore, we have sought clarification from the product manufacturer in relation to the CSO specific comment regarding flood barriers and the response was quite candid:

> *"Hi ***,*
>
> *Many thanks for your email and telephone call.*
>
> *This is sheer stupidity. Flood barriers are made to be removeable to ensure they can be used as and when needed, during flood. If someone has the environment agency alerts set up, watch the weather or check up online daily – any grown adult will know when is the best time to put in the barrier and if they are prone to flooding, this can be put in as and whenever needed. Every evening before bed if needs be. Removable flood barriers are a fantastic option and are easily used and stored. Our white board style, lightweight flood defence barrier can be removed in under 20 seconds, put in within this same timescale. They are not a time consuming product. They work on a vacuum seal, a quick pinch in of the base seal and barrier*

both left and right, align with the channel, apply pressure and its in. to remove you just push up using the two handles attached to the barrier to take it out.

If they are trying to push flood doors over flood prevention barriers this isn't right, as not everyone can afford the expense of a flood door as they start at around £2,100+ vat per door. So that instantly cuts out 50% of customers in need, as they simply cannot afford when they potentially have 3+ doors to protect. Secondly, flood doors cannot be opened during a flood, once the door is shut/locked and the flooding hits, you cannot open that door until the water has diminished, if you did open the door, you would allow your property to flood. In areas that flood waters can stand for 48+ more hours, this obviously is not the best course of action. Flood doors also are prone to sticking due to their 12 point locking mechanism which ensures a door is either stuck shut or open, rendering It un-useable until fixed. Flood doors are great when in full working order, but using a flood door on everyday use, causes more on going maintenance as it is used as a heavy traffic door – not their intended use. We'd always recommend flood barriers over doors unless in a remote area or a holiday home, the kind of places that are left for long periods of time and no one is home. But even then you can just insert a barrier before leaving and so on.

Please let me know if you need anymore information, however we have been in business since 2009 and not once has this been raised as a problem. Thank you.

Kind regards,

****

Stormguard Floodplan Ltd,
Unit 1,
Newman Close,
Greenfield Industrial Estate,
Congleton,
Cheshire,
CW12 4TR."

A response which we trust is self explanatory.

In summation we consider the comment regarding such barriers by the CSO to be wrong, unsupported by the local evidence base of the SFRA and contrary to the views of the leading manufacturer of these products.

We therefore request the SCO review their comment in view of the above.

Drop in flood barriers will however be provided, regardless.

2.3.3 Raising of floors

The plans have been approved with the floor levels as depicted within.

The ground floor levels are existing and retained (to align with the existing street scene). Furthermore the elevations are all Approved. These elevations would be significantly impacted because the Government "recommends" that:

> "floor levels are set at least 600 millimetres (mm) above the estimated flood level"

Hence, the raising of floors to 750mm above external ground level of the adjacent highway (600mm + 150mm flood depth) is not considered approriate given the existing floor levels, the adjacent shop's floor levels and the extents of the Approval in place without the need for a full re-submission and significant re-design.

2.3.4 Proposed measures

Further to the details previously submitted (dated 18/04/23):

In accordance with the Council's SFRA and the Government's document "Improving the Flood Performance of New Buildings - Flood Resilient Construction"[?] the following measures will be incorporated based on a "water exclusion" strategy:

- Externally: Drop in Stormguard flood barriers in full alignment with the recommendations of the Council's SFRA (refer to Section 2.3.2).
- Externally: No service penetrations, letter boxes or cat flaps in the zone from ground level to 1 .15m above external ground level.
- Internally: Where applicable, wet plaster systems at ground floor level (as opposed to plasterboard) to at least 1m above FFL.

Table 1 provides guidance on which materials are most suitable, suitable and unsuitable, when considering any ground floor internal construction work involved in this project.

Where not specified above, the construction will make use of materials from the "most suitable" column were this is at all possible at ground floor level, however they are not mandatory requirements.

Component	Most suitable	Suitable	Unsuitable
Flooring	Concrete, pre-cast or in situ	Timber floor, fully sealed, use of marine plywood.	Untreated timber, Chipboard
Floor Covering	Clay tiles, Rubber sheet floors, Vinyl sheet floors	Vinyl tiles, Ceramic tiles	
External Walls - to max flood level	Engineering brick, Reinforced concrete	Low water absorption brick	Large window openings
Doors	Solid panels with waterproof adhesives, Aluminium, plastic or steel	Epoxy sealed doors	Hollow core plywood doors
Internal Partitions	Brick with waterproof mortar, Lime based plasters	Common bricks	Chipboard, Fibreboard panels, Plasterboard, Gypsum plaster
Insulation	Foam or closed cell types	Reflective insulation	Open cell fibres
Windows	Plastic, metal	Epoxy sealed timber with waterproof glues and steel or brass fittings.	Timber with PVA glues and mild steel fittings

Table 1: Summary of Material Suitability for Building Components[?]

