BAUDER

TECHNICAL SYSTEM SUMMARY

BIODIVERSITY GREEN ROOF SYSTEM

EXTENSIVE GREEN ROOF SOLUTION

This specific type of green, brown or 'living' roof typically either tries to replicate as closely as is practical the ecological environment of the site where construction has taken place or sets out to create a natural habitat to support a variety of plants, birds, animals and invertebrates. A comprehensive range of guarantees are available for this system.

Vegetation chosen to replicate a natural environment to support the local flora and fauna or a specific eco system.

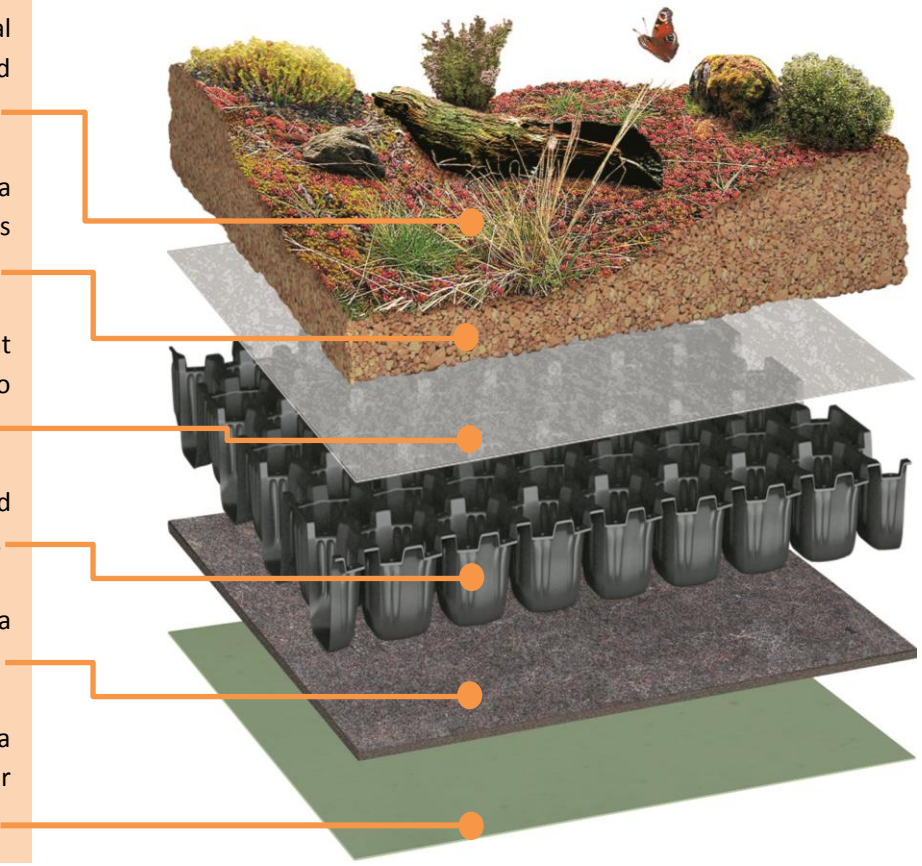
Bauder Extensive Substrate is a lightweight growing material that is manufactured to meet FLL guidelines.

Bauder Filter Fleece is a filtration layer that prevents substrate fines from washing into the drainage and water storage layer.

DSE 40 is a lightweight water storage and drainage layer made of HDPE, 40mm thick.

Bauder FSM600 Protection Mat is a polyester and polypropylene fibre mix.

Bauder PE Foil Separation Layer is a polyethylene foil separation and slip layer manufactured from recycled granules.



When to Specify

Biodiversity roofs can be created on both new build construction and refurbishment projects. The vegetation selected should be suitable to support the differing biodiversity species the roof is designed for.

Waterproofing Options

There are different waterproofing systems available to suit the individual project criteria for the green roof, its landscaping options, weight loading limits, performance and durability requirements. Please contact us so that a technical advisor can take you through the system best suited to your project.

