

Green Roof Descriptions

Types of Green Roofs

Extensive: PROPOSED GREEN ROOF

Providing environmental and cost benefits these roofs are very low maintenance and aesthetically pleasing. Generally a shallow layer of substrate (25-100mm) planted with low-growing succulents called sedum, and occasionally wildflowers, herbs and other alpine species. The plants will give excellent coverage of the entire roof. Extensive roofs are not designed for access, but are ideal for both retro-fitting & new build of pitched roofs or flat roofs to provide insulation or water attenuation. These light-weight systems require only annual or six monthly maintenance, and do not impose any significant weight on the building structure; therefore there are usually no structural implications. A low cost long-term solution that does not require irrigation. The Extensive green roof is designed to be self-sustaining and to look 'natural'.

Intensive:

Intensive gardens are based on a thick layer of soil or substrate (150mm+) These are roof gardens which are created to provide additional space for people to use as amenity; they usually have a flat roof or shallow pitch and can incorporate lawns and specially selected shrubs, trees and plants. Roof gardens require the same 'intensive' maintenance and upkeep as the ground level garden. Irrigation and drainage systems must be adequately designed. Pathways, terraces and other architectural features can be included. Intensive roof gardens place significant weight on the building structure and need to be engineered to conform to load requirements and health and safety. Visually they are very attractive but have high capital and maintenance costs.

Simple Intensive:

Of slightly greater depth than extensive systems (100-200mm), allowing a greater diversity of plants to be grown and local habitats recreated. Based on the same principles as extensive roofs, they are light weight and generally low maintenance. The planting usually covers the surface of the roof.

Brown or Rubble roofs:

The by-products of the development process such as rubble, brick and subsoil are added to the roof and allowed to colonise naturally over time or planted with wildflower meadows. The concept behind such roofs is to replace the 'foot print' of the building on the roof thereby recreating 'Brownfield' conditions and

providing a habitat to encourage the local species of plants, birds and invertebrates, displaced by development, to return and colonise the roof.

They consist of a lightweight growing medium, typically made up of crushed brick or concrete mixed with site excavated soil. This can be recycled material that has an association with the site; demolition material then left to colonize on its own. Similar results can be had by leaving a commercial substrate to colonize naturally. Experience has shown that there is a need to seed and ALSO apply some sedums to such roofs to ensure that the roof develops to its maximum. The substrate will be free draining and has a low-fertility. The finished surface is 'sculpted', to provide habitat for the specific flora and fauna it is designed to accommodate. Features such as logs and boulders are often added.

Planting Methods

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Sedum Mats

Instant greening, with a complete system.

Installed directly onto the fully adhered waterproofing/ root proofing

Available to install throughout the year.

Exceptions are at times of frost, snow or extremely wet weather.

Installed on roofs with a pitch up to 20°, where there is additional support.

Mature sedum plants of mixed varieties, which have been established over a minimum of 12 -18mths

Sedum Sprouts

Cost effective greening with a lightweight, easy to install, system

Sown in situ on the roof with freshly harvested cuttings of mixed sedum varieties.

Seasonal sowing times are April/ May or September/ October.

Mats laid profile down to fully adhered waterproofing/ root proofing. Substrate spread to a depth of 40mm. Sprouts are sown at 50g per square metre, tamped & watered in.

Installed on roofs with a pitch up to 12°

12- 15 months establishment period for minimum 60% total coverage.

The Green Roofs Naturally Garden Roof

Annual maintenance is recommended with extensive green roofs, to guarantee that they continue to flourish, particularly in the early years. In the case of the sown in situ system, more frequent visits will be required in the initial period of establishment (12-15 months).

We provide a warranty whenever we install & maintain your green roof. We will be happy to talk about your requirements with you.

Why Sedum?

Why Sedum?

Extensive green roofs are by their very nature designed to be low maintenance.

Our Extensive green roofs are created using sedum, grown in Yorkshire.

