

# GREEN ROOF STUDY

PARTNERS IN PLANNING 2020

COLLECTIVE ARCHITECTURE



# COLLECTIVE ARCHITECTURE



# OVERVIEW

**Client:** City of Edinburgh Council

**Location:** Edinburgh

**Stage of the Project:** Planning  
(AMSC - Masterplan)

**Number of units proposed:** 596

**Tenure:** Mix under review but at  
least 25% affordable housing





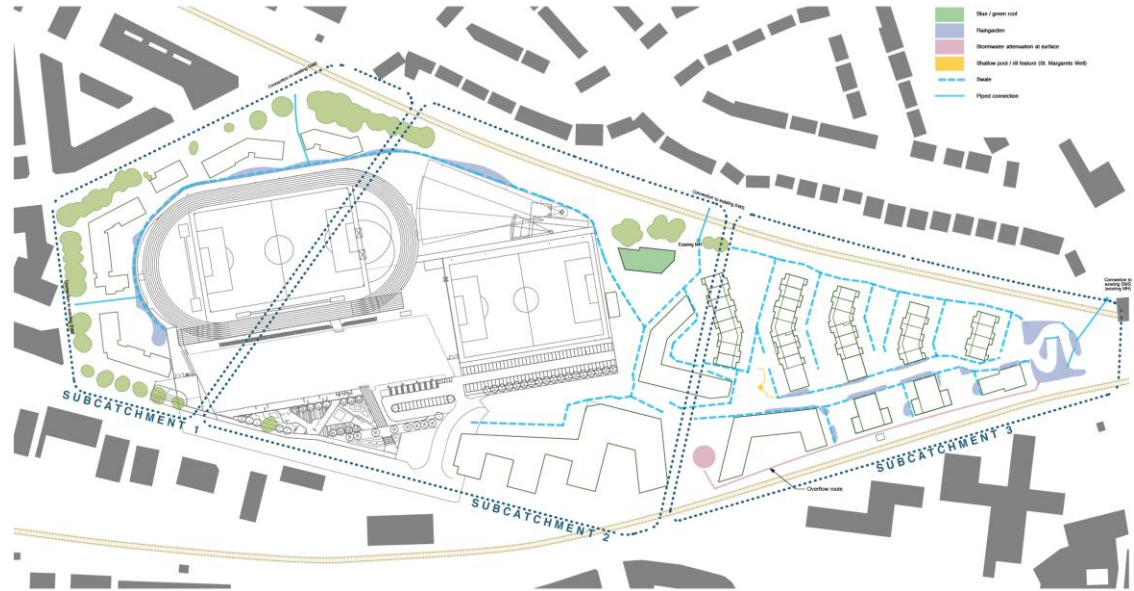
# The Proposal



- A mix of housing typologies
- Pedestrian Priority Development
- Protection of existing rare trees
- Community and commercial space (potential for a GP surgery and Nursery)
- Minimum parking to help Edinburgh meet its Net Zero Carbon Target

# SuDs APPROACH

- Currently NO Green Roofs on residential buildings.
- Integrated SuDs approach using swales and small rain gardens to treat water run off at source.





# “Are Green roofs viable in Scotland?”

## ENVIRONMENTAL AIMS

- Explore zero - discharge
- Explore benefits to ecology and wildlife.
- Exploring carbon negative substrates (hay, biochar and others)

## SOCIAL AIMS

- Health and Well-being:
  - links to horticultural therapy
  - outdoor play and learning
  - urban growing
- Education/ Community Uses
- Public vs Private Space






## ECONOMIC AIMS

- Demonstrate the business case for green roofs
- Review market products
- Explore life cycle costs
- Explore renewable options including use of solar panels.

