

# PROJECT STUDY



Cambridge University  
Department of Civil Engineering

Bauder Total Green Roof System,  
BioSOLAR and BauderBLUE Roof

## The Brief

This new build project in the centre of Cambridge combines a Sustainable urban Drainage Solution (SuDS) with vegetation and renewable energy in a warm roof construction.

The client for the Department of Civil Engineering at Cambridge University, R H Partnership, identified sustainability as being a key driver in the design of the roof, but also sought a single source supplier that could provide a guarantee for both workmanship and products. Bauder's systems range encompasses products to meet all the sustainability objectives, and with our network of approved contractors carrying out the installation, we could offer the comprehensive guarantee that was required.

and durable waterproofing with a life span in excess of 35 years, as validated by BBA Certificate 10/4744. The Plant E cap sheet has also been tested by the FLL to ensure long term root-resistance, making it ideal for use in conjunction with the BioSOLAR system.

The Bauder BioSOLAR system is a unique way to combine rooftop vegetation with renewable solar energy. The PV panel mounting boards are held in position using the growing medium as ballast, meaning the waterproofing is not penetrated and therefore compromised. The mounting boards incorporate a water retention feature which allows a small amount of excess rainwater to be stored for short periods of time for the various plant species to feed from. The Bauder BioSOLAR system's unique mounting system lifts the panels above the vegetation allowing the plant life to grow freely and therefore qualify a greater area of the roof as biodiverse.

## BUILDING BOARD

Project Name:	Cambridge University, Department of Engineering
Location:	Cambridge
Total Roof Size:	1610m <sup>2</sup>
Client:	University of Cambridge
Specifier:	R H Partnership Architects
Main Contractor :	SDC Construction
Approved Contractor:	Voland Limited

## The Systems

To meet the sustainability criteria set out by the client, the Bauder technical team designed a roof system combining an extensive blue roof, a green roof and a solar PV array. The first and most fundamental element of the roof system though is the waterproofing. Bauder Total Green Roof System (BTGRS) was selected as it provides robust



**BAUDER**



In addition to the BioSOLAR system, a blue roof was added to the build-up. Blue roofs are sustainable drainage solutions designed to manage stormwater on a flat roof to reduce water runoff rates and ease flash flooding and standing water in built up areas. The BauderBLUE Roof System attenuates water from a flat roof over a 24-hour period via a restrictive flow outlet. Calculations are carried out to determine the rate at which the water should egress the rooftop. This is determined by the local planning authority and for greenfield sites, this is often set as low as 5-8 litres per second per hectare. Bauder can design each flow restrictor to meet the necessary runoff rate. For the Department of Civil Engineering, the main roof area of 1455.5m<sup>2</sup> required two flow restrictors, each with flow control holes, to ensure the specified discharge rate of 0.77 litres per second was achieved. See overleaf for flow restrictor components.