Sedums or stonecrops are evergreen succulents popularly used by gardeners to create beautiful rock gardens and borders and also as pictorial displays in parks. They are self-generating, drought resistant and capable of withstanding extremes of climate, which makes them particularly suitable for roofs.



Sedum will thrive in a shallow, free draining substrate and their dense, low growth will grow rapidly to cover the surface of the soil or substrate in a blanket of foliage.

They flower from early summer through to autumn in shades of pink, purple, yellow and white. Needing very little attention and no mowing or cutting back, they give excellent foliage colour and texture and are attractive to all kinds of insects and birds.

The mixture of sedums on your Green Roofs Naturally extensive roof will ensure varying flowering periods and colours throughout the growing seasons. The leaves of the plants will also change in colour and aspect, throughout the year.

Sedum plants will 'die back' in the autumn and winter and produce new vibrant growth in spring and summer.

There are all sorts of alternative planting options you can consider for your roof, from wildflowers to

chamomile, herbs, shrubs and a variety of mixed planting.

We will be very happy to offer help and advice to meet your particular requirements.

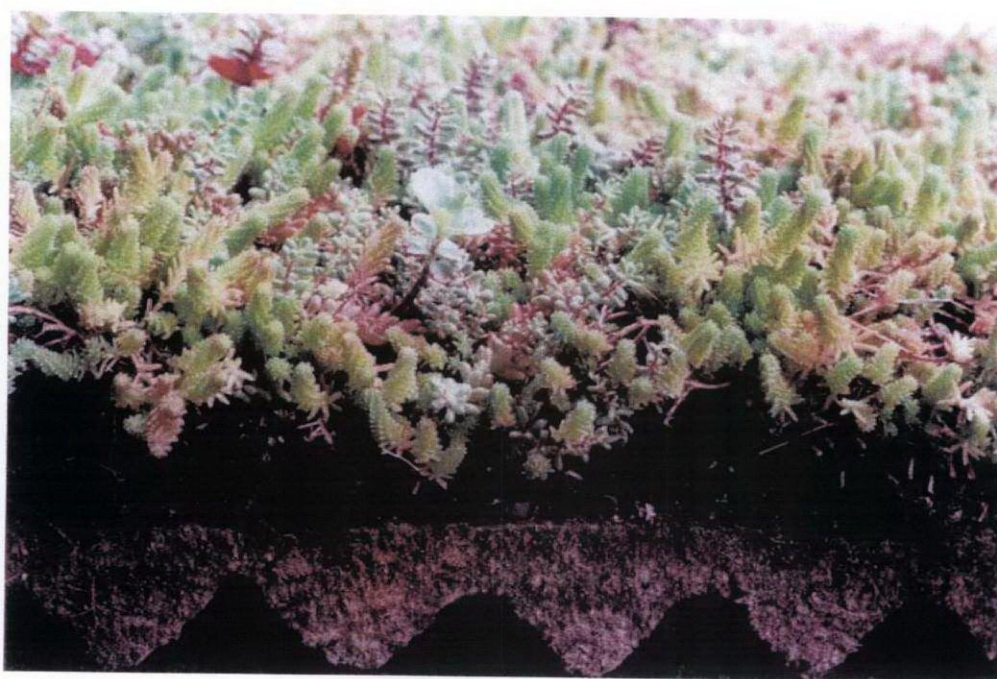
Maintenance

Maintenance

Sedum

A Green Roofs Naturally extensive green roof is created using a variety of sedum plants that will grow and carpet the roof surface. Sedums are low growing succulents – plants with thick fleshy leaves and stems. They are also extremely drought tolerant which makes them particularly suitable for growing in the harsh conditions found on a roof. We use a variety of sedum, to ensure maximum coverage & diversity as each species prospers under particular seasonal or weather conditions.

