

Climate Resilience - Supplementary Planning Document (SPD)

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Contents

<u>1. INTRODUCTION</u>	4
• <u>Who is this SPD for?</u>	4
• <u>Why has this SPD been created now?</u>	4
• <u>Declaration of climate emergency</u>	4
• <u>How will this SPD help us?</u>	5
<u>Background</u>	6
• <u>Existing local policy, regional policy</u>	6
• <u>Greenwich context</u>	7
<u>How to use this SPD</u>	8
• <u>Key concepts to clarify</u>	8
• <u>Key messages</u>	12
<u>2. GREENING the GREY – Urban planting, biodiversity & air quality</u>	14
<u>Introduction</u>	14
<u>a. Biodiversity loss & climate change</u>	16
• <u>Why do we need biodiversity?</u>	16
• <u>Biodiversity in Royal Greenwich incl. SINCS</u>	18
• <u>Common reasons for loss of urban planting and biodiversity?</u>	21
• <u>What can you do to improve biodiversity?</u>	22
• <u>More about urban planting</u>	24
• <u>Living/green roofs & vertical planting or green walls</u>	25
• <u>Biophilic design</u>	27
<u>b. Natural drainage for climate resilience</u>	28
• <u>Permeable hard surfacing</u>	29
• <u>Sustainable Urban Drainage Systems (SuDs): blue-green roofs; rain gardens; Swales</u>	30
<u>c. Temperature control, air quality & climate resilience</u>	36
• <u>Temperature control through urban planting</u>	36
• <u>Air pollution & urban planting</u>	37
<u>d. Community cohesion, nature, local economy, & climate resilience</u>	46
• <u>Food growing</u>	47
• <u>Local economy & landscaping</u>	48

<u>Summary of interventions for climate resilience for existing and new developments</u>	51
<u>3. ENERGY EFFICIENCY for existing buildings and new developments</u>	52
<u>Introduction</u>	52
<u>Existing buildings - whole building approach, refurbishment first, retrofit second</u>	54
• <u>Refurbishment to improve effectiveness</u>	57
• <u>Roof insulation</u>	57
• <u>Wall insulation</u>	57
• <u>Windows – double/triple & secondary glazing</u>	58
• <u>Shading for cooling</u>	59
• <u>Listed buildings</u>	60
<u>Retrofitting a new energy system</u>	64
• <u>Solar/photovoltaic panels</u>	64
• <u>Solar thermal</u>	66
• <u>Air source heat pumps (ASHP)</u>	67
• <u>Ground source heat pumps (GSHP)</u>	69
• <u>Other low carbon energy sources</u>	69
<u>New build schemes - whole site approach</u>	70
• <u>Major schemes</u>	76
• <u>Non-major schemes</u>	77
• <u>District Heat Network connections</u>	78
<u>4. TRANSFORMATIVE ADAPTATION - extensions & improvements to homes and other buildings</u>	84
• <u>Consider materials</u>	88
• <u>Additions to improve climate resilience</u>	90
<u>5. GLOSSARY</u>	94

1. Introduction

1.1 This Supplementary Planning Document (SPD) has been created as an interim guidance to support the Royal Borough of Greenwich's Local Plan (2014). It is intended that this document be updated once a new Local Plan is adopted. An SPD is a formal document and of material consideration for decision-making where the development requires planning permission.

Who is this SPD for?

1.2 We have created the SPD for the benefit of our residents, businesses, and developers of existing buildings and of new build schemes in the Royal Borough. It aims to include everyone with an interest in Royal Greenwich.

Why has this SPD been created now?

1.3 Global overheating has resulted in climate change and is one of the biggest dangers that London faces. Its impact to our health, infrastructure and economy cannot be ignored as already experienced with the 2021 flash floods, the 40-degree heatwave in 2022 and more recently flooding in September 2024. Mitigation alone to prevent the impacts of climate change is no longer an option because global temperatures have continued to rise; the 1.5°C threshold established through the Paris Agreement in 2015 which the UK signed up to is now considered to have been exceeded. As such, with greenhouse gas emissions continuing to increase we need to make faster progress towards climate resilience through transformative adaptations that offer immediate and localised co-benefits.

1.4 Royal Greenwich declared a Climate Emergency in 2019 and subsequently published the Carbon Neutral Plan (2021) which set out ambitious targets to achieve net zero carbon emissions by 2030. The SPD seeks to support the up-scale of the Royal Borough's ongoing transition to a low-carbon future, where practical; and with the recommendations set out in the London Climate Resilience Review (2024).

1 - See glossary

2 - [Landscape Architecture Foundation](#), fast fact library



We need to stop greenhouse gas emissions from rising and curb further human-triggered increases to the global temperature.

1.5 As well as rapidly reducing carbon emissions, we must tackle the extreme weather events that are predicted to become more frequent. We can do this by re-building our ecological wealth as a transformative adaptation measure that will future proof our built environment and ecosystems. This will bring safety through community and will be one of our strongest foundations for resilience.

How will this SPD help us?

1.6 Global warming has reached a point where unpredictable extreme weather events can no longer be prevented; but the impacts of which could be made less worse by transformative adaptation measures to our homes, built environment and behaviours. The SPD presents a holistic and accessible approach to development in the Royal Borough and aims to encourage a creative route to future-proofing Royal Greenwich, with ideas and practical measures to make our built environment more resilient to weather extremes and reduce carbon emissions.

1.7 The main transformative adaptation discussed in this SPD is urban greening. This is because it has multiple benefits and is an accessible and tangible intervention that can be implemented and improved across the whole Royal Borough. For climate change, urban planting can reduce greenhouse gas emissions (sequester carbon) as well as guard against the impacts of extreme weather events. With an ability to naturally reduce heat risk, prevent drought, prevent surface water flooding and improve local biodiversity, it has an ecological wealth that should not be overlooked. As such, urban greening is our superpower for climate resilience and will support the re-building of a greener Greenwich overall.

1.8 The SPD will also explain how our reliance on fossil fuel-based energy systems for power and transport can be phased out to further reduce the carbon emissions that contribute to global overheating and climate change. Moreover, through a reduction of fossil fuel usage, there will be a much needed decrease in air pollution. This means better health outcomes for us (C40 Cities).

1.9 If we can undertake the suggested interventions and positive behaviours towards our built environment, we can initiate an adaptive transformation to climate resilience and become better ancestors to our future generations.

Background

Planning Policy context

1.10 This SPD sits within a wider suite of policies, strategies and action plans to address local, national and global environmental issues and as such is grounded in the NPPF (2024), the Climate Change Act (2008), the Environmental Improvement Plan (2023) and the London Plan (2021). Until a new local plan for Royal Greenwich has been adopted, the following local planning policies will still be used to determine development proposals, albeit they may be superseded by the latest national or regional policies, where relevant:

- Policy DH(a) Residential Extensions
- Policy DH(h) Conservation Areas i) Character and Setting
- Policy OS4 Biodiversity
- Policy OS(e) Wildlife Deficiency Areas
- Policy OS(g) Green and River Corridors
- Policy E1 Carbon Emissions
- Policy E2 Flood Risk
- Policy E3 Residual Flood Risk
- Policy E(a) Pollution (from construction and uses)
- Policy E(c) Air Pollution
- Policy E(f) Living Roofs and Walls

1.11 The Council’s planning team can provide more information about local policies relevant to your development through our pre-application advice service: [Duty Planner and pre-application service | Planning pre-application advice | Royal Borough of Greenwich](#).

The Royal Greenwich context

1.12 The Council has adopted a new Corporate Plan with a vision to address the future direction of growth for the borough, Our Greenwich (2024).

1.13 In relation to planning, Our Greenwich seeks to address the challenge of climate change to ensure its residents, visitors and businesses thrive in an environmentally sustainable way.

Towards climate resilience

1.14 Much of the focus for planning policy has been on reducing the carbon emissions from buildings by moving away from the use of fossil fuels as the main energy source; and to re-use, recycle and re-purpose construction materials for the circular economy as well as provide nature-based solutions to prevent surface water flooding. These policies have largely been related new build major developments.

1.15 For the Royal Borough, we now need greater focus on improving climate resilience to existing buildings through refurbishing and retrofitting.



How to use this SPD

1.16 The primary focus of this SPD is Urban Greening and a nature first approach because it has the most transformative adaptation measures towards climate resilience. Urban greening is also the most accessible intervention towards climate resilience and can capture multiple benefits. It can also be undertaken within the curtilage of a building without the need for planning permission for most business and homeowners.

Key concepts

1.17 The topic of climate change and how it feeds into our lives is often complicated with phrases and terminology that bear no tangible relationship to our everyday routines. To better explain how we would want to see interventions incorporated into all types of development, we have set out the following most common key concepts to make it easier to understand climate resilience and future proofing. There is also a glossary where many terms related to climate resilience can be found.

Climate change & the weather

1.18 Climate change refers to long-term shifts in temperatures and weather patterns. Human activities have been the main driver of climate change, primarily due to the release of



greenhouse gases (GHG) from the burning of fossil fuels like coal, oil and gas. The GHGs are measured as carbon emissions; the most prevalent of which is carbon dioxide (CO₂).

1.19 Overwhelming evidence indicates that the continued release of GHGs into the atmosphere will make worse the significant changes to the weather we are already experiencing. These include heavy rainfall that creates excessive surface water flooding; extreme heat and extreme cold spells which create unpleasant living conditions with excessive fuel bills.

As such, by reducing carbon emissions from buildings and traffic we can future proof our lives to experience better health, better financial security, and an overall better quality of life. This would also align with the Royal Borough's carbon neutral plan which has identified buildings and vehicles as some of our biggest emitters.

Carbon Neutral & Net Zero Carbon

1.20 Carbon neutral and net zero are similar in principle in that they both seek to remove carbon emissions from the atmosphere to tackle climate change. With carbon neutral, it means taking steps to remove the equivalent amount of carbon dioxide (CO₂) to what's emitted through activities across the construction and lifetime of a building, by investing in carbon sinks or design interventions to off-set CO₂ emissions. Whereas net-zero seeks to abate all greenhouse gases being emitted into the atmosphere, such as methane (CH₄), nitrous oxides (NO_x) and other hydrofluorocarbons; not just CO₂.

Whole life-cycle carbon (WLC) & circular economy

1.12 The whole life-cycle carbon (WLC) would be the quantity of all carbon emissions from a development, measured through the materials used, its construction processes, its operation post-construction, its maintenance and then demolition phases of a building. The carbon emissions are then expressed in two ways - embodied and operational

1.13 Circular economy refers to the production and use of goods. In relation to construction, it can involve the sharing, leasing, reuse, repair and recycling of existing materials or products for as long as possible, so that minimal waste goes to landfill. For example, the re-use of roof tiles for another roof or the re-purposing of them as borders for planting beds in a garden.

Embodied carbon & Operational carbon

1.14 These terms are used to describe how carbon is associated with a material or product:

- ‘Operational carbon’ means the quantity of carbon emitted by use of a fixed building service such as heating, hot water, cooling, ventilation or lighting and the unregulated emissions used for cooking.
- ‘Embodied carbon’ means the quantity of carbon emitted by a product through its manufacture and use over its lifetime. For example, compared to timber window frames, uPVC frames have a high embodied carbon because of the energy that is used in the extraction of petroleum, its manufacturing process into hard plastic and all the transportation costs from extraction to the construction site. Whereas the embodied carbon of timber framed windows has no energy intensive extraction processes and consumes less energy in the manufacturing process and the transportation cost could be local from a sustainable forest where trees are replanted.





1.15 There is an interaction between the two and we encourage you to reduce carbon emissions as much as possible through both embodied and operational methods. Reduction of operational and embodied carbon emissions as relayed through the London Energy Transformation Initiative (LETI).

Sponge City

1.16 This refers to the installation of additional green/planted areas and the replacement of concrete hardstanding with permeable surfaces in urban areas. For the Royal Borough, additional nature can be incorporated through the restoration of front gardens with trees and hedged boundaries; better planting and maintenance of street verges and installation of new ones in the form of Sustainable Urban Drainage Systems (SuDs). SuDs should also be designed into all new developments help to improve water quality, biodiversity and climate resilience.

KEY MESSAGES

- **Future proofing for a Greener Greenwich through transformative adaptations** – improve urban planting to reap co-benefits
- **Understand the value of planting for climate resilience and our well-being:** The need for biodiversity; encourage the re-greening of front and rear gardens of residential and commercial properties; more community food growing spaces; encourage the installation of green roofs, blue-green roofs and vertical planting to existing and new buildings. Create a sponge city.
- **Decrease our carbon emissions:** Encourage the refurbishment of buildings and installation of low carbon energy systems; provide and understanding of low embodied carbon for construction materials and the need to integrate climate resilient adaptations
 - existing buildings: Take a Whole Building Approach
 - new buildings: Take a Whole Site Approach

GOOD TO KNOW

- **Permitted Development rights** – These are alterations that can be undertaken at a property without the need to seek full planning permission as set out by the “Town and Country Planning (General Permitted Development etc.) (England) Order 2015 (as amended)”. In the case of this SPD under:
 - o **Schedule 2, Part 1** (development within the curtilage of a dwellinghouse), some extensions and other external additions within the curtilage of a house (NOT flats) can be undertaken.

- o **Schedule 2, Part 2** (minor operations) for any building type. Development works cover installation of electric vehicle charge points; a means of enclosure; and access to a highway
- o **Schedule 2, Part 14** (renewable technologies) all properties, including flats, can retrofit low carbon energy systems to their property, provided it is within specific parameters set by conditions in the legislation.
- o **If you require legal confirmation** that the planned works to your property do not require full planning permission, a **Lawful Development Certificate (LDC)**, can be submitted to the council.
- o **Further details can be found here:**
Permitted Development Rights - Planning Permission - Planning Portal
- o **If you require extra guidance**, you can email the duty planner: **dutyplanner@royalgreenwich.gov.uk**
- **Statutory listed buildings** - Planning permission is required for external and internal alterations to a listed building. The council does operate a pre-application service, as such you can email the Council for further advice. Heritage England provide guidance about Climate Resilience that will be useful: Energy Efficiency and Retrofit in Historic Buildings | Historic England
- **Building Regulations** – This covers the construction and extension of buildings. We request you check the ‘Approved Documents’ that would cover the type of development work you wish to undertake. These can be found at Approved Documents - Approved Documents - Planning Portal. You can also check with the Council’s Building Control team by emailing: **building.control@royalgreenwich.gov.uk**

2. Greening the grey – Urban planting, biodiversity & air quality

This chapter will advise on why we need more outdoor planting to help manage climate resilience. We need to:

- Understand **why we need nature and biodiversity** for climate resilience and the **multiple benefits** of urban planting
- **Decrease** areas of **non-porous hardstanding** and improve planted areas to prevent flash flooding, reduce heat risk and reduce poor air quality
- Understand the **environmental, economic and social benefits** of green-blue infrastructure

Introduction

2.1 The greenery or urban planting we see in London within gardens, parks and along highways and railways all contributes to the removal of carbon dioxide from our atmosphere. Urban planting is a natural carbon sink for fossil fuel emissions and air quality improvements. It is also an easy and achievable intervention towards long term climate resilience and biodiversity recovery.

2.2 Whilst infrastructure building is a necessity for population growth, there has been a piecemeal loss of garden planting, allotments, natural habitats and ecosystems across London which has contributed to the intensification of the urban heat island effect¹. This has left our city more susceptible to heat risk and flooding, because carbon sinks and urban greenery provide natural cooling for the city and absorb excess rainfall.

2.3 Trees, boundary hedges and other types of urban planting are a bonus intervention for climate resilience because it has multiple benefits². These include:

- **Biodiversity** – Planting supports insects that pollinate flowers and crops, and the breakdown of organic waste. The decline of insect species has led to the decline in birds, bats, fish and other animals that feed on insects and bring balance to the ecosystems which support human life



- **Natural drainage** – Absorbs excess rainfall and prevents flash flooding
- **Temperature regulation** – Keeps external temperatures cool; provides natural shade; can keep a building comfortable during warm and cold weather
- **Air quality** – Foliage is able to remove dangerous particulate matter from traffic pollution
- **Nature** – Quality of place with natural colours, sound and space for mental well-being and relaxation
- **Community cohesion** – through gardening and food growing schemes
- **Local economy** – Planting provides a softening and attractive framing to a building which can result in more business interest within the Royal Borough with the creation of local jobs.

¹ See glossary

² [Landscape Architecture Foundation](#), fast fact library

Urban planting is a superpower for climate resilience

With the **multiple benefits of urban planting**, we need all **residents, business owners and visitors** of Royal Greenwich to understand the **value of urban planting** whether it is in their private gardens, forecourts, yards or the public realm.

2.4 The term urban greening encompasses all planting interventions or [green infrastructure](#), the most common of these are trees, hedges and general soft landscaping. But this can also include green roofs and green walls/vertical planting. Currently, policies G5 (urban greening) and G6 (biodiversity) of the London Plan (2021) require all major schemes to include urban greening measures and biodiversity considerations into the design of a major scheme. More recently, legislation has also been introduced to facilitate Biodiversity Net Gain (BNG), which seeks to help improve biodiversity in an area (see Box 1). Policies and legislation all seek to replenish and improve biodiversity across the Royal Borough, London and England.

The Council's adopted [Urban Design Guide \(2023\)](#) provides design principles for new buildings and how their design can minimise environmental impacts.

a. Biodiversity loss & climate change

2.5 The State of Nature report (2023)³ officially set out the decline of wildlife in the UK. Climate change is one of the main drivers of biodiversity loss, and human activity has accelerated climate change. With the increase in extreme weather events due to global overheating, the various ecosystems on land and water that support wildlife have become altered. This has increasingly led to the loss of local species and the increase of disease which has then driven the further decline of animals and plants⁴.

Why do we need biodiversity?

2.6 We need biodiversity for our health and survival. Without the inter-connection of plants, microorganisms, insects and other animals, we cannot have the healthy ecosystems that we rely on to provide us with breathable clean air, the food we eat or the



colours of nature we enjoy. As our ecosystems become more eroded, the further loss of green spaces and planting adds to climate change, and we become more susceptible to its impacts. You can find out more about the **importance of biodiversity** as a natural self-defence against climate change here: [Biodiversity - our strongest natural defense against climate change | United Nations](#).

2.7 In England, to slow the decline of biodiversity and to help support its recovery, the government has now set out a ‘Biodiversity Objective’ as a new legal driver of change within the Natural Environment and Rural Communities Act (2006) (as amended). This legal requirement has also been written into planning legislation under a requirement for specific developments to provide **Biodiversity Net Gain (BNG)**⁵.

BOX 1

Biodiversity Net Gain (BNG)

Planning legislation that seeks to ensure all new major development schemes, and some minor ones, will increase biodiversity where it is existing on a development site. The legislation requires a 10% net gain of biodiversity to be provided and maintained on-site. There is potential for mitigation off-site but only where on-site provision is not possible. There can be cases where an exemption to the provision of 10% BNG will exist because the development would be below the de minimis threshold, or they are excluded as part of the legislation, such as householder planning applications.

