ENVIRONMENTAL GAINS

As a new building, the redeveloped hotel will undergo a BREEAM assessment which is a measure of best practice in sustainable building design, construction and operation. A broad range of categories and criteria are covered and include aspects related to energy and water use, the internal environment (health and well-being), pollution, transport, materials, waste, and ecology.

Specific measures the new hotel hopes to implement to achieve **high levels of sustainability** include:

- Meeting all heating, cooling and hot water needs renewably via a Q-ton ESA30E Air Source Heat Pump (ASHP) which can produce 3,500 litres of 60°C hot water in 8 hrs during the night (o/s temp 5°C) to benefit from off peak electricity rates (⅓ cheaper) @ 3.75 COP. Flat roof mounted Varisol evacuated solar tubes may also be fitted on the flat roof to reduce the ASHP's load by 20-25% pa - these don't require sunlight and generate heat energy even on overcast and cloudy days. Both ASHP/solar tubes result in zero *onsite* carbon (CO_2) emissions re the building's heating, cooling and hot water needs

- Servicing all occupied areas of the new building with 24 hr fresh air ventilation - the fresh air will be *preheated* by extracting 80% of the heat from the expelled air, thereby minimising the additional heat (if any) required to raise it to the required temperature

- Using Waste Water Heat Recovery (WWHR) to *extract 75%* of the heat from all discharged shower water to *preheat* the incoming supply of cold mains water to the shower. This reduces the amount of hot water required for each shower and consequently associated *offsite* Greenhouse Gas emissions (as less imported electricity is used by the ASHP).

  Based on a shower head temperature of 38-42^{o}C, water exiting a shower will run to drain between 31-35^{o}C meaning WWHR can extract a minimum 23^{o}C of heat from the wastewater and preheat the incoming mains water from 10 to 33^{o}C. WWHR may be extended to laundry/dishwashing facilities

- Onsite composting for all food waste. High Peak BC offer no recycling for trade waste. Presently we recycle paper/cardboard privately but food waste remains destined for landfill. Once buried, it degrades anaerobically (without oxygen) producing methane (CH_4) which is 72 times worse for the atmosphere in the short term than carbon dioxide (CO_2). The effect on global warming is huge due to worldwide volumes of food waste sent to landfill (50 kg/day to landfill = 75 tonnes of released CO_2)

  A Liquid Food Composter (LFC) will be installed, which is an enclosed automatic bio-digester that fully breaks down any raw/cooked food matter within 24 hours. The process uses no chemicals and is totally green. Decomposition in the LFC is a natural aerobic process (in the presence of oxygen) which produces CO_2 and water - accelerated by computer controlled optimisation of the aeration, moisture & temperature within the LFC. The output is environmentally safe grey water.

  This natural process is carbon neutral as carbon was taken from atmospheric CO_2 to produce the food in the first place. 90 kg (200 lb) of food waste per day can be disposed of as such in a unit the size of a 3ft chest freezer. It is hoped to maintain the existing paper recycling and add glass too

- Installing a greywater system which reuses the water from showers and sinks for flushing toilets, laundry, dishwashing and any outdoor requirements

Build & Design features the new hotel intends to use to achieve **high levels of sustainability** include:

- Sustainable Building Materials which in addition are environmentally friendly too, such as
    - Fermacell - which has 94% recycled content and is 100% recyclable, unlike standard plasterboard which has nominal recycled content and is non-recyclable
    - Precast concrete – the cross-wall structural design permits use of precast concrete insulated wall panels which deliver a complete energy-efficient monowall building envelope, including exterior membrane, moisture barrier, insulation and interior finish…and can include pre-fitted windows as well as pre-affixed exterior cladding (which in our case will be the existing dressed stone). Precast slabs will also be used for the floor (subject to design constraints). Environmentally friendly concrete (ecocrete) contains a minimum of 80% recycled content. As well as guaranteed quality control, precast concrete offers reduced on-site activity (speedier construction and elimination of wet trades) and energy efficiency compared to other materials given its high thermal mass, which stabilises internal building temperatures (reducing heating/cooling needs)
- Thermal Efficiency – through exemplary levels of insulation (U value 0.1) and air tightness (1 m^3 / m^2 /h)
- Low Energy lighting usage throughout (eg LED lighting, intelligent building management systems)
- Innovative Solutions – the following are four examples