Living Roofs



We recommend that clients take out our maintenance contract for the first few years to ensure the initial establishment and upkeep of the sedum plants. The maintenance requirements of an extensive sedum roof will be affected by their situation. Professionally installed or planted extensive and wildlife roofs are specifically designed to be self maintaining. As with all of Nature, Sedum change appearance along with the seasons. Some species change colour entirely, from green to red or their leaves will become much smaller; it is a "living roof". Customers are therefore advised that the roof will not always look 'Green' and that as with the plants in your garden, the roof will not look as 'fresh' throughout the winter months as it does in spring and summer. Plants die back and will look brown and woody. In the spring these can be cut

back, otherwise they will naturally rot away. A certain degree of 'maintenance' is about the aesthetics of the way the roof looks.

Maintenance Agreements

If you wish to take out a maintenance agreement the details will be confirmed within the contract prior to installation. The contract will take account of the specific features of your roof, size, pitch, site, accessibility and will be costed at a price per m² per visit. An Extensive Green roof will generally only require two maintenance visits every year. The frequency and level of maintenance of the Green roof is down to the discretion of the client/building owner and the plant appearance they wish to maintain. After the first two years, when the roof is well established, you may wish to review your maintenance requirements.

Maintenance Regime

Green Roofs Naturally recommend two visits per year carried out by our approved contractor, to ensure the guarantee of function. Ideally these would be in the spring time and autumn.

The maintenance regime would include:

- Removal of debris and dead vegetation from the roof surface, drainage outlets, guttering and washed pebbles, etc.
- Weeding and removal of grass / saplings (purely aesthetic.)
- Sowing of additional sprouts to repair patches of poor growth
- Application of maximum 30gm² of slow release, low nitrogen fertiliser- if we assess this to be beneficial to the plant growth. Green Roofs Naturally ensure that the maintenance is carefully designed in order to maximise the quality of the water runoff.
- Review Inspection Chambers and ensure that water outlets are all free draining.
- Clear and clean all perimeter and detailing surrounds [e.g. pipe upstands]

In severe drought it is recommended that the plants receive a small amount of irrigation, though this is largely unnecessary in the UK climate, unless the roof has a steep pitch. Green Roofs Naturally's low density "Nutrifoam"® mat absorbs up to 25 litres of water per square metre, assisting plant growth and minimising any such need for additional watering.

Any maintenance should be carried out by the Green Roofs Naturally team who installed your roof. They are fully trained and qualified in the installation and maintenance of our system. The visits would be arranged at your convenience and carried out in a professional and considerate manner.

Access to the roof will be required in order to carry out routine maintenance annually. As with all roofing projects, Green roof installations must comply with relevant Health and Safety requirements. Under current

legislation, a fall arrest system, safety harness attachments or man safe systems should be used to ensure safety during installation and to allow for routine maintenance.

Benefits

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Stormwater management/ Sustainable Urban Drainage

Green roofs act as a stormwater management device, quite simply because they replicate the open space previously at ground level. Vegetated roofs play an important role in modern urban drainage because of their ability to slow down and reduce runoff response. Unlike some other best management practices, green roofs may be able to offer controls and improvements in both the quantity and quality of stormwater runoff.

Improved insulation

Green Roofs moderate and minimise temperature variations within the building. Any heat loss or heat gain through the roof creates a demand for energy. By installing a green roof the building is better insulated. Each layer of the Green roof has an insulating effect; even the soil itself has a low insulating property. The soil and the plants absorb the energy from the sun and store it. A Green roof is more effective at reducing heat gain rather than heat loss. Therefore it is sensible to consider the benefits from an annual perspective taking into account the variance between summer and winter.



Sound insulation

The growing medium or soil substrate acts as a noise barrier and reduces the transferred noise by up to

18Db.

Moderating the Urban "heat island" effect

In cities the buildings, pavements, car parks etc are all impervious surfaces. This can mean that on warm summer days the temperature in the city is several degrees higher than in surrounding rural areas. This is particularly noticeable at night, when urban areas take longer to cool down and the air quality is poor. Green roofs increase vegetation in urban areas. The plants cool the air and add moisture through 'evapotranspiration'. Green roofs also shade the heat absorbing surfaces, thereby reducing the **albedo** effect.