2.4 Water efficiency

The CSO states above that:

> *"....the Applicant has confirmed that the units would be fitted with water efficiency appliances to achieve a consumption of no more than 110 litres per person per day. However, it is noted that the condition requires a target a consumption of no more than 105 litres per person per day, therefore further clarity regarding water efficiency calculations is required."*

2.4.1 Clarity

The approved methodology for the water efficiency calculations can be found in the Building Regulation's guidance Approved Document G (AD.G).

The calculation results in a value for the total daily demand in litres per person per day. The target for compliance is (as imposed under Regulation 36 optional requirement 2(b)) is a maximum of 110 litres/person/day (see Figure 4).

of potable water used throughout a home.

Performance target	Maximum calculated consumption of potable water (litres/person/day)
Regulation 36 para (2)a	125
Regulation 36 optional requirement para (2)b	110

A2 The calculation methodology requires

Figure 4: Requirements for water efficiency

This value includes a default (which cannot be altered) allowance of 5 litres/person/day for "external water use":

> "To calculate the total water consumption, an additional allowance for external water use is added on to the total water consumption. This figure is set at 5 litres/person/day" (ref: AD.G).

The remaining 105 litres/person/day is for internal use.

Hence a water efficiency calculation meeting the 110 litres/person/day also meets in full the Condition which seeks:

"internal water efficiency to target a consumption of no more than 105 litres per person per day"

3 Summary

In the order as listed within the Condition:

- An internal water use not exceeding per person of 105 litres per person per day will be achieved under Part G of the Building Regulations.
- Grey water recycling is not required to achieve the above target. This is far easier to achieve through careful selection of sanitary ware.
- A blue roof and rainwater harvesting provide a viable SuDS provision resulting in a greater than 50% reduction in post development run-off rates.
- Internal flood resilience at ground floor will be incorporated in line with the Governments best practice guidance.
- Externally, drop in flood barriers will be installed in alignment with the Council's SFRA.

We trust that this supplementary information, in conjunction with that previously submitted, will allow Condition 4 to be cleared.

Signed:

Dr Robin Saunders CEng, C. Build E, MCABE, BEng(Hons), PhD

Date: 6th September, 2024

A Blue roof design

A.1 Flat roof area

All water arising from $74m^2$ new roof area is to be managed on site via a bespoke "blue roof" system. This is a vegetative based system that also incorporates attenuation and hydraulic control as per details provided at Appendix B.

The residual outfall from the roofs is directed to the existing SW connection(s) on site.

A.1.1 Blue roof design calculations

Preliminary attenuation calculations for a design drained area of $74m^2$ over a range of storm duration are shown in Table 2.

These values are however only based on a simple balance equation[1] and do not take into account flow under a variable head, or indeed check against Winter and Summer storm profiles.

Duration (mins)	Intensity ($mmhr^{-1}$) + 40% CC	Inflow, m^3 (A)	Outflow, m^3 (B)	Prelim balance volume required (A-B), m^3
5	178.36	1.10	0.17	0.93
10	178.36	2.20	0.34	1.86
15	178.36	3.30	0.51	2.79
30	114.24	4.23	1.03	3.20
60	69.64	5.15	2.06	3.10
120	43.70	6.47	4.11	2.36
240	26.81	7.94	8.23	0.00
360	19.76	8.77	12.34	0.00
600	13.10	9.70	20.57	0.00
700	11.52	9.95	23.99	0.00
1440	6.17	10.95	49.36	0.00

Table 2: Preliminary balance volume required at roof level for a range of 1 in 100yr + 1.4% CC storm durations based on a total roof outfall rate of $0.57ls^{-1}$

To arrive at the correct roof level attenuation volume an assessment at each roof outlet is required. The output of this calculation is provided in Table 3.

- The roof will be drained via a total 3 outlets.

[1] Attenuation volume required = Inflow volume - Outflow volume

- A single roof outlet is considered here serving 33.3% roof area = $25m^2$.
- If a Bauder device is used each outlet has a designed array of 4 orifices (n number) within the control device, otherwise an orifice of equivalent area is used.
- The calculations below are based on a single orifice per outlet (as per an ACO or similar style outlet) with equivalent CSA of $314mm^2$ (20mm orifice from d_{eq}= n x ${d_1}^{0.5}$). CD = 0.7

Hence for a single roof outlet the following applies:

