City of London Corporation

Planning for Sustainability

Supplementary Planning Document | January 2025

CITY OF LONDON

PLANNING FOR SUSTAINABILITY
CONTENTS

ABBREVIATIONS

Abbreviation	Definition
AEP	Annual Exceedance Probability
ASHP	Air Source Heat Pump
AZP	Advanced Zoning Programme
BAP	Biodiversity Action Plan
BGI	(Urban) Blue-Green Infrastructure
BGP	Biodiversity Gain Plan
BIM	Building Information Metric
BM	Biodiversity Metric
BSI	British Standards Institution
BNG	Biodiversity Net Gain
BREEAM	Building Research Establishment Environmental Assessment Method
BU	Biodiversity Unit
CCAS	Clean City Awards Scheme
CCRSS	Climate Change Resilience Sustainability Statement
CE	Circular Economy
CFD	Computational Fluid Dynamics
CIBSE	Chartered Institution of Building Services Engineers
CIL	Community Infrastructure Levy
CLT	Cross-Laminated Timber
CoLC	City of London Corporation
DEFRA	Department for Environment Food and Rural Affairs
DFP	Design for Performance (NABERs UK)
DHW	Domestic Hot Water
DSY	Design Summer Year
EA	Environmental Agency
EAF	Electric Arc Furnace
EASIN	European Alien Species Information Network
ECAP	Embodied Carbon Action Plan
ERIC	Eliminate, Reduce, Isolate, Control
ESG	Environmental, Social and Governance-based investing framework
EUI	Energy Use Intensity
EV	Electric Vehicle
GGBS	Ground Granulated Blast-furnace Slag
GHG	Greenhouse Gas
GiGL	Greenspace Information for Greater London
GLA	Greater London Authority
GWP	Global Warming Potential
HMMP	Habitat Management and Monitoring Plan
HVAC	Heating, Ventilation, and Air Conditioning
INNS	Invasive Non-Native Species
LAEP	Local Area Energy Plan
LEED	Leadership in Energy and Environmental Design (rating system)
LEMP	Landscape and Ecological Management Plan
LERC	Local Environment Records Centre
LETI	Low Energy Transformation Initiative
LFRMS	Local Flood Risk Management Strategy
LISI	London Invasive Species Initiative
LLFA	Lead Local Flood Authority
LNRS	Local Nature Recovery Strategy
LPG	London Plan Guidance
MEP	Mechanical, Electrical and Plumbing
MI	Management Information
NABERS UK	National Australian Built Environment Rating System (UK Version)
NPPF	National Planning Policy Framework
PAN	Planning Advice Note
PAS	Publicly Available Specification
PTAL	Public Transport Accessibility Level
PV	Photovoltaic
RIBA	Royal Institute of British Architects
RICS	Royal Institution of Chartered Surveyors
SINCs	Sites of Importance for Nature Conservation(s)
SPD	Supplementary Planning Document
SuDS	Sustainable Drainage Systems
TFND	Taskforce on Nature-related Financial Disclosures
TM54	Technical Memorandum (CIBSE) Evaluating operational energy use at the design stage
TSE	Treated Sewage Effluent
UGF	Urban Greening Factor
UHI	Urban Heat Island
UKBGC	UK Building Green Council
UKNZCBS	UK Net Zero Carbon Building Standard
UKPN	UK Power Network
UTCI	Universal Thermal Climate Index
WBCSD	World Business Council for Sustainable Development
WELL	Building standard - measures attributes of health and wellbeing
WHO	World Health Organisation
WLC	Whole Life Carbon
WLCA	Whole Life-Cycle Carbon Assessment

INTRODUCTION TO THIS DOCUMENT

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1. INTRODUCTION TO THIS DOCUMENT

City of London context

The City of London (the City) is one of the world's leading international financial and professional services centres and a driver of the UK economy, continually innovating and developing new business areas and flexible ways of working. The quantity and quality of new development, particularly office-led development, will need to meet growing business needs, supporting and strengthening opportunities for the continued collaboration and clustering of businesses that is vital to the City's operations. The demand for additional office floorspace and high land values within the Square Mile have resulted in a high-density and rapidly changing townscape. This presents challenges and opportunities in ensuring that the right amount of development is delivered in in suitable locations.

The future growth of the City needs to take place in an economically, socially and environmentally sustainable and inclusive way, incorporating the principles of Good Growth set out in the London Plan 2021. These principles ensure that London remains resilient to our changing climate and is green and healthy; with clean air, easy access to green space and more efficient buildings supplied by cleaner energy.

The emerging Local Plan, called City Plan 2040, sets out the City of London Corporation's (City Corporation) vision, strategy and objectives, providing a framework for future development in the Square Mile. This framework outlines priorities for our people, businesses, places, and spaces until 2040 and beyond.

This Supplementary Planning Document (SPD) focusses on the environmental sustainability of the City. In the context of widespread climate action, the City Corporation has adopted an ambitious Climate Action Strategy (CAS) which sets out how the organisation will achieve net zero, build up climate resilience and champion sustainable growth. It has also identified climate-related risks that are likely to affect the City in the future, including flooding, overheating, water stress, biodiversity losses, pests and diseases, and disruption to infrastructure.

A sustainable and more resilient City will contribute to reducing the impact on the climate and mitigating future risks. However, it will also enhance the quality of the environment for residents and occupiers by improving air quality, thermal comfort, natural amenities, public realm quality, and accessibility. Developments should support, contribute to, and enhance the quality and sustainability of the environment throughout their life-cycle, including deconstruction, construction, operation and end-of-life.

Furthermore, a sustainable and more resilient City will appeal to landowners and commercial occupiers who are increasingly focussed on high environmental, social and governance (ESG) standards to ensure that risks and opportunities affecting their buildings are managed effectively and in the long term.

Both images: City of London Corporation

1. INTRODUCTION TO THIS DOCUMENT

The aim of this SPD

The purpose of this SPD is to provide guidance on how applicants should approach environmental sustainability in their developments through the application process.

It has been prepared to provide additional detail and guidance on how to fulfil policies of the adopted Local Plan 2015, as well as emerging policies within the City Plan 2040. It sits within a wider suite of policies, strategies and action plans to address key sustainability issues in the local, national and global context. Specifically, this SPD:

- sets out the key approaches that the City Corporation is targeting on different sustainability topics
- identifies a list of key actions to be considered throughout the design process and provides details specific to the City for each sustainability topic
- provides guidance on what, how and when relevant sustainability aspects should be taken into consideration during the planning application process and sets out submission requirements throughout the development process, from pre-application to post-completion stage
- provides a collation of relevant recommended standards, certifications and guidelines.

Applicant teams should work through all topics to maximise co-benefits and reach the best-balanced design package for their site.

The SPD provides further detail on how to interpret polices and is a material consideration in determining planning applications. The SPD sets out guidance about what planning officers expect to see addressed through the proposed design in applications.

The SPD references policy and document requirements applied through the planning process. Requirements referenced as:

- 'must' are mandatory, as required by the Development Plan (Local Plan 2015 until the adoption of City Plan 2040 and the London Plan)
- 'should' are strongly recommended, as applied on case-by-case basis where they constitute a significant opportunity to drive sustainability. Application will be determined by City Corporation planning officers during the pre-application process

Benches in front of the Bloomberg Building © Clive Totman, 2023

1. INTRODUCTION TO THIS DOCUMENT

This SPD is particularly for the use of applicant teams, City Corporation officers and decision makers. The content of this document applies to all major and minor applications for new buildings, refurbishment and retrofitting of existing buildings, extension and alterations, works to open spaces and landscaped areas on sites, and relate to all types of land uses. Specific requirements apply to major developments only, where the floorspace to be created by the development is 1,000sqm+, the site is 1 hectare or more, a residential development of 10+ dwellings, or a residential development on a site of 0.5 hectares or more. For minor developments that include substantial works (e.g. major retrofit, extension etc), detailed sustainability information may be requested in the planning application to demonstrate policy alignment.

Requirements of this SPD will be applied to applications submitted after its adoption. It is recognised that sustainability is an evolving field and that flexibility to allow for future learning and innovations must be applied. The document is expected to be reviewed and updated as and when relevant changes to overarching policy frameworks, strategies and technologies and processes require this.

This document recognises that the guidance contained within it should consider the implications for people within the protected characteristics under The Public Sector Equality Duty set out in the Equality Act 2010. Regard should be given to the principles of inclusive and accessible design in all developments and initiatives, and consideration given to vulnerable groups, including the elderly and children, whenever climate change mitigation and adaptation measures are implemented.

Many of the case studies featured in this document relate to planning applications approved by the City Corporation. The details of these case studies reflect the information submitted by applicants at planning stage, and it is acknowledged that more recent omissions or amendments implemented later on in the design process may not be fully captured in the details displayed. There are also case studies showing a range of completed developments and public realm works.

Structure and themes of the SPD

This SPD is divided into thematic chapters, each with subtopics identified as key sustainability considerations for all development proposals within the City. Despite this separation, it is important to consider the inter-linkages between elements, which can include positive synergies (such as nature-based sustainable urban drainage systems (SuDS) supporting biodiversity), as well as trade-offs between different sustainability issues that need to be balanced. As an example for the latter, high performing thermal insulation materials improve energy efficiency, however, they could contribute to the embodied carbon intensity of a building.

The City Corporation seeks a holistic approach to development and its thorough integration into the strategic sustainability aims of the local and wider context. Opportunities and constraints will vary for each site and schemes should balance all facets of sustainability with the needs of applicants, tenants, residents and the public and local ecosystem.

Chapter 1 – INTRODUCTION

Introduces the overall purpose and structure of this document, how to use the information contained.

Chapter 2 – ENVIRONMENTAL SUSTAINABILITY POLICY FRAMEWORK

Explains the current policy context and provides an overview of the current strategies adopted by the City Corporation to address climate change mitigation and adaptation. It also introduces the sustainability themes identified as key to the City.

Chapter 3 – RETROFIT AND REUSE

Outlines the City Corporation's aspiration to achieve sustainable development though the retrofit and reuse of the existing building stock. It provides guidance on light retrofit, deep retrofit and retrofit with new-build.

Chapter 4 – GREENHOUSE GAS EMISSIONS AND ENERGY USE

Whole Life-Cycle Carbon (WLC) - provides guidance on how to reduce or mitigate the carbon emissions resulting from the construction and use of a building over its entire life, including its demolition and disposal.

Operational Emissions and energy use - examines how to reduce the emissions generated from the day-to-day operation of a development, which are principally driven by energy use and efficiency.

Chapter 5 - CIRCULAR ECONOMY

Circular Economy in Construction - provides guidance on how to shift from a linear to a more circular construction model, where a long-life, loose-fit, low-energy approach is taken to all new and existing buildings and materials.

Operational Circular Economy - focuses on reducing waste produced by occupants, and how to ensure waste that is produced is sorted, stored and treated appropriately.

Chapter 6 – CLIMATE RESILIENCE

Flood Risk and sustainable drainage systems - sets out how flood risk management and sustainable drainage systems should be approached for developments within the City.

Water Resource Management - outlines considerations for City developments to reduce water use.

Building and Urban Overheating - provides guidance on preventing overheating in a dense and urbanised environment such as the City.

Pests & Diseases – provides guidance on how to manage the threat of pests and diseases which could be raised by milder, wetter winters and warmer summers.

Infrastructure Resilience - outlines key considerations for designing efficient and resilient infrastructure for a building and its interface with the context.

Chapter 7 – URBAN GREENING AND BIODIVERSITY

Urban greening - provides guidance on how to connect green spaces and increase biodiversity and amenity value of urban greening in the City.

Urban Greening Factor - defines the Urban Greening Factor and describes the approach needed to achieve the desired outcomes.

Biodiversity – provides guidance on how developments can enhance biodiversity and support the City Corporation's Biodiversity Action Plan.

Biodiversity Net Gain - advice on the application of emerging BNG policy in the City context including how to meet and exceed statutory and policy targets.

Chapter 8 – KEY CONSIDERATIONS AND REQUIREMENTS

Key considerations, recommendations and submission requirements for all stages of the planning process.

APPENDICES

A list of standards, certifications, guidelines and guidance that could help developments drive further sustainability outcomes.

ENVIRONMENTAL SUSTAINABILITY POLICY FRAMEWORK

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2. ENVIRONMENTAL SUSTAINABILITY POLICY FRAMEWORK

Introduction

In transforming the built environment, it is fundamental to adapt to and mitigate the impacts of climate change and achieve sustainable development.

In 2020, 67% of London's direct carbon emissions were attributable to buildings[1] (not accounting for indirect 'embodied' emissions). Embodied carbon makes up an increasing percentage of the total direct and indirect emissions in buildings. Due to the role of the City as a financial and professional services centre and its high-density nature, commercial buildings have a major impact on whole life-cycle emissions.

This chapter outlines key sustainability planning policies and guidance that applies to City developments after the adoption of this SPD. As policies, guidance and certifications are updated and/or new versions are released, it is expected that the current version is applied when referenced in this SPD (unless specifically noted).

National policies

The National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG) set out the government's planning policies for England and how these should be applied. The NPPF reiterates that the purpose of the planning system is to 'contribute to the achievement of sustainable development', acknowledging the role planning can play in securing radical reductions in greenhouse gas emissions and adapting to climate change. The NPPF states that 'The planning system should support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks, and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure'.

The NPPF states that plans should take a proactive approach to mitigating and adapting to climate change, in line with the objectives and provisions of the Climate Change Act 2008.

Under the Environment Act 2021, all planning permissions granted in England (with a few exemptions) have to deliver a Biodiversity Net Gain (BNG). The City Corporation's BNG approach is set out in Chapter 7 with further detail confirmed in the City Plan 2040 upon its adoption.

1 London Assembly (2020) Emissions from Buildings.

Local policies and key guidance

The London Plan 2021 and London Plan Guidance (LPG) published by the Greater London Authority (GLA) will be used alongside the City Corporation's policies when determining planning applications. This SPD has been produced in conformity with the policies and guidance of the London Plan, which are referenced throughout the document where relevant.

For applications referable to the Mayor, this document should be interpreted as supplementary to the submission requirements set by the GLA. For non-referable schemes, this document should be interpreted as primary guidance on how to achieve sustainable development in the City.

The London Plan 2021 is committed to ensuring the capital leads the way to tackle the impacts of climate change by making London a net zero-carbon city by 2030. To support this goal, the GLA expects that new homes are environmentally sustainable and meet emissions targets. The London Plan introduces circular economy principles, with a focus on reducing waste, material reuse and recycling throughout the whole life-cycle (WLC) of a development. It requires developments to achieve an Urban Greening Factor (UGF) score, and for major schemes to demonstrate that they are 'Air Quality Neutral' developments. The London Plan introduces and promotes the Mayor's 'healthy streets' agenda, with a focus on walking and cycling, freight consolidation and green infrastructure.

The City Corporation's Local Plan, adopted in 2015, is the strategy for planning the City. It sets out the vision for shaping the Square Mile up to 2026 and contains policies which guide planning decisions within the City. The Local Plan is currently under review and will be replaced by the emerging City Plan 2040 once it is adopted.

The emerging City Plan 2040, is a plan for the future development of the City of London, setting out what type of development the City Corporation expects to take place and where. It sets out the City Corporation's vision, strategy and objectives for planning up to 2040, together with policies that will guide future decisions on planning applications. This includes the introduction of the 'Retrofit First' approach. Climate change mitigation and adaptation are key priorities and threaded throughout policies in the plan.

Source: City of London Corporation

2. ENVIRONMENTAL SUSTAINABILITY POLICY FRAMEWORK

Connectivity and the City of London Transport Strategy

The City of London is very well-connected, with sustainable transport modes, to surrounding London boroughs and the wider regional context. It has the highest possible Public Transport Accessibility (PTAL) level of 6b. The Department for Energy Security and Net Zero states in its 2021 Local Authority and Regional Greenhouse Gas Emissions Report that "London has the lowest emissions per capita of any region due to the urban nature of the transport system, a high population density and its lower level of large industrial facilities than other regions". The City of London is named as one of the local authorities that had the largest decreases in greenhouse gas emissions since 2005, mostly due to decreases in the commercial electricity sector. The correlation between high levels of sustainable connectivity, the concentration of mixed commercial activities and associated commuting, contributes to the carbon efficiency of the Square Mile and supports a compact, high density, built environment in designated areas of the City.

People walking and cycling make up more than two-thirds of all observed travel activity in the City, whilst cycles made up a greater proportion of traffic than cars and private hire vehicles counted on our streets in 2022.

The City Corporation's Transport Strategy 2024 addresses transport and mobility challenges and opportunities presented by a growing and evolving City. With regard to sustainable development, the strategy provides the framework for continuously improving connectivity between places and accessibility of the City's public realm. This is subject to detailed negotiations with applicants, in particular to:

- Improve the quality and permeability of City streets and spaces to enhance inclusion and accessibility, connectivity between transport modes and enable more people to choose and enjoy walking, wheeling and cycling as part of the Healthy Streets Approach
- Create new pedestrian routes through buildings and development sites, where feasible, and respect, maintain and restore the City's characteristic network of accessible buildings, streets, courts and alleyways
- Identify opportunities to create new public spaces by reallocating carriageway space to more sustainable uses
- Identify opportunities for temporary public realm improvements to renew and rejuvenate spaces in advance of permanent change. This could include temporary planting and greening, art installations, or seating
- Increase the amount of formal and informal seating on-street and in squares, public spaces and parks to maximise opportunities for social interaction
- Identify opportunities to integrate exercise and play into the public realm
- Achieve publicly accessible ground floors and external amenity spaces for improved pedestrian movement, where feasible
- Design inclusive, attractive and convenient building entrances, including for cyclists, and other forms of active travel
- Ensure that adequate cycle parking for visitors is provided
- Reduce detrimental impacts, such as severance of amenity spaces, public realm and pedestrian routes, through servicing access to buildings, by incorporating flexible and innovative servicing solutions for the design of the public realm
- Ensure that our streets and public spaces are safe, feel safe, are shaded and sheltered, cleaner and quieter. This includes designs that are climate resilient, durable and that minimise carbon emissions.

Applicants in the City of London will be required to provide design solutions for improving connectivity, accessibility and the quality of public realm. In particular, measures that increase the use of sustainable transport modes by occupiers and visitors will support the transition to net zero carbon.

The topic chapters of this SPD include key actions, measures and recommendations to improve connectivity and accessibility of developments, including the public realm and private open spaces and their relationship with buildings.

Image: Festival Gardens
Source: Clive Totman, 2023 ©

2. ENVIRONMENTAL SUSTAINABILITY POLICY FRAMEWORK

Climate Action Strategy 2020-2027

The City Corporation has long been a champion of air quality, open space provision, sustainability and, more recently, green finance, recognising that a healthy environment is critical to business and personal wellbeing.

In 2020, the City Corporation adopted a radical Climate Action Strategy (CAS) which breaks new ground and sets out a pathway to achieving net zero emissions for both the City Corporation's activities and the wider activities of businesses and residents in the Square Mile. In adopting the strategy, the City Corporation has committed to:

- Achieve net zero carbon emissions in its own operations by 2027
- Achieve net zero carbon emissions across its investments and supply chain by 2040
- Support the achievement of net zero for the Square Mile by 2040
- Climate resilience in our buildings, public space and infrastructure

The City Corporation is investing £68m between 2020-2027 to support these goals of which £15m is dedicated to preparing the Square Mile for extreme weather events.

The CAS and the actions outlined in the document will help enable the Square Mile to achieve net zero carbon by 2040, tackle climate change, and create opportunities while transitioning to a low-carbon economy.

The City Corporation is enacting a variety of further measures to support the implementation of the CAS

These include:

- A Local Area Energy Plan which sets out the road map to achieve a net-zero energy system in the City by 2040, to be delivered in partnership with our key stakeholders.
- A programme of transport measures to introduce further pedestrian priority and pavement widening across the Square Mile as well as freight consolidation.
- The Cool Streets and Greening Programme which is introducing climate resilience measures to the City's streets and public spaces. The measures include sustainable urban drainage systems, integrated water management, climate resilient greening and enhancements to biodiversity.
- Guidance and case studies on building refurbishment in the City as a way of incentivising retrofit within the construction sector.
- A Heritage Building Retrofit Toolkit to support the adaptation of the 600+ listed buildings, and many more non-listed historic buildings, in the City.
- As the local planning authority, the Corporation has adopted the Carbon Options Guidance Planning Advice Note which seeks to reduce the operational and embodied carbon emissions of schemes in the City.
- An Embodied Carbon Action Plan to reduce the embodied carbon of the built environment in the Square Mile.
- The Skills for a Sustainable Skyline Taskforce established by the Corporation recently reported on its finding to ensure we have the skills, capacity and capability to deliver on our net-zero goals.
- Smart lighting upgrades to the City Corporation's buildings

The City Corporation seeks to use the planning process to implement a range of resilience measures in the Square Mile including green roofs, urban greening, landscaping interventions, flood resilience and climate resilient new buildings. Chapter 6 of this document provides an expanded range of guidance.

Local Area Energy Plan 2023

The City Corporation Local Area Energy Plan (LEAP) sets out the details of what the future collective energy system could look like in the Square Mile with a view to achieving Net Zero across the Square Mile and City Corporation's operations by 2040. It combines robust technical analysis with stakeholder engagement to develop priority action areas.

The LEAP sets out actions that need to be taken by key actors in the Square Mile, including the City Corporation itself, local and national government, energy providers, regulators, industry and residents. Further details are set out in the Operational Energy Use section of this SPD.

Embodied Carbon Action Plan

The City Corporation is developing an Embodied Carbon Action Plan (ECAP) which provides a focus on better understanding the scale of embodied carbon in the Square Mile and developing innovative collective actions to reduce these emissions as part of our Climate Action Strategy. The Plan aims for a 40% reduction target in embodied carbon emissions for all new buildings, infrastructure and renovations in the Square Mile by 2030, in line with World Green Building Council recommendations. The Plan is focused on four main action areas:

- Develop evidence-based targets
- Build for longer-term carbon value
- Build efficiently with the right resources
- Learning and collaboration

Air Quality Strategy 2025-2030 (draft)

Twenty years ago, levels of air pollution across the Square Mile were almost three times what they are today. Over that time, the City Corporation has been taking focussed action through a series of action plans and strategies to improve the quality of the air within the Square Mile and across London. Working collaboratively within the City Corporation, and with external partners and stakeholders, the City Corporation works to reduce ambient concentrations of nitrogen dioxide (NO2) and particulates (PM10 and PM2.5). The variety of pollutant sources require a diverse suite of measures including regulation, enforcement and planning control. Aligning the requirements of this SPD with the Air Quality Strategy ensures cohesion across emission source within development.

The Air Quality Strategy 2025-2030 builds upon continual learning of previous strategies to outline the actions required to achieve compliance with national pollutant standards and to provide a pathway towards meeting 2021 World Health Organisation (WHO) air quality guidelines.

RETROFIT AND REUSE

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3. RETROFIT AND REUSE

Introduction

New development has a high impact on the environment, due to the embodied carbon associated with the extraction, transportation, and production of new materials, energy required for the construction and demolition work itself, and from the building waste materials that need to be transported off the site and processed. A retrofit scheme is likely to result in less upfront embodied carbon emissions than a new-build scheme.

It is critical to retrofit large amounts of existing building stock in the City in order to meet the UK's net zero carbon target. Retrofit also offers opportunities for improving energy efficiency, climate resilience, amenity, health and wellbeing for occupiers.