Improved biodiversity and ecology

Green roofs provide a habitat for birds, insects and wildlife; they replace the land lost to development. Specifically designed Green roofs can focus on providing habitats for species native to the local environment.

Improve air quality

Green roofs take up CO² and filter dust and pollutants from the air and also from the rainwater that they hold. This means that the quality of the runoff is improved as well as the air that we are breathing.

Reduce energy consumption

Because homes and buildings absorb the sun's energy, heat islands can increase the demand for summertime cooling and raise energy expenditures. For every 1° F (0.6° C) increase in summertime temperature, peak utility loads in medium and large cities increase by an estimated 1.5–2.0%. On hot summer days, the surface temperature of a Green roof can be cooler than the air temperature, whereas the surface of a traditional rooftop can be up to 90°F (50°C) warmer. In Germany, studies have estimated the electricity savings to be £5.20 per m² per annum if you have a green roof.

Addressing Climate change with Sustainable roofing

It is important to address the issues of climate change on all our current and future developments. Green roofs are best placed to deal with the potential effects of increased rain fall, and stronger and more frequent winds.

Aesthetic appeal & Psychological benefits of contact with nature

Green roofs naturally improve the outlook for the surrounding buildings. Health research has demonstrated

restore watershed health over time. Graham and Kim (2003) Not only are green roofs able to filter contaminants out of rainwater that has flowed across the roof surface (Dramstad et al., 1996), but they can also degrade contaminants, either by direct plant uptake, or by binding them within the growing medium itself (Johnston and Newton, 1996).

Numerous studies have demonstrated quantitatively that a properly installed and maintained green roof will absorb water and release it slowly over a period of time, as opposed to a conventional roof where stormwater is immediately discharged. Typical extensive green roofs, depending on the substrate depth, can retain 60 to 100% of the stormwater they receive (Thompson, 1998). In addition, living roofs are normally able to retain 70 to 80% of the stormwater that falls on them during the summer months, depending on the frequency of rain and drying rates. In winter months, green roofs are predicted to retain 25 - 40% of the stormwater. These data are subject to variation based on variations in climatic conditions. The amount retained also depends on numerous factors such as the volume and intensity of rainfall, the amount of time since the previous rainfall event, and the depth and saturation level of the existing substrate (Monterusso, 2003).

Green roofs can retain up to 60% of stormwater on an annual basis (Liesecke, 1993). Liesecke also indicated that there were noticeable differences between retention in warm weather and in cool weather. In warm weather, shallow substrate depth can retain 11% more stormwater than it can during cold weather (Liesecke, 1993). Liptan et al, (2003) demonstrated similar findings. Within a 15-month monitoring period, they found that precipitation retention was approximately 69% of the total. However, between December and March the rainfall retention was 59%, while from April to November, rainfall retention was 92%. Research conducted by Jennings et al. (2003) in North Carolina showed that a green roof can retain up to 100% of the precipitation that falls on it in warm weather. However, the percentage retained for each storm decreased when there had not been an adequate amount of time between each storm event.

During a heavy downpour, pollution is mobilized from impermeable surfaces and transported with the water. Green roofs not only reduce the quantity of runoff from roofs but can also filter contaminants from rainwater. Runoff from urbanized areas is the leading source of water quality impairment. Most of the stormwater runoff enters water bodies directly without any treatment.

The substrate on the Green roof has the ability to retain particulate matter in the stormwater and to reduce the quantity of the runoff and, as a result the total mass of pollutants that flow off the roof. Thus, the stormwater runoff quality as well as the receiving surface water quality can be improved.