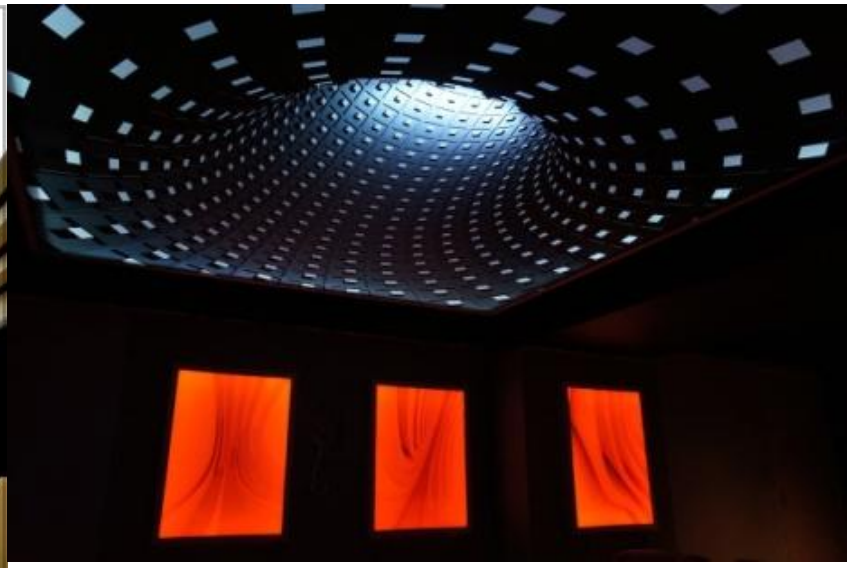
1. Moondraught Windcatcher

    Windcatcher units will directly capture air for servicing the fresh air ventilation requirement. Windcatchers are flat roof based units which channel a controllable quantity of fresh air into a vertical duct regardless of wind direction and without mechanical assistance (passively) and hence provide zero-energy natural ventilation.

    Internal fans then force the air downwards through the vertical duct which runs to the lowest floor. At each level the air is drawn into horizontal ducts serving each floor. The outer louvres are static but a second internal set can be raised or lowered to regulate air flow in accordance with the requirements of the Building Management System or fully closed to prevent weather ingress during exceptional conditions.

2. Stretch Ceilings

Are a form of suspended ceiling comprised of a membrane that is literally stretched (at 35° C) and fitted to wall guides below the structural (concrete) ceiling providing a perfect finish whilst eliminating wet trades. Stretch ceilings are fully recyclable, washable, non toxic and anti-static (so do not attract dust). Furthermore they don't crack or require painting and provide acoustic benefits by absorbing echo and high frequency reverberation. More exciting are the design options which allow 3D effects, all manner of diffused back lighting options and pre printed design



3. Water Mist Fire Protection

Traditional fire sprinklers risk water damage, which may even occur during false activation, and has the potential to extend well beyond the fire zone, especially if sprinkler activation occurs on upper floors.

Water mist systems all but eliminate the water damage issue and extend fire extinguishing capabilities beyond the immediate area which sprinklers are limited to. Upon activation, a water mist fire protection system discharges a fine spray of small water droplets which reduce the dangerous levels of toxic gas and temperature from the fire, displace oxygen and dilute fuel vapour, resulting in fire suppression or extinguishment. Water mist systems require 5-10% of the water of a sprinkler system and thus minimise consequential water damage and runoff.