It is recognised that new developments can provide enhanced opportunities for accessibility, connectivity, density, and sharing of space, facilities and services by a large number of occupiers, residents and visitors. However, retrofitting existing buildings is a principal way of reducing waste and carbon emissions in the construction industry and the Square Mile, whilst maintaining or introducing a characteristic and vibrant mix of building types and uses within them. Different levels of retrofit can help strike the right balance between a low-carbon project and one that works for final users.

Opportunities to retain and retrofit existing buildings, following GLA guidance on WLC assessments and Circular Economy statements, must be fully explored and prioritised before a project team considers demolition of any kind, ideally at concept stage for maximum impact. This is supported by the emerging City Plan 2040's Strategic Policy S8 which, upon its adoption, requires applicants to take a "retrofit-first" approach, prioritising the retention and retrofit of existing buildings, informed by an appraisal of the development options. This approach will contribute to future-proofing and transitioning the Square Mile to a net zero carbon city by 2040.

Key approaches for the City

In the City of London context, retrofitting existing buildings contributes to preserving and enhancing the sensitive character of conservation areas and heritage assets, creating an architecturally innovative environment, and contributing towards making the City a leading leisure and culture destination. The City Corporation will welcome applications that set strong precedents in this regard and promote new ways of thinking about repurposing buildings as an effective way to drive down carbon intensity and create a unique sense of place. Thus, retrofit and reuse respond to developers' and occupiers' wishes to create, live or work in the most sustainable environment possible. The City Corporation strongly supports the creative shift of focus of architects, engineers and designers to the transformation of existing buildings into sustainable, characterful and interesting architecture. Imaginative adaptations of buildings can contribute to the humanity of spaces and improve the creativity of people and their enjoyment of work or life in them.

Adopting a retrofit approach which reduces waste and disturbance to the surrounding context during construction also helps support these aims. The most important actions for achieving success in retrofit projects generally, and in heritage contexts, are outlined on the next pages.

The earlier the potential for retrofitting is discussed, the more likely it is to be a success. Retrofitting measures should aim to maximise building retention (or minimise new work), improve energy efficiency and introduce other sustainability benefits, such as improved climate resilience, enhanced health and well-being of the occupants, contribution to biodiversity and urban greening, and reduction in water use.

Further retrofit guidance including institutional guidance based on best practice set out by LETI is provided in Appendix A and B.

Key policies and guidance

Table 3.1 Retrofit and reuse key planning policies

London Plan 2021

D3 Optimising site capacity through the design-led approach

SI2 Minimising greenhouse gas emissions

GLA Circular Economy Statement Guidance

Local Plan 2015

CS15: Sustainable Development and Climate Change

CS17: Waste

DM17.2 Designing out construction waste

Emerging City Plan 2040

S4: Offices

OF1: Office Development

OF2: Protection of Existing Office Floorspace

S8: Design

DE1: Sustainable Design

S11: Historic Environment

HE1: Managing Change to Historic Environment

Additional Guidance

Carbon Options Guidance Planning Advice Note

Heritage Building retrofit toolkit (CoLC)

Embodied Carbon Action Plan (CoLC)

Adapting Historic Buildings for Energy and Carbon Efficiency: Historic England Advice Note 18

Case Study: St Magnus House

Use: Offices and mixed-use

Retrofit

Visual of St Magnus House following a deep retrofit. Source: Design and Access Statement

Key facts:

- Improved thermal performance achieved by replacement of the existing ribbon windows and the addition of internal insulation to the rear of retained cladding panels
- Waste minimised through high levels of retention across the existing fabric, and reuse of deconstructed materials

Additional Features:

- Utilisation of a heat pump system to provide the building's annual space heating and DHW demands, and a PV array to generate renewable electricity
- Low WLC emissions and high levels of energy efficiency
- Replacement and upgrade of HVAC systems, to all-electric plant with heat recovery
- New external lift to access the public terrace - negotiated through the pre-application process

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3. RETROFIT AND REUSE

Key actions to develop an exemplar City scheme

The following key actions are required to positively address the City Corporation's policy framework and should be discussed at pre-application stage. Applicants should clearly present the relevant information in the application documents.

- Adopt a retrofit first approach that is informed by a carbon optioneering assessment in accordance with the Carbon Options Guidance Planning Advice Note
- Consider whether a staged approach starting with light retrofit before advancing to deep retrofit (and new build if applicable) would be feasible to push back high carbon impacts in the short term.
- Consider the optimal use of an existing building and the arrangement of the interior that would enable a retrofit approach while supporting strategic land use policies
- Ensure that retrofit schemes achieve the highest possible level of energy efficiency, climate resilience, health and well-being, and occupier amenity.

Optioneering requirements are set out in detail in the City Corporation's Carbon Options Guidance. In addition, the GLA's pre-redevelopment audit approach must be followed to demonstrate that the lowest feasible upfront carbon and deconstruction waste option is pursued for development. This includes considering an appropriate change of use that would enable building elements to be retained and adapted, and that would be likely to result in overall lower upfront carbon emissions compared to a new build option. In this case, retrofit projects involving a change of use away from office would not need to be justified by a viability assessment (emerging City Plan 2040 Policy OF2.2b Retrofit fast track).

Other opportunities to reduce embodied carbon emissions in the short term, to address the 2050 Paris agreement target of limiting global warming to 1.5 degrees C above pre-industrial levels, should be considered, such as pushing higher upfront carbon development back until lower carbon solutions become available, and starting with a light retrofit approach. Subject to the retrofit approach, successful schemes should demonstrate holistic sustainability benefits beyond carbon emission reduction to future-proof the City of London's built environment.

The following key actions are strongly recommended to develop an exemplary scheme that achieves the best balance of planning benefits for the City. Measures should be discussed at pre-application stage and highlighted in the application to support the proposals

- Engage creative architects, engineers and designers that focus on the opportunities of existing buildings and transform the exterior and interior to the highest environmental and design quality
- Define the sustainability aspirations for the site and its context to develop the best practice circular economy and low carbon solutions
- Seek specialist heritage expertise for historic buildings to identify sensitive solutions for retrofit.

Successful retrofit case studies in London demonstrate a high level of creativity, flexibility, collaboration and innovation. In addition to considering site specific conditions for retrofit, applicants should seek to employ creative structural and architectural designers who focus on the opportunities and merits of the existing building, townscape, urban grain and local area context and apply innovative thinking about potentials for environmental synergies and wider improvements. This could relate for example to urban greening and climate resilience measures or sharing of resources, or it could strengthen historic character and create a positive sense of place for the local area with wider benefits for the City's communities. In addition, collaboration with specialist heritage advice should be sought for historic buildings to achieve long term successful solutions.

It is recognised that the noise emitted from the deconstruction and construction can be more disruptive in particular in retrofit schemes. Early engagement is encouraged to ensure the best available mitigations are in place.

Case Study: Museum of London (including Grade II Listed Poultry Market)

Use: Museum and ancillary uses including offices and retail

Refurbishment, Retrofit, and Extension

Visualisatios (above, left) of the new Museum of London.
Source: Design and Access Statement

Key facts:

- High proportion of retention of substructure, superstructure, façades and roof (varying between buildings)
- Incorporation of upgrades to windows, roofs and walls and a high level of reuse of salvaged historic deconstruction material
- Utilisation of natural ventilation and thermal mass to maintain required conditions

Additional Features:

- 72% reduction of carbon emissions over Part L 2013, the majority of which is achieved through energy efficiency measures, 9% through energy provided by nearby district heat network, 1% through PV panel installation on roofs
- Embodied carbon intensity targeted to meet and exceed the GLA standard benchmark
- Installation of green roofs and biodiverse landscaping on roofs and incorporation of rainwater harvesting

3. RETROFIT AND REUSE

Retrofit first approach

Initial considerations about the extent of retrofit should be based on the opportunities and challenges of a site using design approaches that consider circular economy principles and whole life-cycle carbon impact. Ideally, this process commences at the concept stage and includes:

1. Undertaking optioneering to establish whether existing buildings, structures and materials can be retained, refurbished, or incorporated into the new proposal. Guidance on optioneering is included in Chapter 4 and Chapter 5.
2. Considering whether the current structures and buildings can be developed to suit the evolving requirements of the site and the needs of the site and surrounding area. This involves the consideration of three key strands:
    i. The development plan, heritage matters, and sustainability drivers for the whole area (e.g. Local Plan and public consultation)
    ii. The development and sustainability aspirations for the site (e.g. developer brief, pre-app engagement, project sustainability brief)
    iii. Resulting circular economy and low WLC carbon development opportunities identified for the site.
3. Undertaking a pre-deconstruction audit to identify salvageable materials for reuse and recycling. This could be developed in the form of a "reuse schedule" with more in-depth considerations about how materials can be reused at their highest values. This should be supported with salvage/ demolition drawings from the architects, deconstruction drawings from structural engineers, information about materials brokers/reuse platforms, and potential storage options. Guidance on the development and content of pre-deconstruction audit is included in Chapter 5 – Circular Economy. When not practical at planning application stage, supporting information can be triggered by conditions.

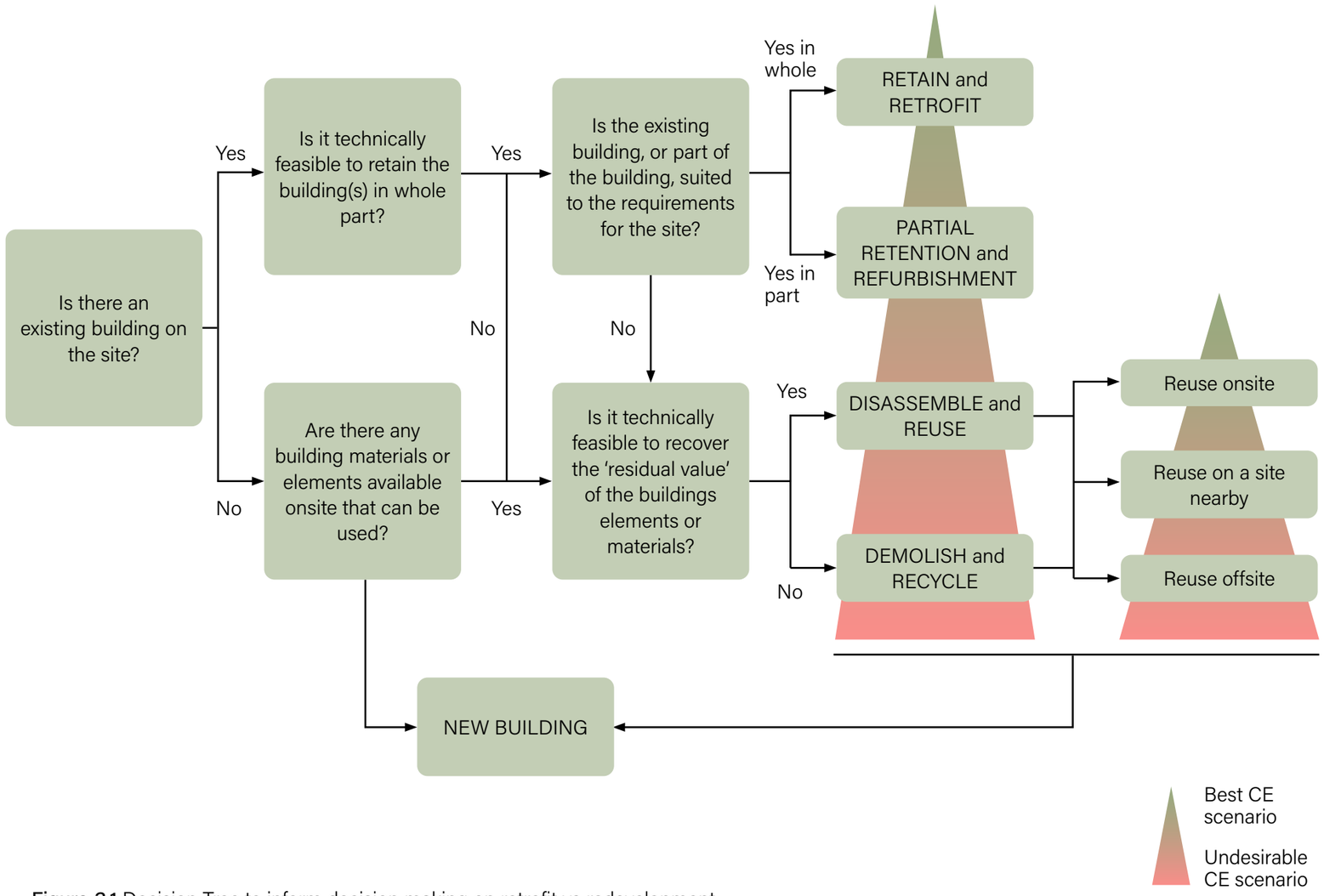

Figure 3.1 Decision Tree to inform decision making on retrofit vs redevelopment.
Source: GLA (2022) Circular Economy Guidance.

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3. RETROFIT AND REUSE

Defining retrofit

Retrofit is defined as the upgrading of a building in relation to the installation of new building systems or building fabric to improve efficiency, reduce environmental impacts and/or adapt for climate change. A range of interventions may be deployed, from 'light retrofit' to 'deep retrofit'. The City Corporation considers that a retrofit should retain and reuse at least 50% of the existing building(s)' superstructure (by mass).

The following definitions have been adapted from the LETI Climate Emergency, UKGBC Guidance Delivering Net Zero: Key Considerations for Commercial Retrofit, and UK Net Zero Carbon Buildings Standard Pilot Version.

Light retrofit

- Involves energy performance optimisation through basic fabric improvements, replacement or adaptation of existing building elements. Usually minimally invasive.
- Typically focusses on individual building components.
- Often carried out in conjunction with energy efficiency surveys and stakeholder need assessments to further increase the efficiency or maintain good performance of a building.
- Example interventions include: upgrades to heat source and ventilation systems, improving insulation and sealing gaps, lighting upgrades, installing building service monitoring and optimisation technologies. These may be accompanied by 'low/no cost' interventions such as fine tuning and behaviour change measures.

Deep retrofit

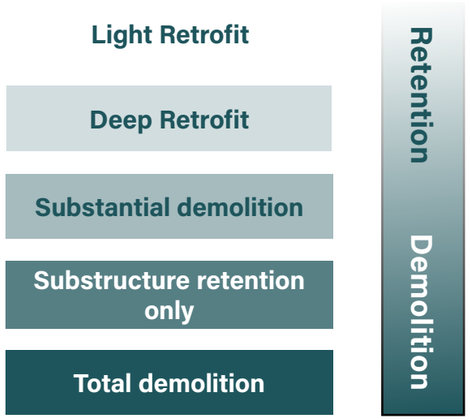
- Retention and reuse of the majority of the existing building(s). Can involve a collection of light retrofit measures and/ or works of a more significant size or scale that result in a fundamental change to the building structure or services.
- Long term efficiency gains of deep retrofit are significant, and the approach is likely to result in less embodied carbon emissions than a new build alternative.
- Example interventions may include: adapting the structure to facilitate alterations and changes such as to cores or basements to include end of trip facilities, changes to the building envelope including glazing, openings, façade and roof elements, central MEP upgrades including creating new locations for plant, consolidation of roof areas to facilitate amenity terraces and urban greening.

Retrofit with new build

- A combined approach integrating deep retrofit and new-build elements. In this case, works go beyond extensive refurbishment of existing structures.
- Typically pursued where additional floor space or amenity is sought or the existing building is unfit for its new use.
- The end result usually combines partial retrofit with demolition and new build or extension, such as the construction of additional floors.
- Can be significantly more intrusive and carbon intensive than light or deep retrofits but can enable a marked increase in capacity and quality whilst delivering substantial carbon savings overall compared to complete demolition and rebuild.
- Example interventions include: Adapting the structure and substructure/foundations to facilitate extensions and alterations, new strengthening or transfer structures and relocation or changes to cores, changes to the building envelope, central MEP upgrades including creating new locations for plant, creation of terraces of amenity, urban greening, biodiversity and climate resilience measures.

New build

- The removal, deconstruction or demolition of more than 50% of the existing building's substructure and superstructure (by combined mass).
- Façade retention only is not considered to be a carbon reduction measure due to the carbon impact of temporary works.



Case Study: 1 Appold Street

Use: Office and retail

Retrofit and extension

Source: Planning Application, Circular Economy Statement

Key facts:

- Retention of a minimum of 55% of the existing basement and 8-storey structure
- Insertion of new core, designed to allow retention of primary beams without trimming
- Mechanically fixed façade that can be easily deconstructed and replaced in parts
- Targeting the use of 20% of recycled and reused building materials by value
- Minimising material consumption and incorporating future flexibility in the structure and configuration of internal spaces
- Material passports created to meet the client brief requirements

Additional features:

- Low embodied whole life-cycle carbon intensity due to level of reuse (life-cycle modules A1-A5: 415kgCO2/m2, modules A-C exclusive B6/B7: 621kgCO2/m2 -compared to 970kgCO2/m2 GLA Aspirational Benchmark)

3. RETROFIT AND REUSE

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Retrofit Plan

A whole building retrofit plan is encouraged to ensure developments can facilitate future retrofit, adaptive reuse and emerging technologies. The plan should determine the most appropriate retrofit option, or series of retrofit options that could be stages over several years. It should consider what retrofit option achieves the optimum carbon balance in reducing embodied and operational carbon, and what option immediately minimises upfront embodied carbon. Deep retrofit options could be delayed until building technologies can offer lower carbon solutions. However, a whole building approach is recommended to ensure each phase is considered as part of the wider objectives, potential risks are managed, and ensuring one retrofit option doesn't affect the outcomes or performance a future option. It is recommended this plan is based on 'medium-term improvement plans' in the retrofit standard PAS 2038.

Retrofit Standards

Introduced in September 2021, PAS 2038 serves as the UK Standard for energy efficiency and retrofit of non-domestic buildings. It provides a structured framework designed to ensure a comprehensive and systematic approach to retrofitting, covering all stages from initial assessment to final evaluation. It is expected that government schemes will require professionals to follow PAS 2038 to access funding.

Retrofit in historic buildings

The City is home to many non-designated and designated heritage assets including over 600 listed buildings and 27 conservation areas. The City's unique historic environment is of exceptional richness and significance and makes a vital contribution to its commercial and cultural vibrancy.

In the case of historic buildings, the Planning (Listed Buildings and Conservation Areas) Act will need to be considered, particularly in relation to certain building fabric and thermal performance improvements. Work should not harm the special architectural or historic significance of a building or increase the risk of long-term deterioration to the fabric or fittings.

In many cases, it is possible to make energy and water efficiency improvements without detriment to the heritage significance of a historic building with the support of expert advice. In fact, it is important that heritage properties are subject to regular building repair, maintenance and cleaning pre and post retrofit to conserve and enhance a building's heritage significance.

The City Corporation has released a Historic Building Retrofit Toolkit to provide clear and actionable guidance for owners, occupiers and caretakers of historic and listed buildings, to help them take steps to reduce carbon and build climate resilience in their heritage buildings whilst maintaining their significance.

The toolkit aims to collate and signpost best practice principles and examples, providing a resource that will allow building owners to confidently start the process of responsible retrofit, build a business case and deliver the adaptations necessary.

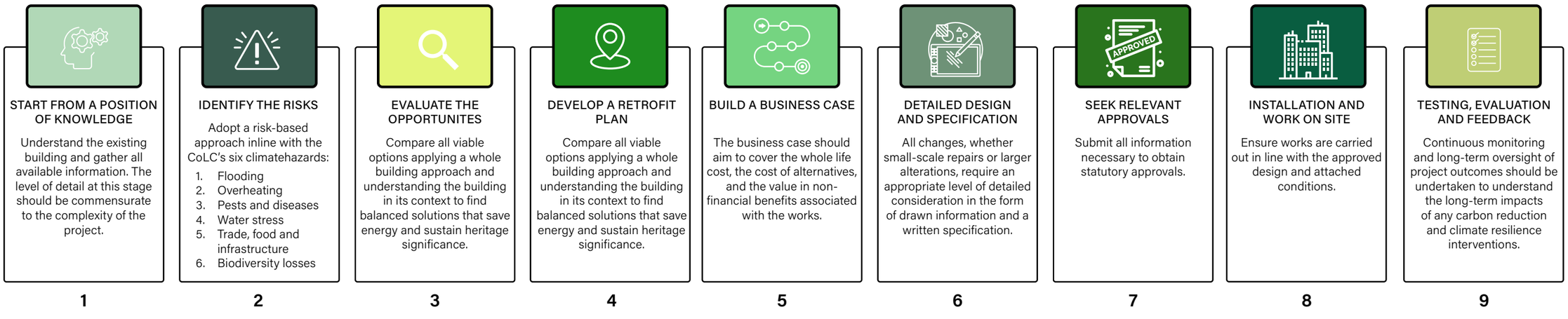
The Toolkit includes a Heritage Retrofit Roadmap comprising nine defined steps for undertaking a successful retrofit project in the Square Mile - see graphic below.

The Toolkit is available on the *Supporting the Square Mile Achieve net-zero* page of the City Corporation's Climate Action Strategy webpages.

Climate change adaptation and greening interventions to historic parks, gardens and open spaces can offer valuable ecosystem services, flood and urban heat island alleviation, and habitat creation. However, any intervention should follow a significance-led approach to avoid harm to the significance of these heritage assets. More detail on climate resilience and urban greening and biodiversity measures are included in Chapters 6 and 7.

Figure 3.2: Render of the Baltic Exchange post retrofit. Source: MATT Architecture

Figure 3.3: Heritage Retrofit Roadmap.
Source: City of London Corporation (2024)



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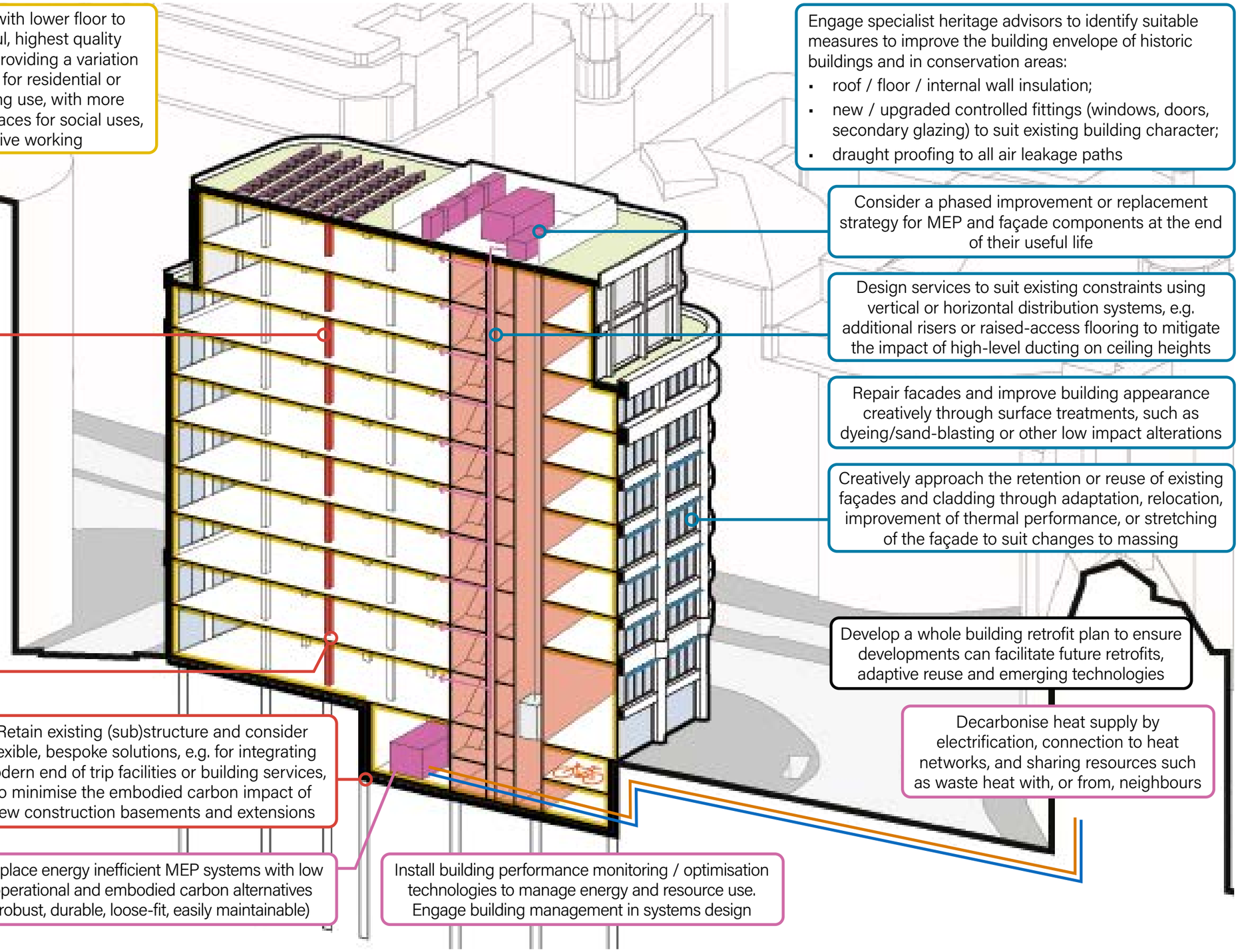
3. RETROFIT AND REUSE

KEY MEASURES FOR CITY DEVELOPMENTS

This infographic provides a list of potential measures, which is not exhaustive. Applicants are encouraged to propose innovative measures that drive best practice. All measures to be agreed on a case-by-case basis.