# ROOF TYPES











EXTENSIVE

-  Substrate depth: 60-80mm
-  Saturation weight: 90-120 kg/m2
-  Low Maintenance
-  Low Cost
-  No irrigation














SEMI-INTENSIVE

-  Substrate depth: 120-250mm
-  Saturation weight: 120-300 kg/m2
-   Periodic Maintenance
-   Medium Cost
-   Some irrigation may be required



INTENSIVE

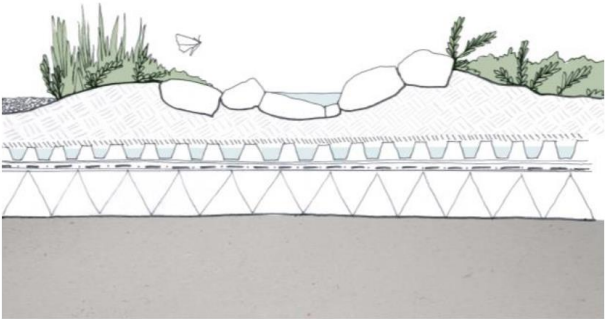
-  Substrate depth: 200-+1000mm
-  Saturation weight: 150-500 kg/m2
-    Higher Maintenance
-    Higher Cost
-    Some irrigation may be required



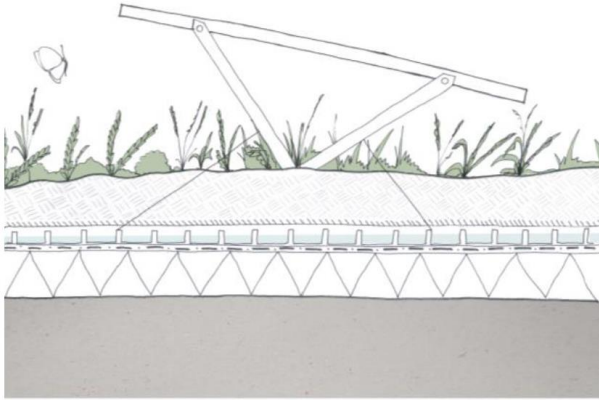
# ROOF TYPES



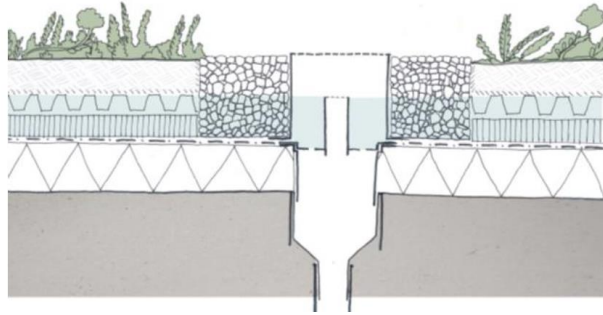
EXTENSIVE WILDFLOWER  
BIODIVERSE



SOLAR GREEN/ BIOSOLAR

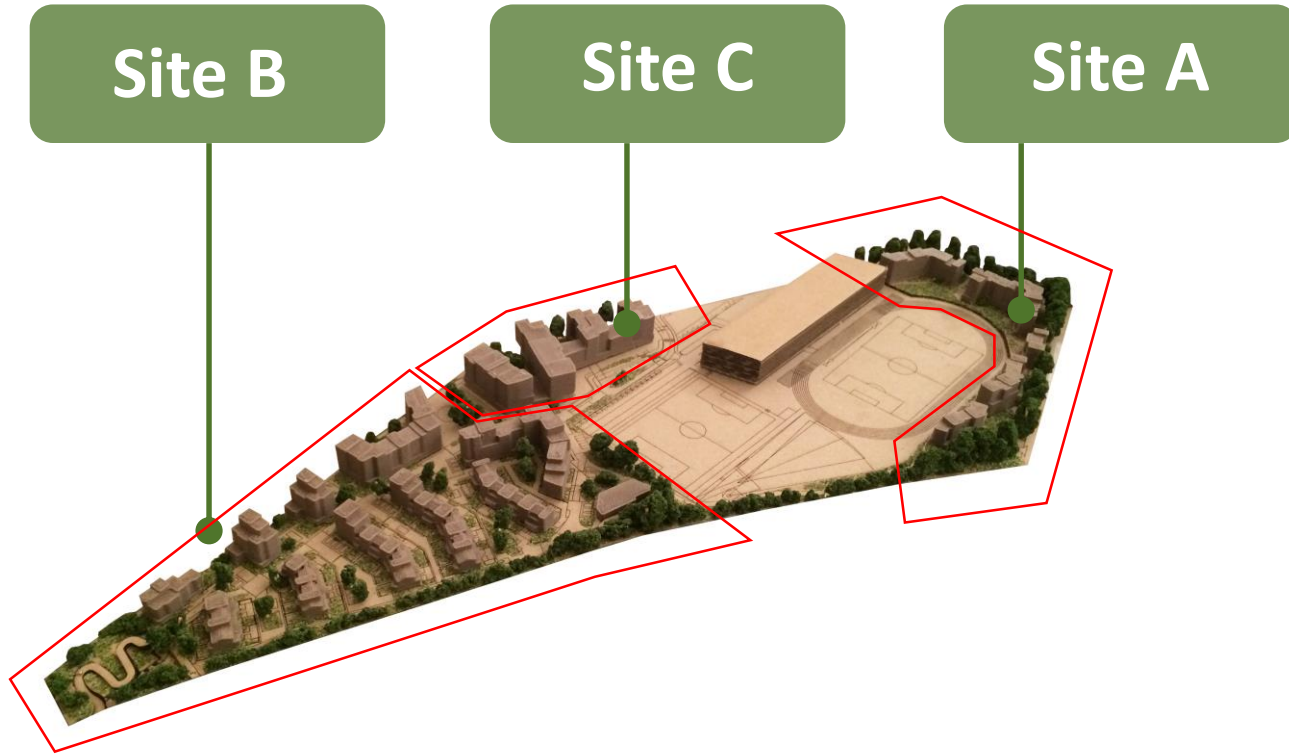


BLUE ROOF

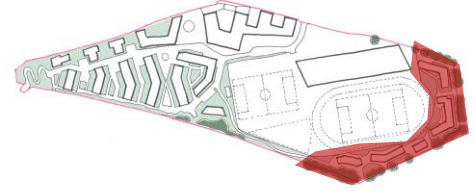