More importantly, in enclosed areas, mist systems *improve* human survivability, increasing time to incapacitation by a factor of 6 and prevent fatal conditions. Environmentally they can be serviced by greywater, eliminate the need for wet or chemical based extinguishers, and in comparison, can be reused ad infinitum without refilling/replacement

4. Hi-Velocity Draught-Free HVAC (Heating, Ventilation & Air Conditioning)

The biggest complaints made against traditional HVAC systems are draughts, hot & cold spots, uneven room temperatures and the length of time taken to warm a room. These are simply an inevitable side effect of their methodology which generally features a ceiling mounted unit (cassette/cartridge) blowing warm air downwards.

Depending on how cold it is, those underneath may well feel a draught as the warm air loses heat by the time it makes contact with their skin. Even if the air remains warm enough, those not underneath may still feel cold as the warm air doesn't spread out sideways, but naturally rises above the cold air (stratification), leading to warm nose/cold toes syndrome. Even if the air is sufficient to warm those underneath, the sensation of having warm air blowing on you is not one many people enjoy, plus any such benefit relies on permanent operation of the ceiling unit.

Hi Velocity's small duct system eliminates all of these by using the laws of physics, de-stratification and a unique air movement pattern to provide superior indoor air quality. The effect is to provide heating that is draught-free, warms the entire room evenly and is massively responsive, so a room can be heated within a minute. The principles and benefits of Hi-Velocity's system are best appreciated visually – the following clip shows a room warmed within 40 seconds; the first part focuses on the vent expelling warm air whilst the later section shows the effect on the entire room .

https://www.youtube.com/watch?v=yqqfJYja2og

Note, that the warm air from the ceiling vent is not being mechanically blown, but is accelerating as a result of being forced through a narrower room duct, resulting in a pressure reduction and increased velocity – this principle is known as the Venturi effect. The importance of the pressure drop is the differential created - the cooler room air is now at a higher pressure and automatically drawn towards the lower pressure warm air entering the room, creating natural circulation - this is Bernoulli's Theorem in action.

Bernoulli's Theorem and the Venturi Effect prevent the warm air becoming trapped at ceiling level (de-stratification) and ensure the entire room is heated evenly from floor-ceiling and wall-wall, which is both increases energy efficiency and guest comfort (these air movements are imperceptible and undetectable to human skin).

Furthermore, the warm air supplied will be fresh-air (not recycled), which has been preheated by extracting 80% of the heat from the expelled air, thereby requiring only a nominal heat rise before entering the room . Before doing so, it will be HEPS purified to remove allergens, exhaust fumes and airborne disease-causing microscopic particles.

ECOLOGICAL ENHANCEMENTS

1 Wild Bee Green Roof Meadow

A 500 m² biodiverse meadow will be planted on the flat roof part of the new building, specifically designed to create a 'habitat analogue' capable of supporting and (hopefully) enhancing the local wild bee (and larger pollinator) population as well as providing research opportunities. The chosen habitat is C*alcareous Grassland*.

Calcareous grassland, is widely considered to be one of the most species-rich and important habitats for conservation of wild bees in Europe. It is identified as a (conservation) Priority Habitat in the UK Biodiversity Action Plan (UK BAP) as well in the local Peak District BAP. Derbyshire, it is estimated, lost between 80 - 91% of its species-rich grasslands from 1984 to 1999.

The planting regime will be developed in consultancy with Pictorial Meadows who have indicated a willingness to assist in with the seed mix. Pictorial Meadows are part owned by the University of Sheffield, directly benefiting from research undertaken by the University's Landscape Dept and by The Green Roof Research Centre (based at the University) which is the leading UK centre for green roof studies.

Pictorial Meadows was founded by Nigel Dunnett - the UK's ecological expert on pictorial meadows and green roofs, Professor of Planting, Design and Vegetation Technology at Sheffield University and a Director of The Green Roof Centre.