³ [State of Nature – Natural England](#)

⁴ [Biodiversity - our strongest natural defense against climate change | United Nations](#)

⁵ [Schedule 7A of the Town and Country Planning Act 1990 \(as inserted by Schedule 14 of the Environment Act 2021\)](#).

2.8 Where exemptions to BNG are present, there is still scope for new urban planting and wildlife to be delivered through London Plan (2021) policies for green infrastructure, Urban Greening Factor and the natural environment and its associated guidance. Furthermore, the Royal Borough will consider new local policy to support the increase and maintenance of urban planting within new development, including access to it, in order to capture the multiple benefits as well as increase biodiversity.

Biodiversity in Royal Greenwich

2.9 The value and vulnerability of having inclusive and accessible green-blue spaces in urban areas for nature and well-being has been brought into sharp focus by the climate emergency and COVID-19 pandemic. Whilst Royal Greenwich benefits from many parks, green spaces, woodlands and access to the river Thames and river Quaggy, these ecosystems are vulnerable to pollution and to the extreme weather conditions resulting from climate change. As such, it is important that, as a Borough, we help maintain these ecosystems to ensure they flourish. Currently, Policy G6 (biodiversity) of the London Plan (2021) requires the Council to protect all its Sites of Importance for Nature Conservation (SINCs); to prevent harm to them, and that new developments should reduce deficiencies in access to nature.

2.10 Further information about biodiversity in the Royal borough can be found in here: [Priority habitats and species in our local area | Biodiversity Action Plan | Royal Borough of Greenwich.](#)





Sites of Important Nature Conservation (SINCs)

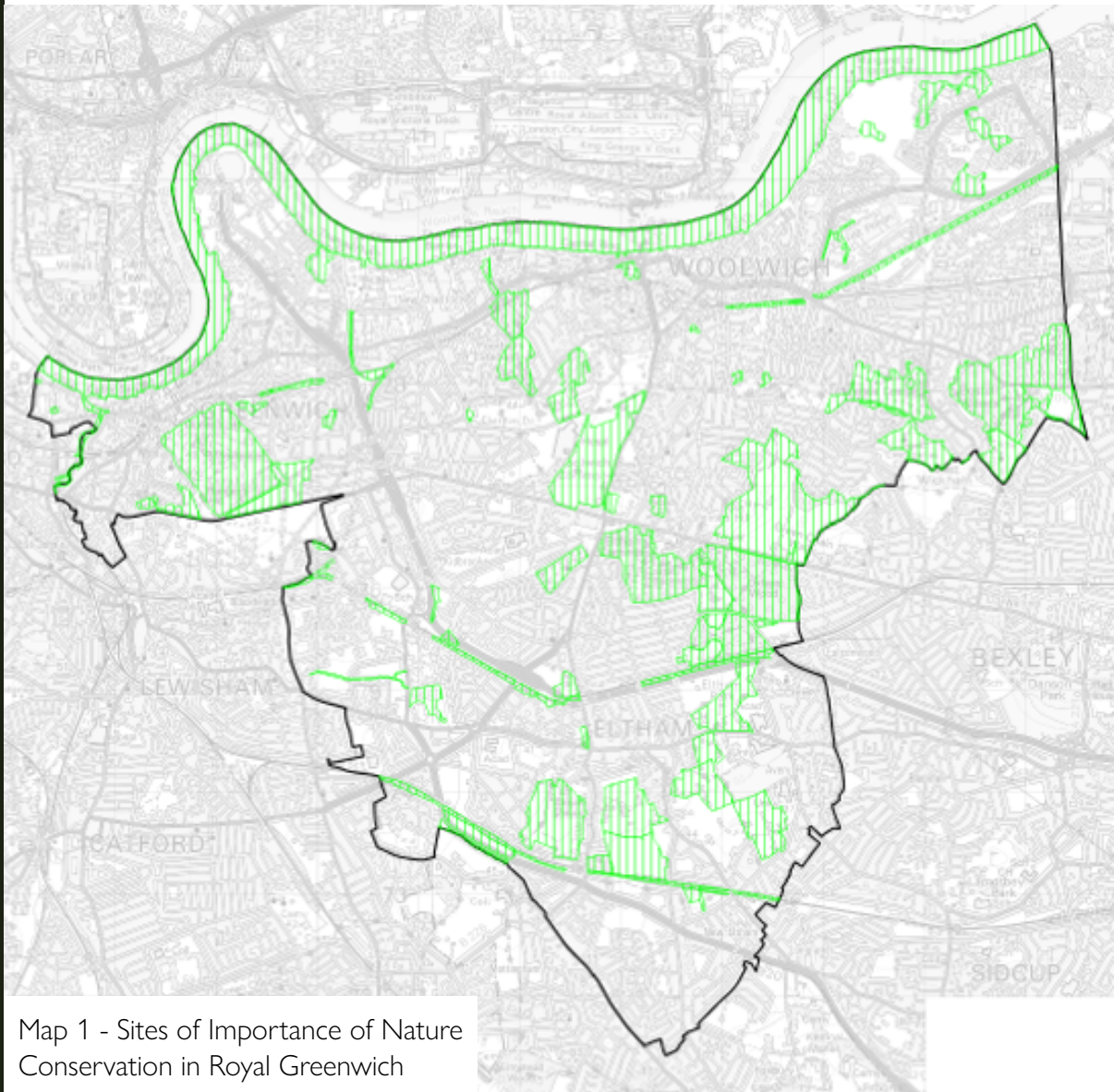
2.11 Royal Greenwich currently holds 55 Sites of Important Nature Conservation (SINCS) comprising green spaces of varying size and importance⁶. An updated SINC assessment has been commissioned to undertake health check on the existing designations and investigate whether there are any new sites in the borough that require protection. The new SINC study will be made available online once completed and will inform the Borough's Local Plan policies for development in the borough.

Preliminary ecological assessment may also be needed if the site location is adjacent to a SINC. Impacts on SINCS can occur through construction in the form of dust deposition, vibration, etc. as well as post completion through overshadowing and increased light spill, etc.

Any planning application, whether major or non-major that is within a SINC, for reasonably sized works, must submit a preliminary ecological assessment as part of the application process.

⁶ See glossary for SINC designation

2.12 At present enhancements to biodiversity across the borough are delivered by the Council in partnership with key organisations and community groups. Nevertheless, we still need to protect existing biodiversity and provide an environment for it to flourish so its multiple benefits can help us thrive. The Royal Borough will support delivery of the wider London Local Nature Recovery Strategy (LNRS) that will be published by the Mayor of London.



Map 1 - Sites of Importance of Nature Conservation in Royal Greenwich

⁷ [Local Nature Recovery Strategies](#)

Common reasons for loss of urban planting & biodiversity

2.13 Domestic gardens and boundary planting are an important and yet underrated source of habitats and biodiversity that is a vital part of London's ecosystem. New developments and permitted development rights have progressively enabled the disappearance of mature garden/forecourt planting to give way to vehicle parking or blank spaces of non-porous hardstanding that require little or no maintenance⁸.

2.14 This loss of local garden ecosystems has therefore led to the decline in numbers of common garden birds, butterflies, pollinators, hedgehogs and more. The loss of urban planting has also diminished the multiple benefits that vegetation brings to an area including the reduction of particulate matter from air pollution.

2.15 Added to this is building work that takes place during the breeding season of common urban wildlife that can impact biodiversity. For example, the breeding season for birds is between 1st March and 31st July; so any vegetation removal, site clearance or demolition that takes place during the breeding season can affect the local bird population if not checked beforehand. Even scaffolding for minor external work can prevent birds accessing their nest sites in buildings. This is something we need to be more mindful of.

Multiple benefits of urban planting

- improves air quality
- improves the visual appearance of an area
- positively impacts mental health & wellbeing
- community cohesion
- food growing
- temperature regulation

The Royal Horticultural Society's State of Gardening Report studied and documented the extraordinary scale and impact of gardening and planting. Gardens nurture biodiversity, strengthen climate resilience and support health, wellbeing and the economy.



⁸ Only the [Shrewsbury Park Conservation Area](#) has had its permitted development rights removed for the laying of hardstanding within the curtilage of the property

What can you do to improve biodiversity?

2.16 Without the need of planning permission, most homes and commercial properties that have a garden or forecourt or backyard, have the opportunity to support urban planting, allow biodiversity to recover and hence improve climate resilience in their locality. As such, owners and renters are encouraged to consider any outdoor spaces and boundaries on the ground and the roof of the building as places where biodiversity can be supported. If a property is listed, you are advised to check with the Council before undertaking and alterations to the setting of the property.

2.17 This could be as small as a single tree canopy or boundary hedge that can support birds, insects and bats; a terrace with outdoor seating where vegetation can be planted; and/or a roof space or outside wall where greenery can be planted; or swift bricks or bird boxes installed. These interventions can all help to recover urban biodiversity.

Biodiversity interventions for wildlife

- Bird boxes
- Bat boxes
- Swift bricks
- Bug motels
- Hedgehog corridors
- Green/living walls
- Green/living roofs

Expert advice and preliminary ecological assessments can help prevent planting of invasive species. The Royal Horticultural Society's plants for pollinators list contains information regarding the species suitable for urban planting. London's Local Nature Recovery Strategy, which will be published by the Greater London Authority in early 2026, also recommends strategic biodiversity priorities and maps London's habitats.



More about urban planting

2.18 Trees, hedges and tall growing vegetation should be considered for all buildings where the curtilage allows for it; so that the plants have a maximum visual and moisture retention impact to the local area as well as provide corridors for biodiversity. Tall planting should be mixed with shrubs and bedding plants to create multiple layers of texture and ground coverage. Shading for buildings and windows should also be considered by use of tall planting including appropriate trees.

2.19 The removal of non-porous hardstanding is also recommended to create planting beds and areas where excess rainfall can be absorbed and help provide cooling for an area. Hardstanding absorbs heat and then radiates it during warmer seasons which adds to the urban heat island effect. Where hardstanding is necessary, it should be replaced with permeable paving or a porous layer to at least allow for natural drainage, [Permeable hard surfacing](#). Where a forecourt is used for parking, it is advised that gravel, grass or any other loose material not be used for the driveway.

2.20 It is advised that a landscape architect be employed to help you decide which plant species would better suit the green spaces at your property. This will ensure the chosen planting can flourish, engender biodiversity and improve drainage for the benefit of climate resilience and reducing carbon emissions. For proposals affecting trees, it is important to consider tree siting, planting method and maintenance to ensure trees can grow healthily and provide benefits. An Arboricultural Impact Assessment should be undertaken to evaluate how a proposed development will affect trees on the site, identifying risks to roots/branches, and planning protection measures (like fencing/exclusion zones) to preserve healthy trees, ensuring compliance with planning policies. To find a qualified landscape architect or arboriculture specialist, you can check: [Home - British Association of Landscape Industries](#)

2.21 If you are unable to afford a landscape architect, the following websites are a useful for knowledge and ideas:

- [Front gardens / RHS Gardening](#)
- [10 easy plants for driveways / RHS Gardening](#)

- [The Wildlife Gardening Forum](#)
- [Products | Green Cities](#)
- [Trees and Shrubs for Boosting Heart Health - Permaculture](#)
- [GD Audit Report Test](#) (Great Dixter Biodiversity Audit 2017-2019)

Public realm planting

2.22 The Council will be making progress towards improved biodiversity with planted verges using Sustainable Drainage Systems (SuDS) and improving tree coverage along active travel routes, as well as supporting community food growing and the Good Food in Greenwich network. Further supplementary guidance will emerge in time from the Royal Borough's Public Health Team. Transport for London (TfL) has already published a city-wide strategy for green infrastructure and biodiversity. There is also the London Surface Water Strategy, published in late 2025 by the Mayor which identifies hotspots for flooding with suggested SuDS to alleviate the flooding at a cross-borough level.

Living /green roofs & vertical planting or green walls

2.23 Urban planting to roofs and walls/vertical planting is becoming more common in London as part of its green infrastructure, particularly because of London Plan policies for major development schemes. They can enhance urban biodiversity by providing a base for complex vegetation structures to grow and they can supply increased foraging and roosting opportunities for animals with increased habitat connectivity.

2.24 Whilst green roofs/walls/vertical planting are not a replacement for natural habitats, they do improve biodiversity in an urban setting. Further to this, they also provide the multiple benefits that urban planting brings: ([benefits of green roofing](#))

- Enhanced air quality
- Improved stormwater management
- Urban heat island mitigation
- Energy efficiency
- Noise reduction
- Extended roof lifespan
- Health & wellness
- Aesthetic appeal



Green Roofing

2.25 An example of a successful major green roof in Royal Greenwich is found at the [Millenium Retail park](#). Green roofing to household extensions and garden sheds/outbuildings is also possible and would still benefit biodiversity and climate resilience in the locality ([blue -green roofing](#)). Green roofing can also be retrofitted to improve the insulation of a building, though advice from a professional should be sought because the structure of the host property must be able to take the weight of the substrate layers required for a green roof. Best practice guidance is also available from industry bodies such as the Green Roof Organisation.

Green walls/vertical planting

2.26 The Building Regulations for Fire Safety were amended in 2019 with regard to the materials that can be used for the external walls of a building. This includes a restriction in the use of green walls as part of a building façade because planting can become combustible. The regulations are specifically restrictive to residential buildings over 11m in height, schools, hotels and even open-sided carparks. However, it is not impossible to incorporate a green wall as part of a new scheme provided it does not form part of the external walls to a building. For acceptability with the Fire Safety Regulations, applicants must check the design and placement of a green wall with a competent Fire Engineer.

2.27 An example of a retrofitted green wall can be found at the Reubens Hotel in Victoria, London. This is a very large green wall that is over 10 years old and therefore created prior to the 2019 amendment for Fire Safety. Its growth has helped to improve air quality around a very busy area of central London and supports biodiversity for the locality. Whilst such a retrofit is unlikely to emerge with the new Fire Safety regulations, the retrofit of bioactive facades and vertical meadows is still possible and is a good intervention for climate resilience. Closer to home, is the living wall at Union Wharf, Creekside which was built as part of the regeneration scheme in the area. For households and minor schemes, a simple example of vertical planting is the growing of ivy (*Hedera helix*) and other climbers along a strengthened wire fence, which is just as effective for combating air pollution and improving biodiversity, particularly when combined with other plants.

With any form of development, please refer to the latest building regulations and fire safety.

2.28 If your property is within a designated conservation area, or a listed building or you're unsure about the permitted development rights for a commercial building, please contact the Council's Planning Service for further advice – dutyplanner@royalgreenwich.gov.uk.

Biophilic design

2.29 Biophilic design is a concept used within the building industry to increase occupant connectivity to the natural environment through the use of planting on the building, around the building and through the building. Further information about this concept and how to understand it can be found here: [14 Patterns of Biophilic Design](#) .

2.30 As set out in [3.34](#). The Royal Borough wants a whole site approach (WSA) to be taken when a new development is being considered. The first stage of the WSA is the Nature First consideration for the whole site. Once existing trees, hedges and other planting has been assessed by an ecologist for their biodiversity value and for possible biodiversity net gain (BNG), the Council encourages architects and developers to harness biophilic design with other energy efficient considerations to create new development that is carbon neutral.

Useful links for gardening and improving biodiversity:

- [How to garden with extremes of weather / RHS Gardening](#)
- [Wildlife Gardening Home](#)
- [gardening-matters-urban-greening.pdf](#)
- [London Wildlife Trust](#)
- [Hedgehog Street](#)
- [Swift Conservation Homepage](#)
- [Livingroofs.org, the leading UK green roof website](#)
- [Vertical planting](#)
- [Vertical Meadow | Bringing Biodiversity Back Into Our Cities](#)
- [What is biophilic architecture? 15 real-world examples in the built environment - University College of Estate Management](#)
- [GD Audit Report Test](#) (Great Dixter Biodiversity Audit 2017-2019)
- [Nature & wildlife | The Royal Parks](#)

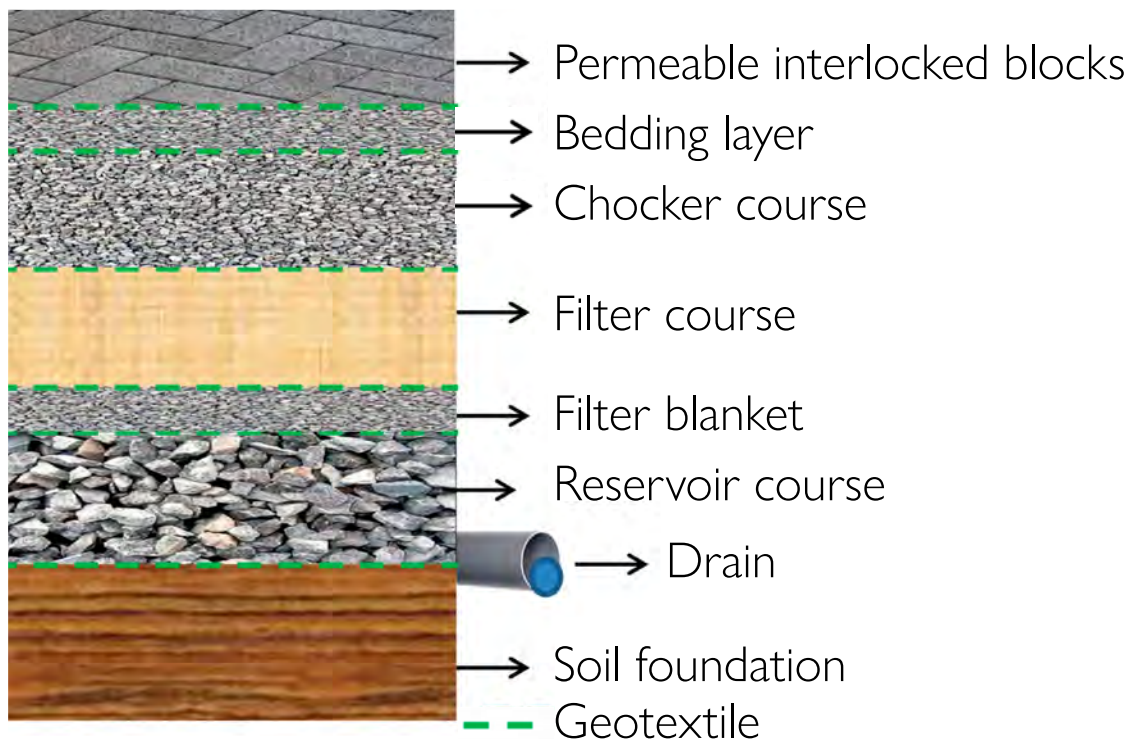
b. Natural drainage for climate resilience

2.31 Excessive rainfall and flash flooding because of climate breakdown is a constant threat to London's population and infrastructure. Since 2021, the London Surface Water Strategic Group has been creating a London-wide strategy to help us better deal with excess rainfall and to prevent flash flooding at any time of the year. The full London strategy is to be published in March 2025, for which further information can be found here: [London's Surface Water Strategy | London City Hall](#).