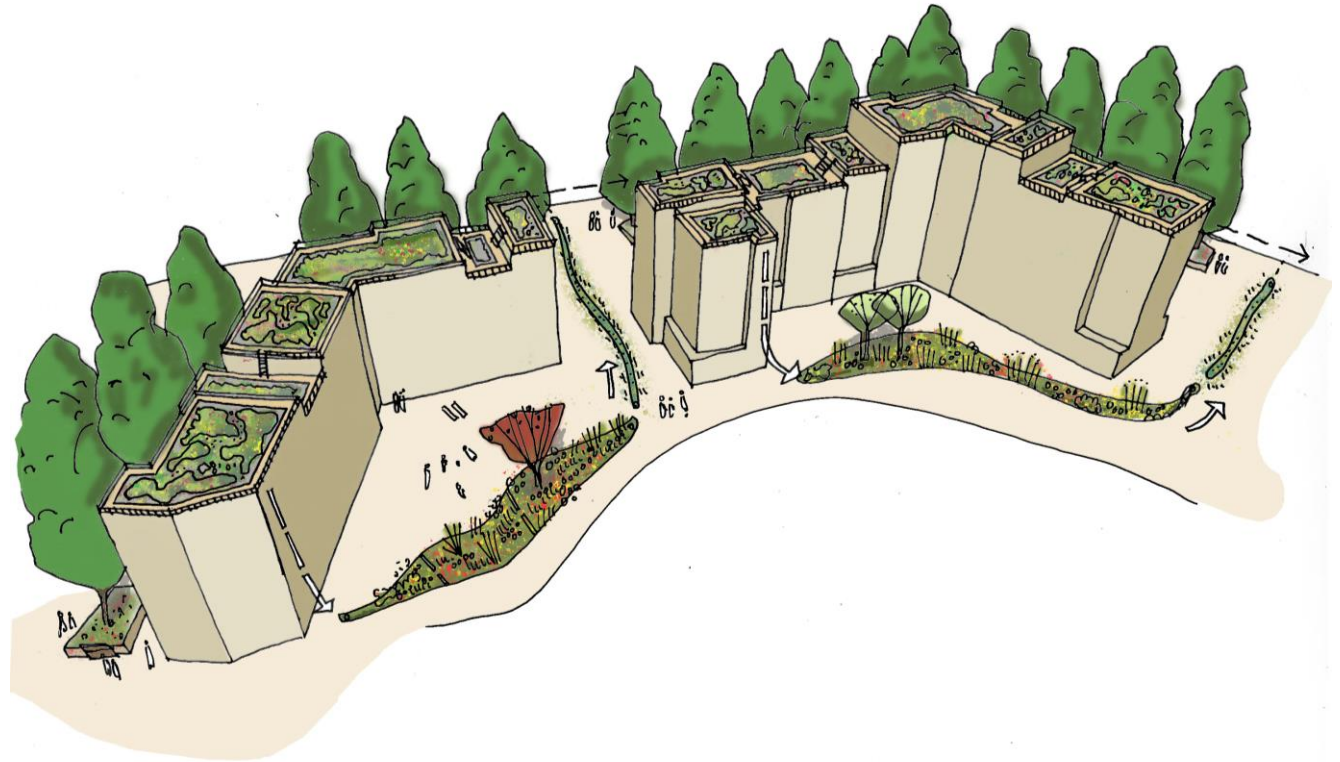
# PROPOSAL: PLACE BASED APPROACH



## SITE A

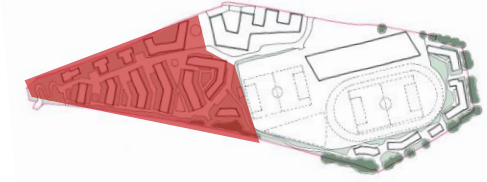


- Extensive Biodiverse Blue roofs with raingardens and swales at ground level



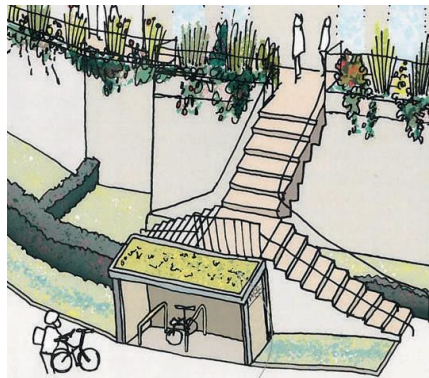


## SITE B



A variety of roof types:

- Intensive roofs with raised planters
- Extensive Biodiverse to roof tops and stores at ground level connecting to swales