Create interior spaces that work with lower floor to ceiling heights through thoughtful, highest quality design and specifications, and by providing a variation of areas such as intimate spaces for residential or individual work and virtual meeting use, with more generous (double height, atrium) spaces for social uses, wintergardens or collaborative working

Embrace existing conditions and constraints to create characterful refurbishments, such as by exposing the structure or services

Optimise existing structural capacity for alterations and extensions

Maximise opportunities to improve energy efficiency (e.g. minimise use of deep plan spaces requiring high levels of HVAC)

Undertake a structural audit (including relevant testing) early to understand the condition / capacity of the existing structure

Design lightweight and creative structural solutions to minimise the embodied carbon of any alterations, extensions or necessary structural interventions

Typical measures for developments in the City by building element:

STRUCTURE
ENVELOPE
MATERIALS
PLANT & MEP
WHOLE BUILDING
BEYOND THE BUILDING

Retain existing (sub)structure and consider flexible, bespoke solutions, e.g. for integrating modern end of trip facilities or building services, to minimise the embodied carbon impact of new construction basements and extensions

Replace energy inefficient MEP systems with low operational and embodied carbon alternatives (robust, durable, loose-fit, easily maintainable)

Install building performance monitoring / optimisation technologies to manage energy and resource use. Engage building management in systems design

Engage specialist heritage advisors to identify suitable measures to improve the building envelope of historic buildings and in conservation areas:

- roof / floor / internal wall insulation;
- new / upgraded controlled fittings (windows, doors, secondary glazing) to suit existing building character;
- draught proofing to all air leakage paths

Consider a phased improvement or replacement strategy for MEP and façade components at the end of their useful life

Design services to suit existing constraints using vertical or horizontal distribution systems, e.g. additional risers or raised-access flooring to mitigate the impact of high-level ducting on ceiling heights

Repair facades and improve building appearance creatively through surface treatments, such as dyeing/sand-blasting or other low impact alterations

Creatively approach the retention or reuse of existing façades and cladding through adaptation, relocation, improvement of thermal performance, or stretching of the façade to suit changes to massing

Develop a whole building retrofit plan to ensure developments can facilitate future retrofits, adaptive reuse and emerging technologies

Decarbonise heat supply by electrification, connection to heat networks, and sharing resources such as waste heat with, or from, neighbours

GREENHOUSE GAS EMISSIONS AND ENERGY USE

04

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4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

Introduction

Greenhouse gas emissions are a principal driver of climate change. With 25% of the UK's total emissions directly attributable to the built environment it is essential to tackle emissions associated with the construction, use and operation of buildings as a matter of urgency.

The City is a very dense and intensely used area with a high overall level of emissions, largely as a result of the energy needed to serve over 600,000 daytime users. A significant amount of CO2 emissions also arise from the deconstruction and construction of new buildings, including upfront embodied carbon associated with the production, transportation and disposal of products and materials.

Key approaches for the City

As buildings become more energy-efficient and the grid decarbonises, the share of embodied carbon will become a more significant element of whole life-cycle carbon emissions. Low carbon design and construction measures as well as efficient and robust building services systems need to be employed to drive down whole life-cycle carbon emissions. Innovation, new insights and technologies evolve continually and should be considered throughout all stages of the planning and design process, to allow for improved outcomes overall.

Approaches to minimise carbon emissions include the reuse of existing buildings, designing new build with exemplary whole life-cycle carbon reduction, including material retention, sharing of resources, use of low-carbon materials and modular construction methods. All developments must employ circular economy principles (see Chapter 5) and maintain and reuse as many building components as possible in accordance with the Development Plan.

Major developments are required by the Development Plan to aim for net zero operational carbon dioxide emissions (and other emissions). This can be achieved through retrofitting existing buildings or designing new builds with a high energy efficiency, heat and transport electrification, and connections to local heat networks.

Key policies and guidance

Table 4.1 Greenhouse gas emission and energy planning policies

London Plan 2021

- SI 1: Improving Air Quality
- SI 2: Minimising greenhouse gas emissions
- SI 3 Energy Infrastructure
- T2: Healthy Streets
- GLA Whole Life-cycle Carbon Assessment Guidance
- GLA Energy Assessment Guidance
- Mayor's Transport Strategy & Healthy Streets Approach

Local Plan 2015

- CS15: Sustainable Development and Climate Change
  - DM15.1 Sustainability requirements
  - DM15.2: Energy and CO2 emissions assessments
  - DM15.3 Low and Zero Carbon Technologies
  - DM15.4 Offsetting of carbon emissions
  - DM15.5 Climate change resilience and adaptation
  - DM15.6 Air quality
  - DM15.7 Noise and light pollution

Emerging City Plan 2040

- CR1: Overheating and Urban Heat Island Effect
  - DE1: Sustainability Standards
  - DE8: Daylight and sunlight
  - DE9: Lighting
- S1: Healthy and inclusive city
  - HL2: Air Quality
- S10: Active Travel and Healthy Streets
  - AT1: Pedestrian Movement, Permeability, and Wayfinding
  - AT2: Active Travel including Cycling

Additional guidance

- Carbon Options Guidance Planning Advice Note (CoLC)

Case Study: 115-123 Houndsditch

Use: Office and retail

New build

Entrance to 115-123 Houndsditch. Source: Design and Access Statement.

Key facts:

- Overall reduction of carbon emissions by 44% over Part L 2013, with 17% achieved through energy efficiency measures including improved envelope performance, solar shading, thermal mass of exposed concrete slabs, passive ventilation and extensive urban greening on roofs and terraces to provide cooling
- Embodied carbon intensity of 1020 kgCO2e/m^2 meets the GLA standard benchmark of <1400 kgCO2e/m^2 and is close to GLA aspirational benchmark of <970 kgCO2e/m^2
- Waste heat storage and export of heat to a neighbouring residential estate

Additional Features:

- Ambitious circular economy strategy incorporating partial retention of basement, utilising low carbon materials with high recycled content, prioritising prefabricated products
- Adaptable to future needs with flexible floorspace layouts and bolted structural connections (designed for eventual deconstruction)
- Use of green leases to achieve energy efficient tenant space fit-out and operation
- Targeting a BREEAM 'outstanding' rating, and commitment to highest scores in WELL and LEED standards
- Reduction of water demand through rainwater recycling and harvesting systems

4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

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Key actions to develop an exemplar City scheme

The following key actions are required to positively address the City Corporation's policy framework and should be discussed with planning officers at pre-application stage. Applicants should clearly present the information in the relevant application documents.

- Develop the lowest whole life-cycle carbon solution that optimises the social, economic and environmental sustainability of a scheme through undertaking a carbon options appraisal
- Prioritise retrofit over redevelopment solutions upon adoption of the City Plan 2040. Where the GLA WLC (standard) benchmark is not achieved, mitigate high upfront carbon emissions by incorporating substantial wider environmental sustainability benefits into the proposal's design
- Enable attractive, comfortable and inclusive access to, and connectivity between public realm, private open spaces and buildings to encourage active and sustainable transport patterns
- Ensure that all public and open spaces are designed with low carbon, preferably reused, repurposed and robust materials
- Develop a bespoke and optimised energy strategy for a development, including considering links to energy networks, focussing on adaptability, robust and low embodied carbon building services, floorspaces and building envelopes

An options appraisal should be undertaken in all cases where substantial new build elements are proposed. Generally, all major developments, as well as minor applications with more than 50% demolition, should follow the requirements of the Carbon Options Guidance Planning Advice Note (PAN). This methodology is designed to identify the lowest carbon solutions, evaluate their wider sustainability potential, and support the retrofit first approach (when required by the Development Plan).

If the proposed upfront carbon emissions (life-cycle modules A1-A5) of any major development are higher than the GLA standard benchmark, applicants should seek to provide significant environmental sustainability benefits onsite beyond policy requirements, or beyond the site's boundary when required by the Development Plan (see page 23 in this document for relevant examples).

Public realm design, integration and interfaces are core considerations to improve access, connectivity and amenity in the Square Mile. Thoughtful designs in this regard will encourage active and low energy transport patterns and strengthen the City's position as a sustainable location in the region in accordance with the City of London Transport Strategy.

City occupiers and residents are particularly concerned about the operational energy performance of buildings, and bespoke energy strategies are sought to achieve optimal solutions for the building type and context of a development, ensuring longevity and flexibility of the proposed design.

The following key actions are strongly recommended to develop an exemplary scheme that achieves the best balance of planning benefits for the City. Measures should be discussed at pre-application stage and highlighted in the application as sustainability benefits to support the proposals.

- Pursue best practice and transformative solutions in low carbon design and construction principles
- Develop innovative approaches to low carbon servicing and servicing access of buildings
- Seek wider environmental sustainability benefits incorporated into the design of proposals or beyond the site to contribute to the wider sustainability of the Square Mile where opportunities can be identified.

Throughout the planning process, from pre-application stage to the discharge of conditions stage, applicants will be challenged by planning officers and City communities to demonstrate best practice sustainable designs and ensure that development is future-proof and contributes to the sustainability of the Square Mile as a whole. Proposals that are pathfinders for low carbon design approaches and that share resources in relation to the construction, operation and servicing of City building types will be supported. Interaction and synergies between development processes, buildings and their contexts are encouraged as the collaboration and sharing of resources will be most successful at scale. Applicants are expected to utilise opportunities to impact positively on sustainability beyond their development and site boundary.

Case Study: 65 Crutched Friars

Use: Student accommodation and museum

New build

Ground floor view of 65 Crutched Friar.
Source: 65crutchedfriars.co.uk 2023

Key facts:

- Operational carbon emissions reduction of 70% beyond Part L 2021 including savings provided by renewable and low carbon technologies including air source heat pumps and PV panels
- Upfront whole life-cycle carbon emissions (693kgCO2/m^2) exceed GLA's standard benchmark

Additional Features:

- Wastewater heat recovery from 770 bedrooms and bathrooms
- Natural ventilation through openable panels in each bedroom
- BREEAM "Outstanding" rating

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4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

WHOLE LIFE-CYCLE CARBON

What is whole life-cycle carbon?

Whole life-cycle carbon (WLC) is the total carbon equivalent emissions resulting from the construction and use of a building over its entire life, including its construction, deconstruction and disposal. It captures a building's operational carbon emissions (both regulated and unregulated energy use), as well as embodied carbon emissions - that is, emissions associated with raw material extraction, the manufacture and transport of building materials, the construction process, and the emissions associated with maintenance, repair and replacement, as well as dismantling, deconstruction, demolition and eventual material disposal.

Key measures

Whole building

Refurbishment and retrofit should be prioritised where feasible to reduce carbon emissions, especially in the short term. Reducing embodied carbon emissions helps limit global warming caused by construction activities. Applications should therefore demonstrate how adaptation of the building (and maximising reuse) rather than demolishing and rebuilding has been fully considered.

Generally, all major developments, as well as minor applications that do not retain the majority of substructure and superstructure (by mass) must undertake a carbon options assessment, in line with the City Corporation's Carbon Options Guidance PAN. Optioneering should be conducted early in the pre-application stage in collaboration with City Corporation officers. It's recommended that the guidance is used to establish the most sustainable and suitable approach for the site. The options should include retention and retrofit, as relevant to the site, to ensure that the retrofit first approach has been thoroughly applied and evaluated. The optioneering process and outcome should be presented in planning application documents, such as in the Design and Access Statement, to clearly demonstrate the rationale for the proposed development.

When required by development plan policy, all major developments must submit a Whole Life-Cycle Carbon (WLC) Assessment that complies with GLA WLC Assessment Guidance (as current at the time at the time of application submission) including using assessment tools. Proposals should achieve the GLA 'WLC benchmark' ('standard' benchmark) as a minimum for upfront carbon emissions (life-cycle modules A1 – A5). Proposals should target the GLA 'aspirational WLC benchmark' for all embodied carbon emissions (life-cycle modules A – C). Any deviation from the aspirational benchmark should be justified in the WLC Assessment. Until relevant benchmarks are available, hotels and student accommodation should agree an appropriate benchmark with City Corporation Officers (residential or office) to apply on a case by case basis.

All WLC Assessments should include operational energy use (life-cycle module B6) using a predictive energy modelling method, following guidance such as CIBSE TM54 or NABERS UK Design for Performance (as detailed in the operational emissions section). The in-use embodied carbon emissions (life-cycle modules B-C) should be reported using the assumptions for replacement of building elements in accordance with RICS WLC Assessment Professional Standard.

All major applications submitted after 2030 should achieve the GLA 'aspirational WLC benchmark' as a minimum for all embodied carbon emissions (life-cycle modules A–C), to align with the World Green Building Council's (WGBC) target of 40% reduction in greenhouse gas emissions by 2030.

Where the standard benchmark is not achieved (or aspirational from 2030), high embodied carbon impacts of development proposals should be mitigated by providing substantial environmental sustainability benefits, either beyond policy requirements onsite or beyond the site boundary, as required by the Development Plan and detailed in the 'Beyond the building' section below.

The City Corporation encourages applicants to target and meet more ambitious industry standards (e.g. UK Net Zero Carbon Buildings Standard) wherever possible.

The carbon options assessment and WLC Assessments should be independently reviewed to ensure consistency, accuracy and quality assurance in reporting. The reviews will be arranged by City Corporation planning officers.

Planning stage WLC Assessments include assumptions in advance of subsequent design and procurement stages of the proposed development. Estimated carbon emissions may change due to design development, market availability, available carbon data etc. This may result in an embodied carbon gap between planning stage and practical completion. To manage this process more constructively in collaboration with applicants, major applications will be conditioned to submit RIBA Stage 4 and RIBA Stage 6 WLC Assessments. The updated WLC Assessments should include details and information that explain

Case Study: One Exchange Square

Use: Commercial office

Retrofit and Extension

View of the proposed main entrance.
Source: Design and Access Statement

Key facts:

- 90% retention of existing structure including foundations, and retention and restoration of the existing granite façade elements
- Cantilevering 11-storey extension to rear and of upper levels with new façades designed to be replaceable in component parts
- Structural grid and elements of the extensions designed to be adaptable and flexible

Additional Features:

- 62.2% reduction in carbon emissions over Part L 2013 overall, of this 45.5% through energy demand reduction
- Aspiring to BREEAM 'outstanding' rating and engagement with NABERS UK benchmarking
- Embodied carbon intensity of 984 kg $CO2e/m^2$ meets the GLA standard benchmark of <1400 kg $CO2e/m^2$ and is close to meeting the GLA aspirational benchmark of <970 $kgCO2e/m^2$
- Incorporation of extensive landscaping on the ground-floor and roof including the provision of wildlife habitats

4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

WHOLE LIFE-CYCLE CARBON

changes to the reported carbon emissions. The RIBA Stage 6 submission should include details of data validation in line with section 2.7 of the GLA's WLC Assessment guidance (Materials and products) including the 'Acceptable sources of carbon data for materials and products' section.

Aspects of WLC emission reduction are covered by certification schemes such as BREEAM and NABERS, as detailed in the Operational Energy section below.

Creative thinking and innovation for achieving sustainability best practice is encouraged in planning submissions.

Beyond the building

Large scale new development will result in considerable environmental impacts on the quality of the local context and beyond, including on the amenity and quality of the public realm, on the urban heat island effect, microclimatic conditions and overall embodied carbon. All new developments are expected to assess their impact beyond the site boundary and utilise opportunities to positively impact sustainability in the wider area.

Given the high number of concurrent developments in the Square Mile and Central London, synergies with nearby developments to share services, facilities, technologies and materials should be sought out to increase efficiency and reduce carbon emissions during construction and operation. These synergies could facilitate measures at greater scale and efficiency, and benefit neighbouring local schools, churches, community facilities and the quality of public realm, as well as support sensitive historic buildings to improve their sustainability and competitiveness in a property market that is increasingly driven by energy performance and sustainability credentials.

Where the standard benchmark for upfront emissions (life-cycle modules A1-A5) is not achieved at planning stage, especially if this is due to competing planning policy priorities, applicants should seek to provide significant environmental sustainability benefits onsite beyond policy requirements, or beyond their site's boundary when required by the Development Plan. The nature and extent of environmental sustainability benefits should be proportionate to the carbon impact caused by the proposed development and could include, but are not limited to:

- implementing priorities of the City of London Local Area Energy Plan (LAEP), including the creation or extension of local energy networks and the use of waste heat sources (example: London Wall West)
- facilitating heating and cooling exchange with nearby developments (example: 115-123 Houndsditch)
- supporting sustainable transport modes, with a climate resilient, green and low carbon design of the public realm around the site (example: 65 Gresham Street)
- testing innovative measures (e.g. low carbon/reused materials, energy generation, storage technologies etc) to drive best practice in sustainable development for example sharing space by integrating a service lift into the public realm
- creating climate resilience, urban greening infrastructure and cool routes in the local area (see Climate resilience chapter) (example: New Change Garden)
- providing detailed deconstruction material information or passports to facilitate efficiency of reuse (example: 100 Fetter Lane material passport)
- including a sustainable construction skills centre for City of London building types or a facility to showcase sustainable practices
- providing opportunities for meanwhile uses that provide environmental or social benefits.

Suitable measures are subject to pre-application discussions, based on the nature of the site and the proposal, and opportunities identified in the context of the development. If a development is expected to exceed the standard benchmark for upfront emissions, it should integrate environmental sustainability benefits in the early design phase. However, all development proposals are encouraged to assess the opportunities for environmental improvements in the context of the site and respond to these in the design of the proposals.

Case Study: Ibex House (Grade II listed)

Use: Offices, retail and cultural space

Refurbishment and Extension

Visual illustrating the new steel Crittal windows to match original style. Source: Design and Access Statement.

Key facts:

- Gradual phasing out of gas boilers and incorporation of a high-performance electric plant
- Achieves a 35.9% carbon emissions reduction over Part L 2013

Additional Features:

- Minimal demolition predominantly comprised of internal modern partitions and plant installations
- Replacement of balustrades and previous replacement windows with new steel Crittal windows
- Restoration of original fabric and matching repairs
- Installation of green roofs on new built ground level extensions and at upper floor levels

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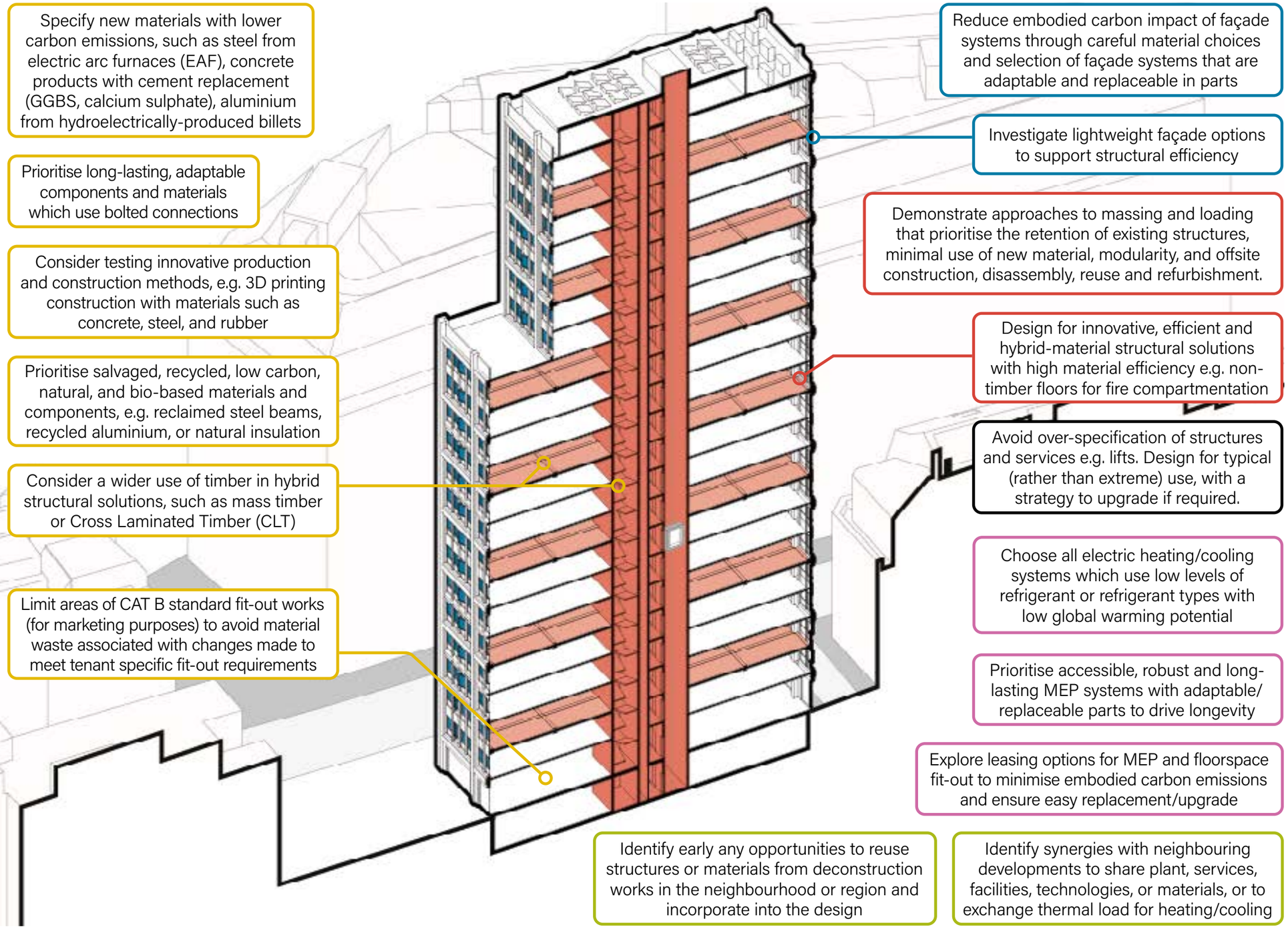
4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

KEY MEASURES FOR CITY BUILDINGS - WHOLE LIFE-CYCLE CARBON

This infographic provides a list of potential measures, which is not exhaustive. Applicants are encouraged to propose innovative measures that drive best practice. All measures to be agreed on a case-by-case basis.