2.32 The increased urbanisation of areas has contributed to flood risk because of the decrease in permeable surfaces. Rainwater run-off can wash chemicals, sediment and litter from pavements and roads, construction sites, industry and gardens into waterways. This then causes drains to become silted and blocked but can also pollute our water system and overload the sewer system.

2.33 Through the replacement of non-porous hardstanding with permeable surfaces, and the installation of sustainable drainage systems (SUDs) we can better manage the risk of urban flooding within the Royal borough.

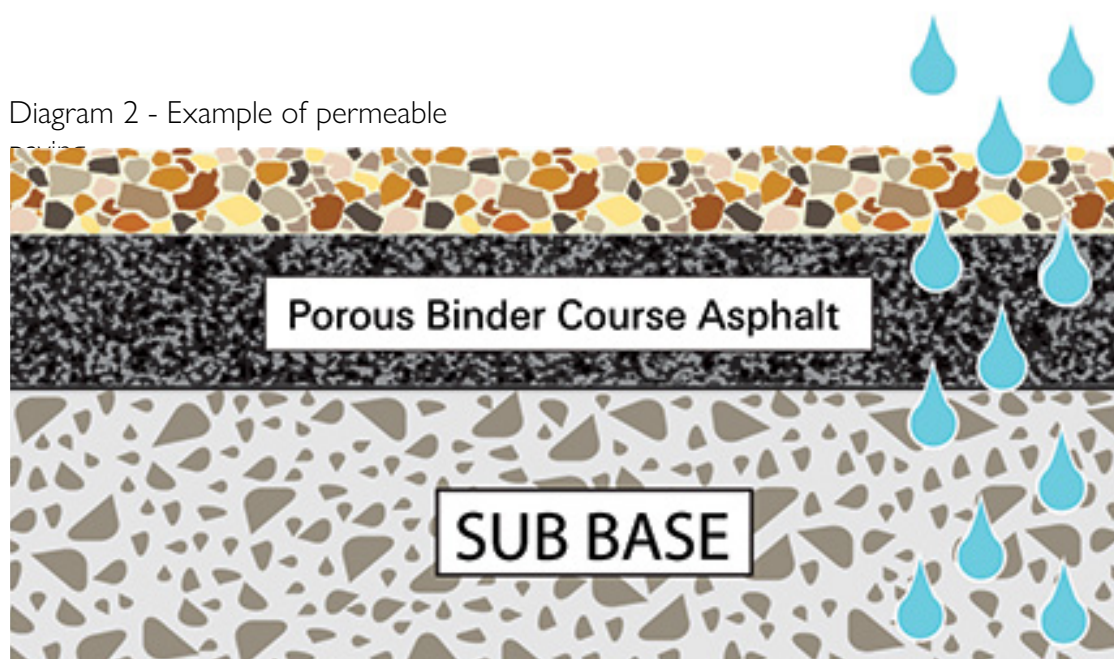
Diagram 1 - Example of permeable paving



Permeable hard surfacing

2.34 The increase of non-permeable hardstanding has meant there is an equivalent loss or reduction in permeable outdoor surfaces available for rainfall absorption. This also adds to the heat island effect and to water stress within London because rain cannot be stored in-situ in the ground.

2.35 Whilst much of the hardstanding is laid for car parking, pedestrians or outdoor terraces, it is still practical to use permeable pavers or resin-bound gravel which can contribute to urban flood management because it will allow excess water to soak into the ground beneath without pooling or flooding adjacent areas and the public highway. As such, separate surface drainage is not required. Examples of permeable paving are shown in the diagrams below.



Resin BOUND (Trowelled)
Top surface: 15-18mm thick 'bound'
mixture of stones and resin

Sustainable Drainage Systems (SuDS)

2.36 A Sustainable Drainage System (SuDS) is a sequence of water management components put together to help to absorb excess rainfall, minimise the pollution of urban run-off and improve water quality. It provides a more sustainable approach to managing rainfall by mimicking the way water moves naturally through a site. If you need advice about whether planning permission is required for installation of a SuDS at a site, please contact the duty planner: **dutyplanning@royalgreenwich.gov.uk**

2.37 There are different methods around how SuDS can be designed and how they can deal with the excess rainfall; but in urban areas, the retrofitting of these systems must engender multiple benefits such as being able to use SuDS as pocket parks or planting that can be used as buffers between pedestrians and main roads. Typically, any form of well-designed soft landscaping that can absorb excess rainfall without run-off onto hard surfaces and into drains or rivers would be considered a form of SuDS. Creating a series of SuDS interventions through retrofitting and from new developments, a sponge landscape is created to absorb excess rainfall quickly and naturally.

2.38 It is the planting that helps to slow down the excess rain run-off and can also help to filter out pollutants depending on where the SuDS is implemented. For example, bioretention rain gardens can filter out pollutants. This is particularly essential around industrial areas and busy roads where human exposure to pollutants would be damaging to health. Please refer to part (c) of this chapter for air pollution and Air Quality Management Areas (AQMA) in the Royal Borough.

2.39 Common types of SuDS include rainwater harvesting, rain gardens, swales, attenuation tanks, moisture banks, blue-green roofs, filter strips, filter drains, tree pits, and basins/ponds. The type of SuDS intervention that is designed should be site specific and take into account the site's footfall, its landscape character, sewer capacity and flood risk as set out in the strategic and local flood risk maps. Ideally, the first flush of rain or source control should seek to remove 10-15mm of a rain event. This would help attenuate 90% of all rainfall events, because it helps to lose lots of water volume.

2.40 For new developments a SuDS scheme should be designed into the development from its inception and should also consider public realm areas adjacent to the site where excess runoff from the site can be diverted to planted verges and street trees, where practical. Developers should refer to the local flood risk strategy and discuss their scheme with our lead flood risk officer to ensure greenfield runoff rates and discharge are calculated correctly and with the latest information.

Planting adjacent to water bodies

2.41 The Estuary Edges Guidance document, developed by the Thames Estuary Partnership, is a 'how to' guide on ecological design for soft natural riverbank edges to encourage wildlife on the Thames that developers are encouraged to refer to where relevant in their development proposals.

There are successful cases in Greenwich Peninsula Terraces North East and North West, Thanet Wharf in Deptford Creek, and Point Wharf in Greenwich.

Principles for Reducing flood risk

Run off rates

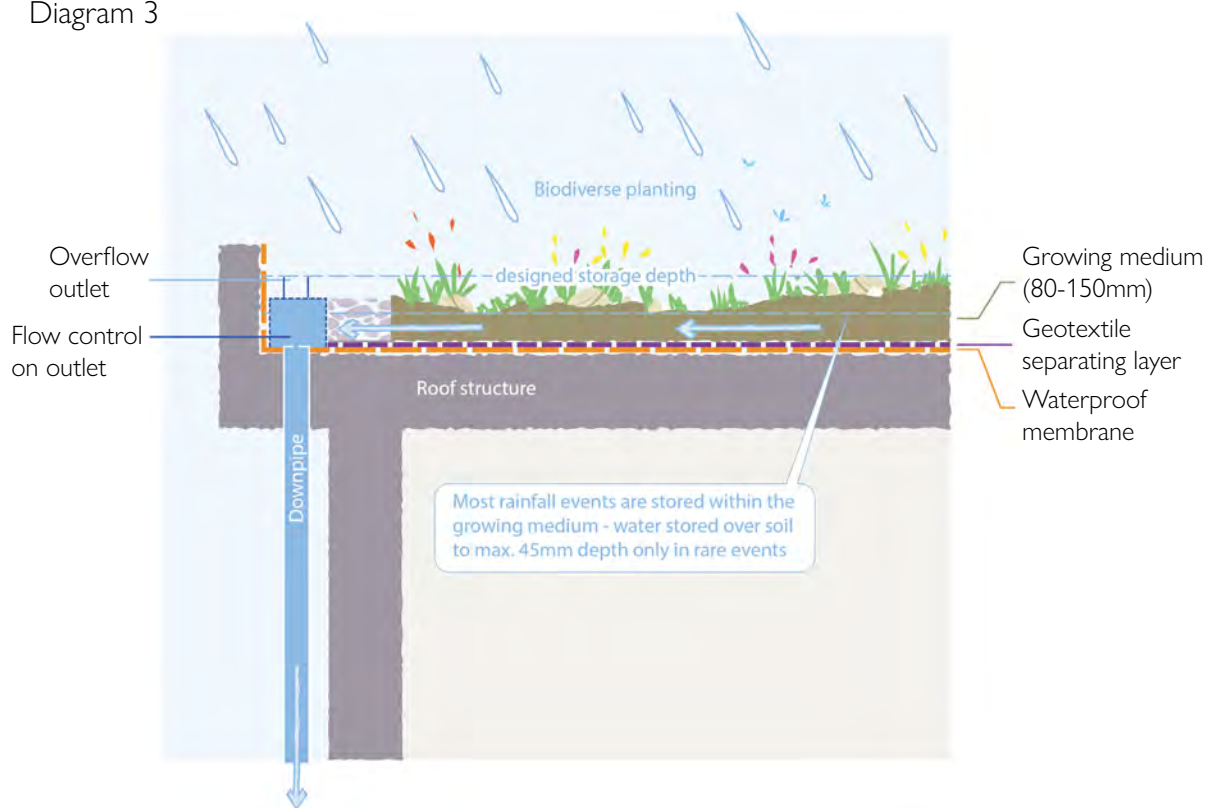
- Retrofit as much source control as possible. This should focus on the first 10-15mm of rain for source control using blue-green roofs, rain gardens, permeable surfaces with where source control features that have multiple benefits
- Householder applications must reduce the rate of runoff from the site in a way that is proportionate to the scale of development and reflects the site constraints.
- New developments – Greenfield run-off rates should be achieved with surface water run-off managed as close to its source as possible with use of green features in line with the drainage hierarchy of London Plan policy SI13. A10-15mm source control is recommended to engender multiple benefits
- Natural drainage should be designed and implemented in ways that deliver multiple benefits and to comply with wider local policies



2.42 With existing buildings, it is possible to retrofit SuDS within a site or in the public realm. Below are some common SuDS designs.

Blue-green roofs – This form of SuDS can store rainwater and provide multiple benefits including bringing nature back to urban areas and temperature control for the building. They comprise biodiverse planting as a green roof that has storage depth to allow for water retention in the roof and for excess water to flow to an outlet and downpipe, thereby slowing down the rainfall wash-off from a roof. This form of SuDS can be easier to install and less costly than other forms of flood management, such as attenuation tanks which can be more complex to install.

Diagram 3



Rain gardens – These are gardens that are designed to temporarily hold and soak in rainwater runoff that flows from roofs, driveways, patios, lawns and areas where there is an excessive amount of non-porous surfaces. The rain garden can contain shrubs, perennials and flowers planted in the form of an attractive low maintenance wildlife friendly space. They are becoming more common in the public realm as a means of rainwater runoff and climate resilience. Further details about rain gardens can be found here:

[How to make a rain garden | WWT;](#)

[UKRainGarden-Guide.pdf](#)

[Rain gardens / RHS Gardening ;](#)

[Alma Road SuDS project | London City Hall ;](#)

[How to Create a Rain Garden](#)



Swales – These are purposely dug shallow drainage channels, designed to store and/or convey water runoff. They can be designed to remove urban pollutants and manage stormwater runoff. They are lined with vegetation such as grasses, shrubs or even trees, that help slow down and filter water. The plants also absorb excess moisture, reducing the amount of rainfall that reaches the storm drains. They blend into the surrounding area and can be used to channel run-off from roads, parks and car parks where it collects into pools before allowing the water to infiltrate and percolate into the soil, replenishing groundwater and reducing the risk of flooding. In some cases, the swale might be lined with permeable gravel or stones to help with infiltration and prevent erosion, soaking away. Swales can also be used to carry water through a site to (e.g.) a treatment works, depending on where the run-off is coming from. Further details about swales can be found here:

- [Swales](#)
- [PG Manual HowTo Swale R2.pdf](#)
- [How to Build a Swale in the Home Landscape \[+ Free Download\] - Tenth Acre Farm](#)



BOX 2

New buildings & flooding

Development that is at risk from flooding from any source must incorporate suitable flood risk measures to account for site conditions. These measures must be designed and implemented in accordance with the latest Building Regulations, existing guidance and the recommendations of the site-specific Flood Risk Assessment, the Strategic Flood Risk Assessment (SFRA) and the Local Flood Risk Management Strategy. These measures should:

- Address all flood depths for each 'design storm' event (with an allowance for the impacts from climate change) to ensure the development will remain safe during a flood event throughout its lifetime.
- Assess the risk of flooding from a breach in the tidal flood defences.
- Include an emergency plan to consider access, egress and emergency exit routes and ensure buildings remain safe for occupants in case of flooding.
- Ensure that development at basement or lower ground floor level connected to the sewer network is protected from sewer flooding through the installation of a suitable pumped device.
- Prioritise sustainable drainage with urban planting for a nature-based solution to address climate resilience and for achieving multiple benefits.

Useful information about SuDS

- [Tools for SuDS design | UK SuDS](#)
- [Guide to SuDS for developers - British Geological Survey](#)
- [Susdrain - The community for sustainable drainage](#)
- [SuDS Sector Guidance | London City Hall](#)

Useful information for flood risk management

- [Flood risk assessments: applying for planning permission - GOV.UK](#)
- Contact the Environment Agency for [pre-application advice and guidance](#) on managing flood risk and other environmental issues and opportunities.
- [Thames Estuary 2100 \(TE2100\) - GOV.UK](#)
- [Check if a Flood Risk Activity Permit is required](#) from the Environment Agency

c. Temperature control, air pollution & climate resilience

2.43 As mentioned above, one of the multiple benefits of urban planting is its ability to provide cooling and shade during hotter seasons which helps to combat the heat island effect; and to also tackle air pollution.

2.44 Urban planting can take the form of vertical planting, urban forests/tree planting or tall shrubs that provide shade, trap particulate matter from the air and help to retain water in the ground.

Temperature control through urban planting

2.45 Urban planting is known to help cool down the surrounding environment, particularly domestic gardens. Furthermore, through the restoration of areas with pocket forests, measurable changes in temperature have been found as shown in photo below of Danehy Park Forest. Research⁹ has shown that nature-based solutions were consistently the most cost-effective approach to mitigating hazards from climate change, particularly overheating.

2.46 **Use of blue-green roofing and vertical planting** can also help to make the internal environment of a building cooler during warmer seasons¹⁰ and warmer during colder seasons. Furthermore, this form of green infrastructure helps to alleviate flash flooding.

2.47 **Tree planting** can help to cool down areas as well as retain water in the ground which can prevent drought during the hotter seasons. A tree with a wide canopy can provide shade outdoors as well as provide shade to windows. In terms of the species of tree you plant, you will need to determine the right tree for the right space. The Tree Design and Action Group provides guidance for public realm and communal planting whilst the Royal Horticultural Society and Woodland Trust provide guidance about suitable trees for small gardens.

2.48 **Biophilic design** would also provide temperature control for a buildings. Whilst this is a relatively new concept within the UK's construction industry, it is a method for future proofing our built environment from the effects of climate breakdown and reducing our carbon emissions.



Biophilic design would need to be cross-referenced with the latest building regulations to also make sure it is fire safety compliant. An example of biophilic design is the Le Nouvel Tower in Kuala Lumpur, Malaysia, where vertical planting has been designed as part of the fascia to the tower. Whilst current Fire Safety regulations would restrict the design of such a tall building with external planting in England, the co-benefits of installing bioactive facades and vertical meadow planting where possible, are still a good intervention for climate resilience.

Air pollution & urban planting

2.49 Air quality is a material consideration in the determination of a planning application and must therefore be considered at all stages of the planning process. London Plan (2021) policy SI1(Improving air quality) highlights the requirements for improving London’s poor air quality. It requires new development to meet the legal obligations for improving air quality in an area, to not lead to the further deterioration of existing poor air quality and to be at least air quality neutral.

Applicants are advised to refer to the **London Plan (2021)** for attaining **benchmarks** towards **improving air quality**.

⁹ Kumar, Prashant et al.; The Innovation, Volume 5, Issue 2, 100588; March 2024; ‘Urban heat mitigation by green and blue infrastructure: Drivers, effectiveness, and future needs’

¹⁰ - [Green Infrastructure: creating habitable towns and cities fit for the future – Natural England](#)

What is air pollution?

2.50 Air pollution refers to toxic substances that are known to have a damaging effect on human health, the natural environment and biodiversity. In London, most air pollution is caused by road transport, domestic and commercial heating and cooling systems; and activities from construction sites, all of which burn fossil fuels. As such, air pollution is intrinsically linked to climate change and the climate emergency.

2.51 The UK Air Quality Standards Regulations (2010) set out a list of pollutants to be monitored and measured in order to limit human and environmental exposure. Whilst a number of air pollutants are listed, the main ones that affect public health for London Boroughs are nitrogen dioxide (NO₂), nitrogen oxides (NO_x), and fine particles measured at a diameter of PM₁₀ and PM_{2.5}. Particulate matter is released from tyre and brake wear and resuspended dust from vehicles, including electric ones. These pollutants are measured by most London Boroughs and the GLA because they are at a significant level that exceeds the National Air Quality Objectives and World Health Organisation Guidelines. Further information about the exposure impacts on health these pollutants have can be found here: [Health and exposure to pollution | London City Hall](#). Additionally, the level of these air pollutants for Royal Greenwich has been mapped here: [Health effects of air pollution - Programmes - Impact on Urban Health](#). Fine particulate matter can easily penetrate the human respiratory system, causing lung and cardiovascular diseases and exacerbate other respiratory issues such as asthma. It is also linked to inflammation and heart disease.

Air Quality Management Areas (AQMAs)

2.52 These are borough designated areas where air pollutants have been measured above levels that are toxic to humans. In 2001 the Council designated the whole of Royal Greenwich is an Air Quality Management Area (AQMA). Levels of nitrogen dioxide (NO₂) and the fine particulate matter measured as PM₁₀ are monitored and the results published annually by the Royal Borough as part of the Air Quality Action Plan, with Annual Status Reports.

Air Quality Focus Areas (AQFAs)

2.53 Designated by the Mayor of London, an Air Quality Focus Area (AQFA) is a hotspot where there exists a high human exposure to NO₂ levels measured above the European Union annual mean limit value. The AQFA designations are separate to AQMAs; and have a level of poor air quality where current planned national, regional and local measures to reduce air pollution may not fully resolve the poor air quality issues. Policy S1 (Improving Air Quality) of the London Plan (2021) sets out criteria where improvements to air quality in AQFA will be required with development. Data for AQFA's can be found at the London Atmospheric Emissions Inventory (LAEI).