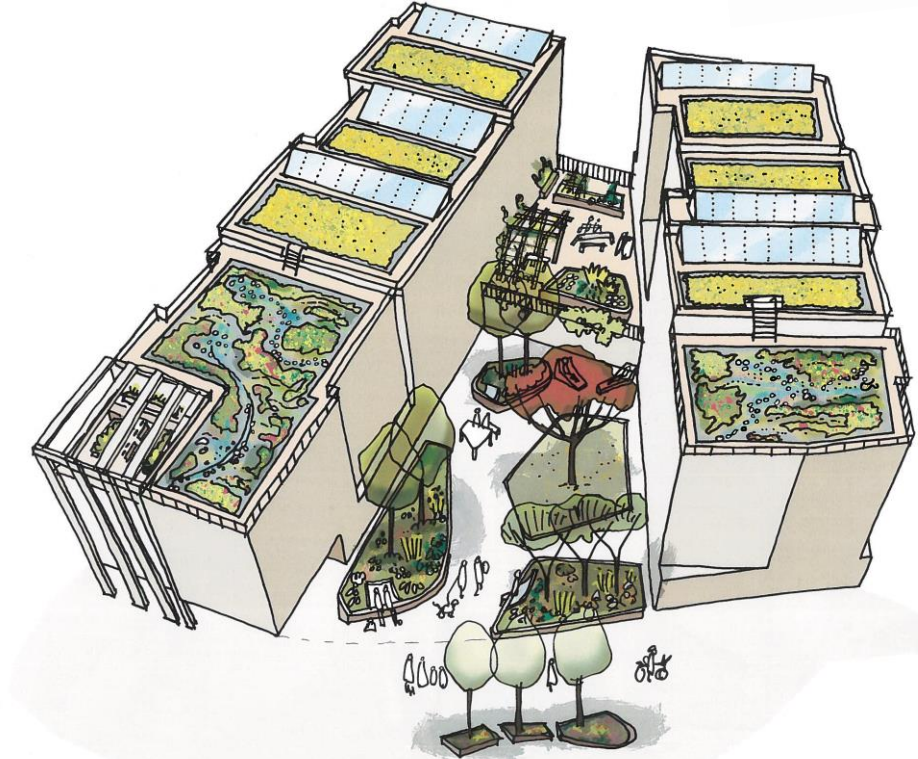


## SITE C



A variety of roof types:

- Extensive podium decks with raised planters at ground level
- A combination of Biosolar, biodiverse and semi-intensive resident terraces at roof level





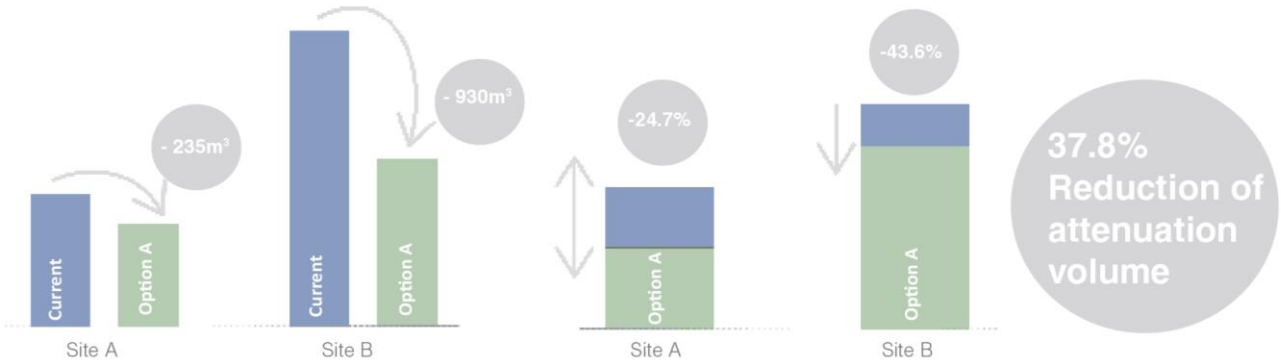
# DRAINAGE

Working to greenfield run-off rate and attenuated for up to 200 year storm + 40% climate change allowance.

## Green Roof Impact:

- Reduction in attenuation volumes required and tank sizes by 37.8%.
- Removal of SuDs treatment required for traditional roof.
- Potentially decreasing underground pipework and clashes
- Reducing interference with contaminated land and remediation works

CURRENT SCHEME		OPTION A		
Site	Traditional Roof + Hardstanding Areas Attenuation Volume (m³)	Green Roof + Hardstanding Areas Attenuation Volume (m³)	Reduction (m³)	% Difference
A	950	715	235	24.7
B and C	2,130	1,200	930	43.6
Total	3,080	1,915	1,165	37.8