Drained area	$24.67m^2$	
Urban Creep	1	
Designed drained area	$24.67m^2$	
Return periods considered	1yr, 30yr, 100yr	
Storm profiles used	50% Summer	75% Winter
Storm coeffs	a = 0.1, b = 0.815	a = 0.06, b = 1.026
Storm range, storm increments	From 5 minutes duration in further 2 min. intervals until critical storm reached	
Rainfall model	FEH 2022	
Critical design storm	120 mins, Winter	
Climate change	1.4	
Storm mean intensity	$31.2mm.hr^{-1}$	
Design mean intensity	$43.7mm.hr^{-1}$	
Storm peak intensity	$82.3mm.hr^{-1}$	
Design peak intensity	$115.2mm.hr^{-1}$	
Design maximum head	0.054m	
Calculated maximum head	0.05m	
Minimum attenuation volume required	$1.14m^3$	
Void ratio	95%	
Design attenuation volume	$1.3m^3$	($0.054m \times 23.43m^2$)
Provided attenuation volume	$1.5m^3$	($0.95 \times 25m^2 \times 0.065m$)
Factor of Safety	1.20	
1 in 1yr maximum outfall rate	$0.12ls^{-1}$	(See Figure 5.)
1 in 30yr maximum outfall rate	$0.16ls^{-1}$	(See Figure 6.)
1 in 100yr maximum outfall rate	$0.19ls^{-1}$	(See Figure 7.)
1 in 100yr Time to peak	90 mins	
1 in 100yr Max head: Time to drop to 50%	0.98 hrs	
Outfall control method	20mm Orifice	CD = 0.62