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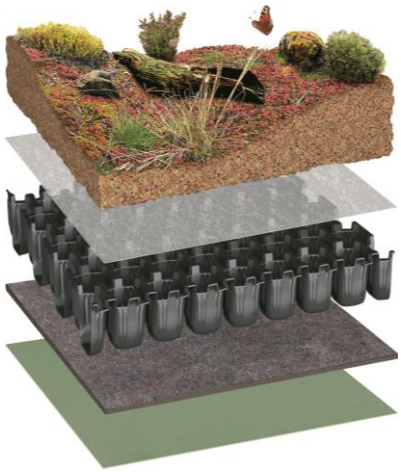
TECHNICAL
SYSTEM SUMMARY

Weight Loading

Based on 100mm substrate depth



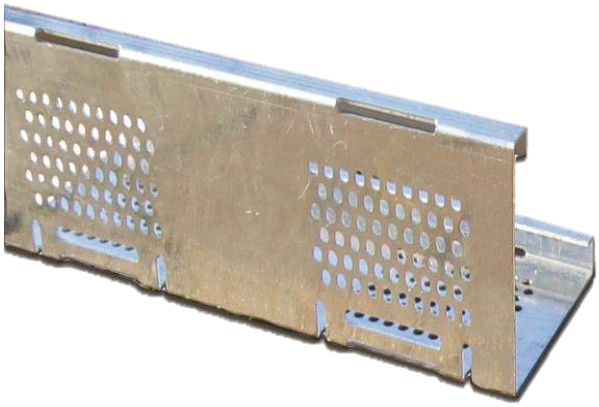
Product	Thickness (mm)	Saturated Weight (Kg/m²)
Vegetation *	N/A	N/A
Bauder Extensive Substrate	100.0 (varies)	120.0
Bauder Filter Fleece	1.0	0.125
DSE40 Drainage Layer	40.0	15.3
Bauder FSM600 Protection Mat	4.0	0.6
Bauder PE Foil Separation Layer	0.2	0.190
Totals	**145.20**	**136.215**

* Seeded or plug plant vegetation chosen to replicate a natural environment to support the local flora and fauna or a specific eco system.

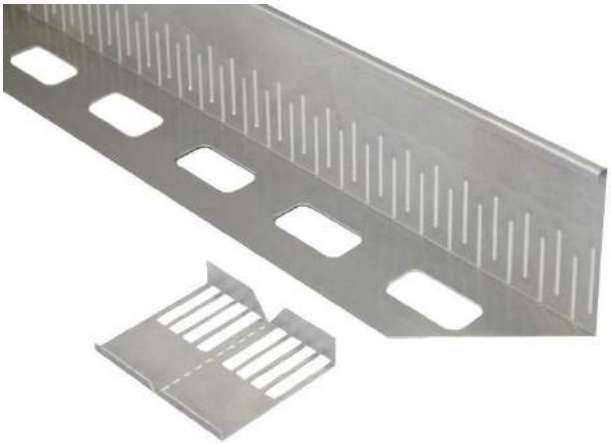
TECHNICAL DATASHEET

BAUDER AL40, AL80/100 & AL150 EDGE & DRAINAGE TRIM

AL40



AL80/100



AL150

Description
Perforated edge/drainage trims for use with sedum blankets or substrate based extensive green roof systems. Fabricated from 1.5mm aluminium these trims are all purpose designed for this application.

Application
The Bauder AL40, AL80/100 and AL150 Edge & Drainage Trim are roofing accessories used in collaboration with Bauder's green roof systems. They are designed to be held in place using straps of Bauder membrane.

Technical Helpline
Full support is available from Bauder Technical Department.
T: +44 (0)845 271 8800
E: technical@bauder.co.uk

Green Roof Approvals and Certification
British Board of Agrément Certificate No. 10/4744

DoP's, CAD Drawings & NBS Specifications
www.bauder.co.uk/technical-centre

Health and Safety Data
Safety Data Sheets (SDS) are available on request and online.