Pictorial Meadows were responsible for the acclaimed gardens and meadows at the Olympic Park, London where Professor Dunnett was chief designer and horticultural consultant *(for more information see the **Green Roof Wild Bee Meadow** commissioned report).*

Wild flowers in calcareous grassland - Miller's Dale Quarry, Derbyshire

Wild bees should not be confused with honeybees given the latter's recent high media profile regarding population decline and publicity for roof top domestic honeybee keeping. Despite both bee types being equally threatened, wild bees are more effective pollinators, forage at much reduced distances to honey bees, thus making more use of local pollen sources, rather than heading for the nearest oil seed rape field 2 miles away - plus wild bees do not sting. Their value is now being more widely recognised (http://www.theguardian.com/environment/2013/feb/28/wild-bees-pollinators-crop-yields).

The largest ever international survey of insect pollinators undertaken (a three-year study published, June 2015) reported that wild bees have become as important as domesticated honeybees in pollinating food crops around the world due to the dramatic decline in number of healthy honeybee colonies over the past half century.

Amazingly the survey found that just 2 per cent of wild bee species now account for 80 per cent of global crop pollination.

The scientists warned that relying on the free services of a small number of wild bee species threatens the future security of food production. The Centre for Agri-Environmental Research at Reading University commented: "At one time, honeybees were enough to pollinate most of Britain's crops. Now there are only enough to pollinate around a quarter of them. If we didn't have other species of bees to turn to, we would already be facing a food security catastrophe."

As well as nectar provision, our roof meadow will provide nesting sites for solitary wild bees, even their own roof top hotel… the second option below allows observation of the bees from the inside seated area through some of the open honeycomb panels.

The potential exists for commercial rearing of wild bees - compared to honeybees, they are less-labour intensive and many more can be accommodated in a similar area. Additionally, there are established sampling methods, using solitary bees as bio-indicators, for monitoring habitat quality and diversity (of say ecological enhancement schemes or for comparing green roof planting designs) - providing both valuable and rare research opportunities.

2 Replacement Trees & Hedgerows

The existing onsite trees will be removed to enable the basement part of the development.

These trees were subject to a professional survey which found (with one exception) all to be individually of only low amenity (category C) value as per BS: 5837.

The most visually significant of the current trees are the group of five limes bordering St Johns Road - these will be replaced with Category A fastigiate trees. The new tress will be of greater amenity value than the present limes and improve the current street scene too.

Furthermore, the fastigiate trees trees will have greater biodiversity value by way of featuring specimens that are highly regarded in respect of their all year round Wild Pollinator/Nectar provision.

This approach will be extended to include the hedgerow, which the Ecological Asst presently regards as species poor and of no ecological value *(for more information see the commissioned report –Replacement Planting).*

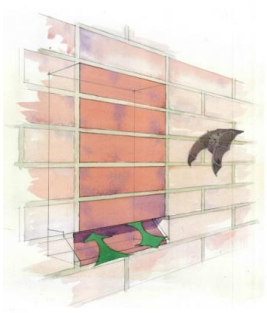
3 Bat Provision & Monitoring

Roosting space for bats will be provided through the installation of Ecosurv Habibat Bat boxes.

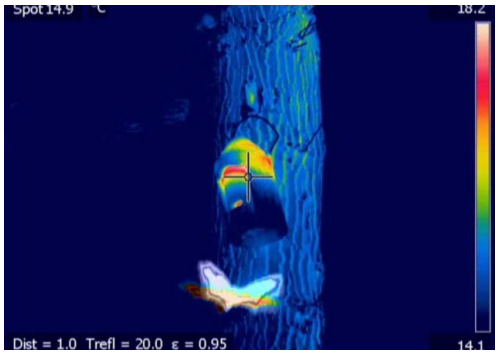
Habibat is an integrated, bespoke, unobtrusive and aesthetically pleasing bat box with an internal roost space which is expandable as Habibats can be joined side by side to increase this. They are incorporated into the fabric of a structure as it is built and faced to match the external finish of the building (existing stone).