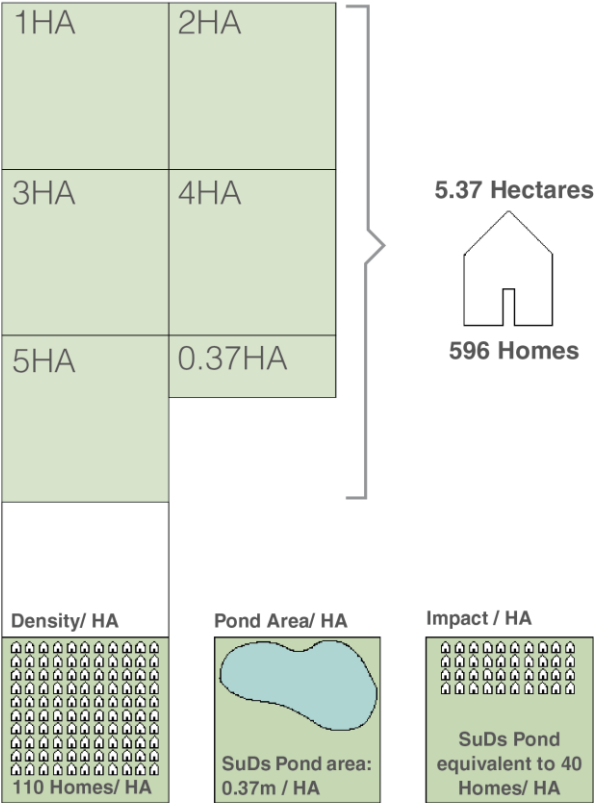


# SUDS POND AREA ANALYSIS

SuD's pond area: 0.36ha  
Density per hectare: 110 homes

**Impact of SuDs pond:**

Approx. unit loss per hectare: **40 units**

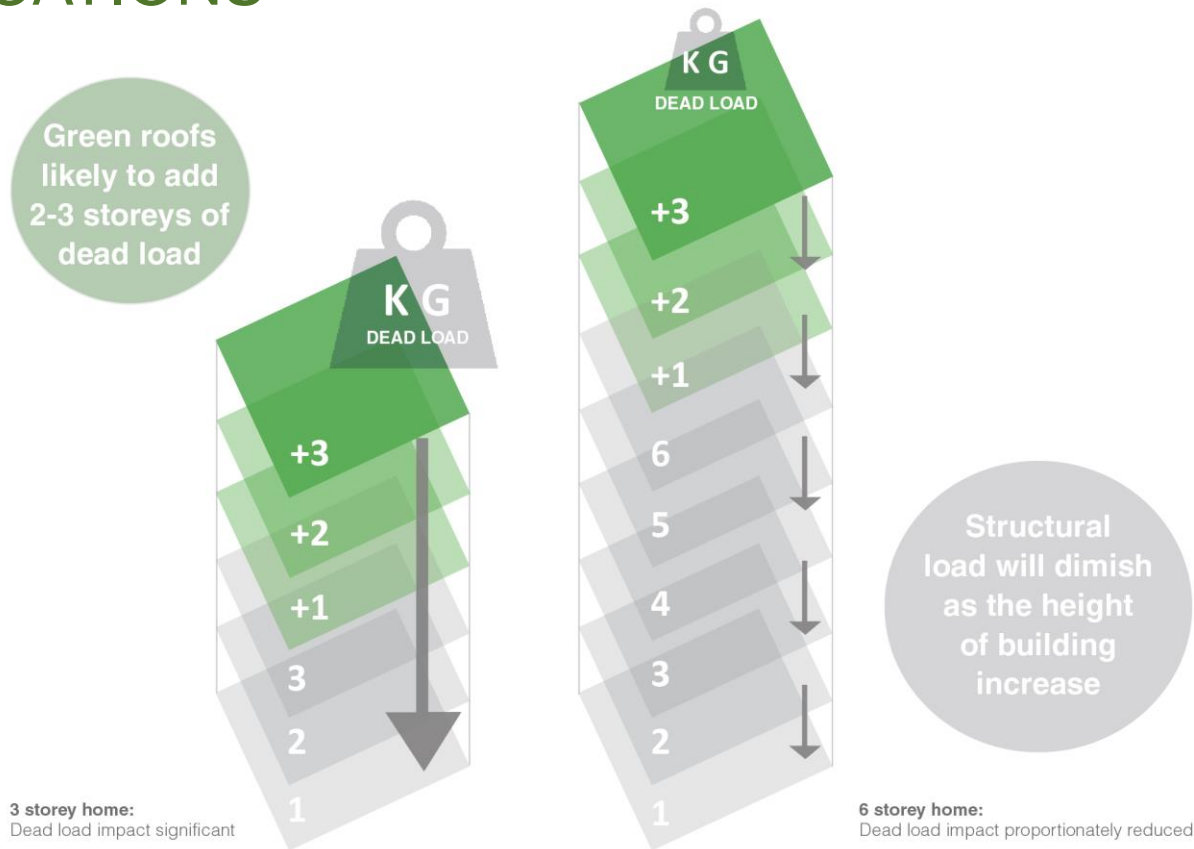




# STRUCTURAL IMPLICATIONS

## Green Roof Impact:

- Typical cost increase as dead loads rise.
- However, proportionally the structural load diminishes as building height increases
- May impact on method of construction
- Therefore, not so cost effective for buildings less than 3 storeys