Within the Royal Borough, there are eight AQFAs:

- Westthorne Avenue A205
- Eltham High Street
- Greenwich Centre
- Sun-in-the-Sands junction A102/A2 Shooters Hill and Charlton Rd
- Woolwich and Woolwich Arsenal A205 Woolwich Rd/A206 Plumstead Rd
- Greenwich South St/Lewisham High St Junction and Blackheath Hill
- Plumstead High Street (A206)
- Greenwich Trafalgar Road (A206) and Woolwich Road

The construction industry and air pollution

2.54 Given the London Plan Opportunity Areas, the AQMA and AQFAs in the Royal Borough, it is desirable that the construction industry take real action to negate their contribution towards poor air quality in the borough. Dust emissions; use of non-road mobile machinery (NRMM); and the emissions from heavy goods vehicles (HGVs) and light duty vehicles (LDVs) all release excessive air pollutants including greenhouse gases into the local area. Human exposure to these pollutants is high given the urban setting of the borough. Whilst dust can be controlled by effective implementation of well-established good industry practice dust management and monitoring strategies, the level of pollutants from the construction industry is expected to grow as development in the Royal Borough progresses. As such, there will be need to monitor the Construction & Environmental Management Plans (CEMP) in order to reduce emissions from construction sites.

2.55 The Mayor of London has set up a NRMM Low Emission Zone (LEZ) scheme: [Non-Road Mobile Machinery \(NRMM\) | London City Hall](#). This sets minimum emission standards for equipment used on construction sites with a higher standard required for London's Central Activities Zone (CAZ) and Opportunity Areas. As discussed in paragraph [2.22](#), vertical planting can be set up around the large development sites to help mitigate pollutants from a construction site. Where possible, the construction company is encouraged to use a hydrogen fuel generator which have zero carbon emissions and do not emit air pollution.

How can urban planting improve air quality?

2.56 Scientific research into air pollution and urban planting indicates that the foliage of trees¹¹, shrubs, hedges and climbing plants can trap air pollutants on their leaves and disperse particulate matter higher into the air away from human exposure, thereby improving air quality. The charity [Trees for Cities](#), report that tree coverage in London remove an estimated 2,241 tonnes of pollution each year making them a particularly effective barrier to the flow of toxic air. The type of green infrastructure and species required for air pollution mitigation can be site specific depending on the prevalence of a pollutant and street context¹². This means there is no generic urban planting plan that would have the maximum effective abatement across all development sites in the Royal Borough. This is a positive in relation to improving biodiversity across Royal Greenwich. Further advice is provided in the Mayoral guidance 'Using Green Infrastructure to Protect People from Air Pollution' (April 2019)

2.57 Trees are good for filtering out particulate matter and dispersing it into the air away from street level and human exposure. The larger the tree canopy, the greater quantity of particulate matter dispersed into the atmosphere; and the larger the leaves, the more pollutants are trapped too. However, the width of a street can limit the effectiveness of a tree to remove and disperse air pollution away from human exposure because there is less of a through-flow for air for dispersal.

As such, hedges, ivy and green walls are considered more effective for narrow streets particularly where tall buildings are present. Wider streets with low-rise buildings can disperse pollutants into the air more freely away from human exposure¹³. Use of ivy to mitigate air pollution as a form of green wall alongside a busy road can be viewed here: [A cheap way to green cities and reduce local air pollution](#)

A design-led approach towards urban planting & air pollution

2.58 All new development should seek to improve air quality within the Royal Borough and protect people from further exposure to NO_x and particulate matter. Whilst it is acknowledged that urban planting will not be the sole intervention necessary for improving air quality, its ability to reduce air pollutants from human exposure is the most accessible and carbon positive. As such, urban planting for air quality should be considered as part of the nature first approach to the design of a scheme as set out at 3.34 'Whole Site Approach' of the SPD. This would help to secure the multiple benefits of urban planting upfront.



¹¹ [The best trees to reduce air pollution \(BBC\)](#)

¹² [Y. Barwise & Kumar, P. \(2020\):npj Climate and Atmospheric Science Vol 3,12.](#)

¹³ [Using Green Infrastructure to Protect People from Air Pollution](#)

2.59 Where a site is adjacent or within an Air Quality Focus Area (AQFA), a landscaping plan should be devised with plants and trees known to mitigate air pollutants prevalent in the vicinity of the development site. As such, baseline air quality should always be checked and monitored for a reasonable amount of time prior to designing a development.

2.60 London Plan policy SI 1 (Improving air quality) is clear about development proposals not leading to a further deterioration of existing poor air quality; and should aim to be air quality neutral (AQN) as set out by the required benchmarks¹⁴. Major schemes are required to submit an air quality assessment, but for non-major schemes it may be necessary to establish a baseline for air pollution at a development site to ascertain how a proposed urban planting scheme is best designed to mitigate human exposure to air pollution and therefore create a scheme that is ideally air quality neutral.

2.61 For housing, public and community developments, the siting of any outdoor amenity space is an important consideration where air pollution and human exposure is above acceptable levels for public health. As such, toxic exposure to air pollutants around gardens and roof terraces should have some form of intervention such as planted screens.

2.62 The impact of outdoor air pollution on indoor air quality should also be designed into a proposal at the earliest stages of building design. This includes ensuring:

- ventilation inlets and the location of openable windows are on higher floors away from sources of air pollution at the ground level, but also away from stationary sources such as a combustion plant
- low-carbon air conditioning systems can be fitted with filters which filter particulates and NO₂; the appropriate standard filter should be maintained following installation.

2.63 Where a tall building is proposed, the residential uses should be located on the upper floors where there is less exposure to air pollution (and noise), allowing for balconies and the opening of windows for ventilation.

The lower floors would be suitable for commercial such as retail and office space; and can use low-carbon mechanical ventilation, boundary planting and indoor planting to help mitigate the impacts of outdoor air pollution at podium levels.

BOX 3

- **Air Quality Assessment (AQA)** - required for all major developments. They should identify and prevent or mitigate local impacts from larger schemes. Guidance provided by DEFRA should be followed.
- **[Air Quality Neutral \(AQN\)](#)** - applies to all developments and aims to reduce regional pollution across London by capping emissions from buildings and transport sources. The development is required to meet 2 sets of benchmarks prescribed by the GLA guidance.
- **[Air Quality Positive \(AQP\)](#)** - applies to large-scale developments and masterplans and uses their potential to secure broader maximum improvements in local air quality whilst minimised exposure to existing sources of poor air quality. This will be linked to other spatial policies such as health streets, energy master planning and green infrastructure

Outdoor private and communal space

2.64 The location of outdoor space in relation to sources of air pollution, for example busy roads and boiler flues, is an important consideration. Exposure should be minimised through appropriate positioning and orientation of the space away from busy roads and combustion sources, where this also meets the requirements of the Local Plan to protect the amenity of neighbouring building occupiers. Urban planting should also be considered as screening to mitigate pollution including noise.

¹⁴ See GLA Guidance: [Air Quality Neutral \(AQN\) guidance | London City Hall](#)

2.65 Where public realm forms part of a development it provides an opportunity to encourage through routes with low pollution and areas with casual seating where people can spend time away from busy roads. Such schemes should therefore incorporate permeable design, where possible, that encourages active travel along routes with low pollution through the development, instead of along busy roads. The Public realm should ensure that recreational, seating and exercise areas are away from or screened from sources of pollution, for example by urban planting. The Royal Borough's Urban Design SPD provides further guidance on this.

Principles for reducing poor air quality

Urban Planting

- A nature first approach should be followed as part of the designed approach to a development to help minimise air pollution exposure for occupants and visitors to a new development
- Construction sites should install vertical meadows as part of their construction hoardings to help minimise particulate matter and other air pollutants and to improve the appearance of a construction site
- AQFA should incorporate the most pollution hardy vegetation to combat pollutants but to also provide visual aesthetics

Air quality in developments

- All development is required to be at least 'Air Quality Neutral' so as to not make worse the existing poor air quality of the Royal Borough. Major developments should demonstrate this through the submission of an Air Quality Assessment (AQA).
- Development within or adjacent to an Air Quality Focus Area (AQFA) that is likely to have a high footfall or utilised by vulnerable people, such as children or the elderly, should demonstrate that design measures have been adequately incorporated to minimise exposure.

- Minimise CO2 emissions by selecting appropriate heating and/or cooling systems.
- Major developments should be at least Air Quality Neutral (AQN)
- An Air Quality Positive (AQP) statement is required for very large major schemes

Air quality during construction

- Pre- commencement to any works, all developments must register relevant NRMM online at www.nrmm.london/register. Exemptions to this registration can be found here: www.nrmm.london
- Diesel generators have high emissions of NOx and PM10 and add to the existing poor air quality in the Royal Borough. As such, use of hydrogen engine generators is encouraged, even more so where a secondary electrical power supply cannot be assured. A temporary energy supply should be secured prior to the commencement of works in order to avoid the use of diesel generators on site.

Further Guidance

- [National Planning Policy Framework](#) paragraph 199;
- [Planning Practice Guidance Air Quality](#);
- [DEFRA Clean Air Strategy](#);
- London Plan (2021)
- [Air Quality Neutral London Plan Guidance](#);
- [Air Quality Positive London Plan Guidance](#);
- Wider programme of policies and measures to improve London's air quality in the [London Environment Strategy](#) and [Mayor's Transport Strategy](#).
- Royal Borough of Greenwich Local Plan, Core Strategy Policy E(c);
- [Royal Borough of Greenwich Air Quality Action Plan](#)

d. Community cohesion, nature, local economy & climate resilience

2.66 Social cohesion and social capital are considered the glue that hold communities together, improve local wellbeing and are associated with reduced health inequalities. As such, Natural England (NE) have sought to engender nature at the heart of place-making to regenerate towns and cities and create attractive investible places that are good for people, health, climate and the economy. Nature and green spaces support community cohesion and in relation to climate resilience and in particular, community unity towards decarbonization efforts¹⁵. Furthermore, communities with robust social cohesion demonstrate a heightened commitment to climate action with increased engagement in sustainable practices, support for local economy, information sharing and mutual support among community members. This is essential for the Local Area Energy Planning (LAEP) process.

2.67 When it comes to property values, locations with urban trees¹⁶ were found to have a 3 to 15 percent higher value compared to similar properties in less green locations. This gives rise to a greener form of sustainable economic growth through the simple incorporation of a nature-based solution.

2.68 As such, in relation to climate resilience, where the Royal Borough can help support planting initiatives and nature, climate action can be improved. Such initiatives include food growing, creating new community gardens and improving public realm planting in local green spaces.

¹⁵ Phemelo Tamasiga et al, [[Full article: Amplifying climate resilience: The impact of social protection, social cohesion, and social capital on public support for climate change action](#)] in Sustainable Environmental, 2024, Vol 10 No.1, 2361568

¹⁶ [Urban Trees: Boosting Economy & Wildlife in Cities - Arborist Now](#)

Urban food growing

2.69 Core Strategy policy CH2 (Healthy communities) seeks to reduce health inequalities by various interventions, one of them being the inclusion of allotments and community gardens for major schemes. Traditionally, councils have provided allotments spaces for residents who want a local food growing in space. The Royal Borough currently own 15 allotment sites which provide 855 plots for which there is a high demand with a waiting list of 603 residents for currently only 32 vacant plots. In a largely urbanised London borough such as Royal Greenwich, it is important to ensure there is no net loss in provision per capita as set out in Natural England's Green Infrastructure Standards. Developments should safeguard existing allotments and provide new food growing spaces where appropriate.

2.70 By growing food locally, this also shortens the food chain and reduces carbon emissions generated by delivery vehicles. This benefits the local economy if local markets are used and generates footfall for other shops in the area. Organisations such as the The Greenwich Co-operative Development Agency (GCDA) undertake various community programmes, and in relation to urban planting they support community food growing.



Major developments

2.71 Developers of major schemes should contact the GCDA and/ or other community groups to discuss the possibility of including food growing spaces and/ or community gardens within their schemes so as to improve climate resilience as well as capture the multiple benefits of urban planting. Food growing spaces and community gardens can be placed on flat roof area with green roofing and the necessary safety requirements. The design consideration of this would be part of the nature first approach to a whole site re-development.

Existing developments

2.72 Where community garden spaces are being retrofitted to existing large properties and estates, the orientation of a growing space would need to be considered. Roof spaces can be retrofitted too. North facing gardens are not the best, but plants and vegetables can still be grown if the correct ones are chosen. The GCDA and similar groups would be able to provide advice on how to grow food and what would grow best.

Local economy & urban planting

2.73 Good quality legible landscaping in public spaces can create an aesthetically inviting space where people can spend time and enjoy nature because it is well planned and looked after. With climate change and the need for climate resilience, good urban planting should comprise a mixture of native and drought tolerant plants that are layered together to provide plant coverage throughout the seasons to provide complex greenery and maximise diversity for pollinators and other insects and animals.





The design for urban planting should not forget to take into consideration its role as a potential SuDS intervention with 10-15mm source control with layered vegetation that hydrates the sub-soil effectively. A good example of such planting is present at the Elephant Park re-development.

2.74 The placement of street furniture should be included as part of the design which will improve its legibility and useability, particularly in public places. For mixed use development that have commercial frontages at ground floor level, outdoor seating should be considered with a planted buffer from the pavement to create better framing for the customers and for the building as a whole, particularly if adjacent to a road.

Existing buildings – offices, industrial buildings, retail

2.75 Where existing buildings have the space, it is encouraged that planting schemes be retrofitted to the frontage or forecourt of their buildings for reasons of climate resilience and to capture the multiple benefits that urban planting brings. Elaborate planting schemes are not required and can comprise simple pollinators with a small tree and layered green vegetation that would maximise diversity.

Non-major new developments

2.76 Small new developments that are not captured by regional policies for urban greenery are encouraged to add value to their schemes with regard to climate resilience and planting. Taking up advice set out throughout this chapter, creative planting can bring better fiscal value to the scheme. Low maintenance planting for blue-green roofing, trees for shading and cooling as SuDS and hedging or ivy boundary treatments to capture air pollutants.

Principles for improving community cohesion and local economy

Community cohesion

- Major schemes to incorporate layered mix of native and non-native plants for green coverage throughout the year. Incorporate a diversity of shrubs, perennials, trees for SuDS, cooling and shading. Remember legibility, safety and public seating, enjoyability of space
- Food growing – Major and non-major new schemes are encouraged to design food growing plots and/or community garden spaces in the scheme. Contact community organisations such as Greenwich Cooperative Development Agency (GCDA) for local advice
- Existing residential – Consider retrofitting food growing plots or community food growing gardens to flat roofs and/or to existing garden space that is under utilised

Local economy

- Urban planting can increase the value of local area, bring improvements to local economy, increase footfall to local area
- Public realm - Urban planting to be layered with diversity of plants. Ground floor to incorporate planted buffers, particularly if adjacent to busy roads around a building with seating, where possible
- Privately owned commercial buildings – to consider implementing planting outside the building for climate resilience and improving the appearance of the building. Chosen landscaping can cool the building, prevent surface water flooding, improve poor air quality, provide outdoor seating for staff to relax

Advice for applicants

- **All developments:** Comply with Biodiversity Net Gain requirements according to planning legislation unless exempt.
- **All developments:** Design and implement urban greening and biodiversity measures in the scheme.
- **All developments:** Seek professional fire/building safety advice or assessments when proposing green roofs and walls.
- **All developments:** Consider heritage and amenity impacts when proposing green roofs and walls.
- **All developments:** Consider tree siting, planting method and maintenance when proposal affects or includes trees.
- **All developments:** Greening measures and long-term management plans may be secured via planning conditions and/or legal agreements depending on the scheme and in accordance with adopted legislation and policies.
- **All developments:** Check the latest flood risk management information and guidance including when planning an extension or improvement project.
- **All developments:** Design and implement sustainable drainage systems (SuDS) in accordance with the latest Building Regulations, particularly permeable paving in the scheme. Avoid paving surfaces with non-porous materials.
- **All developments:** Minimise the impact of air pollutants in all development stages including from designing the scheme to construction, in accordance with the latest London Plan and Local Plan policies.
- **Major developments:** Discuss possibility of including food growing spaces and/or community gardens in the scheme with local residents and organisations such as the GCDA.
- **Major developments:** Submit an Air Quality Assessment.
- **Developments within a SINC:** Must submit a preliminary ecological assessment as part of the application process for reasonable sized works.

Summary of urban greening interventions for climate resilience

Interventions	Existing buildings	New Developments
<p>Biodiversity improvements – use permeable hardstanding, plant trees, hedges, perennials, shrubs, green roofing; vertical planting/green walls</p> <p>Install - bird boxes, Swift bricks, bat boxes, Insect motels, hedgehog friendly fencing</p>	✓	✓
<p>Temperature control – Trees, urban forest, planting, green roofing, vertical planting</p>	✓	✓
<p>Improve drainage, avoid flooding: Sustainable Drainage Systems; replace non-porous hardstanding with permeable surfaces; incorporate blue-green roofs</p>	✓	✓
<p>Community gardens</p>	✓	✓
<p>Food growing spaces</p>	✓	✓
<p>Public realm planting</p>	✓	✓



3. Energy efficiency & sufficiency

– Reducing our carbon emissions

This chapter will explain:

- Current practical low carbon energy technologies available to replace the current fossil fuel systems for existing buildings and those for new developments.
- Use of the Whole Building Approach (WBA) for refurbishment first & retrofit second of existing and heritage buildings
- Use of the Whole Site Approach (WSA) for new buildings

Introduction

3.1 There are 120,000 homes and over two million sqm of non-domestic floor space within Royal Greenwich which accounted for 64% of the Royal Borough's emissions in 2019, from use of heat and electricity. Of these 2019 emissions, 41% was solely from homes. A reduction of carbon dioxide and other greenhouse gas emissions is central for the Royal Borough's Climate Emergency declaration target to reach net zero carbon emissions 20 years ahead of the national target of 2050.

3.2 To reduce these emissions the following combination of activities will be needed:

- Buildings designed to be more energy effective and energy efficient.
- The replacement of fossil fuel heating and cooling systems with low carbon alternatives
- The deployment of renewable energy and district heat networks
- Behavioural change – operating our buildings more efficiently.

Refer to research from LETI (Low Energy Transformation Initiative) and the UK Net Zero Carbon Buildings Standards (UKNZCBS) for the ways to reduce carbon emissions in buildings.

3.3 Reducing construction waste – Whether you are refurbishing¹ and retrofitting² an existing building or building a new development where there is demolition, the construction waste should be reduced. Where possible waste can be recycled or disposed of in a sustainable way in line with circular economy principles. The Royal Borough has [material banks](#) and [re-use and recycle centres](#) where different householder items can be taken to reduce waste to landfill and be sorted for re-use and re-cycling.