Habibat is a unique partnership between the Bat Conservation Trust, Ecosurv and purchasers; a portion of the profits from each Habibat sold will be reinvested into the Habibat scheme to improve accommodation for bats through design refinement based on reported monitoring of their use. Ecosurv have expressed a willingness to work with us *post planning* to maximise the value of site for both bats and monitoring.

Monitoring is normally reliant on night time observation by volunteers. Assuming collaborative research partners are found, we would consider automating the process through the use of mounted thermal imaging cameras, thus guaranteeing a record of **all** night time activity relating to the Habitat boxes.



Typical Habibat Bat Box

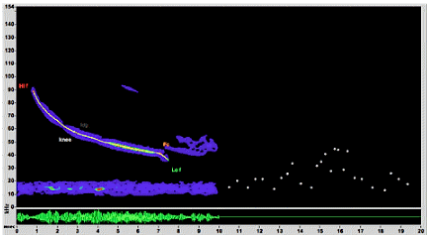


Thermal imaging camera recording of bat activity

Stone finish Habitat Bat Box

Broadening the scope of monitoring to record bat activity over the green roof is a natural extension of the above. The potential for green roofs to provide habitat for bats was noted by Natural England in 2003 and expanded on by the Bat Conservation Trust (BCT, 2012). Further investigations have been limited to only a few studies (Pearce and Walters, 2012). These studies concur that if implemented and managed correctly, green roofs can provide foraging habitat for bats. However more data is needed in order to inform evidence based urban conservation policy and implication. Therefore, the gap is clear for continued research into this area of urban biodiversity.

Monitoring green roof activity involves the real time bio-acoustic recording of bat calls via a full-spectrum ultrasound recorder. This could be permanently mounted on the green roof or located in the building if connected to an external microphone. Recordings are saved to SD card without gaps as a triggering system allows the device to automatically start recording when a sound is detected or falls within chosen frequencies. GPS, time/date/temp stamps can be added to each recording.



MARKETING BENEFITS OF SUSTAINABILITY

"*sustainability will become a defining issue for the industry in 2015 and beyond*" (**Deloitte** *Hospitality: 2015*)

More than 80% of travellers want their hotels to have environmentally-friendly practices, according to a survey of customers and businesses by TripAdvisor who launched their "Green Leader" programme (which gives hotels and BBs a green rating) in the USA in April 2013.

Since then a new TripAdvisor survey revealed that more than a quarter (26%) of European travellers actively made eco-friendly travel choices in the last 12 months, and a third (33%) plan to do so in the next 12 months. The survey also revealed that nearly one in ten European travellers (9%) say they have chosen to stay at a particular hotel because of their green policies. However, nearly half (44%) say they feel that hotels don't currently provide enough information about their sustainability practices – which has led to TripAdvisor extending the scheme to Europe in July 2014.

Gaining one of the four levels of accreditation (Bronze, Silver, Gold or Platinum) gives an opportunity for a hotel to showcase their green practices to millions of people as well as providing an instantly recognisable green ranking.

A number of globally recognised certifications exist, including the UK based Green Tourism Business Scheme (GTBS), the largest sustainable national grading programme in the world.

Travelocity.com confirms that green hotels get higher reviews and bookings than non-green hotels on their website. The site operates on a smiley face ranking system and almost all of their eco-friendly accommodations get an average of three smiley faces or more, compared to 83 percent of standard hotel listings. Furthermore, the hotels that are officially "green certified" receive the highest reviews and ratings.

Clearly an eco certified hotel is likely to have greater appeal to a significant number of potential bookers, in comparison to a non certified competitor with similar facilities/pricing, especially in Buxton, given the absence of any eco hotels and the unlikelihood of meaningful new development of such eco-properties.

To date going green hasn't generally resulted in improvements to the guest experience (other than to their conscience) but the new hotel will showcase the extent to which green practices, when allied with features that enhance well-being, result in levels of comfort well beyond the current norm, and achieved sustainably.