Table 3: Storage volume design summary

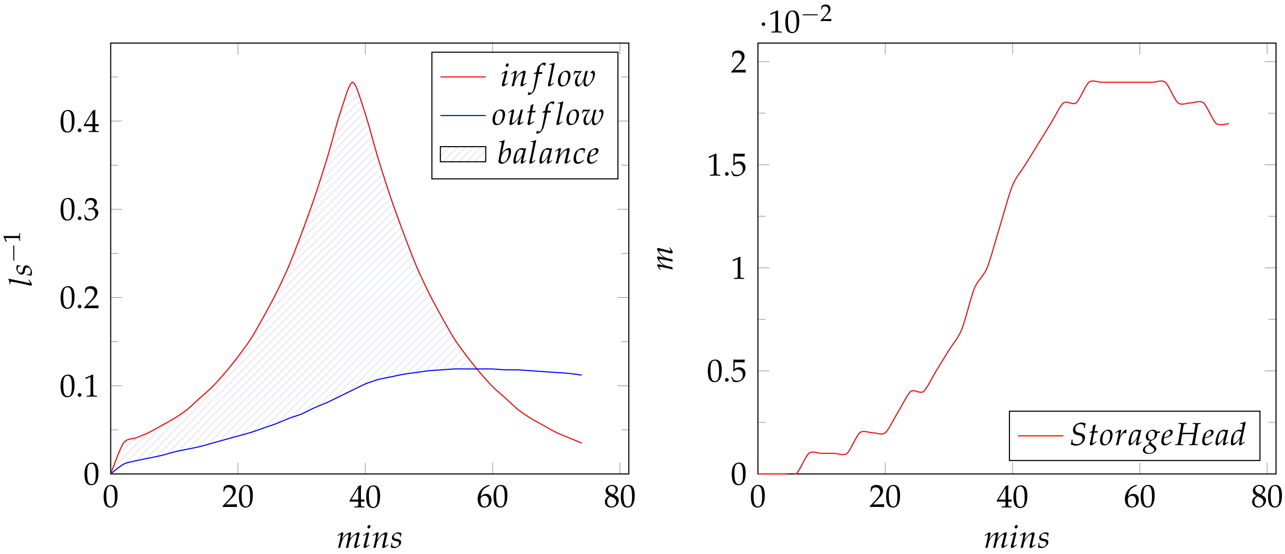


Figure 5: 1 in 1 year critical storm event

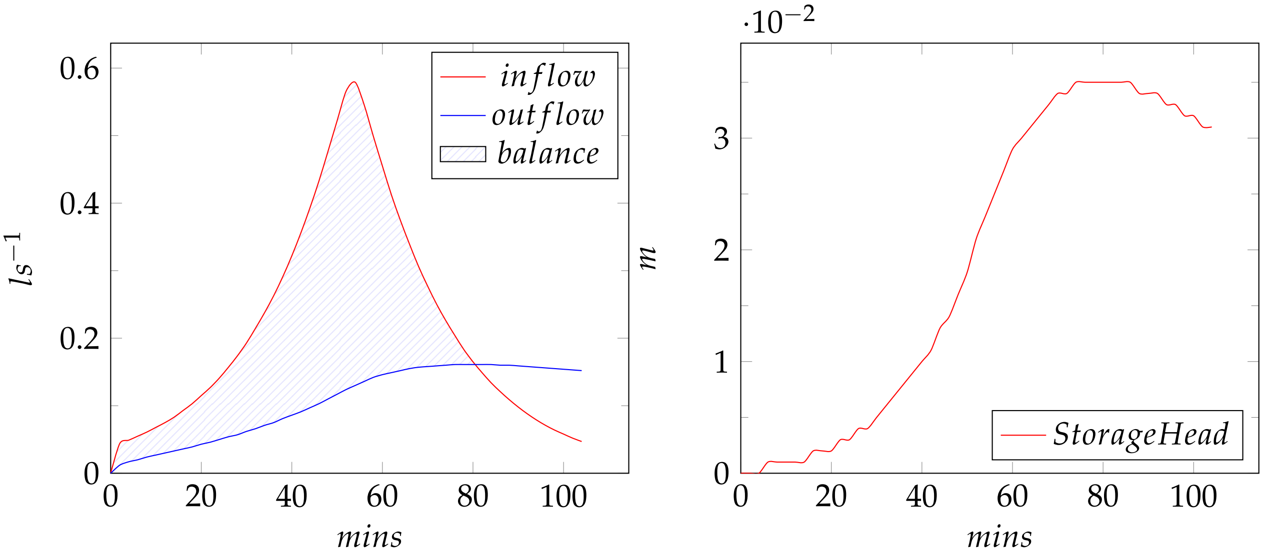


Figure 6: 1 in 30 year critical storm event

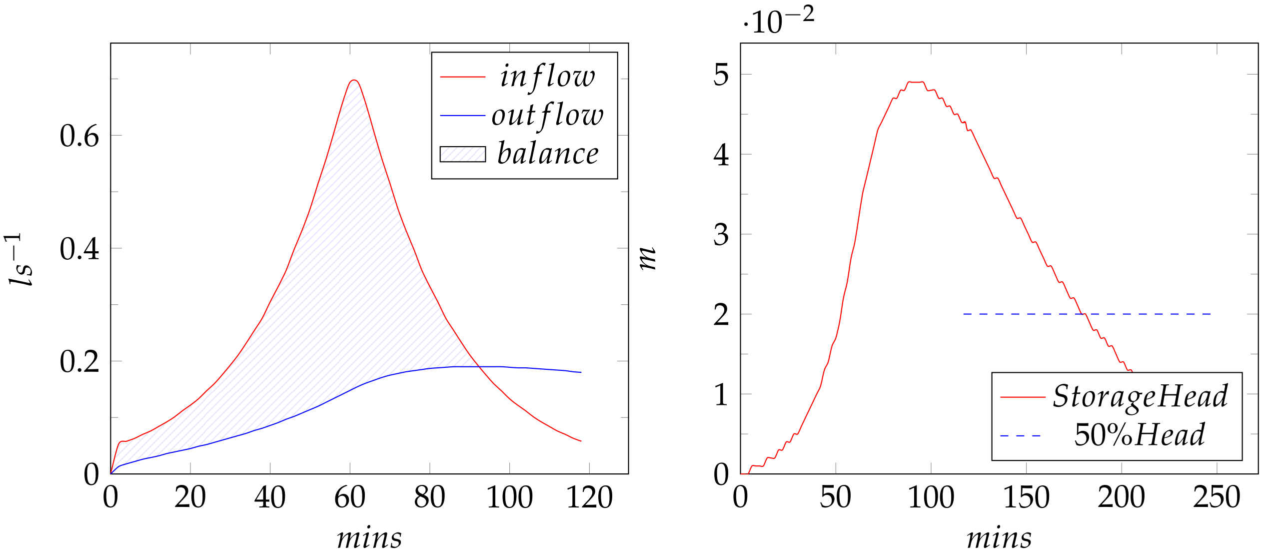


Figure 7: 1 in 100 year critical storm event

Corrected total attenuation volume required

The total roof level attenuation required is 3 x 1.14 = 3.4m^3

This can be achieved using an overall storage volume of 4.57 m^3 formed with 0.065m deep, 0.95% void ratio cells over the roof area of 74m^2.