Specify new materials with lower carbon emissions, such as steel from electric arc furnaces (EAF), concrete products with cement replacement (GGBS, calcium sulphate), aluminium from hydroelectrically-produced billets

Prioritise long-lasting, adaptable components and materials which use bolted connections

Consider testing innovative production and construction methods, e.g. 3D printing construction with materials such as concrete, steel, and rubber

Prioritise salvaged, recycled, low carbon, natural, and bio-based materials and components, e.g. reclaimed steel beams, recycled aluminium, or natural insulation

Consider a wider use of timber in hybrid structural solutions, such as mass timber or Cross Laminated Timber (CLT)

Limit areas of CAT B standard fit-out works (for marketing purposes) to avoid material waste associated with changes made to meet tenant specific fit-out requirements

Reduce embodied carbon impact of façade systems through careful material choices and selection of façade systems that are adaptable and replaceable in parts

Investigate lightweight façade options to support structural efficiency

Demonstrate approaches to massing and loading that prioritise the retention of existing structures, minimal use of new material, modularity, and offsite construction, disassembly, reuse and refurbishment.

Design for innovative, efficient and hybrid-material structural solutions with high material efficiency e.g. non-timber floors for fire compartmentation

Avoid over-specification of structures and services e.g. lifts. Design for typical (rather than extreme) use, with a strategy to upgrade if required.

Choose all electric heating/cooling systems which use low levels of refrigerant or refrigerant types with low global warming potential

Prioritise accessible, robust and long-lasting MEP systems with adaptable/ replaceable parts to drive longevity

Explore leasing options for MEP and floorspace fit-out to minimise embodied carbon emissions and ensure easy replacement/upgrade

Identify early any opportunities to reuse structures or materials from deconstruction works in the neighbourhood or region and incorporate into the design

Identify synergies with neighbouring developments to share plant, services, facilities, technologies, or materials, or to exchange thermal load for heating/cooling

Typical measures for developments in the City by building element:

STRUCTURE
ENVELOPE
MATERIALS
PLANT & MEP
WHOLE BUILDING
BEYOND THE BUILDING

CONTENTS

4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

OPERATIONAL ENERGY USE

What are operational emissions?

Operational emissions are those generated from the operation of a development once it has been constructed. This includes both the emissions of electricity from the National Grid as well as emissions generated onsite via gas-burning boilers, refrigeration and other emitting processes. Operational emissions are largely a result of energy consumption (life-cycle module B6) while a small proportion of these emissions result from operational water use (life-cycle module B7). There will be increasing demand for electric power as fossil fuels are phased out in favour of electric heating, vehicles and other technologies. The type of energy technologies and the use of energy in buildings will be considered in planning applications. Proposals need to develop a strategy to reduce energy use through passive energy efficiency measures and low carbon and renewable energy technologies, including for back-up technologies both for emergencies and fluctuations in grid supply. Water efficiency measures can also reduce operational energy demand, due to reduced Domestic Hot Water demand. The Climate Resilience chapter includes a topic on water resource management with details on water efficiency in development proposals.

Key measures

Whole building

In accordance with the GLA's energy hierarchy, development in the City will need to be designed to achieve highest possible efficiency levels and provide the lowest possible Energy Use Intensity (EUI). Progressive and innovative measures should be incorporated to reduce carbon emissions as soon and significantly as possible.

For refurbishments and retrofits, the existing energy performance could benefit from an assessment prior to the design of any interventions and alterations. The incorporation of all electric or low-carbon energy technologies can help refurbishment schemes improve energy performance requirements, as regulation, policy and user expectations become more stringent in the future. In accordance with the Development Plan, the level of energy efficiency should be optimised and is encouraged to meet future expectations from other drivers such as the Carbon Risk Real Estate Monitor (CRREM) decarbonisation pathways and the Net Zero Carbon Building Standard (NZCBS).

For historic buildings (with or without statutory listing), heritage significance will need to be considered alongside any impacts of energy efficiency interventions and impacts should be positively balanced to achieve heritage, energy efficiency and health benefits.

The most effective way to reduce operational carbon (and other GHG) emissions is to reduce energy demand and - where possible - move to systems powered by electricity or low-carbon alternatives. This includes considering connecting buildings to local heat and cooling networks. If a site is not covered by an existing network, the provision of a future connection point is required by the Development Plan. Large developments may be able to facilitate new locations for heat and cooling networks (see 'Beyond the building' section).

Regarding emergency supply or managing expected fluctuations in grid supply, diesel power backup generators will be discouraged due to high carbon and air quality impacts. Major developments should explore alternatives such as dual diversified electrical supply from different sub-stations and secondary power supply through connections into energy networks where feasible. Innovative solutions, such as battery storage, generators using low carbon and low air polluting fuels, or sharing emergency power with other developments nearby will be encouraged where feasible.

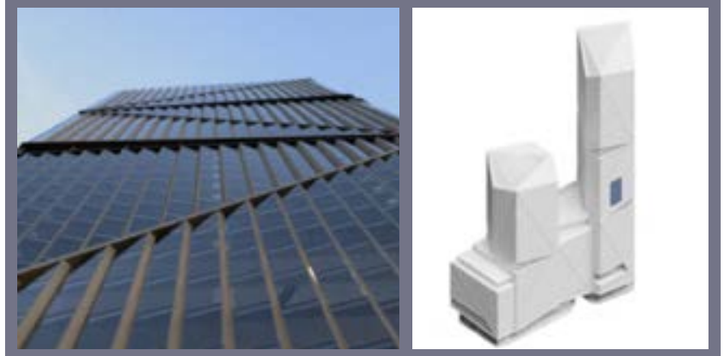
All major developments should conduct predictive energy modelling in accordance with CIBSE TM54 methodology (Technical Memorandum) or a more thorough approach (e.g. NABERS UK Design for Performance) at planning stage and commit to an ambitious industry target for the respective building type. In-use operational energy data for the whole building must be disclosed to the GLA through 'Be Seen' reporting upon completion of the first year of occupation and on the following four anniversaries of that date. Applicants are expected to use the TM54 methodology and provide a copy of the report to the City Corporation. If a development does not achieve the target committed at planning stage, a report should set out the reason why, and detail a strategy for how it will be achieved in the following reporting period.

In addition, to address the performance gap often experienced between the design and as built performances, climate clauses are encouraged for inclusion into building management agreements and leasing documents. Guidance is available from the Better Buildings Parnership and other sources.

Case Study: 2-3 Finsbury Avenue

Use: Office, retail, and open learning hub

New build



Detail of tower façade with glazed and ventilation panels
Source: Energy Strategy

Key facts:

- Passive design to include a building envelope balancing heat loss, solar gains / glare, maximising daylight, achieving a 17.3% reduction in operational carbon emissions from energy efficiency measures alone and exceeding the GLA's target of 15%
- Incorporation of natural ventilation through openable panels to facilitate night purges, reducing energy use and operational emissions by a further 3%

Additional Features:

- Operational carbon emissions reduction of 47% beyond Part L 2013 overall
- Utilisation of heat recovery and air source heat pumps
- Highly efficient water saving fixtures, fittings and appliances, along with low-water irrigation system and water metering will be incorporated to achieve at least 50% water reduction

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4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

OPERATIONAL ENERGY USE

Certifications

Operational carbon emission performance prediction is included in certification schemes such as BREEAM and NABERS UK Design for Performance.

Major developments are required to carry out a BREEAM assessment that demonstrates a minimum rating of 'Excellent' and the pathway to an 'Outstanding' rating (with the final rating to be confirmed after practical completion). Developments should maximise the achievement of credits in the City Corporation's priority categories Energy, Materials, Water, Pollution and Waste. It is acknowledged that an 'Excellent' rating for non-office uses such as retail and leisure uses (shell and core) can be challenging. Strong justification should be provided if an alternative BREEAM rating is targeted in agreement with City Corporation planning officers.

Major office developments must commit to a minimum NABERS UK Energy rating (base-build) of 5 stars for new build projects or 4 stars for retrofit projects, when required by the Development Plan, unless otherwise agreed with planning officers. In the planning application, applicants of major developments are encouraged to provide a written commitment to pursue a Design for Performance (DfP) route to a target rating, setting out the actions and measures to be pursued in order to achieve this. A formal registration for a DfP could be included at planning application, or this will be required by condition by RIBA stage 4 at the latest. The planning application and RIBA stage 4 submission should set out how the design intent for energy performance will be maintained from design through to occupation and formal rating. Estimated tenant consumption must be reported separately in addition to the base-build NABERS UK targets to provide a whole building consumption Energy Use Intensity (EUI). Alternatively, if the occupiers or tenants are known, a whole building DfP could be provided.

The final certification and NABERS assessment should be submitted after the first or second 12-month rating period, as conditioned. If a development does not achieve a 5 stars certification (or 4 stars for retrofit), a report should set out the reasons why, and detail a strategy for how the development will achieve it's target certification.

NABERS UK is an evolving rating scheme that currently only applies to office buildings. When and if it is made available for other building types, an appropriate NABERS target should be agreed at pre-application stage. In the interim, application of other industry benchmarks such as CRREM and the NZCBS are encouraged.

Beyond the building

All development proposals, new builds and retrofits alike, should support sustainable, low energy transport patterns by ensuring attractive, inclusive and safe connectivity between the public and private realm. This includes building entrances, cycle entrances, and open spaces. The public and private realm interface should avoid forming or manifesting barriers but create opportunities and wider benefits such as providing amenity and space for social interaction, shade and shelter, safe and accessible routes, trees and urban greening. Servicing strategies should have particular regard to using low emission servicing vehicles and processes, innovative service access solutions that prioritise high quality public realm and the efficient use of land and floorspace.

The City's Local Area Energy Plan (LAEP) sets out a map and actions to transition the Square Mile energy system to net zero by 2040. Actions include:

- Ensuring high energy-efficiency of new buildings and the use of low-carbon technologies
- Incorporating connections to existing and planned energy networks
- Facilitating the installation of an energy centre for areas consisting of several development sites
- Providing locations for network extensions
- Heat capture through circular systems to enable cooling heat recovery and reuse either onsite or recovered into energy networks
- Support the development of EV charging infrastructure (where needed), modal shift and freight consolidation
- Maximising photovoltaic panel installations in all feasible locations in combination with urban greening and façade and roof cladding
- Supporting the uptake of flexibility technologies through demand management, smart systems and energy storage, to deliver resilient energy systems.

Case Study: London Wall West

Use: Office and mixed-use

New build

Visual of London Wall West. Source: Design and Access Statement

Key facts:

- A1–A5 (excl. sequestration) WLC emissions of 560 kgCO2e/m^2, a significant improvement on the GLA's aspirational benchmark of 600 kgCO2e/m^2
- B–C (excl. B6 & B7) WLC emissions of 248kgCO2e/m^2, a significant improvement on the GLA's aspirational benchmark of 370kgCO2e/m^2
- Provision of an energy centre with air source heat pumps and electric chillers for the extension of the local energy network. Supply of waste heat to the energy network

Additional Features:

- Commitment to a 5* NABERS UK rating
- Targeting an 'outstanding' BREEAM rating for the proposed main use (office space)
- Significant public realm improvements and urban greening
- New trees are designed into the public realm, for more comfortable public spaces as well as for wind mitigation. The provision of shade for thermal comfort has also been incorporated in the public realm
- Vertical fins are included in the "Husk" facades of the Bastion House and Rotunda buildings to reduce solar gain. Overhanging planters along the "Inner" facades of the buildings also provide shade

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4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

OPERATIONAL ENERGY USE

City of London Potential Heat Network Clusters Map

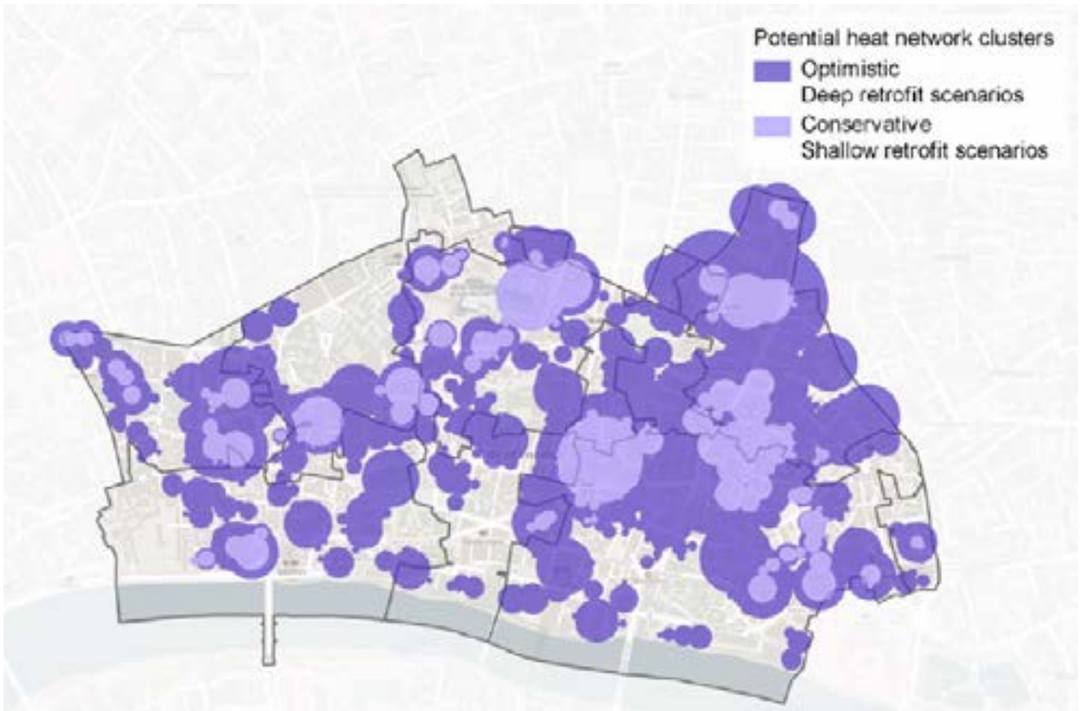

Figure 4.1 Optimistic and Conservative potential heat network clusters.
Source: City of London Local Area Energy Plan

The 'Optimistic' layer is based on multiple blended scenarios, all of which involve deep retrofit, varying degrees of future building growth and demand changes. The 'Conservative' scenario assumes only shallow retrofit, along with high growth of future buildings. Modelling has shown that heat networks could supply 75% of heat in the Optimistic scenario, but only 34% in the Conservative scenario.

City of London Waste Heat Opportunities

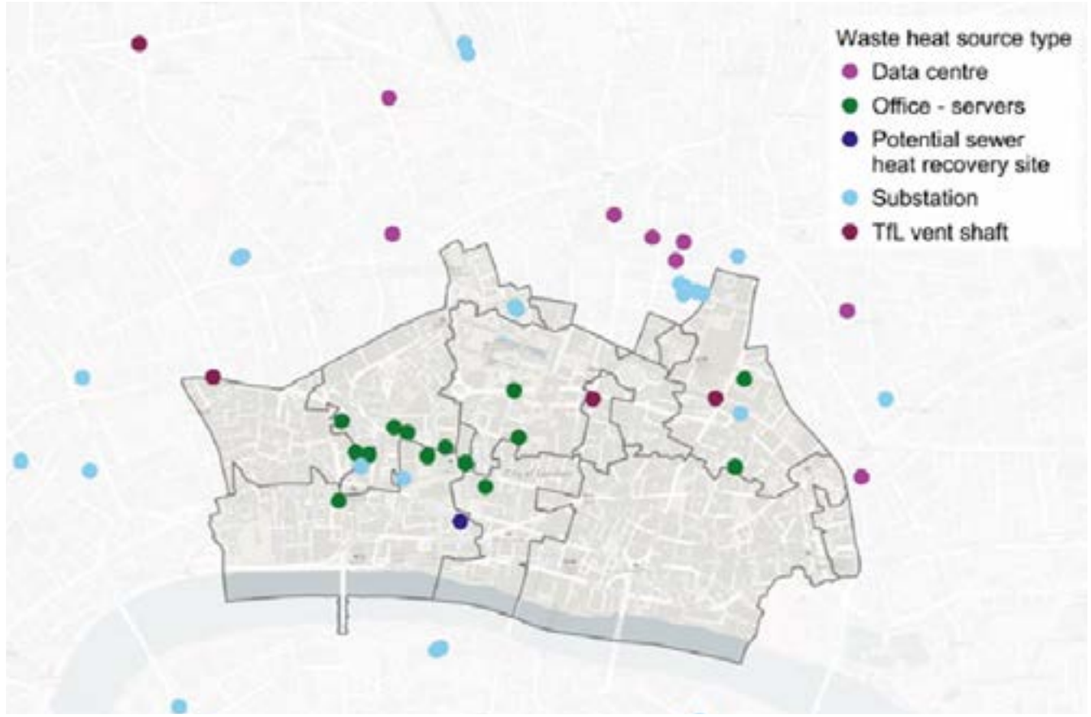

Figure 4.2 Map of potential waste heat sources.
Source: *City of London Local Area Energy Plan*

Waste heat from sources indicated on the map could be captured, reused and shared between buildings by both building level or network scale systems.

A heat network supplies heat to a building from a local network, and any waste heat is fed back to the network. The UK Government considers heat networks an essential component of clean and cost-effective decarbonisation of UK heat, supporting its net-zero goals. It is introducing heat zoning regulations which will designate areas where heat networks are expected to offer the lowest-cost solution for decarbonising heat. A Zone Coordinator will be designated to support management, data collection, delivery and stakeholder engagement. The forthcoming regulations are expected to significantly influence future heat network supply options and will set minimum standards for existing and new networks.

Heat network development is identified in the LAEP as a central route to meeting the City's ambition of a net zero Square Mile by 2040. The City Corporation is participating in the Government's Advanced Zoning Programme (AZP) and the Square Mile is expected to be a priority zone for heat networks. Phase 1 of the AZP has produced a high-level masterplan for a Square Mile Heat Zone. As referenced in the London Plan Guidance, connection to local existing or planned heat networks, and the use of zero-emission or local secondary heat sources, are key criteria of the heating hierarchy for new developments.

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4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

OPERATIONAL ENERGY USE

Applicants for new development in the City are strongly advised to consider the implications of UK government heat network regulations. It is likely that all future new developments and major refurbishments will be required to connect to a nearby heat network within a defined timeframe. To prepare in advance, the City Corporation is encouraging new developments to assess the cost and carbon advantages of heat networks, and to mitigate any future risks of mandated connection (with respect to any future necessary re-design or change of heating/cooling strategy). The City Corporation strongly encourages applicants to take a pro-active approach by:

- Incorporating a heat network connection into their development
- Designing in flexibility solutions including smart systems and energy storage technologies
- Engaging with the City Corporation and district network providers to facilitate extensions to and new networks.

Other opportunities for heat sharing with neighbouring buildings and nearby infrastructure should be investigated. Major developments may have the potential to share resources and plant installations with neighbouring historic buildings. This could improve their energy efficiency whilst relieving historic buildings from modern plant installations and interventions that are detrimental to their heritage value.

Meeting the increased electricity demand due to growth and a shift to electrified transport and heat is likely to require electrical infrastructure network upgrades. This is identified as a priority action within the LAEP to allow new local renewable assets to connect to the electricity grid. The City Corporation will continue to engage and coordinate with UK Power Network (UKPN) to understand the implications of growth and electrification on the electricity infrastructure and to work collaboratively to deliver additional capacity where required.

To minimise the need for further grid infrastructure and to deliver a resilient energy system to businesses and residents, the LAEP encourages the uptake of flexibility technologies including demand side response and smart appliances, thermal/battery storage and vehicle-to-grid technologies. The City Corporation will look to embed flexible technologies in their own assets and developers should review opportunities to provide energy storage and demand management to tie in with local and national energy security priorities.