Date: 23.10.2014

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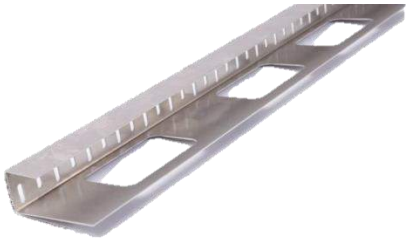
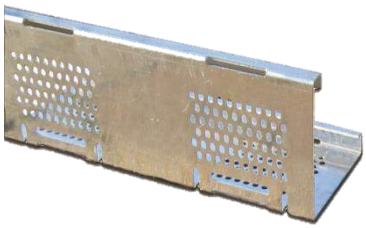
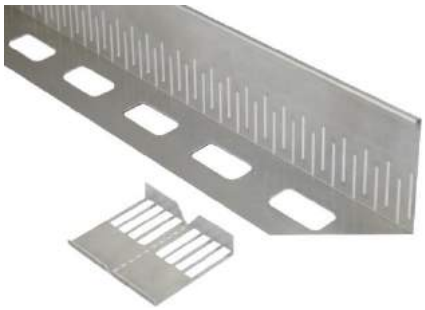
TECHNICAL DATASHEET



AL40 Product Data	
Face height	40mm
Leg width	73mm
Length	2000mm
Supply	10 lengths per box including connectors



AL80/100 Product Data	
Height	80mm/100mm
Width	100mm/80mm
Length	2500mm
Supply	Individual lengths ordered as required



AL150 Product Data	
Face height	150mm
Leg width	146mm
Length	2500mm
Supply	Individual lengths ordered as required. One multi-purpose connection piece is supplied with each length.

Date: 10-11-2014

TECHNICAL DATA SHEET

Bauder Eco Mat Protection Fleece

DESCRIPTION
Lightweight protection fleece to prevent mechanical damage to the underlying waterproofing.

TECHNICAL DATA:
Composition

Material	fleece made from recycled PES and PP

Weights and sizes

Standard roll width	2 metre
Standard roll length	30 metres
Thickness:	ca. 6mm
Weight:	0.6Kg/m²
Saturated weight	ca 3.8Kg/m²

Supply Form
Rolls

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Co. Monaghan Ireland
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bauder.ie

Date: 10-04-2010

TECHNICAL DATA SHEET

Bauder DSE40 Drainage and Protection Layer

DESCRIPTION:

Water storage and multi-directional drainage layer that provides a pressure resistant stable base for high loads or support for roof mounted equipment without compression to the drainage capacity.

TECHNICAL DATA:

Composition

Material	Recycled High Density Polyethylene

Weights and sizes

Size: 1.04m x 2.03m
Thickness: 40mm
Coverage: 2.1m²
Weight: 1.8kg/m²
Saturated Weight: 15.3kg water only/27kg infilled with mineral drain
Water Storage Capacity: 13.5l/m² empty/8.4l/m² infilled with mineral drain
Fill Volume (Mineral Drain): 21l/m²
Compressive Strength: 80kN/m² when empty/≥ 1000kN/m² when infilled

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Date: 10-11-2014

TECHNICAL DATA SHEET

Bauder Filter Fleece

DESCRIPTION
Filtration layer that prevents substrate fines from washing into the drainage layer.

TECHNICAL DATA:

Composition

Material	Polypropylene fleece

Weights and sizes

Standard roll width	1 or 2 metre
Standard roll length	100 metres
Thickness:	ca. 1mm
Weight:	125g/m²
Pore size	ca. 0.13mm

Supply Form
Rolls

Colour
white

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Date: 10-07-2015

TECHNICAL DATA SHEET

Bauder Biodiverse Substrate (FLL Compliant)

DESCRIPTION
This substrate provides a free draining, growing medium for Biodiverse green roof systems. It is a lightweight, substrate designed for biodiverse vegetation (typically plug-planted or seeded). Additionally it provides aeration qualities with some inherent water retention.