Total design outfall rates

1 in 1yr + CC = 0.36ls^{-1}

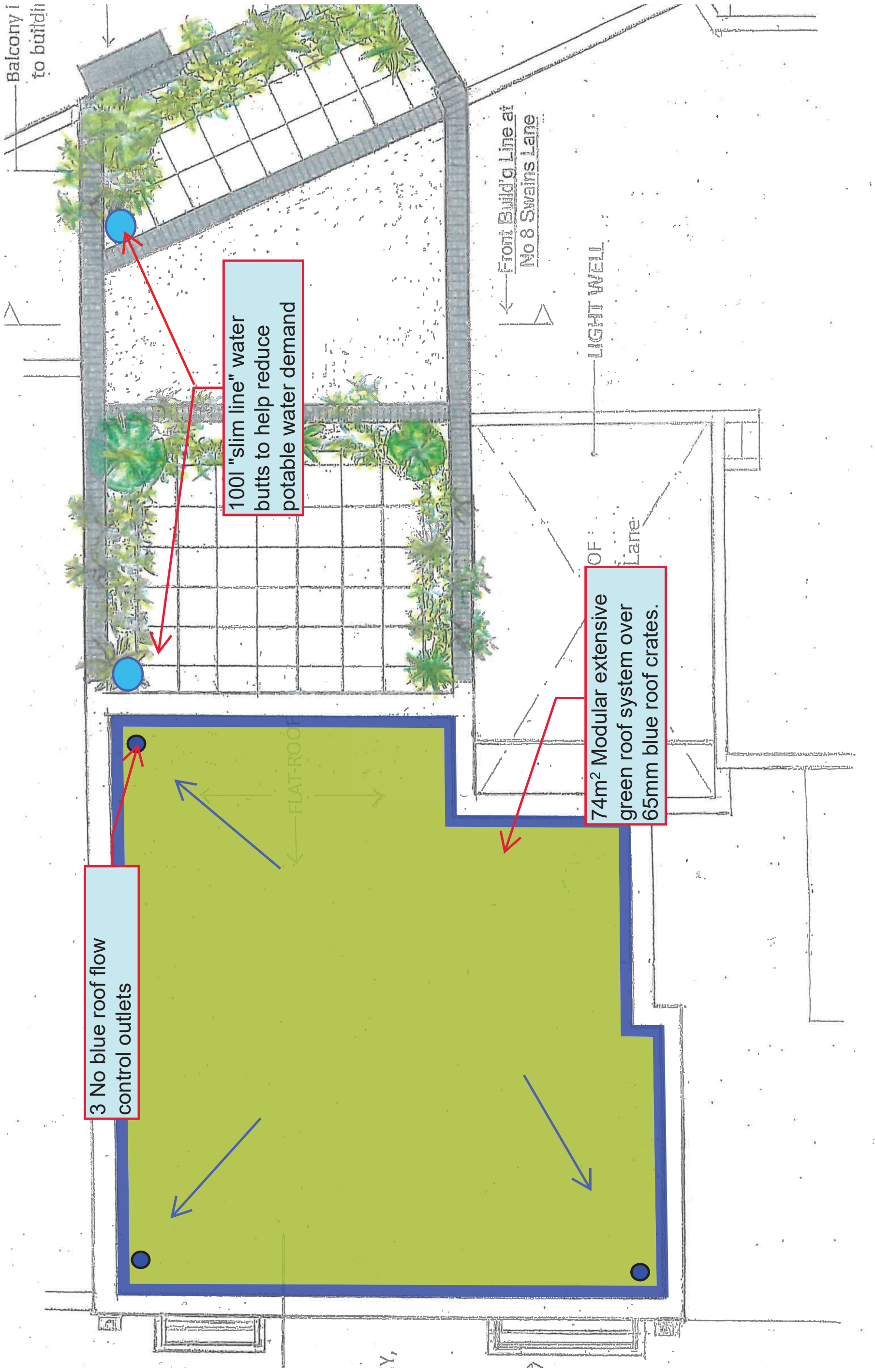
1 in 30yr + CC = 0.48ls^{-1}

1 in 100yr + CC = 0.57ls^{-1}

Design for system failure

Each roof will be provided with a 25mm “tell tale” overflow pipes spilling directly to ground and set at top of cell level so as to indicate system blockage or failure.

A.2 Layout


100l "slim line" water butts to help reduce potable water demand
74m² Modular extensive green roof system over 65mm blue roof crates.
3 No blue roof flow control outlets
Front Build'g Line at No 8 Swains Lane
LIGHT WELL

B Blue roof components

B.1 Flow control option

BAUDER BLUE ROOF SYSTEM

The BauderBLUE Roof System is a sustainable drainage method designed to attenuate and manage stormwater on a flat roof over a 24-hour period via a restrictive flow outlet.

When to specify

Development and expansion of towns and cities has seen exponential use of impervious surfaces causing artificially high rates of rainwater runoff. In measures to prevent flooding, planners are restricting the amount of rainwater leaving a site via the drainage system which can be limited to 5-10 litres per second per hectare, the same flow rates for regional greenfield sites.

A Bauder blue roof is a solution for urban areas where options for ground-based attenuation systems are limited, and in particular, where construction is being carried out within flood sensitive areas. This rooftop sustainable urban drainage system (SuDS) has weight load implications and the project's structural engineer will need to be engaged with the design process from an early stage.

How it works

The specifically engineered outlet restricts the discharge of stormwater to a calculated and predesigned 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 which helps to avoid downstream or localised flooding.

The Bauder Blue Roof system can be constructed at either rooftop or podium level. The designed void space between the flat roof waterproofing membrane and hard or soft landscaping finish allows the stormwater to attenuate.

Key Features

- Simple low maintenance design
- Bespoke, project specific discharge rates to match the requirement of the SuDS report for the site.
- Can be created on zero falls or up to 1:40 pitch
- Correct volume and weight of water storage with built in overflow to ensure the maximum water level (HMax) is never exceeded and a tell-tail parapet overflow is utilised to visibly identify if water levels rise close to the HMax.
- Variants designed to work in conjunction with the Bauder Total Green Roof System and Bauder Hot Melt System.