¹ Refurbishing – in this SPD entails the improvement of a building through décor, fixtures and cleaning as a fabric first approach; closely related to renovation and restoration

² Retrofitting – in this SPD refers to the installation of low-carbon energy systems such as solar panels

Existing & Heritage Buildings

Whole Building Approach (WBA)

3.4 A **Whole Building Approach (WBA)** to your property is advised prior to retrofitting any new energy system. This means that the external fabric of a building should be improved first to ensure your property can make the best use of energy and that you can save on fuel bills where possible, i.e. energy effectiveness is assessed first. It is important to highlight the rules of permitted development and, in most cases, how this can facilitate energy improvements to your property:

- Houses – Can undertake refurbishments under Part 1 (curtilage of a dwellinghouse) and Part 14 (renewable energy) of Schedule 2 of the Town and Country Planning (General Permitted Development) Order (2015). If your property is within a conservation area, you will need to check the Article 4 Direction (see paragraph 3.6) and the legislation
- Flats - Can install low-carbon energy systems under Part 14 (renewable energy) of Schedule 2 of the Town and Country Planning (General Permitted Development) Order (2015) without the need of seeking planning permission. Internal refurbishments do not require planning permission, but all external refurbishments to a flat, such as changing windows, applying cladding to external walls, will require planning permission.
- Listed buildings – Require Listed Building Consent to ensure the alterations proposed will fall within permitted development rights for external or internal alterations to the property. For Listed building consent see paragraph 3.7 and table 1.

Figure 1: Whole Building Approach (WBA)

1. Refurbishment

Permitted Development

Part 1 of Schedule 2

- Roof –external repairs & internal insulation (Class C)
- External walls (Class A)
- Windows & doors (Class A)
- Shading & cooling (Class A)



2. Retrofitting

(energy)

Permitted Development

Part 14 of Schedule 2

Most common low carbon energy systems for domestic properties:

- Solar panels to a roof (Class A)
- Solar thermal to a roof (Class A)
- Ground source heat pump (GSHP) (Class C)
- Air source heat pump (ASHP) (Class G)

If you are unsure about any of this advice, you can email dutyplanner@royalgreenwich.gov.uk



3.5 Often, the windows of a building are changed first because it is the quickest energy efficiency measure to achieve. However, this can still leave gaps in the insulation of the external envelope of the building, known as thermal bridging³, and will affect the energy efficiency of the newly installed windows and the whole property. When a WBA is followed, heat is kept within the building as an entire unit. This means heat energy is more effectively retained during the colder seasons; and the building is kept cooler during the warmer seasons. It is always recommended that professional advice is sought once you have read through the relevant parts of this SPD.

3.6 Within a Conservation Area, external alterations to the fabric of a house may require planning permission depending on the type of alteration that is proposed or whether the permitted development rights have been restricted through an Article 4 Direction. As such, you would need to check the legislation and Article 4 Direction first before undertaking any external works. All internal works to a property within a conservation area, can be undertaken without planning permission, provided it is not a statutory listed building too.

3.7 Listed buildings are a separate category of heritage value and would require listed building consent for any internal and external works. Table 1 provides a quick overview of what the Council would find acceptable as internal and external refurbishment works to a listed building with listed building consent. The Historic England website provides guidance on climate resilience too - [Adapting Historic Buildings for Energy and Carbon Efficiency | Historic England and Energy Efficiency and Retrofit in Historic Buildings | Historic England](#)

³ Thermal bridging occurs where materials that are better conductors of heat are allowed to form a 'bridge' between the inner and outer face of a construction/structure (Kingspan definition)

Refurbishment first...

a. ROOF: The insulating properties of the roof should be investigated first because 30% of the heat to the building will be lost through the roof. As such, it is important to ensure this element of the property is at its maximum efficiency when it comes to retaining heat. Further information about roofs and energy saving can be found here: [Roof and loft insulation guide - Energy Saving Trust](#) . Materials for roof insulation that have a low embodied carbon can be found here: [How to Replace a Roof - GreenBuildingAdvisor](#)

- **Blue-Green/living roof** – If it is possible for your building to support a green/living roof, further details are provided at chapter 1. Additionally, information with case studies can be found here: [Livingroofs.org](#), the leading UK green roof website. A blue-green roof is advised if surface water flooding is common around the site.

b. External Walls: You will need to check whether the external walls can accommodate cavity wall insulation or whether external cladding is required. If your property is within a conservation area and you want to install external cladding as insulation to the outer wall, you will require planning permission because it does not fall within permitted development. Further advice should be sought from the Council's Heritage officers. General guidance can be found here: [Advice on insulating your solid walls - Energy Saving Trust](#).

- **Green/living walls** – If you would like to install a green wall or vertical meadow to an existing external wall, please see chapter 1 of this SPD for more guidance and check the Building Regulations Fire Safety restrictions. Additionally, further information can be found here: [Vertical Meadow | Bringing Biodiversity Back Into Our Cities](#)

c. Windows: To prevent thermal bridging, it is recommended that windows be refurbished once the external walls have been insulated. Windows can be a thermal weak spot for existing buildings, which can allow heat gain on hot summer days and contribute to heat loss during colder seasons. Whilst double glazing is better than single glazing, to combat extremes in temperature change it is recommended that triple glazing with a u-value⁴ of 0.80 be installed in buildings. Additionally, the loss of original windows in certain circumstances will be resisted where it would erode the historic fabric of a building.

- **Window frames:** The Council will always recommend timber frames first because of its low embodied carbon; followed by composite aluminium and timber frames as the second choice. This is because aluminium is a material that can be recycled without ending up in landfill. The Council is also open to other window materials suggestions. Whilst uPVC is the cheaper option and may have an embodied carbon that is lower than aluminium, the whole-life carbon cycle of uPVC is much larger because uPVC ends up in landfill without being recycled and leaches out contaminants such as phthalates and dioxins, over time. Energy efficient windows and doors - Energy Saving Trust
- The Urban Design Guide SPD sets out design considerations at pages 51, 175 and 269. Please refer to this too.

Listed buildings: it is preferred that only single glazed timber frames be used here. However, slim-line double glazing has been supported in some cases where low-level harm was considered to be present. There is also the option of secondary glazing with double glazed panes sitting on the inside of the property. Secondary glazing can work well provided humidity levels in the property are accounted for in the design

⁴ U-value – This is measurement rate of heat transfer through a specific section of a building i.e. through walls, windows, doors, roofs, etc. It indicates how well or poorly that element of a building transmits heat from inside to the outside. The lower the u-value, the better the insulation. See Glossary for list of u-values.

Conservation areas: Where there is an Article 4 Direction, the front windows should only contain slim-line double or triple glazing with a maximum glazing thickness of 16mm with timber or aluminium frames, depending on the character or uniformity of the conservation area

With an Article 4 Direction, only 12mm thickness glazing to the frontage will be acceptable with matching materiality of the frames. Please refer to the correct Article 4 Direction for specific design considerations too:

[Areas with extra planning restrictions](#) | [Article 4 direction areas](#) | [Royal Borough of Greenwich](#).

Low-e glass: a film that sits on the outside of the glazing. It can keep out excessive heat and retain internal heat well. Overall, the whole life carbon cycle (WLC) will reduce carbon emissions. For Listed Buildings, please consult the duty planner: dutyplanner@royalgreenwich.gov.uk.

d. Shading & cooling: The installation and use of air conditioning units for use during the warmer seasons is strongly discouraged because they increase atmospheric carbon emissions. Instead, forms of window shading and planting are advised; and where possible, tree planting to south facing walls. Inside a building, shutters, curtains and blinds can help prevent solar gain; whilst add-ons to the outside of a window for shading can take the form of screening, shutters, brise soleil, awnings or even planting. Low-e glass can also be inserted on large south facing windows where they help to reflect-back high outdoor temperatures.

Table 1: Overview of acceptable refurbishments and retrofitted low-carbon energy systems for a listed building

Intervention	Listed building	Conservation Area
Roof – internal insulation	<ul style="list-style-type: none"> • Acceptable – with Listed Building Consent; will require Listed Building’s Consent. The proposal must include roof replacement in matching original ‘materiality’. 	<ul style="list-style-type: none"> • Acceptable – does not require planning permission. Building control notification may be required
Roof – external repairs	<ul style="list-style-type: none"> • Like for like repairs in matching materiality is Acceptable – with Listed Building Consent; though this is dependent on the nature of the repairs, any alteration to the roof structure or extension will be subject to planning permission 	<ul style="list-style-type: none"> • Acceptable – Planning permission may be required. Small scale repair work can be undertaken without permission, provided it does not materially impact the appearance of non-listed buildings • Check Article 4 Direction to see whether permitted development rights have been removed – If there is an Article 4 in place, planning permission will be needed • No Article 4 Direction - a Lawful Development certificate application is recommended
Roof – green/blue to an extension	<ul style="list-style-type: none"> • Acceptable – with Listed Building Consent subject to the roof would not cause harm to the character of the of the listed building. Pre-application advice recommended. 	<ul style="list-style-type: none"> • Acceptable – to a side or rear extension. May need planning permission if an Article 4 Direction in in place, it will restrict permitted development under Class A • No Article 4 Direction - a Lawful Development certificate application is recommended

Intervention	Listed building	Conservation Area
External walls - cladding	<ul style="list-style-type: none"> Unacceptable (would cause substantial harm) 	<ul style="list-style-type: none"> May be acceptable depending on the conservation area and surrounding context. Will require planning permission because it is restricted under Class A
Windows	<ul style="list-style-type: none"> Acceptable – with Listed Building Consent provided frames are timber and contain slim-line double glazed pane. Original/early windows should be retained with secondary double glazing Secondary internal glazing, acceptable, with Listed Building Consent 	<ul style="list-style-type: none"> Acceptable – timber or aluminium composite with double or triple glazing to rear. Frontage: maximum 16mm glazing thickness With Article 4 Direction: windows on frontage to be slim-line with glazing of no more than 12mm in thickness
Shading & cooling	<ul style="list-style-type: none"> External attachments to the outside of the building such as shutters or awnings - unacceptable Acceptable – planting to be discussed with Council Officer. Does not require Listed Building Consent 	<ul style="list-style-type: none"> Acceptable to rear of property – attachments to the building such as shutters or awnings may need planning permission With an Article 4 Direction: Fixtures/fittings to frontage of building will not be acceptable
Internal walls - insulation	<ul style="list-style-type: none"> Acceptable – would require discussion with Council Officer first. Listed Building Consent, Internal insulation can impact skirting boards, window openings, picture rails etc. 	<ul style="list-style-type: none"> Acceptable – no planning permission required

Intervention	Listed building	Conservation Area
Internal floors - replacement	<ul style="list-style-type: none"> Unacceptable – original floors to be retained and repaired in situ. Carpeting may be acceptable without listed Building Consent. Always seek email confirmation from the Conservation Officer, prior to commencement of works. 	<ul style="list-style-type: none"> Acceptable – no planning permission required
PV panels or solar thermal	<ul style="list-style-type: none"> Unacceptable – to main roof of building visible from any public realm, be it front or rear. Acceptable - to any flat roof of the host building or an extension with a flat roof 	<ul style="list-style-type: none"> Acceptable – no planning permission required. Preferably fixed where it is not visible from the public highway With Article 4 direction – acceptable only where they do not impact the character and appearance of the property and locality
Air Source Heat Pump	<ul style="list-style-type: none"> Acceptable – to the rear and away from any external wall of Listed building and placed within an enclosure, appropriately enclosed in sympathetic materiality. Internal piping to run at low level without any destruction cause to the skirting boards or historic panelling or architectural features 	<ul style="list-style-type: none"> Acceptable – only to rear of property. Should meet all conditions for size and noise set by the permitted development regulations
Ground Source Heat Pump	<ul style="list-style-type: none"> Acceptable – will require Listed building consent 	<ul style="list-style-type: none"> Acceptable – no planning permission required. Preferably fixed where there is no terrestrial equipment visible from the public highway With Article 4 direction – check wording
Electric boiler	<ul style="list-style-type: none"> Acceptable – will require Listed building consent if new piping is required 	<ul style="list-style-type: none"> Acceptable – no planning permission required



Conservation area and Listed building applicants: seek confirmation that works do not require planning permission or listed building consent through a [lawful development certificate](#)

Duty planner: dutyplanner@royalgreenwich.gov.uk

Practical Low Carbon Energy Systems for Existing Buildings - Energy retrofit, second

3.9 The type of renewable energy system you choose will depend on the size of the property and its energy demand. The section below seeks to inform you of the different energy systems that are currently available so that when you seek professional advice from various suppliers, you have an initial understanding of what is out there and can make an informed choice.

3.10 Permitted development rights set at Schedule 2 Part 14 (renewable technologies) of GDPO (as amended) enable most properties to install these energy systems without the need for planning permission, provided the size and location of the system complies with set conditions in the legislation. See figure 1 for Use Classes.

3.11 Generally, if your property is outside of a conservation area and is not a listed building, it will have permitted development rights for the energy systems described below. If you want to place your chosen renewables elsewhere on the building, outside of the permitted development regulations e.g. on external walls or in the front garden, you should contact the council with details of your property for further advice – dutyplanner@royalgreenwich.gov.uk. The South East London Community Energy (SELCE) also provides useful information on energy efficiency improvements: [Home Page - SELCE](#)

Solar/Photovoltaic Panels (PV)

3.12 Solar panels use sunlight to provide electricity for a property. Under Use Class A of Part 14 for permitted development, the panels can be fitted to the roof of a building to allow for maximum sunlight exposure and absorption, preferably fixed in a south facing direction. The panel system would be attached to an energy inverter and maybe a battery for energy storage.

3.13 Integrated solar panel systems are available and are generally less of an eyesore in terms of an addition to the external roof surface, as shown in Photo 1. This type of system is preferable for all properties, more so for those with any heritage or architectural merits.

3.14 If it is not possible to have the PV panels facing fully south, a southwest to southeast direction is the second-best position. Panels on north-facing roofs can still operate, however they would not function at their maximum efficiency. The best angle or gradient for solar panels to be set up in is between 30 – 65 degrees. For a flat roof, the panels would be angled on a mount. You should also ensure the panels would not be overshadowed by neighbouring structures or trees.

3.15 All properties, except listed buildings, have PD rights to install PVs to the roof, but there are conditions that must be met in relation to the height of the equipment from the roof slope:

- For a pitched roof - the PV's should not project more than 0.2m beyond the plane of the roof surface and should not project higher than the highest part of the pitched roof slope (excluding the chimney)
- For a flat roof – the PVs should not project more that 0.6m higher than the highest part of the roof (excluding the chimney)
- For a conservation area – the solar PVs can be installed as above but cannot be installed on a wall which fronts a highway. Ideally, the panels should match the colour of the roof, where they are typically installed



3.16 Whilst the permitted development rights allow for PVs to be placed on the front roof slopes, the council does request that they appear discreet and do not harm the character and appearance of the property or locality. If you're able to install PVs that sit flush/integrated with the roof slope, this would be welcome. Your chosen supplier would be able to advise you on the best arrangement and siting of the panels, their colour and surface finish for your property, which can all play a part for best installation with minimal impact to the property.

You can find out further information here:

- [Solar panels: costs, savings and benefits explained - Energy Saving Trust](#)
- [Solar panels and home batteries | Good Energy](#);
- [Ultimate Solar Guide - Solar Fast](#)

Solar Thermal

3.17 Also falling within Use Class A of Part 14 for permitted development is the installation of solar water heating to the roof of a property. This low-carbon energy system uses heat energy from the sun to heat water for storage in a hot water cylinder or thermal store. The system uses panels or tubes called solar collectors to absorb the sun's heat energy.

3.18 In the UK, given the colder seasons, heat energy from the sun for hot water would be variable and as such an electric boiler or immersion heater would be required to make up any preferred heat difference. Whilst the majority of free hot water would be available during the warmer seasons, solar thermal does reduce carbon emissions and your energy bills.

3.19 Solar thermal has two types of collection system, either by a bank of glass tubes shown in Photo 2; or by a plate of collectors shown in Photo 3. Both systems would have to be placed on the south facing roof slope to optimise exposure to the sun.

3.20 Given the stark presence of this technology on a sloped roof, it is preferable these be installed on the rear roof slope; more so where it is not visible from the public highway. The conditions for siting of solar thermal are the same as those for PV panels as set out in paragraph 3.15 above. Further information can be found here: Advice on installing solar water heating - Energy Saving Trust

Air Source Heat Pump (ASHP)

3.21 Air source heat pumps (ASHP) fall under Class G of Part 14 of the permitted development regulations. They provide energy for heating and hot water and have a significantly reduced carbon dioxide emission compared to traditional gas boilers and electric heating. They are widely advertised as an ideal renewable energy system not only because they help to tackle climate change but also because once installed, they reduce energy bills. The equipment consists of an external unit and an internal unit with a hot water cylinder. If your property is a commercial or industrial building, it will also require a three-phase electricity supply too which means it can carry a larger amount of power. Only very large homes that use a large amount of power to run, may require a three-phase supply. This is something to check with your chosen ASHP supplier.

3.22 Similar to the existing technology used for refrigeration, but in reverse, the ASHP works by gathering small amounts of heat energy from the air and concentrating it through a coil system to warm up the inside of your property and to heat water. If the system has a reverse valve, it can also be used for cooling a building. Photo 4 illustrates a typical external unit for a home, placed on an outside wall alongside an electric vehicle charging point (EVCP).

3.23 Whilst the heat extracted is from a renewable source (air), the process still requires a small amount of electricity to power. When paired with other renewable technology like solar panels, air source heat pumps can provide energy to your property in a more sustainable way.

3.24 Heat pumps are suitable for both new and existing buildings but are most effective (and therefore use less electricity) when the building is reasonably air-tight and well insulated. This means that the whole building approach should be followed to ensure energy efficiency.

3.25 Placement: When installing a heat pump, you should be mindful to place the unit somewhere where it does not impact the character of the property or your ability to use the outdoor amenity space. This would generally be:

- To the side or rear of a property where there is easy accessibility for maintenance. You can partially hide an ASHP or effectively integrate it with the architectural character of the host building by using timber or other appealing material covers or partial enclosures. These should however be carefully implemented so as not to affect the air provision needed by the pump. Landscaping can also be used to your advantage or the installation of a decorative low boundary.
- A flat principal roof towards the rear of the property, set-in from the roof edge by at least 1m and from any walls by 2m to allow for efficiency
- For extensions, placement should be to the rear of a property

3.26 Your chosen supplier should propose a reasonable siting for the ASHP that falls within [permitted development](#)

3.27 Additionally for consideration are noise impacts, accessibility for maintenance and circulation around unit.

Further information about ASHP can be found here:

- [Air source heat pumps | Good Energy](#)
- [Consumer Advice Archives - HeatGeek](#)

Ground Source Heat Pump (GSHP)

3.28 A ground source heat pump (GSHP) falls under Class C of Part 14 of the permitted development regulations. It takes heat from the ground to provide energy for heat and hot water to a building. The system technology is similar to an ASHP, the difference being that a network of pipes filled with water and antifreeze are buried quite deep into the ground and across a large area to draw warmth from the earth into the pipes, see photo 5. The fluid in the pipes then warms up and passes through a heat exchanger within the heat pump to provide heat energy and hot water for the building.