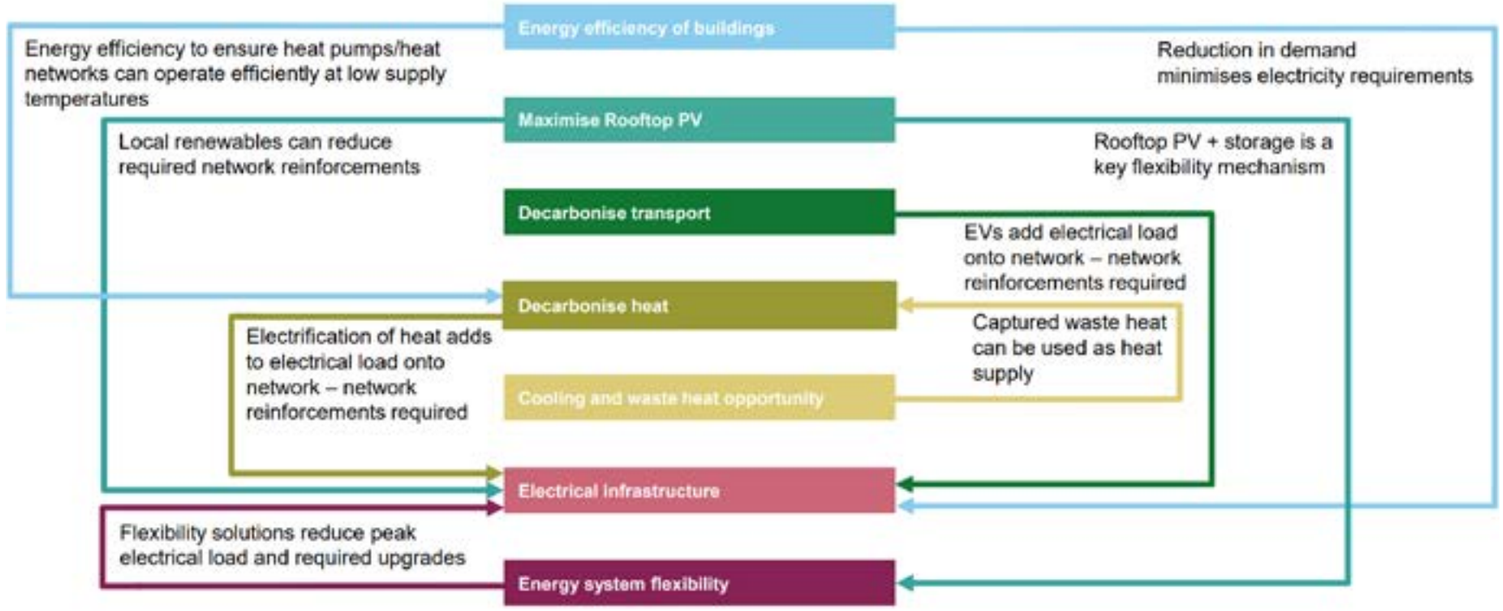

Figure 4.3 Diagram mapping interdependencies across Local Area Energy Plan priority intervention areas
Source: *City of London Local Area Energy Plan*

Image: Biosolar roof installation at Watermark Place
Source: City of London Corporation

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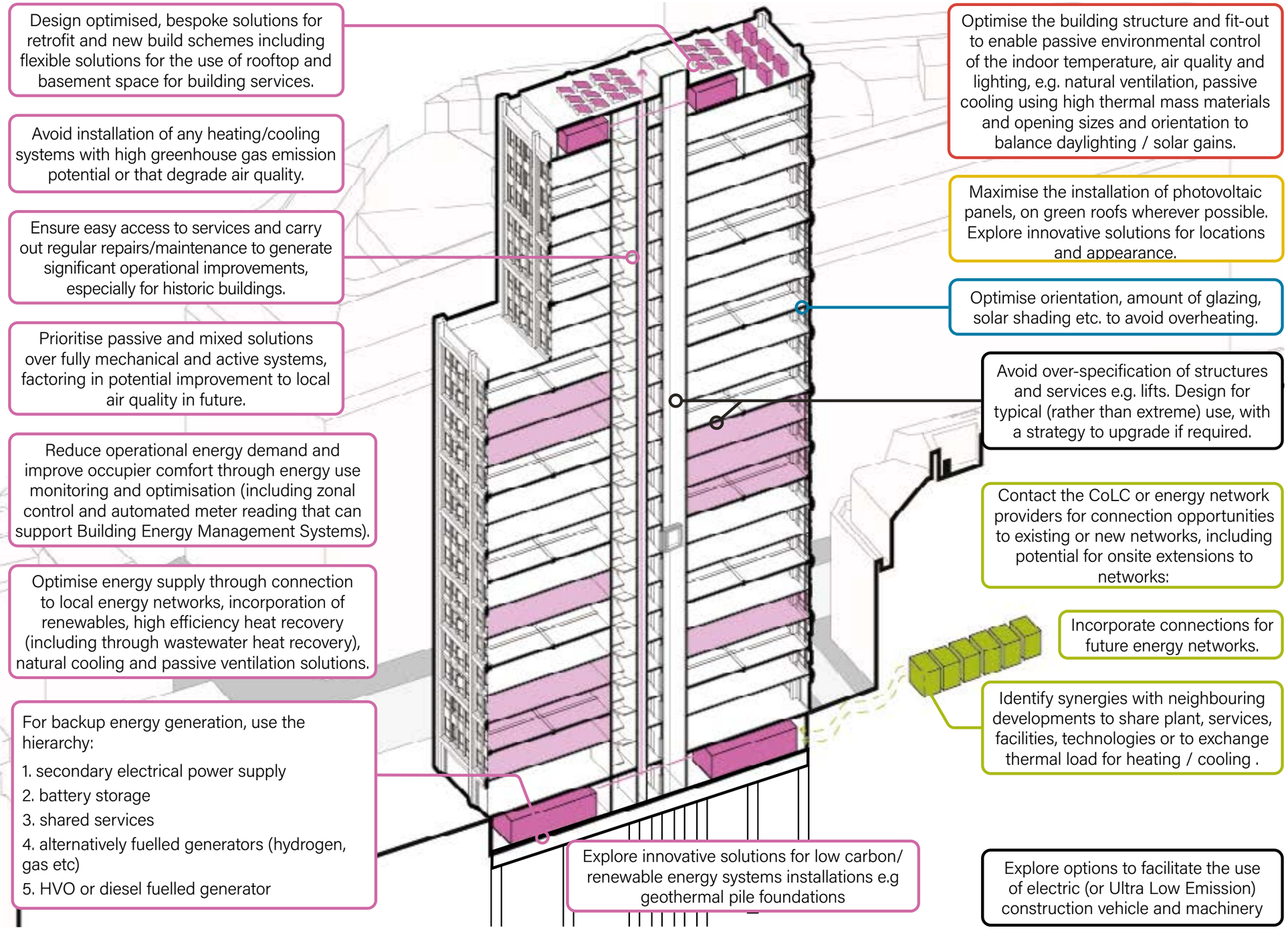
4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

KEY MEASURES FOR CITY DEVELOPMENTS - OPERATIONAL ENERGY USE

This infographic provides a list of potential measures, which is not exhaustive. Applicants are encouraged to propose innovative measures that drive best practice. All measures to be agreed on a case-by-case basis.



CIRCULAR ECONOMY

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5. CIRCULAR ECONOMY

Introduction

The London Plan 2021 defines a circular economy as 'one where materials are retained in use at their highest value for as long as possible and are then reused or recycled, leaving a minimum of residual waste.' It is a move away from the current linear economic model, where materials are mined, manufactured, used and discarded.

In the built environment, this means keeping buildings, products and materials in use for as long as possible through redesign, refurbishment, repair, recycling and other systems. This includes minimising construction waste throughout a building's life-cycle, as well as operational waste while the building is in use.

Key approaches for the City

Construction and deconstruction form a significant proportion of the emissions and waste generated in the City due to high levels of redevelopment. The process of circular economy and designing out waste should begin early in design development and include all parties involved throughout planning and construction stages. In the Square Mile and Greater London, materials designated for removal from site should be deconstructed, salvaged, reused and shared between projects wherever possible to reduce waste and the need for new materials.

Developments should identify synergies between waste reduction and whole life-cycle carbon reduction, transitioning towards zero waste construction sites. Where new buildings are constructed, they should prioritise reused materials and materials with high recycled content, be built in layers (for ease of maintenance and replacement), modular, durable, flexible, adaptable, and designed for disassembly.

Development and refurbishment projects within the City should follow the GLA's Circular Economy Hierarchy for Building Approaches (see policy D3 of the London Plan 2021). This prioritises use of existing assets and efficient use of materials, followed by use of low carbon alternatives.

New developments in the City should be designed with the aim of being zero-waste in operation. Internal systems should be adaptable to new reuse, recycling and waste collection systems and categories that may be introduced in the future.

The GLA's Circular Economy Guidance encourages applicants to 'identify opportunities for the use of reused or recycled materials; and aim for at least 20 per cent recycled or reused content, by value, for the whole building.' Applicants are encouraged to go beyond GLA targets, particularly where new build or high carbon development is proposed. Targets are expected to increase as procurement and supply chains develop.

When required by development plan policy, all major applications must submit a Circular Economy Statement aligned with London Plan Guidance (Policy SI7). This statement should be updated in line with the stages of the development process. In order to support this process constructively in collaboration with applicants, major developments will be required to submit updates to the Circular Economy Statement at detailed design (RIBA Stage 4) and post-completion (RIBA stage 6). This will be secured by condition attached to the planning permission. Post-completion Statements must include retention figures for substructure, superstructure (by mass) and facade (m2).

Key policies and guidance

Table 5.1 Circular Economy key planning policies

London Plan 2021
D3: Optimising site capacity through the design-led approach
D4: Delivering good design
SI 7: Reducing waste and supporting the circular economy
SI 8: Waste capacity and net waste self-sufficiency
GLA Circular Economy Statement Guidance
Local Plan 2015
CS17: Waste
DM: 17.1 Provision for waste in development schemes
DM 17.2 Designing out construction waste
Emerging City Plan 2040
CE1: Sustainable waste facilities and transport
S8: Design
DE1: Sustainable Design
S16: Circular Economy and Waste

Reuse: To use a material, product or component parts, either for their original purpose or for a new one, without significant alteration. For example, repairing or repurposing items instead of discarding them.

Recycling: The process of converting waste materials into new products, preventing the waste of useful resources. It is important to assess whether the quality of the resource is maintained (e.g. it can be used for same purpose again) or if it will be cycled to a lower quality (downcycled) during the process e.g. bricks being downcycled for use as hardcore.

Case Study: 100 Fetter Lane

Use: Office and retail

New build

Visual of proposal for 100 Fetter Lane.
Source: Design and Access Statement

Key facts:

- Use of recycled materials, including for the primary façade (rammed concrete with recycled aggregates or bricks to form façade panels)
- Minimisation of material consumption and incorporating future flexibility in the structure and configuration of internal spaces
- Selection of materials that are easy to install and durable, with low wastage rate and less energy use in manufacture, as well as requiring less maintenance and replacement cycles
- Piloting of material passports (Circuland) to facilitate future materials reuse with information, such as a 3D model, contractor's records, products' specifications and certificates, held in a database.

5. CIRCULAR ECONOMY

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Key actions to develop an exemplar City scheme

The following key actions are required to positively address the City Corporation's policy framework and should be discussed at pre-application stage. Applicants should clearly present the relevant information in the application documents:

- Demonstrate maximum retention and reuse of existing buildings and materials through a pre-redevelopment audit, including any options explored
- Incorporate reuse items and recycled materials into the design of any new development, and support material efficiency by optimising the structure, floorspace arrangement, and the finishes and fit-out design, in accordance with circular economy principles
- In cases of demolition, identify reuse potentials through a pre-deconstruction audit*. Prepare detailed information for a minimum of 5 key materials, components or fittings to enable reuse through materials markets as early as possible
- Demonstrate principles of flexibility, adaptability and ease of repair and maintenance in the proposed design to support future adaptive reuse and to extend the useful life of the building in response to evolving working and living patterns
- Prepare building material data (i.e. material passports) for a minimum of 5 carbon intensive new materials, components or fittings; set up an end-of-life strategy that incorporates as-built information management with ongoing updates, for the lifespan of the development

The key actions clarify the City Corporation's priorities, set out in the Development Plan policy, for how in-depth circular thinking should be applied to the design of City developments from the onset. The GLA's Circular Economy Statement guidance provides details of the content that should be included in an applicant's circular economy strategy. This includes a pre-redevelopment audit that incorporates pre-application stage optioneering relating to circular economy opportunities. It is recommended the same options as the carbon options assessment are used. Pre-deconstruction audit and end-of-life data are expected to become more detailed over time. It is recommended that applicants contribute to driving the reuse process by providing further details of at least 5 key deconstruction and 5 key proposed materials to facilitate reuse opportunities.

New build proposals in the City are expected to demonstrate creative ideas for the reuse of materials from site and from material marketplaces, and how deconstruction material can be reused at its highest value onsite or elsewhere, including for public realm works.

Flexibility and adaptability to increase the longevity of buildings are important qualities of circular design in the City's predominantly commercial property market where quality standards are subject to frequent change, due to quickly changing commercial building specifications. The provision of high-quality material data is key to supporting adaptive reuse of buildings as well.

The following key actions are strongly recommended to develop an exemplary scheme that achieves the best balance of planning benefits for the City of London: Measures should be discussed at pre-application stage and highlighted in the application as environmental benefits to support the proposals:

- Where removal of a building is necessary, use deconstruction methods rather than demolition to maximise the quantity and types of items and materials that can be salvaged. Deconstruction method statements should be provided for key materials and elements.
- Seek coordination opportunities with nearby development sites and public realm works to increase opportunities for material reuse and exchange
- Seek partnerships with specialist manufacturers for works to modify, recertify and store materials for reuse from an early stage

The adoption of circularity in the use of materials is particularly important in areas of high construction activity like the City. Exemplary efforts to deconstruct, record and reuse materials, the efficient use of material exchange markets, and coordination and cooperation with other development sites, manufacturers and tenants (on construction, material strategies and fit-out choices) are sought to reduce waste and carbon emissions from development.

* The term pre-deconstruction audit is used in place of pre-demolition audit to drive recovery and reuse.

Case Study: Salisbury Square

Use: Courts, police station, retail, and office

New Build

Salisbury Square east elevation.
Source: Design and Access Statement

Key facts:

- Stone cladding on façades used for external public paving, and excess stone crushed and used as an aggregate in terrazzo mix for planters
- A large portion of reclaimed materials sourced from Fleetbank House. Many other materials sourced from properties on Fleet Street, Whitefriars, Salisbury square, and the courtyard area
- Material reclamation written into contractual requirements of the Demolition Contractor
- The existing 2-7 Salisbury Court basement to be retained as the basement for the refurbished building, avoiding the need for excavation
- Use of 70% GGBS cement replacement to all the vertical structures (columns, walls, core), firm secant piles and concrete blinding and 50% GGBS cement replacement to all other concrete elements

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5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

Circular economy in construction

Developments should follow the Circular Economy hierarchy (Figure 5.1) to maximise reuse of existing materials and components and minimise use of new materials. Materials, structural elements and spaces should be designed for adaptability and flexibility (to extend a building's useful life), whilst weighing up the impact of any additional carbon emissions incurred as a result.

Based on GLA Guidance, these terms are defined as:

- **Adaptability**: how well a building or development accommodates change with the primary goal being to support longevity of the building. Adaptable design allows for long-life elements to be retained, while short-life elements can easily be reworked, re-organised or rebuilt as needs change – e.g. the spatial layout and services may need to be changed and replaced over time, usually in response to changes in use/needs.
- **Flexibility**: the design of spaces to accommodate more than one use e.g. multiple uses at the same time, or various uses throughout the day, week, or year (seasonally). This principle can be applied to both indoor and outdoor spaces.

Key Measures

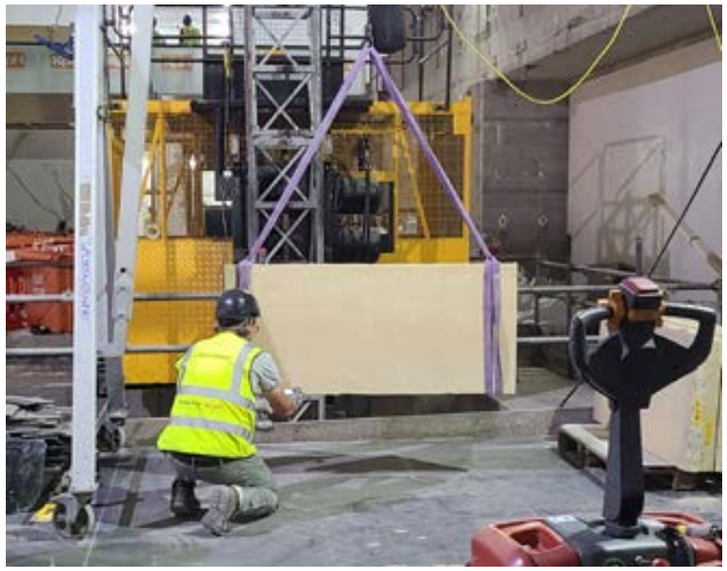
Whole building

Applicants for all major developments are expected to undertake a pre-redevelopment audit to understand to what extent existing buildings, structures and materials can be retained, refurbished, or incorporated into the new proposal. The purpose of the pre-redevelopment audit is to conduct a strategic assessment of reuse opportunities at concept stage and embed circular principles into the design. The pre-redevelopment audit should be submitted as part of the Circular Economy Statement at planning application stage.

Where substantial demolition is proposed, a pre-deconstruction audit is expected to be provided for all planning applications to maximise opportunities for the reuse of materials. Alternatively referred to as a 'pre-demolition audit', the City Corporation uses the term pre-deconstruction audit to encourage deconstruction and material reuse over demolition and waste. The purpose of the pre-deconstruction audit is to provide a quantitative and qualitative record of materials to support the pre-redevelopment audit. The pre-deconstruction audit should be updated as conditioned through the planning process to gather evidence and insights into how the reuse process is managed and implemented, for the benefit of all stakeholders.

The following tables builds upon the GLA Circular Economy Guidance for pre-redevelopment and pre-deconstruction audits, and recommends further actions and detail that are considered to improve reuse opportunities of deconstruction materials in the City. Exemplary developments are envouraged to incorporate as many best-practice aspects as possible.

Images: Salvaged materials being processed on site at 75 London Wall
Source: City of London Corporation



Case Study: 75 London Wall

Use: Office and retail

Retrofit and Extension

Visual of the proposed New Bridge Street elevation
Source: Planning Application Circular Economy Statement

Key facts:

- High levels of retention of the existing building including 100% of substructure, 77% of superstructure, and retention of facade on lower levels
- New steelwork to be designed with bolted rather than welded connections in order to aid their de-mountability and potential reuse
- Diversion of 98% of demolition waste materials from landfill

Additional features:

- A1–A5 (excl. sequestration) WLC emissions of 437 kgCO2e/m^2, a significant improvement on the GLA's Aspirational Benchmark of 600kgCO2e/m^2
- A–C (excl. B6 & B7) WLC emissions of 816kgCO2e/m^2, a significant improvement on the GLA's Aspirational Benchmark of 970kgCO2e/m^2
- Targeting an 'Outstanding' BREEAM rating

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5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

Pre-redevelopment audit guidance

GLA Guidance	City Corporation Guidance	Best-Practice Guidance (City Corporation Guidance +)
Context and existing site analysis ▪ Outline an explanation of the existing buildings on the site and brief description of state of their repair. Details should include: the building's age, key materials, photos of typical internal spaces and facades, and site plans.	**Context and existing site analysis** ▪ Analysis of the site context, existing built form, heritage matters and identification of opportunities for reuse. ▪ A material review to inform optioneering and the materials assessment (as outlined below). ▪ Review relevant surveys: structural and façade, building services and fit-out. Include a description of their current state and conduct intrusive investigations if possible. ▪ The site analysis and material review should be informed by and include details from a site visit.	**Context and existing site analysis** ▪ Incorporate detailed modelling, BIM or digital twin models. ▪ Consider construction sequencing and storage opportunities.
Optioneering ▪ Analysis that fully explores options for retaining existing structures, materials and the fabric of existing buildings into the new development; and the potential to refurbish buildings before considering substantial demolition.	**Optioneering** ▪ Include a strategic assessment of retention and development scenarios that align with the carbon options assessment appraisal (where provided). Optioneering must be evaluated according to whole life-cycle carbon (in the carbon options assessment), circular economy (in the pre-redevelopment audit) and other relevant sustainability criteria. ▪ Assess how each option would embed circular economy principles.	**Optioneering** ▪ Provide opportunities for, or estimates of retained, reused, remanufactured, diverted, recycled materials would apply to each development scenario.
	Early materials considerations and assessment ▪ Include a review of existing materials onsite including estimated types and quantities, as informed by a site visit. ▪ Include a material reuse catalogue for a minimum of 5 key items, materials, components and fittings for reuse. This should: ◦ Include a qualitative assessment of the material properties ◦ Identify opportunities that maximise resource recovery in line with the circular economy hierarchy (Figure 5.1) and prioritise retention/reuse onsite above offsite relocation, repurposing or recycling ◦ Include visuals, photographs, diagrams where helpful and inspiring for the design process. ▪ The qualitative assessment of material properties could consider: ◦ can it be disassembled? ◦ what are the fixings? ◦ is there a take-back scheme? ◦ testing and supply chain considerations ◦ manufacturer warranties ◦ fire resistance ◦ toxicity.	**Early materials considerations and assessment** ▪ Include a material reuse catalogue for the majority of key items, materials, components and fittings for reuse. ▪ Investigate material passport and exchange platforms to understand the material reuse process and information required. ▪ Include case studies where helpful and inspiring for the design process. ▪ Assess the materials and waste impact of temporary structures which support construction.

5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

Pre-redevelopment audit guidance (continued)

GLA Guidance	City Corporation Guidance	Best-Practice Guidance (City Corporation Guidance +)
Development of the pre-redevelopment audit ▪ The audit should be carried out early on (at pre-application stage) and should inform the design. ▪ Applicants should complete and submit a pre-redevelopment audit as supporting evidence to their CE.	**Development of the pre-redevelopment audit** ▪ Establish measurable targets for the preferred scenario of retained, reused, remanufactured, diverted, recycled materials, and opportunities for embodied carbon savings. ▪ Identify any limitations in the findings and results of the audit (e.g. limited access to site) and/or risk in its delivery (e.g. contractor buy-in). Propose how these limitations will be addressed, and risks managed throughout the design stages. ▪ Map and engage key stakeholders, partner organisations, and/or materials platforms that will deliver the pre-redevelopment audit. Each stakeholder should attend the initial site visit. ▪ Detail how the pre-redevelopment audit will be managed and reported throughout design development. Identify a key stakeholder/s to manage and champion this process.	**Development of the pre-redevelopment audit** ▪ Outline collaboration, information and coordination sharing opportunities within a portfolio. ▪ Consider collaboration, information sharing, and coordination opportunities with other developments. ▪ Demonstrate how design-decisions have been influenced by re-use opportunities.

Material Glass

Banding Summary

Band 1
- "As New"
- Applicable to Front of House
- Visible Finish Item
- Standard Sizes

Band 2
- Almost "As New"
- Applicable to Front of House
- Visible wear and tear but applicable to Aesthetic Standards
- Standard Sizes

Band 3
- Visible wear / tear / damage / degradation that can be refurbished
- Applicable to Back of House
- Visual based on Aesthetic Standards of context
- Standard Sizes

Band 4
- Visible wear / tear / damage / degradation that can be transformed
- Applicable to Back of House
- Within Build-up (not visible)
- Non-standard Sizes

Band 5
- Visible wear / tear / damage / degradation that is not practicable to be refurbished
- Applicable to Back of House
- Within Build-up (not visible)
- Usable Non-standard Sizes

Band 6
- Visible wear / tear / damage / degradation that is not practicable to be refurbished
- Applicable composite materials
- Within Build-up (not visible)
- Unusable Non-standard Sizes

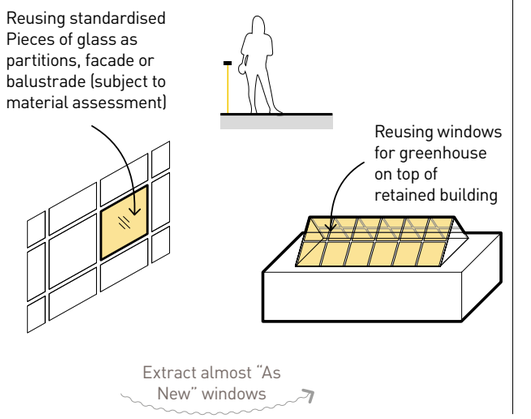

Figure 5.1 - 55 Old Broad Street - Material Reuse Audit
Submitted as part of the Circular Economy Strategy this example demonstrates an in-depth analysis of existing materials and opportunities for reuse

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5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

Pre-deconstruction audit guidance

GLA Guidance (for Pre-Demolition Audit)	City Corporation Guidance	Best-Practice Guidance (City Corporation Guidance +)
A pre-demolition audit is a detailed inventory of the materials in the building that will need to be managed upon demolition. It should include: ▪ A summary of the key components and materials present in the existing buildings, with an estimate of the quantities and associated embodied carbon and whether they are suitable for reclamation. ▪ An explanation and drawings that show the extent of the proposed demolition and whether any parts of the building are being considered for retention. ▪ Opportunities for reuse and recycling either within the proposed development or offsite nearby/locally or further afield. ▪ Reasons for adopting less preferred approaches or moving down the hierarchy of CE design approaches.	The pre-deconstruction audit is a detailed quantitative and qualitative data inventory of existing materials onsite, including retained and deconstructed materials. In addition to the GLA guidance, it should include: ▪ The type and quantities of materials present. ▪ Quantities and value of building elements and materials that can be recovered, including identification of priority deconstruction products for reuse. ▪ Associated embodied carbon savings should be cross-referenced with the WLC assessment. ▪ Any associated programme impacts for reuse onsite, reuse offsite, recycling options.	The collection of quantitative and qualitative data should work towards developing material passport-type information. Provision of this information in an excel spreadsheet is encouraged for use on a materials platform or easy data sharing.
Where possible, the following best practice information should also be included: ▪ How the value of existing building elements or materials can be recovered. ▪ The amount of demolition waste. ▪ A schedule of practical and realistic providers who can act as brokers for each of the reclaimed items. ▪ Target reuse and reclamation rates.	A material reuse schedule for a minimum of 5 key items, materials, components and fittings for reuse. This schedule should add detail to the material reuse catalogue (in the pre-redevelopment audit) and outline targets and commitments: ▪ Include quantitative data (e.g. number and type). ▪ Include a qualitative assessment of condition and properties (from the pre-redevelopment audit). ▪ Establish targets that maximise resource recovery in line with the circular economy hierarchy (Figure 5.1) and prioritise retention/reuse onsite above offsite relocation or repurposing. ▪ Include visuals, photographs, diagrams where helpful and inspiring for the design process.	A material reuse schedule for the majority materials (e.g. timber) / elements (e.g. doors) onsite including a qualitative assessment of relevant material properties and considerations. Include case studies where helpful and inspiring for the design process.