TECHNICAL DATA:
Composition

Mineral component:	recycled crushed brick and expanded clay shale
Organic component:	composted pine bark (made from over 90% recycled material)

Technical Performance

Water storage:	ca. 35%Vol
Saturated weight:	ca. 1200Kg/m²
pH value:	6.0 – 8.5

Supply Form
Silo, tipper, bulk bags or sacks

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Please find below a suggested list for shade tolerant planting.
The plants listed are all British natives and Bauder source these from “Flora Locale” compliant sources.
Note that shaded areas will tend to produce significantly fewer flowers.
Use a shade tolerant seed mix (Bauder Fora 3) as a base seed mix (data sheet attached) and then choose a number of plugs (which you would be planting at circa 12-16 per m2).

Shade Tolerant Mix:
Autumn Hawkbit (Scorzoneroides autumnalis)
Betony (Stachys officinalis)
Birdsfoot Trefoil (Lotus corniculatus)
Common Knapweed (Centaurea nigra)
Common Sorrel (Rumex acetosa)
Common Toadflax (Linaria vulgaris)
Common Vetch (Vicia sativa ssp. segetalis)
Cowslip (Primula veris)
Field Scabious (Knautia arvensis)
Lady's Bedstraw (Galium verum)
Kidney Vetch (Anthyllis vulneraria)
Meadow Buttercup (Ranunculus acris)
Meadow Cranesbill (Geranium pratense)
Ox Eye Daisy (Leucanthemum vulgare)
Pepper Saxifrage (Silaum silaus)
Ragged Robin (Lychnis flos-cuculi)
Red Campion (Silene dioica)
Ribwort Plantain (Plantago lanceolata)
Rough Hawkbit (Leontodon hispidus)
Salad Burnet (Sanguisorba minor)
Self-heal (Prunella vulgaris)
St Johns Wort (Hypericum perforatum)
Tufted Vetch (Vicia cracca)
White Campion (Silene latifolia)
Wild Marjoram (Origanum vulgare)
Wild Mignonette (Reseda lutea)
Wood sage (Teucrium scorodonia)
Yarrow (Achillea millefolium)
Yellow Rattle (Rhinanthus minor)

Grasses
Sheep’s Fescue (Festuca ovina)
Red Fescue (Festuca Rubra)
Crested Dogstail (Cynosurus cristatus)
Yellow Oatgrass (Trisetum flavescens)

Chris Roddick
Green Roof Product Manager

Bauder Limited

United Kingdom

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www.bauder.co.uk

BAUDER FLORA 3 SEED MIX

General / BioSOLAR

The Bauder Flora 3 Seed Mix is a blend of seed, tackifier and additives developed to maximise diversity of vegetation on green roofs. Bauder Flora 3 has all the components required to improve the germination and the successful establishment of vegetation for a variety of rooftop conditions: light and shade; exposed and sheltered. The varied mix of species is designed to deliver the British native, biodiverse species required for BREEAM compliance.

Bauder Flora 3 contains a broad range of wildflowers chosen to give an extended flowering season providing nectar and pollen rich habitat for priority pollinators, larval food plants for butterflies and seed sources for birds.

Mix Details:

- **UK Native British Provenance Seed Mix** (certification on request)
- **49 Species**
  - 31 species of which eight are annuals
  - 8 Grasses/Sedge
  - 2 Sedum species
- **35 of the wildflowers are classed as RHS Perfect for Pollinators**
- 12 Butterfly and moth larval food plants.
- Shade tolerant species.
- Low growing to medium height.
- **Mix percentages; 65% perennial wildflowers, 20% annuals & 15% grasses.**

Key Specification Features

- Very broad spectrum of species ensuring a broad diversity of created habitats.
- Lengthy flowering season – April to October.
- High number of annuals to give excellent colour in first year.
- Shade tolerant species to give coverage in less sunny locations.
- Low growing plants with good wind tolerance suited to exposed locations.
- Ideal mix for BioSOLAR installations establishing quickly to provide substrate stabilisation.
- Designed to deliver British native, biodiverse species required for BREEAM compliance.