Benefits

- Aid to planning and 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 localised or downstream flooding.
- All products covered within the Bauder guarantee.

Technical Credentials

- Full range of guarantees.
- BBA Certificate 10/4744 for Bauder Total Green Roof System and 06/4350 for Bauder Hot Melt System.
- Follows the National Federation of Roofing Contractors blue roof guidelines.
- Overflow outlets designed in accordance with BS EN 12056-3:2000.

Environmental Credentials

- BauderBLUE Roof Outlet manufactured from HDPE, classification 2, which is widely recycled.
- Rooftop solutions form part of the CIRIA SuDS design guide.
- Reduces the discharge rate of rainwater, mitigating the risk of localised or downstream flooding.

BLUE ROOF DESIGN

Engineered Design and Specification

The Bauder Blue Roof is designed for use with either the Bauder Total Green Roof System as a warm roof construction or the Bauder Hot Melt cold roof construction.

The design of the void space requires free-flowing water movement to the specifically engineered outlets.

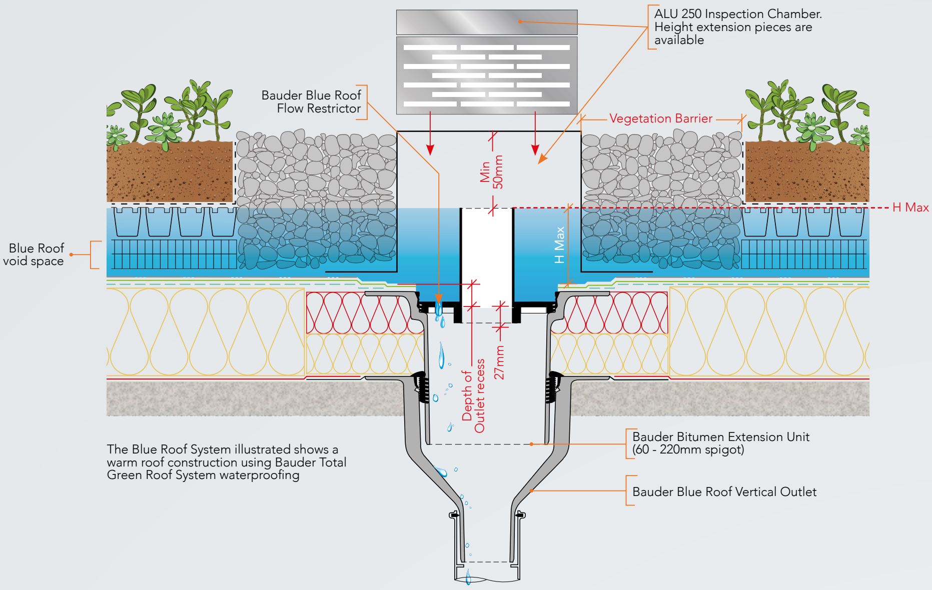
The baseplate of the blue roof system sits within a standard Bauder outlet and slows water from leaving the roof via a calculated number of restrictive flow holes. The number of flow holes, up to a maximum of 12, is calculated to reflect the SuDS calculation for permitted discharge rate for the site.

If, in the event of a storm of greater magnitude than 1:100 plus 40% for climate change, then water will evacuate the roof through the central overflow.

The design of every Bauder blue roof is individual to the project and geographical location. The Roof should have minimal penetrations in the construction. We use details of the roof area and the drainage requirements for the site to produce a roof specific discharge report to show the following:

- Storm profile for the roof during a 1 in 100-year storm event + 40% for climate change.
- Maximum attenuation volume on the roof.
- Number of outlets required, complete with an assigned number of control holes, restricting the flow of water in line with the discharge rate for site.
- The depth of void required on the roof on to which any landscaping finish can be installed.

The report and series of calculations allows us to produce the most effective scheme for your project.



The Blue Roof System illustrated shows a warm roof construction using Bauder Total Green Roof System waterproofing

Installation

The Bauder blue roof outlet overflow is inserted into the baseplate and measured, marked and cut to the specified Hmax for the roof.

The entire blue roof outlet is protected with the Bauder ALU250 Inspection Chamber which allows for ease of access during regular maintenance.

Maintenance

Blue roofs require regular maintenance and inspection of the outlets to ensure the drainage holes are free of debris or blockages.

Inspections should take place following any significant storm event, any notable traffic or remedial works that take place on or around the roof, and following leaf fall during the autumn months to ensure leaf litter is not causing obstruction.

