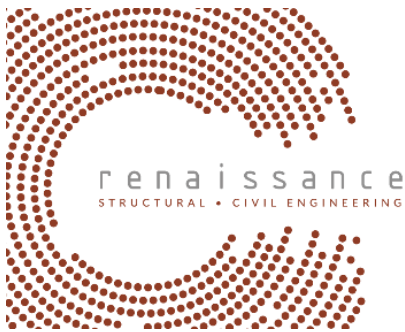




BSM-REN-00-XX-RP-C-00001 - P01

DESIGN NOTE No 1: BLUEROOF

Project: **BRUNSWICK STREET, MANCHESTER**

Project No: 2004-04

Date: 25/05/2020

Author: Helen Gribbon

This design note covers the key features of Blue Roofs to inform the client, design team and contractor in the development of the design for the Bluerroof system to be adopted for Brunswick Street. The recommendation for the adoption of a Bluerroof has been informed by the following: -

- The adoption of a Bluerroof system provides the client with a more easily maintained system of surface water management for this site.
- The proposals for the foundations for the building is to adopt a raft slab and any below ground features such as attenuation tanks would render that portion of the raft foundation sterilised and would therefore impact the efficiency of the design of the raft and its viability. By adopting a Bluerroof, this removes the requirements for any below ground attenuation in the form of a tank.

OVERVIEW

A Bluerroof provides stormwater attenuation capacity at source within ballasted or paved roof construction of a development.

It comprises a combined drainage and attenuation void within the roof structure and a series of roof restrictor chambers which sit over each roof outlet. The chambers are designed to release the attenuated water at a controlled discharge rate as permitted in the planning consent of the site.

This allows storage capacities suitable for up to a one in 100 year storm event, plus an allowance for the effects of climate change (40% for residential).

The water is filtered several times as it passes through the system removing suspended solids thus improving the quality of water at discharge. This stored water, as with a 'traditional' storage system, can be released at a controlled rate.

The Bluerroof system consists of two key components:

- A drainage geo-composite system with integral filter geotextiles which attenuates run off from ballast or paving. Water filters through and builds up into the drainage void formed by the geo-composite layers below.
- This water is gradually dispersed through the zero falls system to the restrictor chamber and discharged to the roof outlet at the rate permitted for the site. The storm water attenuation requirements are met within the roof construction; therefore, the need for underground storage is eliminated.

Important Note about Specifying:

- The Bluerroof system is compatible with hot melt or cold liquid applied water proofing systems.
- Only XPS insulation should be used within the Bluerroof specification.
- Analysis of the roof area available for blue-roof use (237m²) has been assessed and a depth of 40mm for storage is required across the full footprint determined the

ROOF CONFIGURATION OF BUILD-UP

We understand that the proposed roof construction is to be a concrete plank roof. The advice from the Bluroof designer is that this is acceptable to lay at zero gradient. Zero gradient roofs are the configuration most commonly used for blue roofs as they allow for the even distribution of water across the largest possible area preventing concentrated loads upon the structure. This load (discussed later in this document) is often no more than the snow loading allowance that will have already been calculated for.

It should be highlighted however, that zero gradient roofs will, due to build tolerances and deflection, often contain depressions that will hold water. This backfall conflicts with the recommendations of BS 6229:2018. However, roof waterproofing systems are available that have certification covering this application, so providing materials are selected and coordinated carefully this should not represent an issue.

Full details of the proposed roof build are to be confirmed by the architect, and for the purposes of this assessment, the following have been used: -

- Zero gradient roof deck
- Hot melt or similar waterproofing
- Insulation
- Water flow reducing layer
- EGR Ecovoid attenuation zone (50mm)
- Geotextile
- Roof finish (to be specified) – assumed to be pavements

It has assumed that there will be a requirement for a 300mm aggregate zone around the edge of the roof and where the blue roof zone abuts any roof lights or the light well. This is both from a fire protection viewpoint and to minimize the cutting of the Ecovoid geocellular boxes used for the main storage zone. These details are to be developed further by the architect and Bluroof supplier.

Other key features are: -

- The system uses two central rainwater downpipes to discharge water from the roof plus two external downpipes
- An orifice plate of 76mm is required at the point of discharge
- The insulation is located above the waterproofing line and a U-value correction factor should be applied as the product will be wet. (This would be required even without the Bluroof as the roof would be considered to be a “warm” roof with the insulation on the top side.)
- A floatation assessment would be required for the insulation. (This would be required even without the Bluroof as the roof would be considered to be a “warm” roof with the insulation on the top side.)
- There is a requirement for the provision of overflows which are to be set at 20mm above the maximum water depth of 40mm. The overflow should be through the parapet on the external sides of the building. This detail is to be developed by the architect in collaboration with the Bluroof supplier.
- It is recommended that a single warranty is obtained for the roof system by sourcing all components from a single source.

The attached design calculations have been provided by the Bluroof specialist to demonstrate the storage capacity of the roof to inform the surface water drainage design.