Ecological Value

This Flora 3 plant mix has a high ecological value providing a long flowering period and nectar sources for a wide variety of pollinators. Plants with long flower tubes such as Wild Red Clover and Vetch species will provide valuable nectar sources for Long-tongued Bumblebee species including the priority species Brown-banded Carder Bee.

Bird's-foot Trefoil and Kidney Vetch make up 20% of the mix, which are important larval food plants for ten butterfly and moth species, including common and small blue priority species. Plant seed heads provide refuge and overwintering sites for invertebrates and our mix includes Black Knapweed and Common Toadflax, which provide valuable seed sources for birds.

The yellow composite flowers such as Rough Hawkbit and Mousear Hawkweed in this mix provide good nectar sources for generalist pollinators including hoverflies and beetles. The mix also contains native and or naturalised sedums that will provide evergreen ground cover in sunny areas and can support specialist invertebrates such as the notable bug species *Chlamydatus evanescens*.

BAUDER FLORA 3 SEED MIX

Establishment and Growth

Typically the mix will produce flowers from April to October starting with species Wild Strawberry and Cowslip, through the summer with Yarrow and Black Knapweed with Lady's Bedstraw flowering later into the autumn. The annuals, biennials and grasses will provide cover and colour in the first season allowing time for the slower growing perennials to establish in later years. The mix has been specified to be drought tolerant with sedum species and low growing perennials.

BioSOLAR

Plants are chosen that do not exceed 40 cm in height to avoid problems with shading of solar panels when the vegetation is used in conjunction with Bauder BioSOLAR. Shade tolerant ground cover plants were specified that will occupy semi-shade microclimates under the panels.

Green roofs are exposed environments subject to wind erosion therefore the mix contains pioneer and ephemeral species such as annuals, biennials and short perennials, which establish quickly from seed and help to stabilise the substrate and prevent wind erosion prior to perennial root systems getting established. A small percentage (typically <15%) of the mix contains non-aggressive grass and sedge species, which will also help to establish and stabilise the substrate.

The seed source is British Provenance (with the exception of sedum species) and suppliers of the mix adopt the Flora Locale Code of Practice for collectors, growers and suppliers of native flora.

flora LOCALE

(Flora locale is an independent charity. Promoting and advancing the conservation and enhancement of native wild plant populations)

Bauder's Unique Additive Mix

Establishing seed at roof level is difficult, to maximise the germination and establishment of the diverse range of seed used, Bauder has developed a unique blend of seed adhesive, organic nutrients and mycorrhizal fungi to encourage water and nutrient uptake by the developing seedlings.

- The seed mix and additives are combined with a bulking agent which enable the correct sowing rate to be achieved, the adhesive binds the seed to the substrate preventing it from being blown away in windy conditions or washed deep into the substrate and failing to germinate.
- A small quantity of organic slow release fertiliser gives the seed a gentle boost as it establishes. Mycorrhizal fung increases the root surface area helping the transfer of water and nutrients from the substrate to the developing root system of the plant, enabling the plants to establish quickly.

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Specification Support

Specification downloads:
www.bauder.co.uk/technical-centre

NBSPlus BIM DWG

Telephone helpline:
0845 271 8800

BAUDER

GREEN ROOFS

GENERAL MAINTENANCE INFORMATION

BAUDER BIODIVERSE SYSTEMS

XF118, KS Plus seed mix and wildflower planted substrate-based systems

BAUDER BIODIVERSITY GREEN ROOF SYSTEMS

XF118 Wildfower Blanket, KS Plus seed mix and wildflower plug plants

The following is a guide to the maintenance necessary to keep a biodiverse green roof in a condition broadly similar to that in which it was first installed. The information relates to installations that have been completed for one full growing season and where establishment maintenance has been effective. For clarity, establishment maintenance relates to tasks continuing on after installation, where a defined period of regular watering and minor maintenance is required until the planting has rooted into the growing medium, adapted to its location and can be considered established.