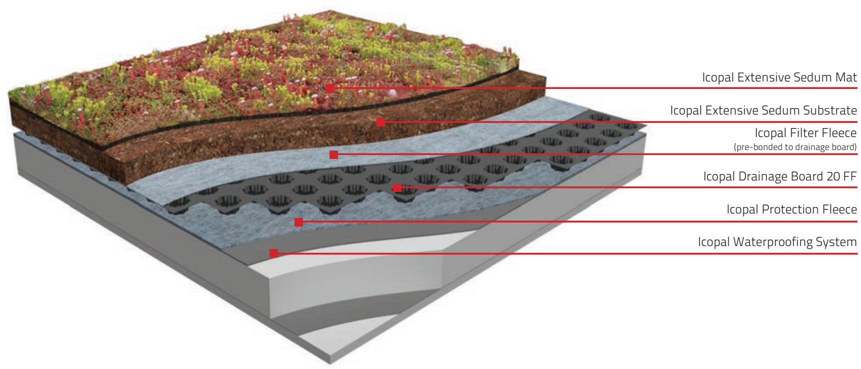
B.2 Sedum option

Icopal **ST Sedum Mat** System

GREEN ROOF SYSTEMS

Code: 3101062

An extensive lightweight green roof system utilising a pre-grown vegetation mat of 8 – 12 sedum species. Provides an immediate green planting scheme for instant impact. The vegetation mat is installed on a shallow depth of specially formulated free-draining substrate and drainage board.



System Properties

The following data relates to the green roof element only.

System Dry Weight:	80 kg/m²
System Saturated Weight:	100 kg/m²
System Typical Depth:	104 mm
Growing Substrate Depth:	50 mm (settled)
Contouring:	Flat/level

Biodiversity: ●●○○○

Pollen/Nectar Richness: ●●●○○

Habitat Provision: ●●○○○

Key Features

- A lightweight system suitable for a range of roof construction types.
- System type allows for shallower substrate depths.
- Attractive mix of sedum species.
- Sedum plants are low-growing.
- Moderate range of bio-diversity.
- Moderate provision of Nectar and Pollen to attract insects.
- Suitable for flat and pitched roofs.
- Versatile system; quick and easy to install.
- Low maintenance and drought tolerant.
- Pre-grown mat provides an instant green coverage.

Icopal
ST Sedum Mat System

Plant Species

The sedum family of flowering plants are succulents and therefore have leaves which are able to store water. The majority grow naturally in arid, well drained areas, often on shallow substrate depths. Therefore they are drought tolerant, and able to survive in extremes of conditions. They generally flower from early summer to autumn.

General Notes

The system is suitable for both new build and refurbishment projects. Roof pitches up to 45° may be used, but for slopes over 9° a retention system is required. All slopes over 5° will require a mechanically fixed eaves edge restraint.

Detailing

A border with a recommended width of 300 – 500 mm of washed river stones (20 – 40 mm diameter) should be used around all roof penetrations, outlets, perimeters and system edges to provide a vegetation free zone.

Irrigation

Initial: Irrigation required immediately after installation for up to 8 – 12 months until fully established. Recommended irrigation period: 12 months. Pitched roofs retain less water and therefore a permanent irrigation system should be considered.

Once established: Irrigation is only generally required during prolonged periods of hot dry weather.

Water Source: A roof top source with a pressure of 2.5 – 3 bar and a flow rate of 60 L/min is recommended to connect a temporary system if required.

Maintenance:

Sedum systems are designed to be low maintenance. Species selection ensures that the roof will evolve naturally, however weeds should be removed periodically through the year to reduce the likelihood that they become dominant. It is recommended that a suitable fertiliser is applied to keep the plants healthy. This may be a spring feed of slow/controlled release fertiliser to last the growing season, or more regular granular/liquid feeds throughout the growing season.

Flowering Period: May – August.

Typical Colours: Seasonal variation of yellows, whites, and pinks. Foliage turns from green to red in periods of plant stress.

N° of Species Sown: 8 – 12.

Typical Species: (subject to season variation) - Sedum acre, Sedum album, Sedum ellacombianum, Sedum floriferum, Sedum forsterianum, Sedum hybridum, Sedum kamtschaticum, Sedum montanum, Sedum oreganum, Sedum reflexum, Sedum rupestre, Sedum selskianum, Sedum sexangulare, Sedum spirium.

Flower Attraction

Low-moderate mixed pollen source, applicable to Bees – Mason, Honey Bombus spp; Insects – Chrysoperla (Lacewing), hoverfly (Episyrphus), Ladybird (Harmonia), Aphidius, Aphilinus, Aphidoletes (beneficial parasitic wasps).

Establishment Period: 6 – 8 months.