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5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

Designing for circularity

The following key principles are central to circular design

- **Multi-use layers** (long-life elements): design long-life structural elements to be adaptable for a variety of uses, this can include incorporating generous floor-to-floor heights, clear spans, non-structural partitioning.
- **Deconstructability** (short-life elements): design systems and elements, particularly shorter life-elements (furniture, fittings, joinery, space layout/partitioning, services, façade elements) for disassembly so they can be reused on other projects.
- **Ease of accessibility**: consider the accessibility of spaces for different user groups and activities when testing different layouts. Consider ease of access to components for servicing and replacement.
- **Modular construction**: consider standardised components or building layers, to reduce construction waste and make it easier to adapt the building. Modular approaches may still be carbon intensive. Therefore, prioritise take-back and standardised modular schemes that use low carbon materials.
- **Flexible programming**: integrate flexible spaces into the masterplan which can change use at different times of the day or year, e.g. a gallery space that can double up as a workshop or collaboration area.

The GLA's Circular Economy Guidance recommends that all new construction should be designed and built considering layers. If each building layer functions as a separate system, shorter life layers can be replaced and adapted without impacting the use and integrity of longer life layers. This involves designing and determining a realistic lifespan for independent layers of the building.

As part of the access and maintenance strategy usually prepared by the design team for the developer, it is recommended that deconstruction is included as a key consideration (especially for building elements that require more frequent replacements, such as façade elements, building services, fit-out), as the reusability of materials depends on ease of disassembly and on how well they are maintained during the building life-cycle. To demonstrate best practice, an access, maintenance and deconstruction strategy is encouraged to be submitted with the detailed Circular Economy Statement.

Data and Information Management

It is recommended that design and construction teams compile and record information on materials and construction methods in a single accessible format, including clear as-built drawings (by the architects) and deconstruction drawings (by the contractor).

Alterations that occur within the building's life should be regularly monitored and added to the building's record or passport to ensure that information is up-to-date for future building managers, and at the end-of-life stage.

Newer systems, such as materials passports, are likely to become established practice in the near future and should be considered during later stages of design and construction, particularly for materials used in new developments. Passport information should be accessible to building owners, building managers, and occupiers as necessary, so that it can be updated throughout the building's life-cycle.

During the design phase, it is best practice to anticipate and test additional future functions of the building which may include changes to technologies or building flexibility, and redundancy if deemed appropriate (this should be informed by relevant studies, area development plans, consultation findings).

Proposals should also consider current and future resource scarcities and address these issues through loose fit in design, construction and operational approaches e.g. use of water audits to support material specification during design or application of rainwater harvesting to support net water positivity on site (see Chapter 6 - Water Resource Management).

Digitisation may be an opportunity to replace hardware with software which does not require material/physical modification and can typically be updated digitally as new tools and requirements emerge.

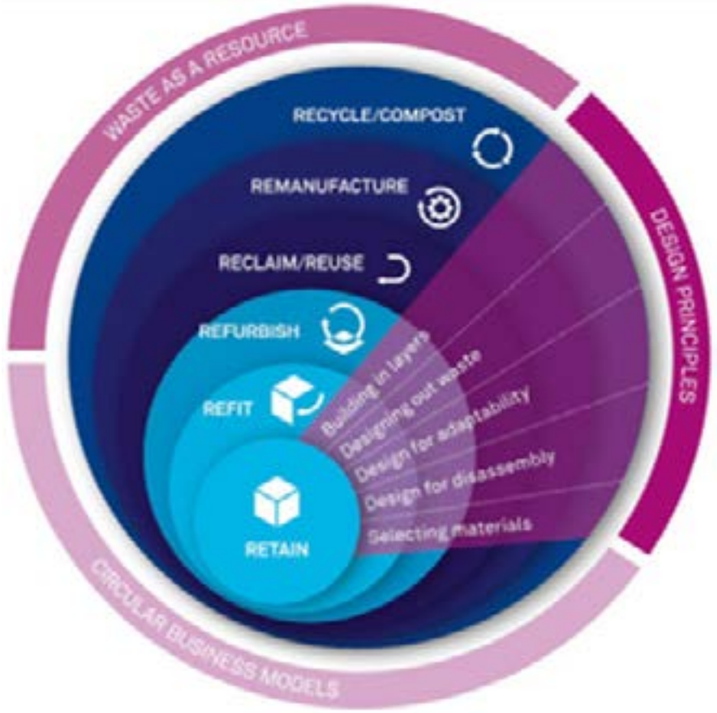

Figure. 5.2 - Circular Economy Hierarchy
Building Revolutions (2016) D. Cheshire, RIBA Publishing

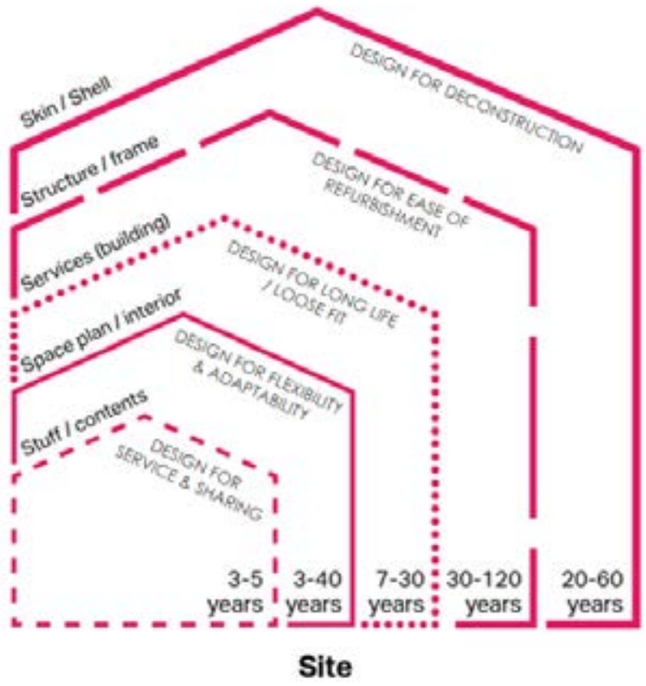

Figure 5.3 - Building layers and their indicative lifespans
Frank Duffy's 'Shearing Layers' concept described in *How Buildings Learn* (1994) S. Brand.

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5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

Beyond the building

It is recognised that there is limited space to store recycled or reusable building items and materials in the City generally or on construction sites, however, the City Corporation welcomes proposals that consider opportunities to share materials with other ongoing construction and public realm projects in the Square Mile or Greater London. Alternative material storage opportunities should be explored offsite, or with demolition contractors, material suppliers and exchange platforms.

Applicants with multiple sites in London are encouraged to explore storage opportunities across their portfolio. Alternatively, materials should be advertised on material reuse platforms as early as possible to maximise the opportunities for offsite reuse.

Developments should consider facilitating meanwhile use of sites awaiting vacancy or construction such as affordable workspace, cultural or community space, pop-up commercial or green space. Meanwhile use has the potential to drive economic outputs, increase positive environmental impacts and deliver social value[3] to the public, local businesses and the developer, for both the short and long term.

Case Study: City Place House, 55 Basinghall Street

Use: Office and retail

New build

Visual of City Place House entrance.
Source: Design and Access Statement

Key facts:

- Optimising the structural design to minimise quantity of materials and enable pre-fabrication and modularisation
- Materials with high recycled content, confirmed by a Sustainable Procurement Plan, such as aluminium with 50% recycled content, cement replacements in concrete, 97-100% recycled content for steel enforcement bars, recycled steelwork and mineral wool insulation
- Use of refurbished raised access flooring
- Designing for ease of disassembly, e.g. through bolted steelwork connections
- Existing steelwork from site confirmed to be reused in a different project

Case Study: Fleet House, 8-12 New Bridge Street

Use: Office and retail including public house

Retrofit and extension

Visual of the proposed New Bridge Street elevation
Source: Planning Application Circular Economy Statement

Key facts:

- Optimisation of the structural design to maximise retention with 72% of the existing basement and superstructure to be retained
- Modular façade design to enable offsite manufacture and waste minimisation
- Minimising material usage and optimising the design to achieve durable and adaptable spaces
- Adaptable and flexible MEP systems to suit low floor to floor heights

Additional features:

- Maximised green infrastructure compared to existing site, including addition of public realm planters and greenery on roof terraces and integrated into facades

3 Meanwhile Use London report – Arup for the GLA

5. CIRCULAR ECONOMY

OPERATIONAL CIRCULAR ECONOMY

Operational circular economy

The application of circular economy principles during the operational period of a building's life-cycle includes anticipating future occupant needs to help reduce waste generation, designing for flexibility to facilitate the sharing of assets, and the consideration of maintenance and repair requirements during the life of the building.

It also involves the design of site-level waste management systems that encourage circularity such as conveniently placed recycling facilities.

The City runs the Clean City Awards Scheme (CCAS) to drive sustainability amongst member businesses in key areas related to waste, such as communication and engagement, resource efficiency and circular economy practices, and reducing plastic waste.

Key measures

Whole building

Waste reduction needs to be considered from the outset of the operational stage of the building's life-cycle. When occupants consider office refurbishments, focus should be placed on repairing over replacing, choosing elements for longevity and flexibility.

After reducing waste production as far as possible, it is important to ensure that adequate space is made for the separation and storage (for a convenient period) of dry recycling and food waste from the outset. This includes the provision of segregated disposal, in alignment with the major waste streams generated in all bin locations, with clear signage. For example, if collecting residual, dry mixed recycling, organics, ensure all three bins are in all waste locations.

In developments with kitchens that are likely to produce large volumes of organic waste, the design proposal should allow for the accommodation of food waste digestion or composting technologies, reducing the need for transportation of food waste and associated carbon emissions.

Waste stores should be constructed using materials that are robust, secure, and non-combustible, with a water outlet for bin washdown, a foul drainage connection, as well as adequate lighting and ventilation. The temperature of waste management spaces should be considered to reduce the risk of odours and vermin based on the nature of the proposed activities, volume and length of waste storage. The servicing areas need to be designed for waste vehicles, which typically require a clear height of 5.5m.

Waste bins within the waste store should be arranged so that they are easily accessible without obstruction. Waste storage areas should be located so that occupiers and waste operatives should not have to transport waste for a distance greater than 30m. Equally, occupiers and waste operatives should not have to move bins along a gradient steeper than a 1:12 slope (although this limit may be exceeded if the lengths are not excessive, and the slope is not part of a series of slopes)*. In commercial buildings with high waste outputs, separate units for different recyclable goods and waste compactors should be considered to allow for efficient transportation.

Developments should include provision of shared storage space, shared appliances or a 'library of things' (tools and other equipment) between different tenants, to reduce the need for purchasing them individually. Spaces should be designed with a culture of reuse rather than disposal, for example, designing storage space for mugs/glasses and providing a sink or dishwasher. Developments should provide space for the deposit of unwanted or bulky items in preparation for reuse or recycling in a convenient location - especially for the many commercial spaces in the City which may experience frequent refitting for new tenants. Where reuse of equipment is not possible, signpost or provide onsite recycling opportunities for complex waste items (such as electrical equipment).

In-building waste management and storage solutions should be well integrated with the collection systems used by the contractor serving the development. Developers should be mindful that collection systems may change over time due to new collection contracts or changing legislation. Systems that rely on hard infrastructure may not be resilient to these types of change.

Solutions that facilitate the collection and reporting of Management Information (MI) on the amount and type of waste generated by waste stream is encouraged for both commercial and residential use. MI can be used to identify performance issues and evaluate impacts of additional interventions.

Proposed waste management systems should encourage a sense of personal responsibility for the correct segregation of waste and use of waste management service/infrastructure. This could include linking use of the service to individuals, households, or businesses via technology (e.g. smart bins) and/or monitoring (via CCTV and care-taking staff).

To raise awareness of the onsite waste management service and to encourage desired recycling behaviours, clear multi- channel communication and signage for commercial and residential use need to be in place. Signage needs to reflect what the appropriate contractor collects (this may evolve over time).

Freehold, leasehold and rental conditions should include clear obligations on commercial tenants/residents to use waste management facilities in the correct way and employ building caretaker(s) with a clear waste management role which includes the engagement of residents and businesses to encourage good recycling behaviours, possibly through incentives. Occupiers should prioritise the use of multiple-use over single-use products, and suppliers with packaging take-back or refill schemes.

Occupiers should be encouraged to incorporate requirements for using recycled goods into procurement contracts (considering waste that is produced across the whole supply chain), and for following the waste hierarchy.

***Refer to Building Regulations Approved Document H for further information.**

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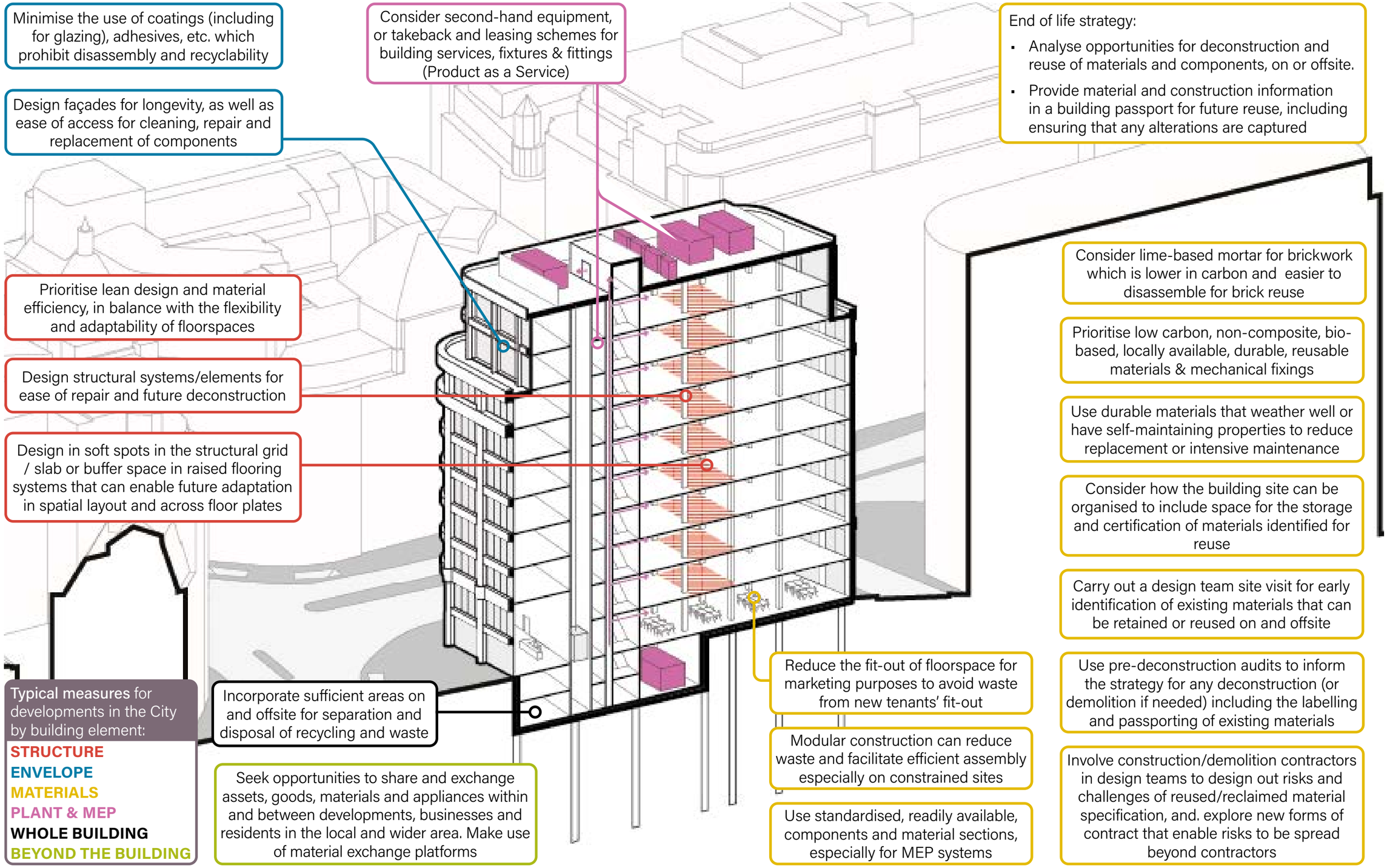
5. CIRCULAR ECONOMY

KEY MEASURES FOR CITY DEVELOPMENTS

This infographic provides a list of potential measures, which is not exhaustive. Applicants are encouraged to propose innovative measures that drive best practice. All measures to be agreed on a case-by-case basis.



Minimise the use of coatings (including for glazing), adhesives, etc. which prohibit disassembly and recyclability

Consider second-hand equipment, or takeback and leasing schemes for building services, fixtures & fittings (Product as a Service)

End of life strategy:

- Analyse opportunities for deconstruction and reuse of materials and components, on or offsite.
- Provide material and construction information in a building passport for future reuse, including ensuring that any alterations are captured

Design façades for longevity, as well as ease of access for cleaning, repair and replacement of components

Consider lime-based mortar for brickwork which is lower in carbon and easier to disassemble for brick reuse

Prioritise lean design and material efficiency, in balance with the flexibility and adaptability of floorspaces

Prioritise low carbon, non-composite, bio-based, locally available, durable, reusable materials & mechanical fixings

Design structural systems/elements for ease of repair and future deconstruction

Use durable materials that weather well or have self-maintaining properties to reduce replacement or intensive maintenance

Design in soft spots in the structural grid / slab or buffer space in raised flooring systems that can enable future adaptation in spatial layout and across floor plates

Consider how the building site can be organised to include space for the storage and certification of materials identified for reuse

Carry out a design team site visit for early identification of existing materials that can be retained or reused on and offsite

Reduce the fit-out of floorspace for marketing purposes to avoid waste from new tenants' fit-out

Use pre-deconstruction audits to inform the strategy for any deconstruction (or demolition if needed) including the labelling and passporting of existing materials

Modular construction can reduce waste and facilitate efficient assembly especially on constrained sites

Involve construction/demolition contractors in design teams to design out risks and challenges of reused/reclaimed material specification, and. explore new forms of contract that enable risks to be spread beyond contractors

Use standardised, readily available, components and material sections, especially for MEP systems

Incorporate sufficient areas on and offsite for separation and disposal of recycling and waste

Seek opportunities to share and exchange assets, goods, materials and appliances within and between developments, businesses and residents in the local and wider area. Make use of material exchange platforms

Typical measures for developments in the City by building element:

- **STRUCTURE**
- **ENVELOPE**
- **MATERIALS**
- **PLANT & MEP**
- **WHOLE BUILDING**
- **BEYOND THE BUILDING**

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5. CIRCULAR ECONOMY
CASE STUDIES

Case Study: 1 Broadgate

Use: Office and retail

New build

Key facts:

- British Land awarded a BREEAM innovation credit for the UK's first large-scale use of a materials passport
- 27% of materials reclaimed from demolition were reused either onsite or within the Broadgate campus
- Additionally, 139 tonnes of steel are being reused in two other developments in Southwark

Additional features:

- Generous terraces and balconies provide over 4,000 sqm of amenity and green space
- First NABERS UK Design for Performance registered building
- BREEAM Outstanding and WELL Platinum target ratings

Visualisation of the proposed 1 Broadgate development
Source: Design and Access Statement

Together with architects GXN, British Land began working with Madaster at the start of 2021 to use their materials data platform. Throughout the development, the project team will update the platform with information on the quality, origin and location of materials and products that will be used in the structure, façade and MEP of the building, thereby creating its materials passport.

The development approach acknowledges circularity as a crucial part of real estate's future; ensuring materials and products are kept in use for as long as possible, extracting the maximum value from them while in use, then recovering and regenerating them when they reach their end of service life.

Case Study: 55 and 65 Old Broad Street

Use: Office and retail

New build

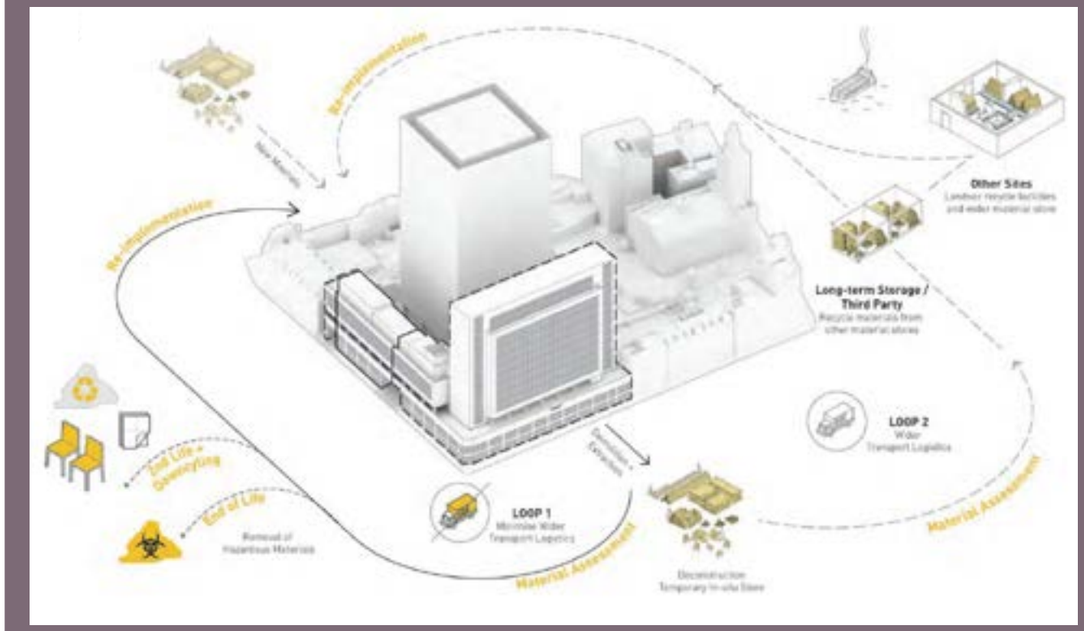

Diagram showing circular flows of materials to and from the development site.
Source: Planning Application Circular Economy Statement

Key facts:

- Materials, components and furnishings in the existing building have been catalogued, creating an extensive material passport database that will allow their reuse
- Materials assessed according to a set of specification metrics including condition and how visible they will be in their next use, to inform decisions on their processing and reuse/ recycling. Material quantities and embodied carbon are key factors
- Modular façade designed for disassembly
- The proposal aims to use primarily mechanical fixings for structural components (steel and CLT), except for the lower level transfer truss structure where heavy loads limit suitability

Additional features:

- Natural ventilation and passive solar shading will reduce operational energy use
- Targeting an 'Outstanding' BREEAM rating

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5. CIRCULAR ECONOMY
CASE STUDIES

Case Study: 47-50 Mark Lane

Use: Office, retail, and cultural learning centre

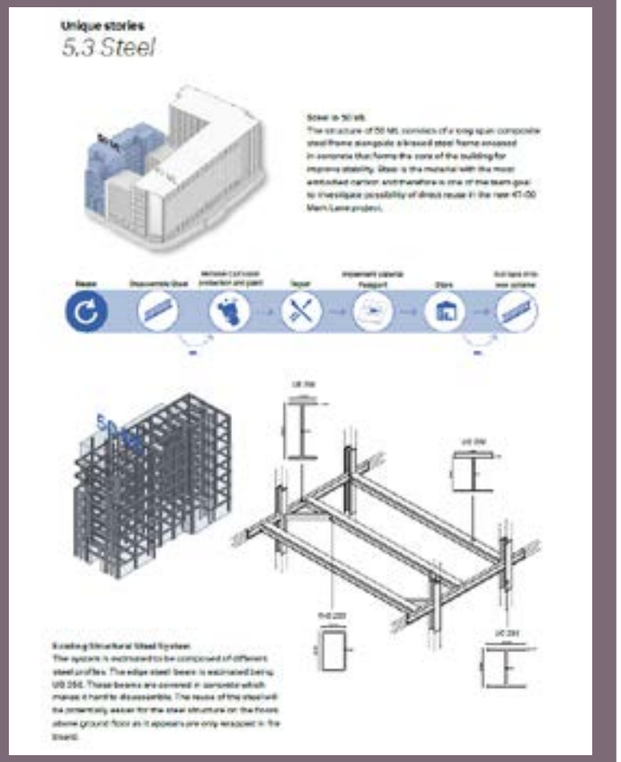
New build

Key facts:

- Worked closely with the appointed demolition contractor and Excess Materials Exchange (EME) to find suitable reuse partners for soft strip materials
- Soft strip materials have been made available on the EME platform until final demolition
- 75% retention of the existing basement which decreases the amount of excavation waste
- Standardised dimensions of the grid and facade to allow for further standardisation of building elements in the internal layout
- The team produced an Upcycling Catalogue, a comprehensive material reuse strategy for materials

Additional features:

- Over 1000sqm of green roof
- Targeting BREEAM 'Outstanding', NABERS 5*, and WELL platinum ratings



'Unique stories' an exploration of potential ways to reuse steel
Source: Planning Application Circular Economy Statement

Right from the start, architects GXN, led a comprehensive assessment of the potential for transformation. An interactive digital model was created using Matterport, 3D scanning tools and software. By scanning real-life spaces, the team could revisit and measure in real-time, analyse and tag objects for review, and plug components into tools that quantify and organise the information.