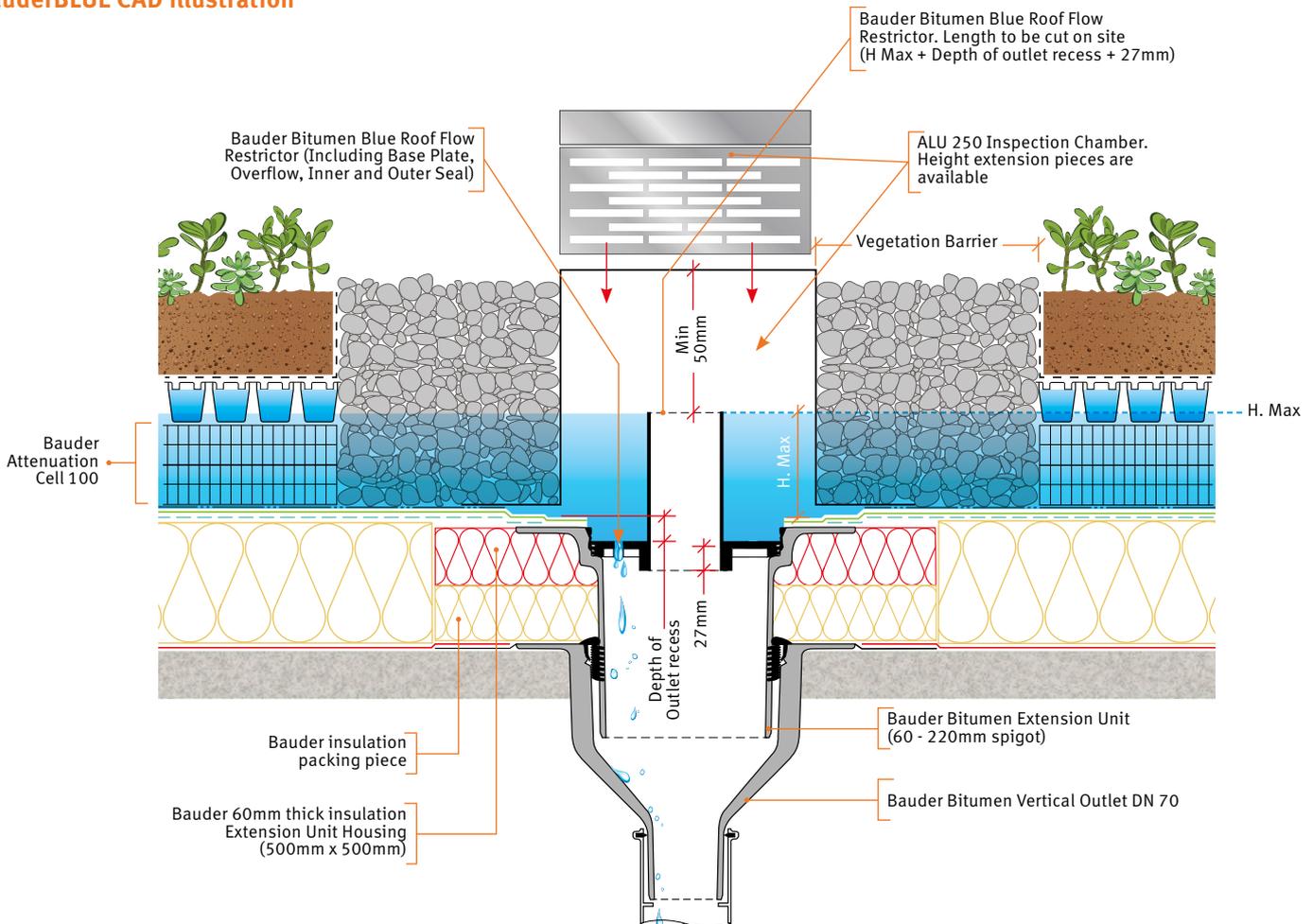
**Flora 3 seed mix** six months after seeding. Fully established vegetation will be seen at 12 months. This mix of seeds was chosen for the Department of Engineering rooftop as it provides a broad combination of low growing species and some shade tolerant vegetation, especially suited to BioSOLAR environments.

The maximum depth of water the roof is designed for is the H-max. When the water level reaches H-max, it will drain via the overflow pipe. These overflow pipes are set at the same height as the H-max level. On this project the H-max was calculated to be 99mm. Although an unlikely scenario, this provision for a 'once-in-a-hundred-years' storm event will ensure that the structural integrity of the building is always preserved.



**BauderBLUE ALU250 inspection chamber.** As the total build-up of the blue-green roof system was over 200mm, a 100mm height adaptor was added to ensure the top of the chamber was level with the surrounding landscaping. The barrier between the outlet and the vegetation comprises of 20-40mm rounded pebbles. This will prevent unwanted growth obstructing the drainage system.

### BauderBLUE CAD illustration



## Challenges

The roof deck was constructed using a pretensioned concrete plank roof structure. Due to the large span of these planks, the dead load weight to the roof would be restricted. This being a blue roof with green landscaping and PV (a reasonably heavy build up), presented the issue of balancing the need of the roof design and the weight restriction of the supporting structure. To add to this challenging scenario, the pretensioned deck did not provide a completely flat finish. When installing a blue roof, a flat deck with no positive or negative falls is essential, as detailed in the 2018 update of BS 6229 – Flat roofs with continuously supported flexible waterproof coverings. To overcome this onsite challenge, the final deflection of the fully loaded roof was calculated and the concrete deck was screeded to give a flat finish.