What to Expect from a Bauder Biodiverse Green Roof System

There is a common misconception that extensive green roofs, and sedum plants in particular, are always green and that from ground level they resemble grass. This is misleading, as they consist mainly of low growing, drought tolerant sedum plants and may also include other species such as Saxifrage, wild flowers, grasses, moss and herbs.

General Maintenance

The level of maintenance of the horticultural element of this type of green roof will vary significantly, dependent upon the various species of vegetation incorporated and the purpose for which it was initially installed. Whilst the original intent may have been to allow the green roof to grow wild, the problems that this can create with the build-up of dead or unwanted vegetation and the impact that this has to the appearance and type of vegetation on the roof will often dictate the need for basic maintenance to be carried out.

The Bauder biodiversity green roofs which are currently being installed to meet either BREEAM or Sustainable Homes codes will include a species mix selected to provide a balanced plant community on the roof and will require basic maintenance if this is to be sustained in the long term.

Maintenance is best carried out annually, during springtime and additionally in late autumn should the particular roof location be affected by local trees that produce surface leaf litter. Some deposited leaf litter may be considered as contributory to the bio-diverse environment, which is acceptable so long as provision is made to ensure that this has no negative effect on other plants and the roof drainage performance.

The following procedures should be carried out in order to ensure the roof is maintained in good condition and to protect the validity of the waterproofing system guarantee.

Note - Specifically designated biodiversity areas should be disturbed as little as possible during maintenance so as not to upset any micro-habitats that may have colonised.

Preliminary Maintenance Procedures

- Ensure safe access can be gained to the roof and that relevant Health and Safety procedures are followed when working at roof level. It is advised that the contractor should always seek proof of current maintenance for any man-safe roof access systems prior to proceeding with the work on site.
- In order to avoid a build-up of bio-mass on the roof it is recommended that all dead vegetation is removed with a strimmer and provision made for the debris to be safely lowered to the ground and disposed of.
- We recommend removing unwanted leaf litter that has fallen onto the roof surface from overhanging trees both in the spring and autumn, to ensure that this does not smother the vegetation beneath.
- Open the lids of all Inspection chambers, to inspect and ensure that all rainwater outlets and downpipes are free from any blockages and that water can flow away freely.
- Ensure that any protective metal flashings and termination bars remain securely fixed in place. Advise the client of the need to repair or renew as necessary.
- Examine all mastic sealant and mortar pointing for signs of degradation. Advise the client of the need to repair or renew as necessary.
- Check that all promenade tiles and paving slabs are securely fixed to the roof surface and in good condition.
- Ensure that any new items of plant/equipment on the roof are mounted on suitable isolated slabs and that any fixings used to secure the plant/equipment in place do not penetrate the waterproofing. If in doubt, please contact Bauder for further advice.
- The Building owner should keep a record of all inspections and maintenance carried out on the roof. Any signs of damage or degradation to the waterproofing should be reported to Bauder immediately, in order that arrangements can be made for remedial work to be carried out if necessary.
- Damage to the landscaping should be reported to the building owner. If this damage includes Bauder components, then Bauder may be contacted for remedial advice.
- Works to adjoining areas - When carrying out any maintenance to adjoining roof areas, care must be taken not to damage either the green roof landscaping or the waterproofing system. If it is considered that either element has been affected, then Bauder should be contacted for advice. Any waterproofing damage caused after completion of the original installation may invalidate the guarantee.
- Alterations - Any unauthorised alterations to the waterproofing system will invalidate the guarantee. If such a situation should arise, then Bauder should be contacted so that we may advise on the alteration and how it should be incorporated without affecting the guarantee.