3.29 Because a large outdoor area is required to lay down the pipes required for a GSHP it is more advisable that this system be used for larger homes or for multiple homes in a block

Further details can be found here:

- [Ground source heat pumps - Energy Saving Trust](#)
- [Air source vs ground source heat pumps - Energy Saving Trust](#)

Other Renewable Energy Systems

3.30 There are other low-carbon energy systems available on the market which the Council advise you investigate further, such as:

- Electric boilers: These can be installed into most buildings under permitted development rights. If you are looking to retrofit a listed building, it is likely that this would be the first low-carbon energy system you consider because of its low impact to the listed property.
- Solar air heaters: This technology is relatively new. Planning permission may be required depending on where the equipment needs to be fixed to your property. However, this should not be considered an obstacle to investigate its suitability for your property. Further information can be found here: [Solar Air Heating using Solar Air Collectors](#)

An environmental permit, consent and licence may be required from the Environment Agency before you install a ground source or surface water source heating or cooling system. [Open loop heat pump systems: apply to install one - GOV.UK](#).

New Developments

3.31 New developments have the opportunity to create exemplar schemes for climate resilience. Through a Whole Site Approach (WSA), new build schemes are expected to have a holistic and integrative design that will yield the maximum reduction of carbon emissions for a net-zero development that is embedded in nature. Whilst regional policy ensures a major scheme seeks to achieve this (net-zero), it is the non-major (minor) new build schemes that the Council is mindful to capture and encourage a nature first net-zero climate resilient development. The WSA includes following concepts to support the creation of a low-carbon climate resilient development:

- **Nature first** – Planting, sustainable drainage (SuDS), shading and cooling, and biodiversity to be embedded into the design of the scheme for climate resilience
- **Carbon reduction** – Demonstrate principles set by the Low Energy Transformation Initiative (LETI). All new build developments should aspire to meet the LETI embodied carbon targets⁵
- **Operational emissions** - low carbon emissions once occupied
- **Passivhaus & BREEAM⁶** – different design methods for buildings to achieve net-zero emissions

3.32 Construction often comes at a cost to nature leading to biodiversity loss and reduced quality of life. As such, bridging the gap between pre-construction landscapes and post development environments is crucial.

3.33 Applicants are also reminded to visit the Royal Borough's Urban Design Guide for further advice about size, scale and the characterisation of an area where a development is proposed.

3.34 The whole site approach (WSA) is not a new design concept. In particular, we urge applicants and developers to always consider opportunities to improve nature on-site and to think about existing and new planted features for its multiple benefits including climate resilience. Nature for climate resilience should be embedded into a new development. The Wildlife Trust has published guidance embedding nature with house building .

3.35 As such, the WSA starts with Nature First, the site's topography; looking at the existing and natural planted features of a site, such as mature trees. Natural features should be retained and adapted for the benefit of climate resilience through SuDS and shading/cooling. This then embeds nature into a new development scheme around which the footprint of the building can be designed, taking into account other design considerations addressed by policy and the Royal Greenwich Urban Design Guide SPD (2023).

3.36 Carbon reduction through a fabric first consideration as part of the whole life-cycle for carbon for the entire scheme is the second stage of WSA. This enables you to consider the embodied carbon for the whole scheme and to reduce carbon emissions towards a net-zero development. Finally, energy supply for the whole scheme should be integrated into the scheme and its efficiency calculated using the Mayor of London's guidance for energy assessments.

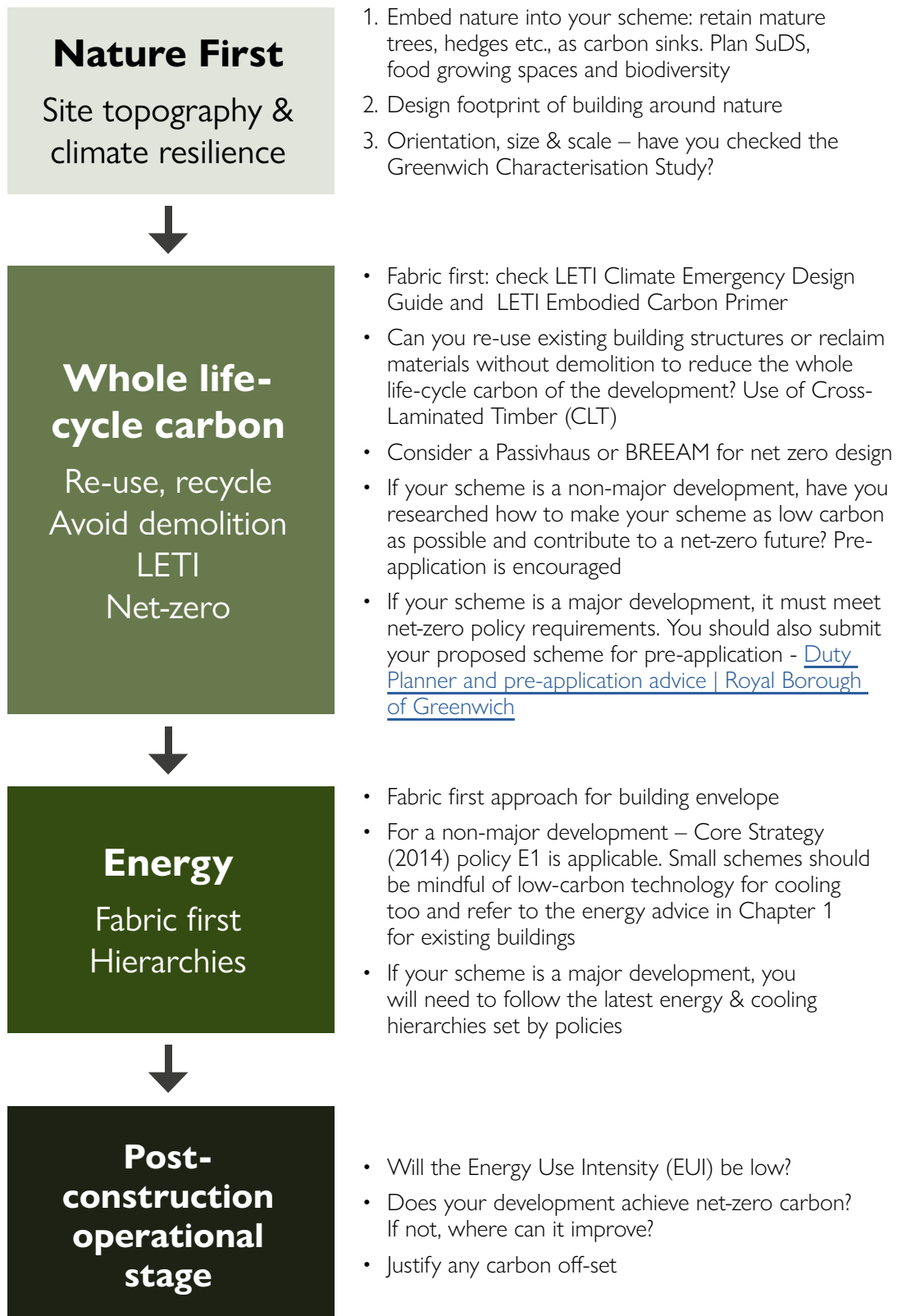


⁵ LETI have created the [Embodied Carbon Primer](#) document as supplementary guidance to their [Climate Emergency Design Guide](#) to aid those working in the built environment to reduce embodied carbon in buildings.

⁶ See Glossary

⁷ 'Swift and Wild. How to building houses and restore nature together'

Figure 2: Whole Site Approach (WSA)



Nature First - site topography

3.37 Nature, climate and urban development are now inseparable, as set out in [chapter 2](#). Improving nature and biodiversity is a key principle for climate mitigation⁸. Moreover, nature-based solutions for climate resilience are carbon positive because vegetation absorbs carbon dioxide and can improve air quality. We also know that broad leaf tree canopies provide vital shading and cooling to a site and its surrounding area and can help decrease heat risk from higher summer temperatures⁹. Mature canopies also contain ecosystems and understanding the benefit of these is essential to supporting biodiversity.

3.38 To embed nature into a development, we request applicants and developers to take a nature first approach to harness any environmental, social and economic value that existing mature vegetation could bring to a proposed development. This means:

- Habitat stability for biodiversity – consider retaining good tree canopies, healthy hedges and mature planted beds which can aid climate resilience
- Nature based solution – Use of sustainable drainage systems (SuDS) and/ or other suitable nature-based solutions for climate resilience, including suitable trees.
- Wider planting for climate resilience – Use of planting for shading and cooling; use climate resilient planting to complement the surrounding area too. Consider the economic, environmental and social good landscaping would bring to the development. For urban tree planting, refer to the [Trees & Action Group](#)
- Construction phase - Use of vertical meadows on hoardings should be considered, particularly along busy roads where noise and pollution from traffic make active travel unpleasant. A case study for a vertical meadow is explained here: [Green Construction | London Borough of Tower Hamlets | The Nature of Building](#).

3.39 Where a nature first assessment concludes that the health of the on-site existing mature planting would be better replaced with a more climate resilient species, then this would be acceptable and would require submission of relevant information from a qualified and reasonably experienced ecologist or landscape architect.

NB: Major developments and some minor ones will need to consider biodiversity net gain (BNG) within the scheme too [Biodiversity net gain - GOV.UK](#).

⁸ [What is climate change mitigation and why is it urgent? | Climate Promise](#)

⁹ [Planting more trees could decrease deaths from higher summer temperatures in cities by a third | LSHTM](#) (Feb 2023)

Whole Life-Cycle Carbon (WLC)

3.40 New building developments have a significant role to play in reducing carbon emissions through the whole life-cycle carbon. A WLC assessment details all carbon emissions that arise from the energy outputs that would result from the construction, operation/occupation, maintenance and demolition phases of a building. Carbon emissions related to buildings are explained in two ways - embodied and the operational (see Glossary). Major schemes referable to the Mayor are required by policy to submit a WLC assessment with a scheme. However, given the climate emergency, Royal Greenwich encourages all new build developments to consider a WLC assessment for major and non-major schemes to demonstrate their commitment to reducing embodied and operational carbon to support the Royal Borough's climate emergency and our Carbon Neutral Plan.

- **Materials:** Prioritise the retention and refurbishment of existing buildings over demolition and rebuild because this can provide one of the greatest opportunities to minimise the embodied carbon emissions of a scheme. After assessing any retention value, the minimisation of carbon emissions through embodied carbon should be considered. This means checking the market for local building materials and for sustainable building methods that will last the lifetime of the building; and can be recycled or re-used without ending up in landfill¹⁰. This should reduce future costs for maintenance, repair, and replacement, further information about materials with low embodied carbon can be found in [chapter 4](#). A WLC approach recognises the embodied carbon and operational carbon of a development.
- **Fabric first:** All new developments should seek to reduce their energy consumption through maximising thermal performance by adopting a fabric first approach. The building 'fabric' is made up of the materials used in walls, floors, roof and windows. The more insulation value contained within these elements, the better the

¹⁰ Circular economy principles



thermal performance of the building. However, ‘fabric’ also includes the building’s overall airtightness, as well as the impact of thermal bridges where the insulation layer is not continuous. You should also be mindful of ventilation for the building.

- **LETI:** Applicants for new developments should aspire to meet the Low Energy Transformation Initiative LETI embodied carbon targets. LETI have created the Embodied Carbon Primer document as supplementary guidance to their Climate Emergency Design Guide to aid those working in the built environment to reduce embodied carbon in buildings. See here: [LETI Whole life Carbon infographic](#)
- **Building regulations:** The current framework within Part L of the Building Regulations uses carbon emissions as the basis to determine compliance under the Standard Assessment Procedure (SAP). The carbon produced by new buildings is estimated using Carbon Emission Factors, which are periodically updated to reflect the changing carbon intensities of fuel supply. Additionally, developers can provide alternative metrics to demonstrate their energy performance such as Energy Use Intensity targets and Space Heating Demand. By providing this information, we can see a clearer picture of how your building will perform.
- **Energy strategies:** Major developments are required to provide a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy. Non-major schemes are also encouraged to maximise on-site carbon reductions through an energy strategy.



Energy

3.41 Through the lean, clean, green, be seen criteria of the energy hierarchy, a few low-carbon and renewable energy sources can be considered for a new development. Set out below are the main ones that can be designed into a major or non-major new build scheme.

Major schemes

3.42 Major developments are required to follow regional policy and comply with the energy and cooling hierarchies¹¹ to ensure the development has a low energy use intensity (EUI) throughout the design, construction and its future operational stages. An energy assessment is expected to be submitted in accordance with the energy assessment guidance (2022) supplementary to the London Plan (2021).

Energy Use Intensity (EUI)

- **Domestic buildings** - All dwellings should achieve an Energy Use Intensity (EUI) of no more than 35 kWh/m²GIA/yr.
- **Non-domestic buildings** - Non-domestic buildings should achieve an Energy Use Intensity (EUI) of no more than the following (where technically feasible) by building type or nearest equivalent:
 - Student/keyworker accommodation, care homes – 35 kWh/m² GIA/yr
 - Warehouses and light industrial units – 35 kWh/m² GIA/yr
 - Schools – 65 kWh/m² GIA/yr
 - Offices, Retail, HE Teaching facilities, GP surgeries – 70 kWh/m² GIA/yr
 - Hotels – 160 kWh/m² GIA/yr

¹¹ London Plan (2021) policies SI2 for Energy hierarchy; and SI⁴ for the cooling hierarchy

3.43 An energy statement submitted with a planning application should incorporate a feasibility discussion on the connection or non-connection to existing or future energy networks within Royal Greenwich.

Non-major schemes

3.44 Non-major developments are encouraged to consider the EUI of the scheme and to choose an energy source that is as low in carbon emissions as possible so as to support the Royal Borough's response to the climate emergency. Policy E1 of the Core Strategy (2014) is still applicable and smaller schemes of 1 to 4 homes should consider solar panels, air source heat pumps and solar air heating technologies.

Space heating demand

- All dwellings should aim to achieve a space heating demand of less than 15 kWh/m² GIA/yr.
- All non-domestic buildings should aim to achieve a space heating demand of less than 15 kWh/m² GIA/yr.

(i). BE LEAN – Fabric first

3.45 For major schemes, the envelope of the building should be designed with a fabric first approach to ensure energy efficiency and energy sufficiency. It is expected that carbon reduction will be reduced by at least 35% above the latest Building regulations baseline for new developments. All new buildings should be built with a low carbon heating and cooling systems and where possible should avoid connecting to the gas network. The fabric of a building should be chosen in relation to the whole life-cycle carbon too to ensure maximum net-zero carbon is achieved.

Net zero

- All new buildings should aspire to be Net Zero Carbon in operation. They should be ultra-low energy buildings; use low carbon heat; contribute to on-site generation of renewable energy; be constructed with low levels of embodied carbon.
- Buildings must also comply with the other requirements of the Building Regulations Part L 2021, e.g. Fabric Energy Efficiency criterion for domestic buildings and Primary Energy criterion for all buildings and demonstrate compliance at planning stage.
- Major development proposals should demonstrate what measures they have taken through submitting an energy strategy. Applicants must undertake predictive energy modelling to demonstrate compliance.

(ii). BE CLEAN – Decentralised energy & district heat networks (DHN)

3.46 These are power plants fuelled by renewable or low-carbon sources that deliver heat energy, similar to the national grid, to a network of several users. All new buildings are expected to connect to an existing heat network, where available, or be designed to connect to one in the future. Royal Greenwich are working with the Government to appraise and develop district heating networks in suitable locations across the borough.

3.47 At present, Royal Greenwich has district heating schemes in Kidbrooke, Greenwich Millennium Village, Greenwich Peninsula and Royal Arsenal & Woolwich. As such, any new building within close proximity range of heat network will be expected to connect to it. Furthermore, any significant planning applications coming forward in areas surrounding existing DH schemes should be made DH-ready (i.e. operating at appropriate temperatures and with identified points / space provision for connection to a DH network).

3.48 There are also new heat networks proposed across the borough. These can be viewed on the London Heat Map, along with other existing and proposed DHNs in the City and **Communal heat networks**. This is an open-access tool showing the relative heat density of different areas, opportunities for connections to ‘anchor heat loads’ and indicate network opportunities. The map also indicates most of the Royal Borough is within a **Heat Network Priority Area**¹². Relevant heat energy information should be cross-referenced as part of the energy planning for both major and non-major developments to identify potential opportunities for network connections to the proposed development site. If there is a future DHN or communal heating system being developed and the development site is in close proximity to the network, then the scheme should be assessed for feasible connection and designed for future connection to a heat network i.e. connection-ready. This will ensure that opportunities emerge for the expansion of DH as a critical mass of ‘enabled’ properties is delivered.

For MAJOR schemes, applicants should follow the process outlined below:

- Prepare a feasibility statement for the connection into an existing heat network. This should be included in the Energy Statement.
- Identify existing DHN systems that could be connected into. Insert an indicative map of to assist developers of the existing and potential DHN in Greenwich.
- If no existing DHN is present in the area, applicants must investigate whether a network is planned in the area by checking the London Heat Map.
- Create their own localised DHN or implement a site-wide low carbon communal heating system.
- Where there is potential for a future DHN or future proofing, but the applicant considers that allowing for future connection will result in uneconomic costs to end users, they must provide a whole life cost (WLC) analysis comparing the communal and proposed systems. Please refer to “Energy planning - Greater London Authority guidance on preparing energy assessments (March 2016)” for details of how this should be approached.
- Larger schemes may choose to opt for alternative heating sources such as energy clusters or batteries.

¹² Much of Royal Greenwich is now identified as a heat network priority area. This means heat density is sufficient for heat networks to provide a competitive solution for supplying heat to buildings and consumers.

(iii). BE GREEN – Renewable energy generation

3.49 On-site renewable energy generation should be maximised regardless of whether the minimum on-site carbon reduction target has already been achieved, to allow the development to minimise its operational emissions and grid-based energy consumption and provide future occupiers with low-cost energy.

3.50 For new buildings, it is recommended that annual renewable energy generation be at least equal to the energy use of the building (the EUI). If this is not possible to gain on-site, the development should seek to achieve generation of the equivalent of 80 kWh/sqm of building footprint/yr of renewable energy.

3.51 On-site renewable energy generation can include solar PV, whereas thermal, air or ground source heat pumps, and solar air heating are also clean and low-carbon heating solutions.

3.52 Offsetting - Once a proposed scheme has designed how it will maximise the reduction of carbon emissions in accordance with the energy hierarchy, you should look towards off-setting any remaining carbon emission with a cash-in-lieu payment. This should be detailed within the energy statement which the Royal Borough will need to assess first for acceptability. The cost of carbon off-set for Royal Greenwich is detailed in the London Plan, and its subsequent updates and updated Local Plans.

(iv). BE SEEN – Monitoring

3.53 To ensure greenhouse gas emissions are being reduced once a major scheme is in operation, it is required that monitoring of this performance be reported, in accordance with regional policy. Depending on the approved scheme, the monitoring will be secured through condition or legal agreement.