Visual surveys, plans and survey drawings were used to identify Key Demolition Products to maximize reuse and recycling and aid decision-making for the Stage 2 proposal. An Upcycling Catalogue outlined potential pathways for each product as well as several unique stories based on direct reuse and up-cycling within the proposed scheme.

GXN worked with prospective deconstruction contractors to identify the materials to be retained, rethink innovative methods of deconstruction, and design efficient workflow.

Case Study: 1 Golden Lane (Grade II Listed)

Use: Office with ground floor community space

Retrofit and extension

Key facts:

- Various products and materials including ceiling / floor finishes and light fittings have been made available on reuse marketplace Globechain, with purchasing priority given to developers working within the City
- Utilisation of standardised units in regard to windows, doors and façade panels to allow for easy replacement and adaptation
- Close to 100% of the products and materials specified for the project are derived from recyclable or re-usable sources
- 86% retention of the structural frame

Additional features:

- Plentiful green terraces, window boxes and a planned green wall on the southern façade
- Targeting BREEAM 'Outstanding' rating

View showing the retained grade II listed facade
Source: Planning Application DAS

Working with the client team (Castleforge, Hawkins Brown and G&T), London Structures Lab established a world-first methodology for the deconstruction, re-fabrication and recertification of steelwork to deliver reuse within the same development site.

Innovative steel cutting work enabled a 40% increase in the reusable tonnage over standard reuse techniques. The process also means that the structural zone across the floorplate could be regularised, giving a consistent service zone and ceiling line, producing the high-quality office space expected.

Sophisticated analysis techniques also allowed steel bracing and historic masonry to be assessed as a single system, avoiding the need for any foundation enhancement even with the increased massing.

CLIMATE RESILIENCE

06

6. CLIMATE RESILIENCE

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The City's climate resilience risks.

The City's Climate Action Strategy and Adaptive Pathways study identified six key risks to the Square Mile as a result of climate change: flooding, water stress, overheating, new and emerging pests and diseases, disruption to food trade and infrastructure, and impacts to biodiversity.

This chapter addresses these climate-related risks and contains guidance to ensure climate resilience principles are embedded within the design process of each development in the City.

Flooding

The risk: It is anticipated that London will experience a change in both the frequency, intensity and season variability of rainfall in the future, which will put pressure on our drainage system.

The 'Flood risk and sustainable drainage systems' section provides guidance on the management of flood risk through water retention and flow control.

Water stress

The risk: Changes in rainfall patterns will impact London's capacity to meet its water demand and lead to drought. Droughts are expected to get longer and occur more frequently, with double the number of days of drought predicted in 2050 compared to 2020.

The 'Water resource management' section provides guidance on effectively managing and optimising the use of available water resources.

Overheating

The risk: Increasing temperatures as well as the frequency and length of heatwaves will be made worse in the City due to the urban heat island effect. This is when dense urban areas remain significantly warmer than the surrounding countryside, due to roads and buildings absorbing and retaining heat in the day and re-emitting it at night.

The 'Building and urban overheating' section provides guidance on preventing overheating in a dense and urbanised environment.

Pests and diseases

The risk: Changing seasonal conditions and global patterns will influence the spread of new and emerging diseases, while pests and invasive non-native species may also increase in number and range in a warmer, wetter atmosphere.

The 'Pests and diseases' section provides guidance on managing the threat of pests and diseases which could be raised by milder, wetter winters and warmer summers.

Trade, food and infrastructure

The risk: Weather-related impacts, geopolitical changes and altered climate conditions are likely to negatively impact major infrastructure, such as the power grid and transport network, as well as disrupting food production and trade on a domestic and international scale.

The 'Infrastructure resilience' section provides guidance on designing efficient and resilient infrastructure for a building, its external plot interface with the city and the wider impacts to supply chains.

Biodiversity losses

The risk: Changes to the climate can fundamentally alter natural trends and cause decline and loss within ecosystems. This includes disruption to fundamental ecological processes such as pollination, carbon storage capacity and our dependence on the natural environment for our well-being and resources.

See Chapter 7 Urban Greening and Biodiversity for guidance that addresses this risk.

Key approaches for the City

It is important developments are designed for future climate scenarios with built-in resilience and adaption to these changes and disruptions. All developments are encouraged to assess future weather data sets (e.g. CIBSE TM49) and design for these future scenarios, rather than just meet current building regulations. Many of these solutions can simultaneously deliver a range of wider co-benefits which address climate change mitigation, local acoustic and air pollution levels, enhance biodiversity and improve health.

Proposals within the City should consider this guidance from an early stage of the design and use it to determine site-specific risks and mitigation measures. The guidance should inform reports submitted in a planning application and/or during any pre- and post-application discussions with the City Corporation.

All developments should provide a Climate Change Resilience Sustainability Statement (CCRSS) to demonstrate the proposal is resilient and adaptable to predicted climate conditions during the lifetime of the development. For minor developments, this could be included in the Sustainability Statement or Design and Access Statement. Major development applications should submit a standalone report that includes details of applicable climate risks and adaptation measures that have been considered. The CCRSS should demonstrate how the proposed adaptation measures will be managed and maintained through the life of the development.

Major developments should achieve the BREEAM Wst 05 credit for 'Adaptation to climate change'. This should include a systematic risk assessment that includes the following:

- Hazard identification
- Hazard assessment
- Risk estimation
- Risk evaluation
- Risk management

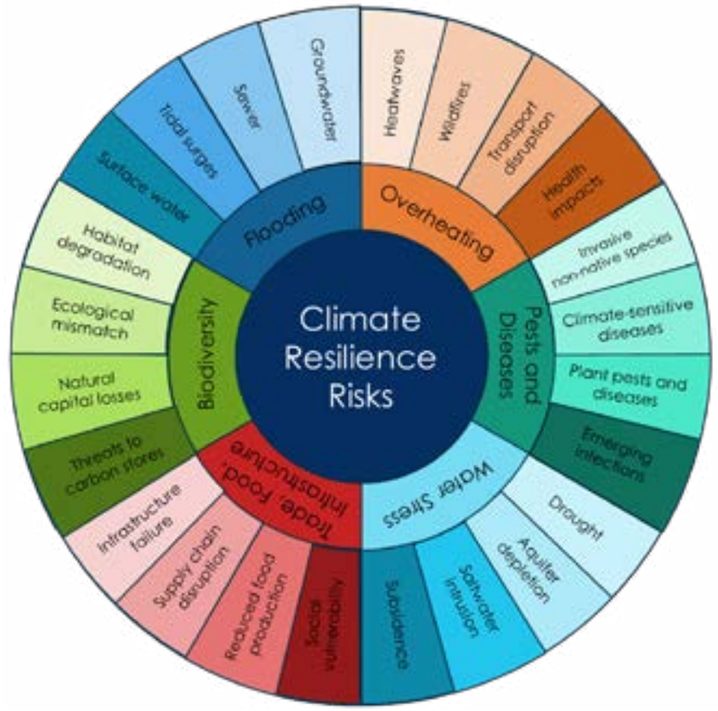

Figure 6.1 City of London Climate Resilience Risks wheel
Source City of London Corpoeration

6. CLIMATE RESILIENCE

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Key policies and guidance

Table 6.1 Climate resilience key planning policies

London Plan 2021

D6: Housing quality and standards

D11: Safety, security and resilience to emergency

GG6: Increasing efficiency and resilience

SI 4: Managing Heat Risk

SI 5: Water Infrastructure

SI 6: Digital Connectivity Infrastructure

SI 12: Flood Risk Management

SI 13: Sustainable drainage

Local Plan 2015

CS10: Design

- DM10.2: Design of green roos and walls
- DM10.4: Environmental enhancement

CS15: Sustainable Development and Climate Change

- DM 15.2: Energy and CO2 emissions assessments
- DM 15.5: Climate change resilience and adaptation

CS18: Flood Risk

- DM 18.1: Development in the City Flood Risk Area
- DM 18.2: Sustainable drainage systems (SuDS)
- DM 18.3 Flood protection and climate change resilience

Emerging City Plan 2040

S7: Infrastructure and Utilies

- IN1: Infrastructure provision and connection

S14 Open space and green infrastructure

S15: Climate Resilience and Flood Risk

- CR1: Overheating and Urban Heat Island Effect
- CR2: Flood Risk
- CR3: Sustainable drainage systems (SuDS)
- CR4: Flood protection and Flood Defences

Other Guidance

Riverside Strategy 2021 (CoLC)

Strategic Flood Risk Assessment (CoLC)

Local Flood Risk Management Strategy 2021-2027 (CoLC)

Mayor's Transport Strategy & Healthy Streets Approach

Thames Estuary 2100 Plan (Environment Agency)

Thames river basin district river basin management plan 2022 (Environment Agency)

Water Framework Directive (European Union)

Key actions to develop an exemplar City scheme

The following key actions are required to positively address the City Corporation's policy framework and should be discussed at pre-application stage. Applicants should clearly present the relevant information in the application documents.

- Reduce the risk of all types of local flooding, including by attenuating water onsite and controlling the run-off rate
- Raising of flood defences at riverside sites in line with the Thames Estuary 2100 plan
- Incorporate an integrated water management approach to minimise potable water demand
- Combat urban heat island effect through the design of the building envelope, building services and public realm. Reducing the risk of overheating in the building by incorporating passive solar shading and minimising the need for active cooling
- Design green spaces, building spaces and services with a focus on nature, health and well-being countering the risk of emerging pests and diseases becoming an issue

The development plan requires all major developments to manage rainwater onsite and reduce discharge rates to the public sewer.

Water resources are becoming increasingly sparse in certain weather conditions. Water demand in the operation of a building, including irrigation of urban greening, needs to be minimised as much as possible.

High density environments contribute to the urban heat island effect, mostly from building surfaces re-radiating heat after sun exposure and also through the emission of waste heat from building services. The urban heat island effect can have negative impacts on human health, air quality and energy costs through changes in the microclimate and therefore buildings must be designed to avoid overheating internally and raising the temperature on the outside.

Open spaces and building surfaces should be designed for the highest proportion of urban greening that is natural, climate resilient and suitable for the location's microclimate - appropriate conditions for planting and habitats to thrive, including shade, water, quiet and dark spaces. Biodiversity and amenity should be balanced and integrated sensitively into public and private realm.

Case Study: 20 Giltspur Street

Giltspur Street facade showing extensive greening.
Source: Design and Access Statement.

Key facts:

- Reduction of potable water consumption by 40% over the BREEAM baseline via water efficient sanitary fittings
- Targeting 'Outstanding' BREEAM rating

Additional features:

- High levels of retention of existing building
- Innovative floor jacking strategy to maximise reuse of existing building structure

6. CLIMATE RESILIENCE

FLOOD RISK MANAGEMENT AND SUSTAINABLE DRAINAGE SYSTEMS

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Flood risk

The term 'flood risk' refers to the probability of flooding within an area and the associated consequences. The likelihood is based on historical and forecast data.

In the City, the primary sources of flood risk are fluvial/tidal flood risk along the riverside and surface water/sewer flooding in the surface water hotspots identified around Farringdon Street and New Bridge Street areas.

Flood risk management

Flood risk management identifies how the risk of flooding can be reduced and managed sustainably. The Thames Estuary Plan 2100 Plan (TE2100) and the City Corporation's Riverside Strategy 2021 outlines how flood defences along the Thames will be maintained and enhanced. Proposed development on riparian sites should maintain flood defences in line with these flood management policies.

As a Lead Local Flood Authority, the City Corporation has the responsibility to develop, maintain, apply and monitor a strategy for local flood risk management in the area. In the Local Flood Risk Management Strategy 2021-2027 (LFRMS), the City Corporation sets out commitments to achieve flood risk mitigation objectives, these include:

- Implementing procedures to maximise the use of Sustainable Drainage Systems (SuDS) in new public realm works and new developments
- Identifying all historic assets in the Square Mile at risk of flooding and working with building owners to adopt resilient design
- Working with utilities providers and infrastructure owners to create a public register of assets at risk of flooding and supporting owners to take action
- Producing guidance specific to retrofitting flood resistance and increasing resilience in commercial buildings.

Flood zone categorisation

Flood risk is defined for all areas of London and shown on the Environment Agency (EA) "Flood risk maps" and "Flood maps for planning." The flood zone associated with the development will dictate the building types/usages permitted by the EA. Depending on a site's location within a flood zone and its proposed use, a development might need to pass the Exception Test.

More information on applying the Exception Test and tidal breach mapping is available in the City Corporation's Strategic Flood Risk Assessment. The flood zones are:

- Flood Zone 1 has a low probability of flooding (Annual Exceedance Probability (AEP) <0.1%) and is appropriate for all land uses
- Flood Zone 2 has a medium probability of fluvial (0.1% <AEP> 1%) and coastal (0.1% < AEP > 0.5%) flooding. This prohibits highly vulnerable developments. Designs should consider measurements to minimise the risk and impact of flooding
- Flood Zone 3a has a high probability of fluvial (AEP > 1%) and coastal (AEP > 0.5%) flooding. It should be noted that large areas of London are within this flood zone. All land uses may be permissible within this zone, provided that flood risk has been assessed fully and appropriate mitigation provided. Mitigation measures may include, but not be restricted to, raising flood defences in accordance with Thames Estuary 2100 Plan, ensuring no critical infrastructure or sleeping accommodation is located at basement level or below breach levels, ensuring podium levels are set above breach levels, and setting in place a Flood Emergency Plan.

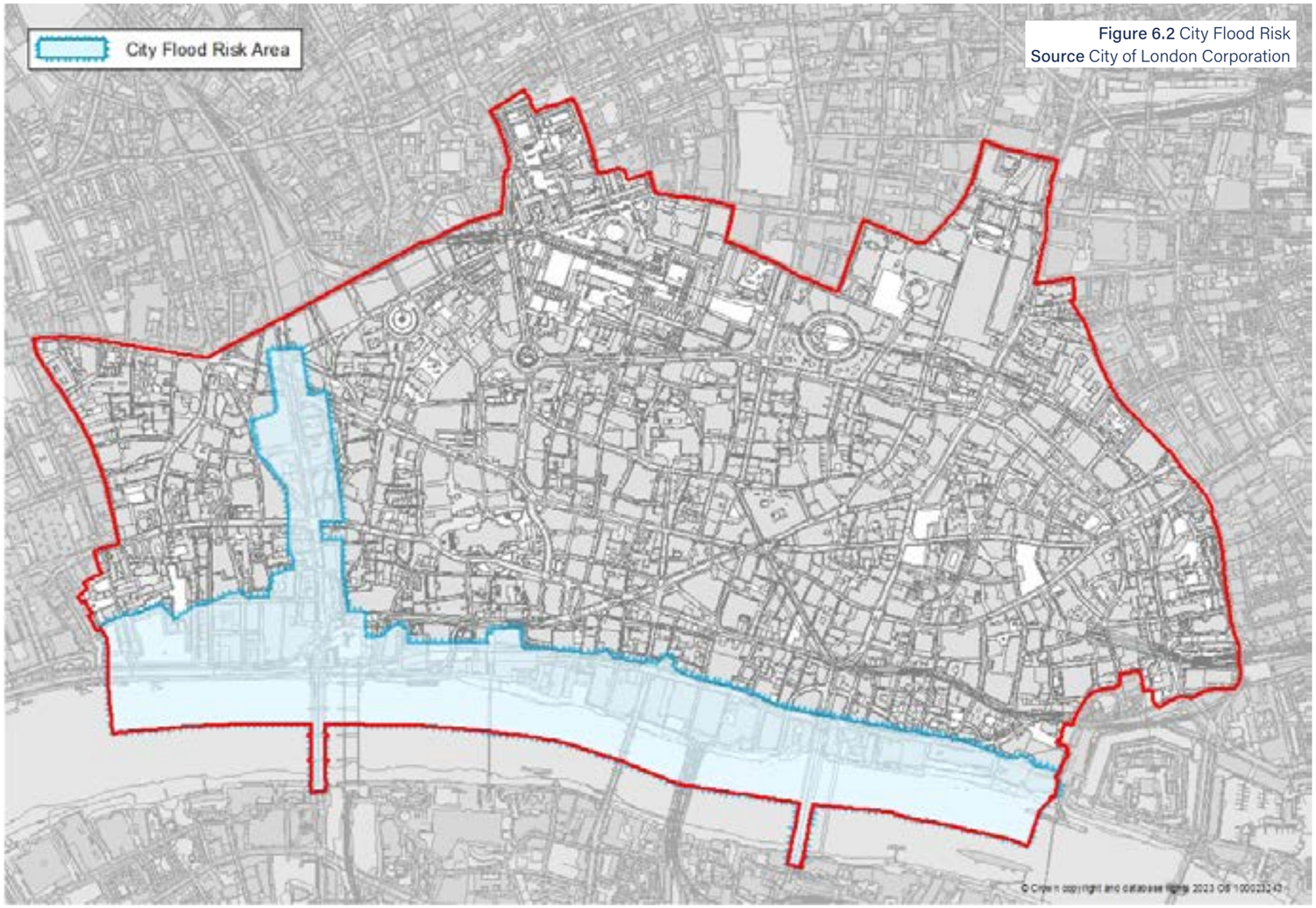

Figure 6.2 City Flood Risk
Source City of London Corporation

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6. CLIMATE RESILIENCE

FLOOD RISK MANAGEMENT AND SUSTAINABLE DRAINAGE SYSTEMS

- Flood Zone 3b categorises the functional floodplain (AEP > 5% or designed to flood in an extreme event). Only water compatible development is permitted within this zone to ensure that there is no impact on the functionality of the floodplain

It is vital that the information within and the limitations of the EA maps are fully understood.

Sustainable Drainage Systems (SuDS)

SuDS are designed to manage surface water volumes and local pollution risks by mimicking natural processes as far as practicable. SuDS should result in reduced runoff, improved water quality, amenity benefits and enhanced biodiversity and habitat.

Key Measures

Whole building

Flood risk should be assessed on a site-specific basis. All development should ensure that the risk of flooding is managed sustainably, taking into consideration the evolving impacts of climate change on flood risk throughout the project's lifetime, while minimising impact on the natural environment. To achieve this, proposals should:

- Ensure that the development is suitable for the flood zone it is situated in and its defined land use vulnerability
- Assess all sources of flood risk to the site. A risk assessment of each flood source should identify the location, speed and consequence of flooding on a site
- Establish a risk threshold. This should be done with reference to relevant flood risk policy and in conjunction with interested parties including future occupants
- Mitigate the risks. This could include moving vulnerable uses to less vulnerable areas, maximising the use of green-blue infrastructure, utilising SuDS to manage flood volumes throughout the development, or further flood resistance and flood resilience measures
- Respect the inherent flooding pathways and make space for water within the proposed development as far as practicably possible. Make use of available public realm to accommodate stormwater, improve water quality and provide amenity
- Ensure that the development does not increase flood risk offsite and, if possible, achieve a reduction in this risk
- Ensure the safety of building occupants, prepare in advance for the consequence of flooding and develop procedures to enable recovery. Safe egress and access should be provided in the event of a flood event, ideally to a safe area offsite. A Flood Emergency Plan can be implemented in order to notify site users of a flood event, provide a safe and efficient route away from danger and ensure the flooded site can return to functional use as soon as possible. As the Lead Local Flood Authority (LLFA), the City Corporation requires a Flood Emergency Plan for most buildings in Flood Zone 2 or Flood Zone 3

Developments within the City Flood Risk Area should undertake a site-specific Flood Risk Assessment. Developments on riparian sites are responsible for the maintenance of flood defences, and works that occur within 16 meters of any part of the flood defence will require a flood risk activity permit from the Environment Agency.

Proposals should consider solutions that combine sustainability and flood risk management measures. Blue roofs (attenuation tank at roof or podium level) store rainwater and reduce flood risk while green roofs (layer of growing medium and plants at roof or podium level) offer minimal rainwater storage but promote biodiversity. At suitable sites, sustainability benefits can be maximised through the combination of blue-green roofs as the attenuated water can be used to irrigate the green roof. Other co-benefits with flood risk management measures include solar panel placement on blue, green and blue-green roofs, as well as greywater reuse and de-paving where possible to transition green-grey roofs to green roofs.

Where space or other constraints mean that urban blue-green infrastructure is not feasible, water may need to be attenuated in more traditional tanked systems. Where these are unavoidable, intelligent rainwater management systems should be utilised to enable rainwater to be stored and then used onsite.

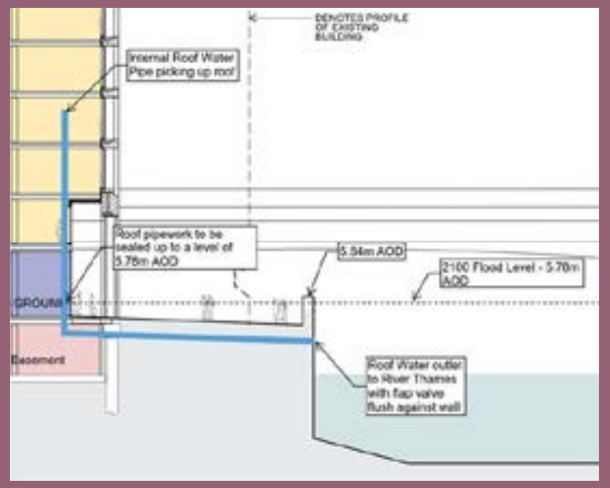
Drainage for all developments should have separate foul and surface systems. As far as practicable the systems should not be reliant on pumping. If pumping is required, such as from basements, then appropriate backup systems should be provided. Positive pump devices can be used in developments located in areas at risk of sewer surcharge.