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Plant Related Maintenance Tasks

1. **Plant encroachment.**
   Any vegetation which has encroached into drainage outlets, Inspection chambers, walkways and the vegetation barriers (pebbles) should be removed. If movement/settlement of the pebble vegetation barrier has occurred, additional washed stone pebbles similar to the existing are to be added.

2. **Plant maintenance**
   In the absence of specific instructions from the building owner or their designated consultant, advice should be sought from both the project landscape designer and the plant supplier and any maintenance carried out according to their specific recommendations.

3. **Maintenance of the Bauder XF118 Wildflower Blanket**.
   If the Bauder XF118 Wildflower Blanket has been installed the minimum recommended maintenance of the vegetation is as follows:
   In the late autumn the vegetation is to be strimmed back to a 50-70mm height and the unwanted waste matter removed and lowered to ground level for composting/disposal.
   In late March/April apply an 80g/m2 dressing of Bauder slow release organic fertiliser to the vegetated surface.

   Note - Should it be decided that the XF118 Wildflower Blanket is to be left unmaintained to naturalise, we would advise that this will lead to a substantial build-up of dead vegetation on the roof that will over time significantly reduce the number of vegetation species within the blanket.

4. **Weeding**
   With the exception of saplings, which should always be removed, weeds in a biodiverse green roof should be considered as a problem only of aesthetics, unless they are particularly invasive. If considered undesirable, they can be removed.

5. **Fertiliser**
   Where the vegetation has been provided by Bauder, our organic slow release fertilizer should be applied at a rate of 80g/m2 in the early spring. For all other vegetation it is recommended that advice be sought from the landscape designer and plant supplier and that any fertiliser required is to be applied according to their specific recommendations.

6. **Irrigation**
   The need for irrigation in a biodiverse green roof system is dependent upon the client requirement for the visual appearance of the vegetation. If it is intended that the roof should have colour and interest for the longest period through the growing season, then irrigation will significantly aid in achieving this. Should the requirement be only to deliver biodiversity, then the provision of sufficient watering points at roof level to allow for only occasional watering in periods of prolonged drought can be considered sufficient.

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Support

Modern biodiversity green roof installations will normally require only minimal maintenance. Bauder is happy to offer advice on any issues concerning your green roof and enquiries should be forwarded to our Technical Department at the address below. We believe our products and systems are of the highest standard and are always prepared to discuss any queries or concerns that may arise. Providing photographs or drawings to accompany your queries will help speed our response.

Please note: In the event of any query arising which it is thought may affect the condition of the system, then Bauder should be contacted at the address below. We cannot accept responsibility for any problem or failure due to use outside those parameters for which the system was designed or 'acts of god' beyond our control e.g. extreme weather conditions or damage through pests.

BAUDER GREEN ROOF MAINTENANCE SERVICE

With over 30 years' experience in the design and supply of green roofs throughout the UK and Ireland Bauder can offer unparalleled experience and expertise in green roof maintenance including sedum, biodiverse and wildflower.

Having established the largest UK facility cultivating green roof vegetation blanket we have unique knowledge and horticultural expertise for roofscape vegetation. With national coverage of over 50 field personnel, you can be assured of a prompt reliable service to fully meet your requirements.

Our Service

Bauder's experienced team will provide you with a tailor-made maintenance programme for your green roof. A typical Bauder Maintenance Programme Includes:

- Full inspection and evaluation of your green roof
- Application of organic slow release granular fertilizer
- Removal of leaves and debris
- Removal of unwanted vegetation
- Inspection and clearance of outlets
- Examination and testing of irrigation

This work is undertaken by Bauder's experienced maintenance engineers who will carry out the necessary risk assessments and comply with all current health and safety legislation throughout the duration of the work. Finally, you will be provided with a bespoke report with photographic verification outlining the condition of the planting and any areas requiring on going treatment.

To discuss your specific requirements, please call our green roof service team for a no obligation quote.

T: 0845 271 8801 **E:** greenmaintenance@bauder.co.uk

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