## The Project

Bauder believes this project to be one of the first of its type in the UK to bring together so many rooftop systems in one space. Project management and clear communication was paramount in order to ensure a smooth installation. The Bauder project team consisted of green roof and solar PV product managers, area technical manager, technical design team, site technicians and approved installers for the waterproofing.

With all the different elements being installed, green roof and solar PV product managers worked with our technical team to design the best possible PV array configuration for optimum energy generation whilst also qualifying for the maximum biodiverse area.

Bauder site technicians worked closely with Bauder approved contractors, Voland Asphalte Ltd, to ensure works were kept to schedule and that a high quality of workmanship was maintained throughout.

To ensure the landscaping is maintained, irrigation was installed by Access Irrigation Ltd. The system, Permadrip Pro, is a drip line irrigation system with anti-syphon design to resist clogging and pressure regulation. Due to the specialist nature of the irrigation system, Access Irrigation Ltd provided a bespoke design service.

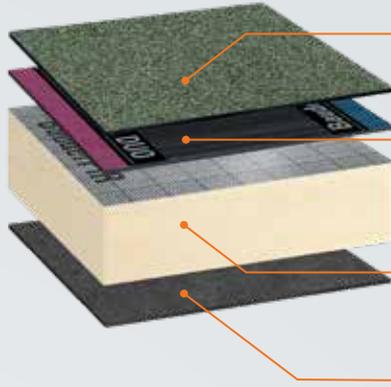
The result of this network of expertise was a multi-faceted support service for the client, specifier, main contractor and roofing and PV installers.



# Applied products:

## BAUDER TOTAL GREEN ROOF SYSTEM

BTGRS warm roof construction was selected for this project for its robust qualities as it needed to endure a high level of foot traffic post installation whilst the blue, green and PV works were added.



### Bauder PLANT E cap sheet

5mm root resistant, heavy duty, SBS modified elastomeric bitumen membrane. Perfectly suited to this project for durability during installation and to withstand ongoing maintenance access.

### BauderTEC KSA DUO underlayer

Self-adhesive elastomeric bitumen underlayer. This underlayer was used to ensure the thorough sealing of lap joints even in lower temperatures. This was particularly pertinent as the waterproofing was installed in winter/spring 2018 which was extremely cold.

### PIR FA-TE insulation 160mm

Bauder PIR FA-TE Insulation is a rigid urethane foam insulation faced on both sides with aluminium foil. In this project 160mm depth was used to meet required U-values.

### VB4-Expal

Thick, robust, torch-applied, elastomeric bitumen vapour barrier. This air & vapour control layer was selected as, once installed on the concrete pretensioned plank deck, it provided a temporary waterproofing layer, allowing internal works to be carried out immediately which was a huge advantage on this new build project.

## BIODIVERSE SUBSTRATE

For this project, the most suitable growing medium was the Bauder Biodiverse FLL compliant substrate. This lightweight substrate provides a free draining growing medium for most vegetation and offers some inherent water retention. Ideal for use in a blue roof combined with vegetation.



## BauderBLUE FLOW RESTRICTOR

The Bauder Bitumen Blue Roof Flow Restrictor is designed to be used in conjunction with a standard Bauder Bitumen Blue Roof Vertical Outlet DN70. The Flow Restrictor is comprised of four parts; Baseplate, overflow pipe, Baseplate inner and Baseplate outer seal. The polyamide Baseplate fits within the 70mm vertical outlet, with the EPDM outer seal creating a watertight fit. The HDPE Overflow slots into the central hole of the Baseplate with an inner EPDM seal preventing any leaks. The Baseplate has a number (1-12) of 10mm restrictive flow holes bespoke to the project. The flow restrictor has no moving parts, hugely reducing the need for maintenance or risk of failure.



## BioSOLAR

This Bauder BioSOLAR system was a key factor in the specification of the project to meet the sustainability criteria specified by the client. 40 PV units were installed on the main roof area on the Department of Engineering. The forecasted energy generated for this array in its first year is 9.91 MWh with a CO2 saving of 5.242 tonnes/a.



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