The outfall from the Bluroof system is limited to 2.5l/s with the overall site discharge limited to 5.0l/s into the UU network.

SUDS MANAGEMENT PLAN

The Sustainable Urban Drainage features are to be maintained by the Building Management Company selected by the client. The building management company will be required to maintain the SUDs features in line with the following recommendations and suppliers' requirements.

The following operation and maintenance requirements for the Bluroof incorporated into the development is to be adopted by the Building Management Company. These requirements are general and have been extracted from the CIRA Guide C753.

*Table 12.5 - Operation and maintenance requirement for green roofs
(also applies to blue roofs)*

The Main Contractor delivering the development will update the general requirements to reflect the product specific requirements of the as installed proprietary SUDs and incorporate these into the Operation & Maintenance manual for the building.

TABLE 12.5 Operation and maintenance requirements for green roofs			
	Maintenance schedule	Required action	Typical frequency
Regular inspections		Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
		Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
		Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
		Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance		Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
		During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
		Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
		Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
		Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
		Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions		If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
		If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

CONCLUSIONS

The final design of the surface water management has been developed for construction adopting a Bluerroof in lieu of providing below ground surface water attenuation storage.

The benefits of this are: -

- The viability of the proposed raft foundation would not be possible with an attenuation tank below ground
- The maintenance of the attenuation tank is no longer a requirement – access for maintenance was prohibitive given its location under the building footprint.
- Certain design features proposed for the attenuation tank below ground were not possible due to its location within the building footprint, for example, vertical vent pipework to an external location.

BLUE ROOF ASSESSMENT



MAY 2020

Brunswick Street, Manchester

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1. Introduction

Watershed Engineering have been appointed by Renaissance Associates Limited to assess the performance of a potential blue roof on the new build residential building at Brunswick Street Manchester.

This report briefly reviews the outline preliminary calculations undertaken to assess the likely performance and discusses some of the key design factors that should be considered.

2. Design Data

We have used the following information in undertaking our assessment.

PARAMETER	DATA	SOURCE
Return Period	1:100 YEARS	Assumption
Climate Change Allowance	40%	Assumption
Location (For FSR Data)	Manchester	Client's documentation
Restricted Flow Rate	2.5 l/s ⁽³⁾	Assumption (see note 3)
Approximate Catchment Area	288 m ²	Take off from client drawing
Approximate Storage (Blue Roof) Area	236 m ² ⁽¹⁾	Assumption
Estimated Void Ratio of storage zone	85% ⁽²⁾	WEL assessment

Notes

1 – This figure includes an allowance for bases and plinths that take away volume from the blue roof storage zone. It is important that Watershed Engineering Ltd (WEL) are made aware of any items to be placed on the roof in order for the calculations to be adjusted as may be necessary. Unless requested, no allowance has been made for any future reduction in the available storage zone by tenants plant for example. This should be communicated to the end user to prevent uncalculated loss of storage volume.

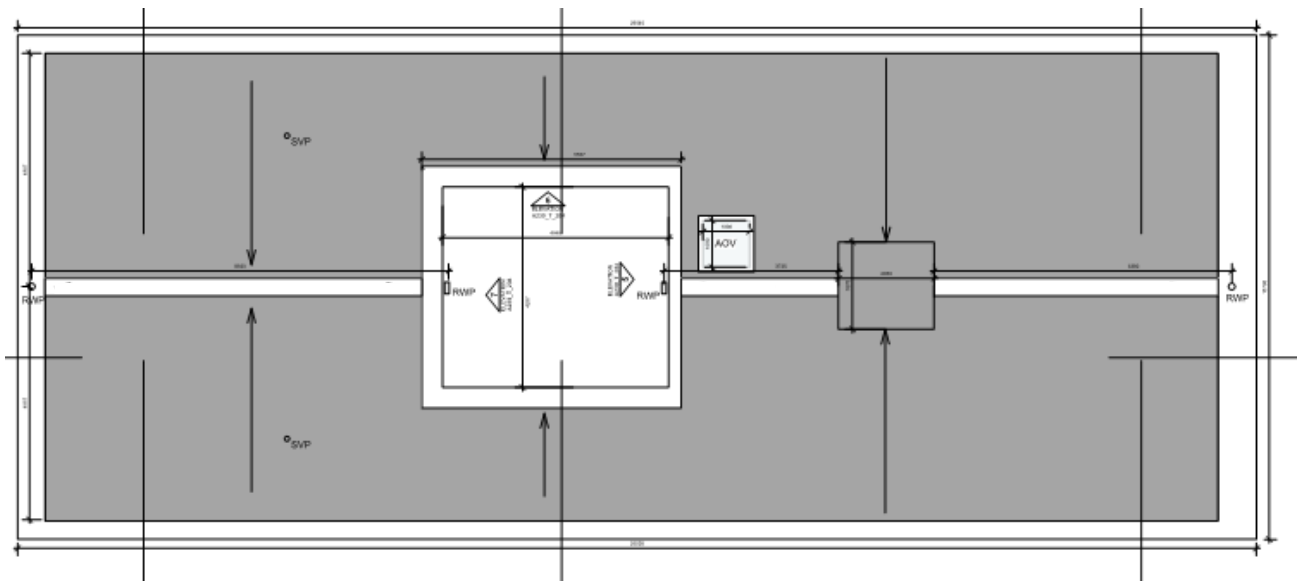
2 – This allows for the structure of the storage components detailed in this proposal together with a small allowance for siltation. Refer to assessment later in this document

3 – We have been informed that the overall site flow rate is to be restricted to 5 l/s. We have assumed that 50% of this figure will be required for the direct connection to drain of the central courtyard and external areas.