# COST IMPLICATIONS & VALUE

## Green Roof Impact:

- **Increase in roofing costs by 6.61 %**
- **However, minimal uplift in % of Construction Cost: 0.23% increase**
- **Net Present Value positive**

## Value:

Value is not just a monetary  
Measurement:

$\text{£}209.035 / 596 \text{ homes} = \text{£}350.72$

## Life Cycle Costs:

- Net Present Value: +145,609.84 (Based on a 3.5% discount rate)
- Initial Rate of Return: 7.06%
- Payback Period: Estimated to be 6-20 years
- Gross Rate of Return: £450,607



## WIDER BENEFITS

- **Health and Well being**  
Creating links to GP surgery  
Horticultural Therapy  
Increasing green space
- **Community**  
Urban Growing  
Visual Amenity
- **Wildlife**  
Creation of Habitats  
Supporting endangered native  
Northern Brown Argus Butterfly

Difficult to put a price on these...





# CLIMATE CHANGE

- **In the UK Buildings are responsible for 44% of CO2 emissions**
- **26% comes from housing**

## How can Green roofs help?

- **Cooling buildings =**
  - reduced cooling loads
  - reduced energy consumption
  - reduced energy costs
  - reduced CO2 levels
- **Cooling the air =**
  - reduced heat island effects
- **Increasing greenery =**
  - improved air quality
- **Stormwater management**

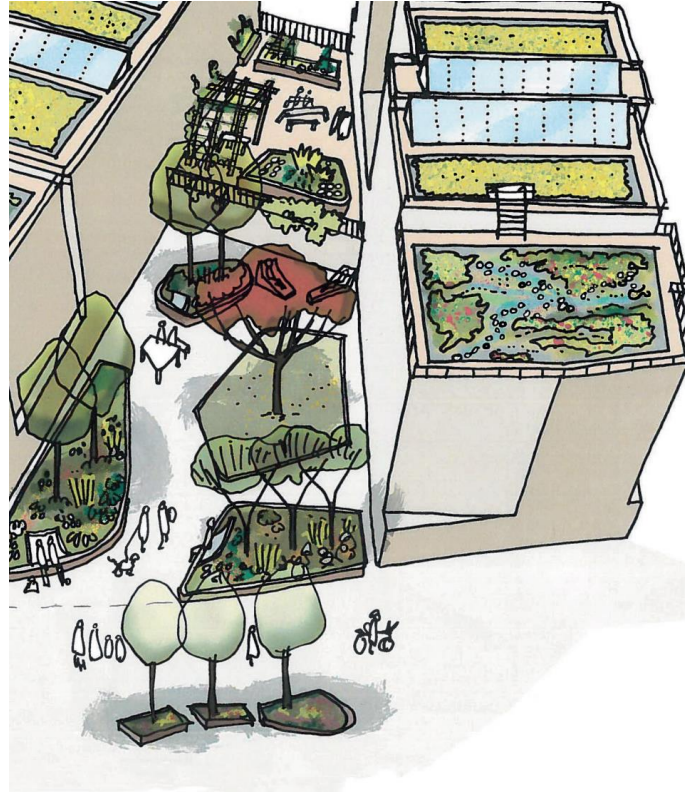


# CONCLUSION

Are green roofs viable in Scotland?

YES...

- Small uplift in roofing cost, but minimal % uplift on construction cost
- Net Present Value is positive
- Payback in 6-20 years
- Significant reduction of attenuation volume resulting in below ground infrastructure cost savings
- Not as economical on structures below 3 stories but can be strategically located to maximize wider benefits: social, ecological, environmental and wellbeing



MEADOWBANK DEVELOPMENT  
GREEN ROOF  
OPTIONS APPRAISAL  
APRIL 2020

COLLECTIVEARCHITECTURE

<https://www.nature.scot/sites/default/files/2020-05/Meadowbank%20Development%20Green%20Roof%20Options%20Appraisal>