Summary - Energy (major schemes)

- Apply the Energy Hierarchy to new development, adopting a Whole life-cycle carbon with 'fabric first' approach.
- Consider [Passivhaus principles](#) for design and/or [BREEAM](#) to attain net zero
- Future heating technologies will be supported if it can be demonstrated that they are low carbon and sustainable.
- All new buildings should be built with a low carbon heating systems and where possible should avoid connecting to the gas network.
- Developments should connect an existing heat network if one is available or be designed to connect to one in the future (connection ready).
- When future proofing for heating networks, development should allow adequate space for infrastructure. This should be in an area located close to the road, and where the heat network pipe can reach the building to allow the connection point in a practical place

Principles for low-carbon housing design

- Prioritise refurbishment/retrofit over new build to keep carbon emissions low
- Use materials with low-embodied carbon, both for new build and retrofit works
- For new build: focus on low-operational carbon standards such as Passivhaus + low embodied carbon materials
- For retrofit: focus on good indoor air quality and elimination of damp/mould. Large schemes should consider the socio-demographic condition of residents to accurately calculate whole-life carbon emissions and savings
- Keep the form factor and fabric design simple so that the fabric does not have to work too hard (U-values)
- Keep heat losses to a minimum to keep construction and running costs down
- PV out put varies greatly from one building to the next, so focus on reducing the heat demand and EUI first

Further Guidance

- National Planning Policy Framework paragraphs (2023)
- London Plan (2021) Policies SI2, SI3, SI4 and HC1;
- Royal Borough of Greenwich Urban Design Guide 2023;
- [Characterisation and Tall Buildings Study | Royal Borough of Greenwich](#)
- [Vertical Meadow | Bringing Biodiversity Back Into Our Cities](#)
- [Livingroofs.org, the leading UK green roof website](#)
- [Trees and Design Action Group - Home](#)
- [New: Living Walls and Fire Safety Best Practice Guide for External Cladding - Biotecture](#)
- [Green infrastructure & biodiversity - Transport for London](#)
- [Passivhaus Trust](#)
- Be Seen Energy Monitoring LPG (2021)
- Whole Lifecycle Carbon Assessment LPG (2022)
- Energy Assessment Guidance (2022)
- Royal Borough of Greenwich Local Plan, Core Policy E1 and DH1
- Royal Borough of Greenwich Carbon Neutral Plan 2021-2030 (2021)
- Greener Greenwich Strategy, Royal Borough of Greenwich (2016)
- Greater London Authority Whole life cycle carbon assessment (2020)
- LETI Embodied Carbon Primer (2020)
- LETI Whole Life Carbon (2020)
- LETI Climate Emergency Design Guide (2020)
- RIBA Climate Challenge 2030 (2021)
- ETUDE/Passivhaus Trust/Levitt Bernstein/ Elementa Net Zero Carbon Toolkit.
- Home - Heat Geek eCourse



4. Transformative adaptation – extensions and improvements to homes and other buildings

This chapter seeks to provide information on:

- A ‘design process’ for common extensions to help you to create a more climate resilient addition to your property
- Provide visualisations for transformative adaptations to different buildings

Introduction

4.1 There are many types of extension that can be undertaken to a building either through permitted development or full planning permission. The Greenwich Urban Design Guide SPD (UDG) provides principles for the design of residential and non-residential additions to ensure that the proportions of an extension create a quality and sustainable development that does not significantly impact the character and appearance of the host property or locality or negatively impact neighbouring amenity. The UDG also provides guidance for carbon reduction and climate resilience from section B.12 to B15.

4.2 Whether you are building an extension through permitted development or one that requires planning permission, this SPD will advise you about considerations for reducing carbon emissions in line with Principle B.12 of the UDG. An illustration for common projects is provided to help iterate adaptations for climate resilience if you are looking to extend your property.

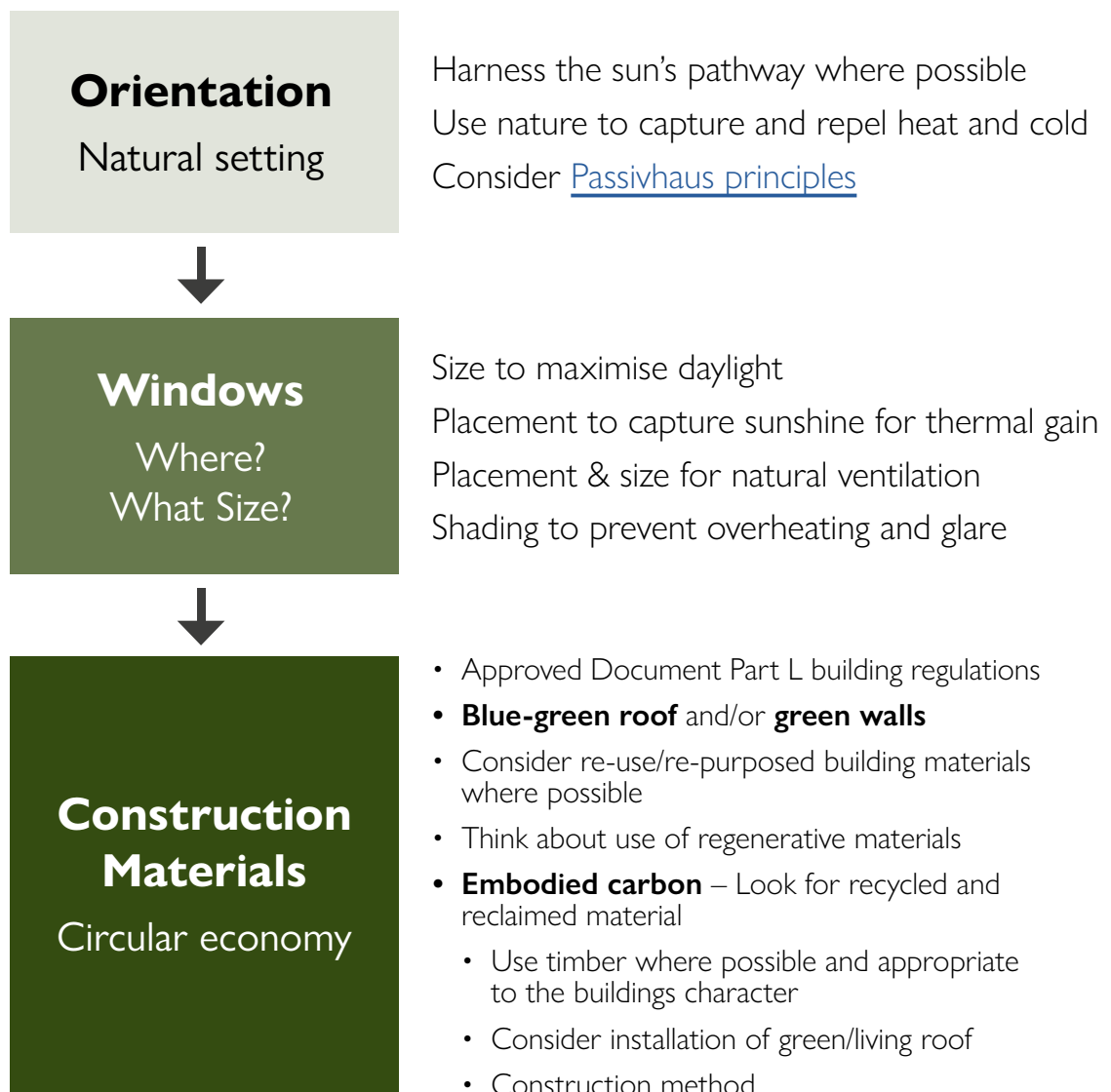
Greenwich Urban Design Guide SPD (UDG): [Urban Design Guide Supplementary Planning Document \(SPD\) | Royal Borough of Greenwich](#)

To reduce carbon emissions for an extension

4.3 In terms of addressing climate resilience, the following design sequence should be considered to ensure your extension will have maximised its reduction of carbon emissions from the outset.

Sequence of design for extensions

Figure 1: Design sequence for improved climate resilience



Orientation & windows

4.4 The pathway of the sun across the sky can be captured for the benefit of natural warmth within your extension and for daylight. Whilst it is understood that there is not always a choice for the siting of an extension due to the existing orientation of the host property, it should be understood the walls and windows that directly face the sun's path will be well lit and warm.

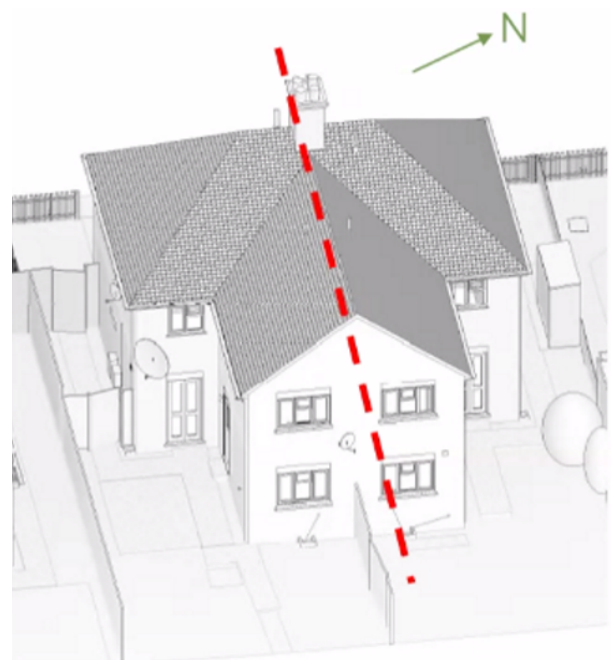
4.5 When an extension is south, east or west facing, you need to be aware that the space would catch sunlight throughout the year which is excellent during the colder seasons meaning less internal heating would be required. But that during the warmer seasons there is a risk of overheating and glare. Solely south-facing extensions would suffer the worst from intense heat. As such, resilience in the form of shading the windows and/or use of low-e glass for glazing should be considered, rather than resorting to mechanical air conditioning which would only increase carbon emissions. The use of a green/living roof is also useful because these will help with temperature regulation during hotter and colder months. Please note that solar panels with a green roof can be installed to the main sloped roof, see photo below.



4.6 For domestic extensions, The Good Homes Alliance provides very useful information about overheating and how to mitigate this.

4.7 For commercial and industrial extensions, the use of the new space should be considered first in terms of how climate resilience can be tackled. Green walls and green roofs will always be encouraged for climate resilience as well as for temperature regulation and adding an attractive feature to the building. NB: please consult Building Regulations, Part L. Volume 2 and/or speak to the council's building control team¹.

4.8 For north facing extensions, the sun's pathway would not directly shine onto its wall, roof or windows. This may sound ideal for the warmer seasons, but it means there would be less natural heat or thermal gain during the colder months of the year and that daylight to its windows would not be as bright and could easily be obscured by adjacent structures. As such, larger than usual windows may be required to maximise daylight, for which double or triple glazing is always recommended for insulation. A blue-green roof would also temperature regulate the internal space of the extension and would collect rainwater.



South half / north half of semi detached home

Heat demand:

South half: 32 kWh/m²a

North half: 51 kWh/m²a

¹ [Building regulations and advice | Find out what to do before starting building works | Royal Borough of Greenwich](#)

Construction materials

4.9 In terms of choosing the materials from which to build your extension, the Council encourages you to research and choose materials that are considered sustainable and have a low embodied carbon conducive to a circular economy. This means, the carbon emissions that were released in creating the building material were not too high. Examples of sustainable and cost-effective building materials include timber, clay bricks, recycled steel, recycled plastic, sheep's wool, cork, rammed earth, straw bales, recycled glass, compressed earth blocks and ferrock (an alternative to cement). You should also be aware of 'green-washing' so as not to be caught out by companies claiming to sell 'eco' or 'enviro' products, but in fact cause harm to the natural environment. Further information about better construction materials can be found at [GreenSpec - Green Building Design, Products and Materials in the UK](#).

4.10 **Reclaimed bricks, reclaimed timber and recycled steel** would all have a low embodied carbon in relation to the whole life-cycle carbon² of an extension. Timber framed windows are always the better choice for low carbon emissions with aluminium and a composite between the two the second choice. Additionally, timber materials are also more appropriate in heritage sensitive settings. Whilst uPVC frames and doors tend to be the more favourable choice for domestic properties because of its comparative price to timber and aluminium, the cost to the environment is greater because of the embodied carbon and lack of ease to recycle the plastic.

4.11 Whichever sustainable construction materials are chosen, you should always cross-reference them with the relevant building regulations too. Building regulations³ are for ensuring the health and safety of a structure, but these would not stop you from being mindful and creative in using sustainable materials.

4.12 **Reduce concrete use** – Whilst concrete has a widespread and practical use in construction and the built environment, this material contains significant embodied carbon. The manufacture of cement for concrete produces the third highest man-made emissions of carbon dioxide, globally⁴. As such, the Council is keen to encourage applicants, householders and developers to research the use of more sustainable materials⁵. Examples of alternatives to concrete for extensions to existing buildings include hempcrete, ferrock or greencrete.

² See glossary

³ [Is building regulations approval needed for an extension? - Extensions - Planning Portal](#)

4.13 Modular building – These are prefabricated extensions which can attach to existing buildings, particularly at ground floor level and can be stacked upwards depending on the type of host property it is attached to. They are also convenient structures for detached outbuildings. Modules can be clad to match the host property and can be built from timber with green roofs and green walls. This form of construction is an acceptable alternative to bricks and blocks and can be made from sustainable materials. It reduces waste production and facilitates the recycling of materials. If you do decide a modular build would suit your property and budget, remember to check the ‘green’ credentials of the construction materials.

Avoid water pollution – When toilets, washing machines, dishwashers and other appliances are incorrectly plumbed into a surface water drain, they’re ‘misconnected’. It is essential they are correctly plumbed into the wastewater sewer, so the water can be taken away and treated properly. Anyone planning an extension or improvement project should check the existing and proposed drainage is connected correctly, following the latest guidance and information.

[ConnectRight: drain connections | Water UK Misconnected pipes | Home improvements | Help | Thames Water](#)

Construction waste – Anyone completing an extension or improvement should be aware of and follow the latest waste management guidance such as the Right Waste Right Place guidance for managing demolition and construction waste and be aware of their Waste Duty of Care. Failure to do so could result in a fine if the waste is found to have been fly-tipped or caused environmental damage. You must use a registered waste carrier to collect, recycle or dispose of any site waste. Check the Environment Agency public register of waste carriers before engaging them. Make sure the waste is accurately described so it is safely managed and know where your waste is going. Anyone who suspects illegal waste activity can report it anonymously to Crimestoppers: 0800 555 111.

Considerations for any extension:

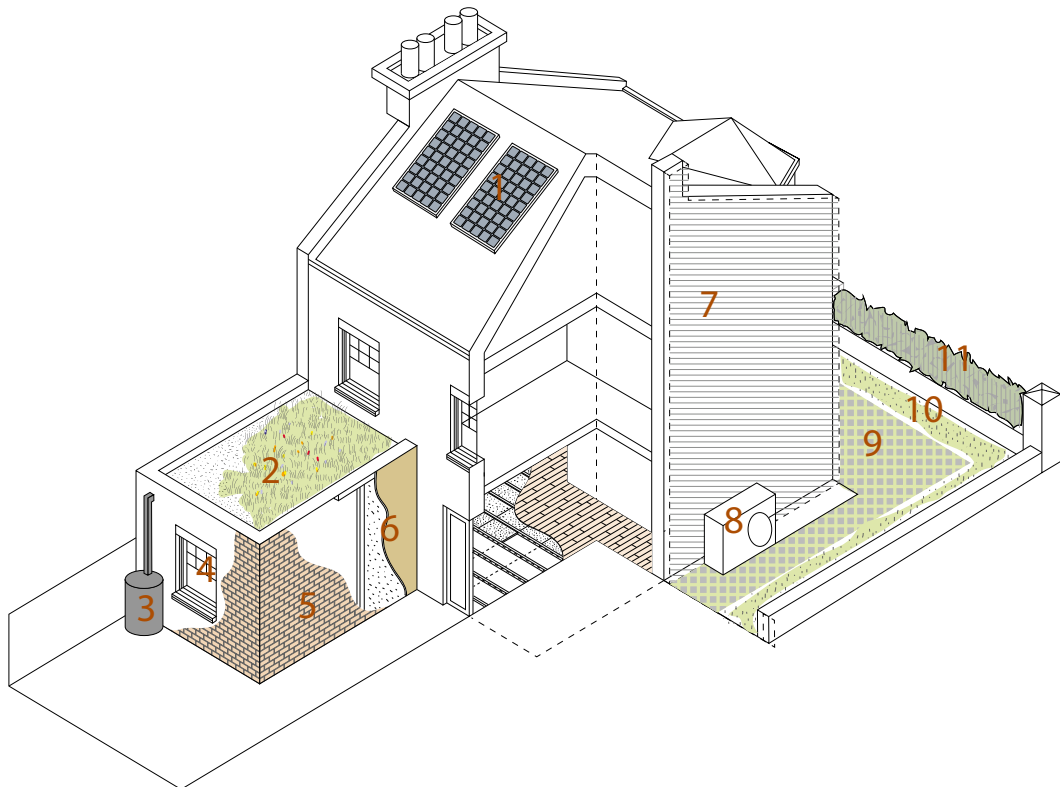
- Orientation - Good daylight/sunlight and shading for windows
- Planting - Natural drainage, biodiversity, cooling and aesthetics
- Roof – for a flat roof, consider a blue-green roof
- Pitched roof – consider solar panels and green roof
- Energy - Low carbon such as ASHP; or zero-carbon energy technology
- Glazing - Use of double or triple glazing, e-glass in a timber frame or aluminium frame
- Circular economy - A construction method and materials that have a low embodied carbon and materials that are environmentally sustainable, re-claimed, re-usable and can be re-cycled

⁴ [The Environmental Impacts of Concrete](#)

⁵ [12 sustainable alternatives to traditional concrete - University College of Estate Management ; Cement alternatives | UKGBC ; Eco-Friendly Alternatives To Traditional Concrete | Specify Concrete](#)

Examples of how additions for climate resilience can be incorporated to a building

a. Property with single storey addition (applicable to 2 storey extension)

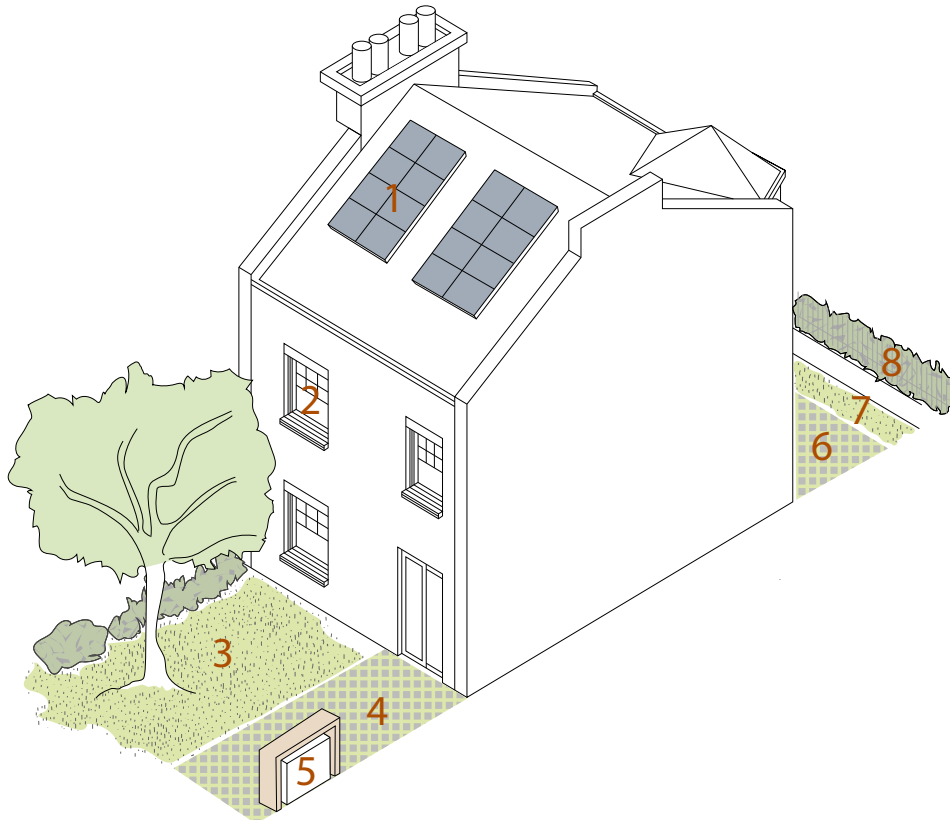


Key: typical property in a non-designated area

1. Solar panels preferably fixed to the rear roof slope
2. Blue-green roof to flat roof of rear extension
3. Water butt collecting rain run-off from downpipe connected to blue-green roof
4. Low-e glass for double or triple glazed window (timber or aluminium framed)
5. Reclaimed bricks
6. Hempcrete with lime render finish
7. External wall or cavity wall insulation
8. Air source heat pump
9. Porous or permeable surfacing
10. Planted beds for rainfall absorption
11. Front boundary hedge or ivy/climbing plants

b. Conservation area property

NB: Many of the features for a property in a non-designated area can be applied to a property within a conservation area. But additions would be stricter here.