3. Catchment Area

Using the plan below we have calculated the overall catchment area for the roof to be 288m²

We have estimated that 236m² of this area will be available as a temporary storage (attenuation) zone for rainwater.



INDICATIVE KEY PLAN - for purposes of highlighting roof area. For final layout refer to architects construction drawing

We have assumed that there are no other potential contributing areas such as vertical facades on abutting buildings.

4. Roof Configuration

We understand that the proposed roof construction is to be altered to a concrete plank roof at zero gradient. Zero gradient roofs are the configuration most commonly used for blue roofs as they allow for the even distribution of water across the largest possible area preventing concentrated loads upon the structure. This load (discussed later in this document) is often no more than the snow loading allowance that will have already been calculated for.

It should be highlighted however, that zero gradient roofs will, due to build tolerances and deflection, often contain depressions that will hold water. This backfall conflicts with the recommendations of BS 6229:2018. However, roof waterproofing systems are available that have certification covering this application, so providing materials are selected and coordinated carefully this should not represent an issue.

At the time of this report, full details of the proposed roof build up were not available. We have therefore assumed the following for the purposes of our assessment.

- Zero gradient roof deck
- Hot melt or similar waterproofing
- Insulation
- Water flow reducing layer
- EGR Ecovoid attenuation zone (50mm)
- Geotextile
- Roof finish (to be specified)

We have assumed that there will be a requirement for a 300mm aggregate zone around the edge of the roof and where the blue roof zone abuts any roof lights or the light well. This is both from a fire protection viewpoint and to minimize the cutting of the Ecovoid geocellular boxes used for the main storage zone.

The void ratio for the Ecovoid product is 96%. The average for the gravel margins is 30%. This has been calculated to give an overall roof void ratio of 85%.

5. Calculations

The following is a summary of our calculations

Project: Brunswick Street, Manchester
 Client: Renaissance
 Designer: Carl Harrop Ref:

Rainfall: Manchester

FSR: r: 0.42 M5-60: 19 mm
 FEH: Parameters Not Set

Method	FSR	
Return Period	100 years	
Percentage Increase	40	
Roof	Roof 1	
Blue Roof Area (m ²)	237	
Percentage Multiplier	100	
Additional Area (m ²)	51	
Percentage Multiplier	100	
Total Area (m ²)	288	
Outlet Location		
Slope (1 in)		
Length (m)		
Width (m)		
Gutter Width (m)		
Gutter Depth (mm)		
Depression Depth (mm)		
Storage void ratio (%)	85	
Drop to orifice (m)	0	
Results		
Critical Storm Duration	39 min	
Critical Rainfall (mm/h)	72.6	
Time to Half Empty	27 min	
Storage Depth (mm)	40	
Max. Outflow Rate (l/s)	2.5	
Storage Volume (m ³)	8.052	
Orifice Diameter (mm)	76	

Some of the key points of note are;

Maximum Water Depth

The calculated maximum water depth is 40mm.

In context, rainwater outlets on a standard rainwater system are calculated at a head over outlet (water depth) of 35mm. It can be seen therefore that significant attenuation of rainfall

can be achieved in this instance with very little additional water depth across the roof (compared to a zero gradient roof designed to BSEN12056).

Half Empty Time

This is a measure of how long water will be stored on the roof. The accepted maximum is generally 24 hours. In this instance it is 27 minutes.

Storage Volume

The calculated volume of water stored during a 1:100 year storm (with an additional 40% allowance for climate change) is 8.1m³.

This is based upon a restricted outflow of 2.5 l/s from the roof with a further 2.5 l/s allocated to the unrestricted discharge of ground level surface water drainage, thus designing out the need for underground storage.

6. Overflows and Exceedance Paths

A critical element of a blue roof is an effective way of dealing with excess water that may derive from a blockage or a storm that exceeds the design criteria, which may lead to ingress into the building or structural failure. This facility should be sized to accommodate a full storm flow.

Overflows through external parapets are the preferred method as downstream drainage systems may be surcharged at the time of need.

For this roof, we would suggest that the overflows are set 20mm above the maximum water depth of 40mm. The overflows should be through the parapets on the external sides of the building.

7. Waterproofing Details

It is necessary to maintain an adequate freeboard above the maximum blue roof storage level. We recommend that the first point of waterproofing breach is no less than 150mm above the maximum blue roof water level.