A number of studies have looked at green roof runoff quality. Dramstad et al. 1996 showed that the physical and chemical properties of the growing substrate, and the vegetation itself, help to control the nitrogen phosphorous and contaminants. These are either broken down by the plants themselves, or more usually bound in the substrate instead of being discharged in the runoff.

Of the many benefits of green roofs the benefits from stormwater flow reduction including impact on the combined sewer overflow (CSO) are included in those with the most quantifiable monetary value. Capital expenditures and operating costs for wastewater treatment in combined sewer areas and stormwater treatment in separated sewer areas are typically assumed to be lessened by the rainfall captured by green roofs. Acks (2003)

Sustainability

Sustainability

Buildings and developments can adversely affect climate change and also be adversely affected themselves by those changes. Consequently it is important to look at ways of mitigating against these issues at the outset and planning for the nature of predicted climate changes throughout the life of the building, not just the current climate.

The Buildings Research Establishment has concluded that Green roofs are altogether better able to cope with the forecast climate changes, namely higher wind speeds, heavier rainfall and longer hotter summers.



The Green Roofs Naturally Green Roof system has been functioning for more than 25 years, it is tried and tested and it is self sustaining and will continue to be so, throughout "the life of the building". Installing a Greenroofs Naturally Green roof will protect the waterproof membrane, preventing exposure to UV light and extremes of temperature, extending the overall life of the roof itself. The basis of the Green Roofs Naturally system is the recycled foam mat. Produced under modern efficient and economic production processes, the NutriFoam Mat is embedded with slow release nutrients, to ensure there is minimal impact on the quality of the water runoff. The Extensive soil substrate, sourced locally, consists of recycled brick (non-contaminated). The simplicity of the system also makes it infinitely adaptable and practical for

installation being non-labour intensive. The cost is competitive and our supply chain and partnership working are all designed to ensure the quality and value of this system is the imperative to ensure the whole of life costs are kept to a minimum.

The NutriFoam mat is unique in its multi-functional purpose, providing both part of the growing medium and the drainage system. This minimises the manufacturing required to produce the Green Roofs Naturally system and the resource consumption.

The system itself is extremely lightweight. When the extensive green roof, with a substrate depth of 4cm, is fully saturated, it weighs 56 kilos per m². Water attenuation is a key element of the sustainable benefit of the Green Roofs Naturally system. From a hydrological point of view the roof functions differently from a hard roof. Rainwater is retained and evapotranspiration takes place from the vegetation, while the rainwater runs off directly from the hard roof. There is a clear seasonal effect for the runoff reduction, runoff does not occur until the mat and the substrate are fully saturated and is also dependant upon the precipitation period and volume. The NutriFoam mat alone will hold 25 litres of water m², effectively acting as a sponge to control and slow the storm water runoff, which means that local urban flooding and combined sewer overflows can be lessened. Throughout the year due to the high level of water storage and transpiration, the runoff is less than 50% of the precipitation. This has important implications for SUDS and as such Green roofs are now considered a SUDS technique.

The thermal mass of a building is important in how it responds to heat loss and gains. Lightweight systems can heat and cool faster. The NutriFoam mat assists in reducing heat gain in summer to maintain comfortable temperatures within the building.

Assuming the roof installed is an extensive green roof, using predominantly sedum as the growing plant material, then maintenance after installation of mature sedum mats could be limited to once per annum- ideally in spring, preferably May. We would recommend this is carried out by our contractors under a maintenance agreement that supports our Guarantee of function.

The maintenance regime would include;

- Removal of debris and dead vegetation, from the roof surface, drainage outlets and guttering and washed pebbles, etc.
- Weeding and removal of grass / saplings (purely aesthetic.)
- Sowing of additional sprouts to repair patches of poor growth.
- Application of maximum 50gm² of slow release, low nitrogen fertiliser.

As awareness grows about the significance of climate change, so too will the demand for and value of, buildings which are designed with sustainable characteristics. Overall it is the simplicity of approach which

is fundamental to the Green Roofs Naturally system which has been proved and tested over the last 25 years.