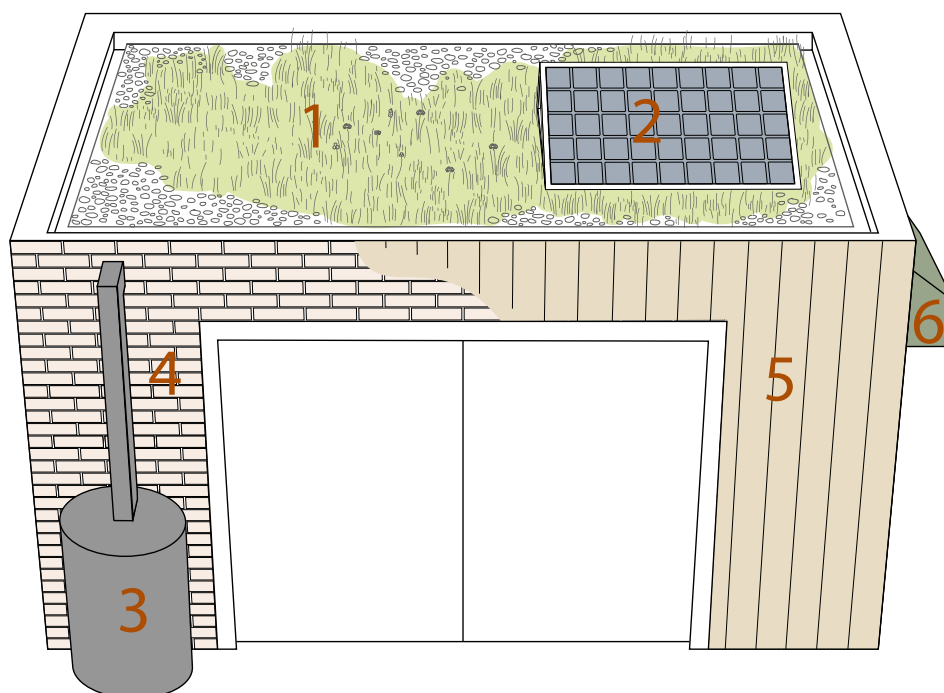


Key: conservation area properties

1. Solar panels preferably fixed where they do not front the public highway and should match colour of roof
2. Timber framed windows with low-e glass and double or triple glazing on rear.
3. Frontage glazing to be slim-line and no more than 16mm in thickness. Where there is an Article 4 Direction to the frontage, only slim-line glazing with a maximum thickness of 12mm is acceptable
4. Soft landscaping with boundary planting & trees
5. Porous or permeable surfacing
6. Front boundary hedge or ivy/climbing plants
7. Air source heat pump with enclosure for noise mitigation, placed away from the property Porous or permeable surfacing Planted beds for rainfall absorption Front boundary hedge; or flowering climbing plants

c. Outbuildings

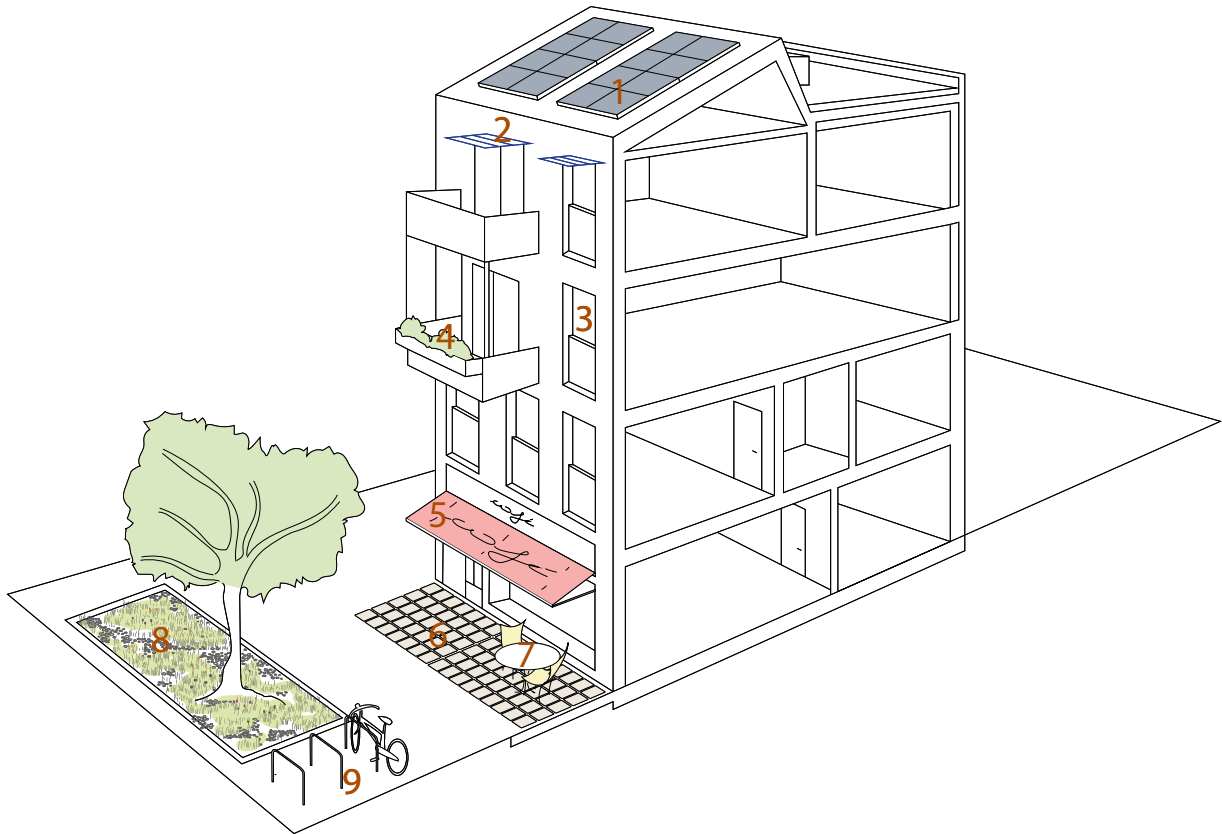
If you're thinking about building a garden room/office, a great example of one which took into account circular economy, rainwater harvesting and biodiversity is given here: [VIEWPOINT: How to build a sustainable shed - a circular economy mini case study](#) → Pollard Thomas Edwards



Key: outbuilding

1. Green-blue roof
2. Solar panel
3. Water butt collecting run-off from the green-blue roof via a downpipe
4. Reclaimed brick
5. Reclaimed timber for cladding
6. Bird box

d. Commercial and mixed-use buildings



Key: commercial building

1. Solar panels
2. Brise soleil
3. Low-e glass, double or triple glazing
4. Planters on balcony
5. Awning for shade
6. Porous hardstanding
7. Outdoor casual seating
8. Rain garden to prevent surface water flooding
9. Short-term cycle parking to encourage active travel

This is an example of a mixed-use building with commercial at ground floor and residential above with additions to deal with extreme weather conditions.

5. Glossary

Biodiversity Net Gain (BNG) – A mandatory planning metric for enhancing existing biodiversity on a development site. Development should not only avoid harm to the environment but should actively contribute to the restoration or enhancement of biodiversity, improving the quality and quantity of the local habitat or ecosystem. [[Understanding biodiversity net gain - GOV.UK](#)]

Bioswale – Is an urban planting solution for accommodating excessive rainfall, particularly in cities. They are a form of sustainable urban drainage. The system comprises channels designed to concentrate and convey stormwater runoff while removing debris and pollution. The planting will be composed of native plants species that support local bird and insect populations.

Blue-green roof – Form of roof covering that enables excess rainfall absorption into the planted roof base and further run-off into a downpipe for collection into a water tank or water butt for either use in planted beds or for slower drainage into the ground without forming puddles/flooding.

Building Research Establishment Environmental Assessment Methodology (BREEAM) is an environmental assessment method for different types of buildings. It has a world standard for rating systems of building and works with net zero goals. [About BREEAM](#)

Carbon Neutral: Carbon neutral refers to the balancing out (making neutral) of carbon emissions from a development. It means that the amount of carbon emitted by a development as a result of its construction and function would be neutralised through interventions in the building that would actively absorb or remove carbon emissions from the atmosphere during its lifetime. For example, concrete has a very high *embodied carbon due to its manufacturing process. When utilised as a construction material, the building could neutralise its embodied carbon by using interventions including a non-fossil fuel energy supply, natural planting that would absorb CO₂, and the use of repurposed or recycled materials.

Circular economy – A Circular Economy is where materials are used for as long as possible and are then adapted for reuse or recycled, leaving minimum waste to go to landfill. In relation to the built environment, a circular economy means prioritising the retention of existing buildings and structures and refurbishment, over demolition and rebuilding, where possible.

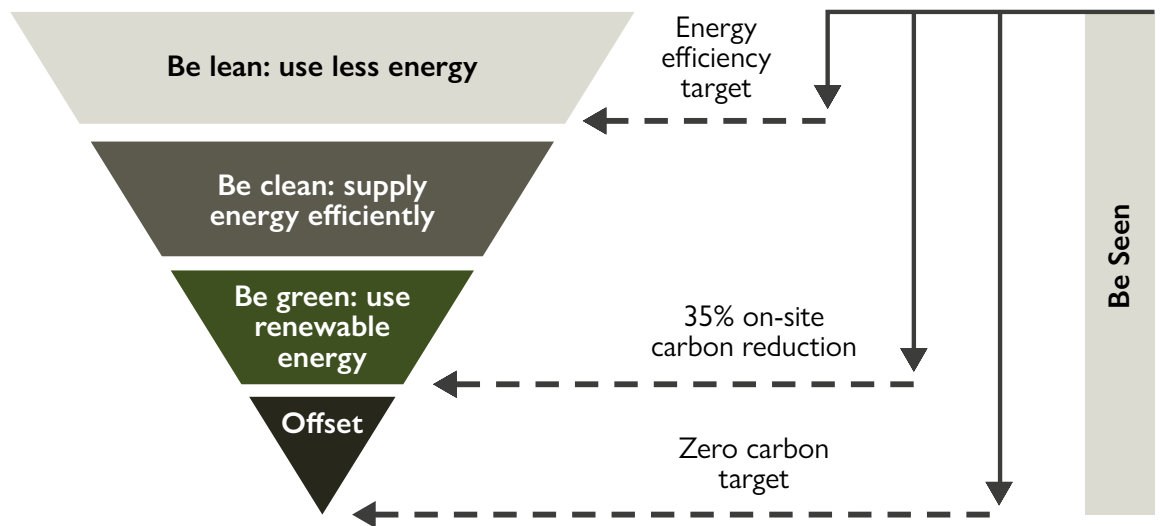
Connection-ready means developments that are optimally designed to connect to a (C)CHP or communal heat network on construction or at some point after construction. Developments will be ‘connection-ready’ if they use a centralised communal wet heating system rather than individual gas/electric boilers or electric heating, and proposals comply with the minimum requirements outlined in the Chartered Institute of Building Services Engineers (CIBSE) Heat Networks Code of Practice.

Embodied carbon: Is the level of carbon associated with the manufacture of each building material used in the construction and operation of a development. Essentially it’s a cradle-to-grave measure that would encompass the carbon emitted through the extraction process for a material, such as petroleum to make plastics; its transportation from the factory to the development site; it’s ‘in-use’ stages of life from maintenance, replacement, and leakage emissions associated with refrigerants; and its ‘end of life’ stages from demolition, disassembly, and disposal of any parts of product or building.

Energy Assessment guidance is provided as a supplementary document to the London Plan (2021).

Energy Use Intensity (EUI) is the total energy needed to run a building over a year (per square metre). It is a measure of the total energy consumption of the building (kWh/m²/yr). The EUI of a building covers all energy uses such as space heating, domestic hot water, ventilation, lighting, cooking and appliances. This metric is also very beneficial as it can be measured after a building is constructed, therefore helping to drive down the performance gap which is such a significant issue in the construction industry. Guidance for an [energy assessment](#) is available as a supplementary document to the London Plan (2021)

Energy hierarchy is set out by London Plan (2021) policy SI2 and figure 9.2 shown below:



External Wall Insulation (EWI) is a type of solid wall insulation attached to the outside walls of your property. Two layers of material are used – the first is to provide insulation, the second is an outer layer of mineral or synthetic render for weather protection and decorative finish.

Greenhouse gases (GHG) are a collection of gases in the Earth's atmosphere which trap heat energy. They occur naturally, but due to human activities, the quantity of these gases has increased and has caused global warming and climate change. The main gases are carbon dioxide (CO₂) which has increased in concentration by 50% since the industrial revolution began in the 1800s ; methane (CH₄) which has increased in concentration due to cattle farming, landfill waste and fossil fuel production; Nitrous oxide (produced by fossil fuel burning, organic fertilisers, nitric-acid production and biomass burning;

Greenspace Information for Greater London (GiGL) is a strategic knowledge base of London's natural environment. It holds data of London's wildlife and green blue infrastructure from which policy and practice decisions can be made across the public, private and voluntary sectors. [Greenspace Information for Greater London CIC - GiGL](#)

Green-blue infrastructure - includes parks, rivers, gardens, lakes woodland and playing fields. Green-blue spaces have an important role in mitigating the effects of climate change. Royal Greenwich will protect and enhance green and blue infrastructure and opportunities for habitat conservation through planning.

Low Energy Transformation Initiative (LETI). [Climate Emergency Design Guide | LETI](#)

Low-e glass – Low emissivity glass. This is glazing that improves energy efficiency for a building. The glass has a microscopically thin and transparent coating that is 500 times thinner than a human hair. It is able to reflect heat (long-wave infrared energy). So when the interior heat energy tries to escape to the colder outside during the winter, the low-e coating reflects the heat back to the inside, reducing the radiant heat loss through the glass. The reverse happens during the summer.

Man-made GHG include fluorinated gases such as hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF₆). These trap heat very effectively in very small concentrations. For example, SF₆ which is used in high-voltage electricity equipment, has a global warming potential that is 23,000 times greater than CO₂.

Operational carbon - This usually includes regulated emissions associated with fixed building services such as heating, hot water, cooling, ventilation, and lighting systems, as well as those associated with energy used by the building occupants such as cooking appliances known as unregulated emissions.

Passivhaus is an international energy performance standard for buildings which aims to reduce the requirement for space heating and cooling. [What is Passivhaus?](#) ; [The Passivhaus standard at BRE](#)

Sites of Importance for Nature Conservation (SINCs) These are London's equivalent of Local Wildlife Sites. They contain important habitats and are designated by a panel of local ecological professionals. It is a non-statutory designation for sites but is given a high level of protection within the planning system. There is hierarchy of designation comprising 1st - Metropolitan Importance; 2nd - Sites of Borough Importance (Grade I & II); 3rd – Sites of Local Importance.

Space Heating Demand refers to the amount of heat energy needed to heat a home over a year and is expressed in kWh/m²/yr. It is a measure of the thermal efficiency of the building elements and is affected by the building form and orientation, insulation, airtightness, windows and doors and the type of ventilation system.

Thermal bridging is the direct connection between the inside and outside of a building where one or more structures is more thermally conductive than the rest of the building envelope, resulting in heat loss outwards, and a local internal surface which is cooler than other, better-insulated internal surfaces, which encourages condensation, and potentially the growth of mould. Thermal bridges can occur in areas such as floor/wall junctions and at door and window surrounds.

Urban heat island effect is caused by the extensive built-up areas absorbing and retaining heat during the day and night leading to higher ambient within the more built-up areas of a city. The concrete and brick and other hard surfaces of buildings and roads absorb greater solar radiation and retain this heat making places like cities hotter and unpleasant to move around. But green spaces and vegetation which also absorb heat can help to cool down and dissipate heat without retaining it making areas more pleasant to be in.

U-values are a rate of measure of heat transfer through a specific section of a building such as the walls, windows, doors, roofs, etc. It indicates how well or poorly that element of a building transmits heat from inside to the outside. The lower the u-value, the better the insulation. Below is a summary of u-values set out in the LETI guidance:

Fabric U-values	(W/m ² .K)
Walls	0.13-0.15
Floor	0.08-0.10
Roof	0.10-0.12
Exposed ceilings/floors	0.13-0.18
Windows	0.08 (triple glazing)
Doors	1.00

Whole building approach (WBA) is the advised design procedure for an existing building. It sets out how assessment of a property should take place to ensure the best way forward to future proof your property for climate resilience

Whole site approach for new build schemes – Employ a nature first approach to planning a new development. Harness the value of existing vegetation on site that would be beneficial to climate resilience and wider environmental benefits – keeping the building cool with shading; absorbing excess rainfall; absorbing air pollution; dampening noise pollution. Following this, the fabric first, energy use and the post-construction of the building can be designed to enhance climate resilience.

Whole life-cycle Carbon (WLC) assessment: A WLC assessment measures the carbon dioxide emitted by a development. It is generally measured as the carbon dioxide equivalent or CO₂e, with the metric measured in comparison emissions to various greenhouse gases on the basis of their global warming potential (GWP). There are assessment templates available for WLC on the GLA website which is useful for all developments. A WLC assessment for a major scheme should be submitted with a proposed development for assessment during the application process. But, if insufficient detail is present, further information will be secured by a pre-commencement condition.