For more information please visit

www.icopal.co.uk

TEL: 0161 865 4444 FAX: 0161 866 2616 E: info.uk@icopal.com

Icopal Limited
Barton Dock Road
Stretford
Manchester
United Kingdom
M32 0YL

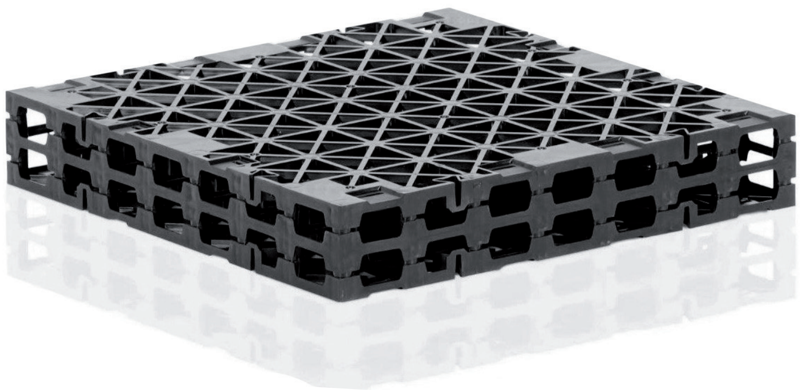
Issue 01 ICO3012

B.3 Attenuation cells (available option)

Specialists in Roofing and Waterproofing

BlueRoof SWB Geocells

Product Data Sheet



SWB Geocells provide attenuation as part of a Blue Roof system that is designed to manage and control incident rainfall at a rate in line with the SuDS strategy or attenuation for a development.

BlueRoof
SWB Geocells

General Information

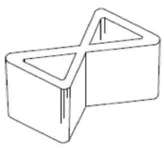
The Radmat range of **SWB Blue Roof Geocells** provides attenuation as part of a Blue Roof system that is designed to manage and control incident rainfall at a rate in line with the SuDS strategy or the attenuation requirements for a development.

Manufactured from Polypropylene SWB Blue Roof Geocells are load bearing modular units that are clipped together to form a single or double layer attenuation cell that is wrapped in **Radmat G12 Geotextile Filter Fleece**. Used in conjunction with rainwater outlet restrictors to control discharge, the Blue Roof is designed to be half empty within 24 hours.

PROPERTY	UNIT	SWB50	SWB65	SWB80	SWB100	SWB150	SWB200
Length	mm	500	600	600	600	600	600
Width	mm	500	600	600	600	600	600
Height	mm	50	65	80	100	150	200
Structure volume	m^3	0.018	0.023	0.029	0.036	0.054	0.072
Storage volume	m^3	0.0162	0.0211	0.0259	0.0324	0.0513	0.0684
Weight	kg	1.0	1.21	1.4	1.8	2.7	3.6
Short term compressive strength							
Vertical	kN/m^2	125	700	700	700	700	700
Lateral	kN/m^2	125	200	200	200	200	200
Long term compressive strength Vertical*	kN/m^2	45	254	254	254	254	254
Volume Void Ratio	%	96	90	90	90	90	95

*Based on a 2.75 Material Safety Factor in accordance with CIRIA c630 guidance.

Ancillaries



Cross Connector

Twin Connector

Control End Plate

Radmat building products

Radmat Building Products Ltd Holland House, Valley Way, Rockingham Road, Market Harborough, Leicestershire, LE16 7PS T : 01858 410 372 E : techenquiries@radmat.com

BlueRoof
SWB Geocells

Installation

1. Install **Radmat G12 Geotextile Filter Fleece** over the roof surface and up all upstands, ensuring enough length is left around the installation for the G12 to wrap up the sides of the SWB Geocells, and enough to overlap a minimum 150mm onto the top of the SWB Geocells.

2. Lay **SWB Blue Roof Geocells**, clipping adjacent panels to each other using the SW Cross Connectors ensuring each SWB Blue Roof Geocell is correctly oriented for the clips to meet.

This is also the jointing method for a 2nd layer of SWB, SWG are connected with a shear connector.

3. Cover with Radmat G12 Geotextile Filter Fleece ensuring minimum 150mm overlaps.

4. Immediately cover with the specified roof finish (green roof/paviors/ballast).

For further information on Radmat products and services please call **01858 410372**, email **techenquiries@radmat.com** or visit our website **www.radmat.com** **JUNE 2019**

Radmat Building Products Ltd Holland House, Valley Way, Rockingham Road, Market Harborough, Leicestershire, LE16 7PS T : 01858 410 372 E : techenquiries@radmat.com

C Existing run-off rates

C.0.1 Variables

$i_1 = 90.4$[2] $mm\ hr^{-1}$

$i_{100} = 127.4\ mm\ hr^{-1}$

$A = 126\ m^2$

Cr = 1

Cv = 0.9

C.0.2 Impermeable area run-off rate for pre-developed site

$$\begin{aligned} Q_{BF1} =& \frac{0.9 * 90.4 * 126}{3600} \\ =& 2.8 ls^{-1} \end{aligned}$$

$$\begin{aligned} Q_{BF100} =& \frac{0.9 * 127.4 * 126}{3600} \\ =& 4.0 ls^{-1} \end{aligned}$$

Existing runoff rates from the impermeable areas of the site are calculated as 2.85ls^{-1} (based on 90.4mm hr^{-1}, 1 in 1 yr summer storm).

[2] 90.4mm hr^{-1} is the mean intensity of a 1 in 1yr 6min duration summer storm, calculated to be the worst case, using standard IDF formula.