All infrastructure and sensitive equipment that is critical to the functioning of a building, such as heating and lighting, should be flood-proofed and situated above anticipated flood levels. This includes risks associated with breach events.

Case Study: Seal House

Use: Office and retail

New build



Roof Water Strategy. *Source: Planning Application, Flood Risk Assessment and Outline Drainage Strategy*

Key facts:

- Internal north-south access designed to ensure that safe egress and access is provided in the event of a breach in the Thames Tidal Defences
- Less vulnerable land uses are located on the ground and basement floors
- Levels slope away from the building, so that surface water flows away from the asset
- Green roofs are provided, which reduce runoff, create habitat and visual amenity
- Attenuation is provided that takes account of tide- lock to surface water discharge from the site
- Surface is water is discharged direct to source (River Thames) in accordance with the SUDs hierarchy

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6. CLIMATE RESILIENCE

FLOOD RISK MANAGEMENT AND SUSTAINABLE DRAINAGE SYSTEMS

Careful substation and plant positioning in relation to flood risk from overland flow, rising river or groundwater as well as tanking measures and raised threshold positions can enhance resilience.

Beyond the building

SuDS and urban blue-green infrastructure (BGI) are effective measures to manage and reduce flood risk and should be integrated into the public realm or open spaces within the development where possible. The design of these spaces can include planters, tree planting, swales, natural detention basins, or soakaways and can play a key role in supporting the urban ecosystem. SuDS systems should follow the drainage hierarchy included in London Plan Policy 5.13 - Sustainable Drainage.

These solutions can:

- Reduce runoff and flood risk - impervious surfaces in urban developments increase run-off volumes and often overwhelm drainage networks/sewers
- Restore the natural water balance – by reducing impervious surfacing, SuDS/BGI promote natural infiltration and encourage aquifer recharge
- Support biodiversity by restoring natural habitats
- Provide carbon reduction benefits – through sequestration and as an alternative to grey infrastructure with higher embodied carbon
- Increase health and well-being in the urban realm – SuDS/BGI can help to reduce the Urban Heat Island effect and improve air quality
- Improve ecology - SuDS and BGI can prevent the deterioration of, and improve the ecological status of the Thames Middle Water Framework Directive water body and/or its associated elements.

For developments along or near the riverbank, surface water should be discharged directly to the Thames, provided the required permissions are secured. This can present an opportunity to incorporate elements from the Estuary Edges guidance therefore also contributing to marine/terrestrial biodiversity.

The City Corporation Resilient Planting Catalogue includes advice on planting species best suited to the City's future climate conditions and to help alleviate flood risk.

Ground infiltration

It is important to understand that opportunities for discharge to ground in the City can be limited due to two reasons:

1. Many areas of London are built over contaminated land. Discharging to ground can result in the mobilisation of these contaminants, which can then enter watercourses;
2. For large parts of the City the underlying geology is not sufficiently permeable to enable the volume of discharge to ground required.

Stone planters designed as benches © Clive Totman, 2018

Source: City of London Corporation

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6. CLIMATE RESILIENCE

WATER RESOURCE MANAGEMENT

Water resources

Water resources are the various types of water which are used or pass through a development. These include potable supply from utilities systems, rainwater and greywater sources.

Water resource management

Water resource management is the effective and optimised use of available resources.

Key measures

Whole building

Water resources should be reliable, sustainable, secure and safe. To achieve this, a development should consider and incorporate the following measures where possible:

Measures for the management of potable water

- Achieve an 'excellent' BREEAM rating (or equivalent) in the WAT 01 category (for major developments)
- Ensure supply network has sufficient capacity
- Forecast supply and demand to avoid inefficiencies. 'Actual water' consumption calculations should be provided at planning submission
- Measure and record usage in order to identify water and energy saving opportunities. Actual water consumption should be reported during operation
- Ensure that distribution is efficient and effective throughout the development by optimising systems and minimising leaks
- Use leak detection technology to improve the performance of networks and reduce wastage
- Use water saving technologies within the building such as low flow taps and aerated showers
- Use timed-release systems to reduce usage
- Where possible, make use of alternative water sources, such as incorporating rainwater and greywater recycling to reduce the demand of potable water
- Recycle water sources, including treated sewage effluent (TSE) and greywater to reduce potable water demand. Regenerative water systems should be considered as standard to recycle water.
- Achieve water consumption of 105 litres of potable water per person per day (pp/pd) in residential developments. This includes a limit for external use of 5L/pp/pd.

Measures for the management of wastewater

- Ensure a network has sufficient capacity
- Minimise volumes of water required to be treated, e.g. ensuring effective flushing
- Consider the use of recycled water for toilet flushing. In a large development, capturing water from one third of a building's showers could meet the toilet flushing demand of the entire development
- Minimise sewage outflow through efficient flushing, this prevents obstructions and helps avoid overwhelming the sewage systems.

Measures to reduce water demand in plant and MEP systems:

- Improve the supply and demand efficiency of plant and MEP systems by ensuring distribution networks are operating effectively and are regularly maintained
- Make use of recycled water in heating and cooling systems
- Create a more efficient supply and use system, such as separating the supply of potable and non-potable water (use of greywater for non-potable and a blend of recycled and utility water for potable water)
- Consider resource scarcity management systems that might need to be instituted to manage periods of water stress, drought, or during extreme weather events.

Case Study: 100 Liverpool Street

Use: Office, retail and leisure

Retrofit and extension

100 Liverpool Street, view from the Circle towards the northern office entrance. Source: Planning Application: DAS

Key facts:

- Water demand partially met through rainwater harvesting and greywater reuse
- Drought resistant planting
- 40% reduction in water consumption against BREEAM defined baseline in 2016

Additional features:

- Targeting BREEAM rating 'Outstanding' and WELL Standard 'Gold' rating
- Associated public realm improvements undertaken to improve accessibility to Liverpool Street station
- The energy strategy seeks to incorporate solar photovoltaic system for zero carbon energy generation, and infrastructure for future connection to district heating

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6. CLIMATE RESILIENCE

WATER RESOURCE MANAGEMENT

Beyond the Building

- To lower the need for potable water for irrigation in the public realm, explore opportunities to harvest and reuse rainwater in the public realm or collected from a building nearby. Opportunities to combine SuDS with water recycling should also be considered.
- Reduce water demand through the use of climate resilient planting types.
- These measures will help to maintain the quality of urban greening during periods of water shortage. The drought in summer 2022 had a significant impact on existing trees and planting in the Square Mile. Silver birches appear to have been particularly effected, but many trees displayed 'false autumn' characteristics due to stress.
- Interconnected neighbourhood systems should be considered with buildings of different roof size and demand profiles, right-sizing of onsite storage, and shared storage facilities.

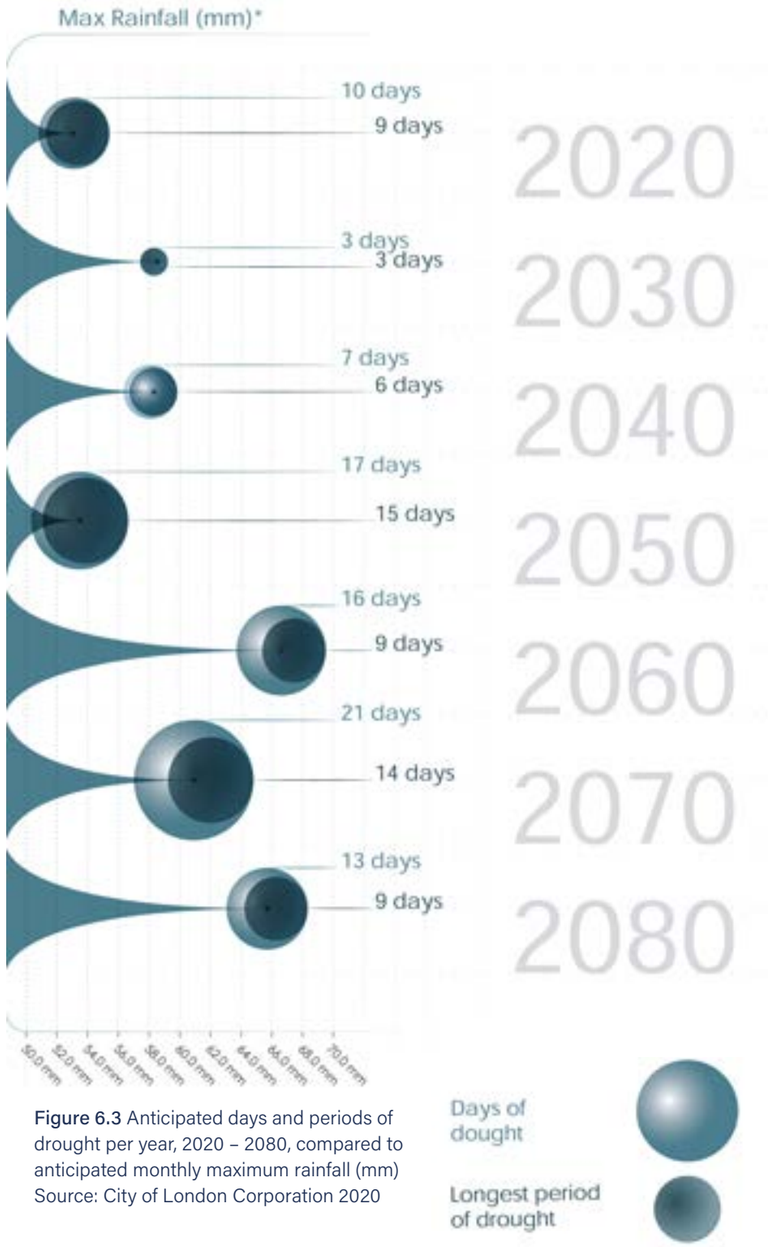

Figure 6.3 Anticipated days and periods of drought per year, 2020 – 2080, compared to anticipated monthly maximum rainfall (mm)
Source: City of London Corporation 2020

**Note that drought is defined at 15 days or more with less than 0.2mm of rainfall. Periods less than 15 days are listed here since the analysis involves calculating predicted days of drought, using this definition, for 12 separate models under UKCP18. The final number shown here is the average of the models' results. Since some models predict 0 days of drought, this may give a result which is smaller than 15 days.*

Case Study: 100 Fetter Lane

Use: Cffice and retail

New build

Visual of proposal for 100 Fetter Lane.
Source: Design and Access Statement

Key facts:

- Blue roof with 'smart' attenuation tank, to collect rainwater for use in WC flushing and irrigation, supplemented by grey water from showers and wash basins
- Specification of low water consumption sanitary ware
- 50% improvement over baseline building water consumption
- Smart tank water to be supplemented by greywater from shower areas

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6. CLIMATE RESILIENCE

BUILDING AND URBAN OVERHEATING

Overheating

Overheating occurs when temperatures inside buildings and in the public realm reach levels that are uncomfortable for humans, animals and plants. This can cause health issues, disrupt infrastructure and damage ecosystems and biodiversity. In the City, key drivers of overheating include the increase in heatwaves, increase in average daily temperatures and the urban heat island effect. It is important to consider the impact of overheating on building fabric and how this in turn impacts internal conditions during overheating events. Consideration should be given to stresses and shocks on materials to avoid infrastructure failure.

The overheating map, Figure 6.5, shows areas that will be affected by the highest average heatwave temperatures as well as distribution of key public spaces that may support impact mitigation by providing cooling (green spaces) or shelter from heat. Temperature data is drawn from the Heat Wave Average Max Temperatures taken from the GLA 2016 study on the London Urban Heat Island Effect.

The Urban Heat Island Effect

The Urban Heat Island (UHI) effect refers to an urban area that is significantly warmer than its surrounding areas. This is most commonly a result of intensive land use, trapping of heat in materials with low reflectivity and a high thermal mass (e.g. concrete), discharge of waste heat from building systems and heat generated by other human activities. The UHI effect can cause night-time temperatures to be 4°C+ higher than outside the centre of London.

Heatwave

In London, a heatwave is defined as 3 or more days with maximum daily temperatures above 28°C. Under Regional UCKP18 projections 'high emissions scenario' the Square Mile is set to see an increase in the maximum daily air temperature, the annual number of days of heatwaves and the period of consecutive days of heatwave. By 2080 the number of heatwave days will have increased to 56 days per year compared to 14 days in 2020, with heatwaves lasting up to 22 days and a maximum daily air temperature of 39°C.

At 27°C indoor temperatures in well-insulated homes can result in overheating, at 30°C some commercial buildings will be vulnerable to power outages and at 35°C healthy adults can begin to experience heat stroke risk.

Thermal comfort

Thermal comfort takes into account a range of environmental and physiological factors to determine a comfortable temperature range. Computational Fluid Dynamics (CFD) modelling can be undertaken to inform the location and massing of buildings as well as landscaping. Best practice entails assessment of the Universal Thermal Climate Index (UTCI) which considers metrological parameters and physiological effects on comfort.

The City Corporation is using a one-to-one virtual model of the City, a 'digital twin', to simulate the impacts of extreme heat events and guide placement of green roofs. This model is being integrated with the City Corporation's Thermal Comfort Guidelines which enhances understanding of microclimatic qualities in the City's public spaces (by merging wind, sunlight, temperature and humidity data). The guidelines include a methodology to assess the potential impact of new developments and can serve as an additional reference to help mitigate overheating risk.

Key measures

Whole building

The City's dense and urbanised environment is at high risk of extreme heat.

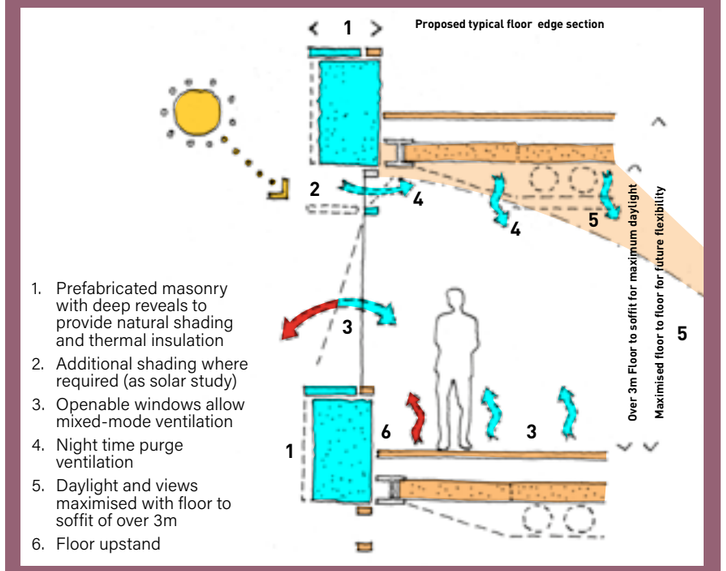
All developments should assess current and future weather scenarios to consider overheating impacts over the development lifespan. A future weather file portrays a location's anticipated annual weather stream in 10, 25, 50, 80, and 100 years into the future. Based on projections derived from global climate models for scenarios of greenhouse gas emissions, future weather files should be utilised in building energy modelling and building performance analysis, to get insights into future energy requirements. The design approach for any development in the City should take into consideration future weather files and their impact, as recommended by BREEAM 2018 Hea 04: Thermal Comfort. As well as the City Corporation's Thermal Comfort Guidelines, developments should consider the following weather files (as updated):

- TM49 CIBSE Design Summer Year (DSY)
- TM52 CIBSE
- TM59 CIBSE

Case Study: 100 Fetter Lane

Use: Cffice and retail

New build



Typical floor edge section explaining strategy to mitigate overheating. Source: Design and Access Statement

Key facts:

- Exposed soffits to allow cooling
- Deep reveals in the building fabric to create shade
- Mixed mode ventilation that combines natural ventilation and automated windows to enable night purging

Additional features:

- Landscaping to include multiple green terraces with edge planting at eight different levels and a shaded sunken garden open to the public

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6. CLIMATE RESILIENCE

BUILDING AND URBAN OVERHEATING

All developments should outline adaptation measures and demonstrate how the design minimises the risk of overheating, actively contributes to reducing the UHI effect and improves thermal comfort within the Square Mile. Design measures could include:

- Improvements to building fabric 'U' values (insulation) and 'G' values (glazing)
- Improvements to air tightness to reduce leakage and manage ventilation
- Choosing façade materials that minimise their contribution towards the UHI effect
- Designing façade fixings allow for fluctuations in thermal expansion
- Optimising window-to-wall ratio and aspects
- Using solar shading techniques to prevent solar gain, such as specified glazing, internal blinds, recesses in facades and external structures that provide shading
- Urban greening measures such as green-blue roofs
- Passive ventilation including natural cross ventilation, stack ventilation, automatic ventilation, and mixed-mode systems.

Ventilation and cooling strategies should be underpinned by thermal modelling with best practice utilising CFD modelling. Strategies could also consider potential future changes of building use.

Materials for landscaping and site access routes should be selected accounting for increasing temperatures, such as using high albedo surfaces. Specifications for asphaltic surfaces should include appropriate non-toxic additives to reduce chances of failure and deformation in high temperatures. Wider or more frequent joining may be necessary to allow for increased movement of susceptible surfaces or bases such as hard paving caused by wider temperature ranges and cycles.

Beyond the Building

All developments should actively contribute to reducing the UHI effect and improving thermal comfort within the City. Developments should avoid the expulsion of waste heat into the environment. Expulsion of waste heat could be minimised by connections to local heat networks, as discussed in Chapter 3.

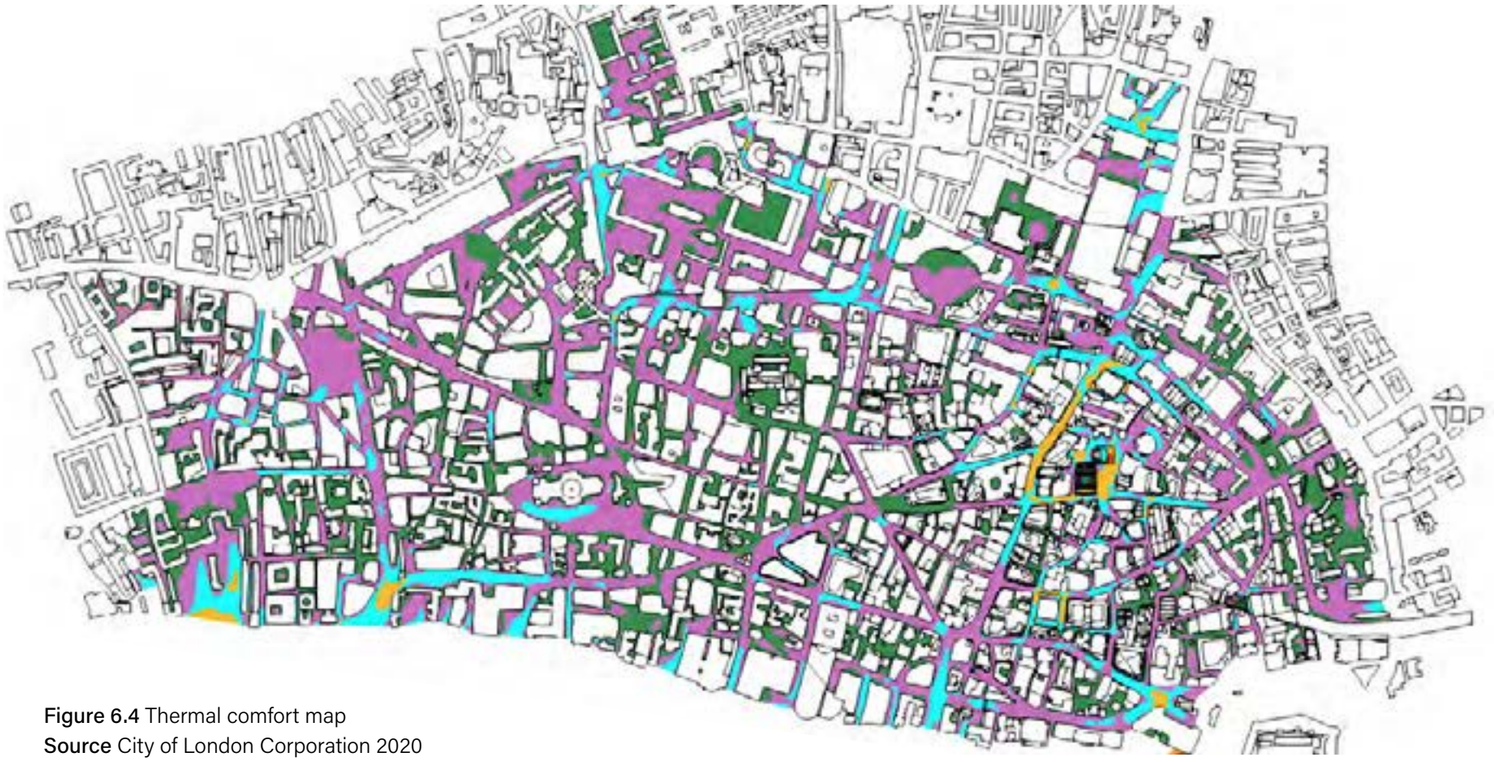

Figure 6.4 Thermal comfort map
Source City of London Corporation 2020

	Usage Category	% of hours with acceptable UTCI	Description
	All Season	≥90% in each season	Appropriate for use year-round (e.g. parks).
	Seasonal	≥90% spring-autumn AND ≥70% winter	Appropriate for use during most of the year (e.g. outdoor dining).
	Short Term	≥50% in all seasons	Appropriate for short duration and/or infrequent sedentary uses (e.g. unsheltered bus stops or entrances) year-round.
	Short Term Seasonal	≥50% spring-autumn AND ≥25% winter	Appropriate for short duration and/or infrequent sedentary uses during most of the year
	Transient	< 25% in winter OR <50% in any other season	Appropriate for public spaces where people are not expected to linger for extended period (e.g. pavements, cycle paths)

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6. CLIMATE RESILIENCE

BUILDING AND URBAN OVERHEATING

The City Corporation is implementing a Cool Streets and Greening Programme, involving the planting of designated tree-shaded cool routes that aim to offer a comfortable pedestrian experience. Cool routes prioritise the growth of biodiversity and the provision of shading (preferably by trees). In some cases, cool routes have reduced air temperatures between 3-8°C during heatwaves.

Applicants are encouraged to integrate and support the expansion of these cool routes by:

- Maximising street level greening in both onsite and offsite public realm to provide natural shade and connect green pockets
- Designing for comfortable microclimatic conditions informed by the analysis of wind, pressure, humidity, and temperature. This analysis should incorporate future climate scenarios using weather files and climate predictions
- Developing a comfort framework in collaboration with the City Corporation, which could be used for extreme higher temperatures
- Choosing appropriate materials for external surfaces, informed by their influence on (e.g. heat absorption, reflection), location (proximity to pedestrians) and resilience (e.g. risk of deformation in high temperatures) in microclimatic conditions
- The resilience and suitability of the proposed planting scheme, in particular trees (access to rainwater, drainage of tree pits, canopy sizes and soil volumes)
- Consideration of the ability to provide future 'cool spaces' within the development
- Opportunities to continue greening across the buildings via balconies and terraces that help create biodiversity corridors for important species, such as wild bees
- Continued microclimatic monitoring to determine the impact and success of the cool routes, and to inform lessons learnt that will support further development.

If cool routes are a key focus area of the development, it is strongly recommended that a stand-alone 'Cool Routes Report' is submitted in the application documentation. The report should include evidence, analysis, and assessment of the considerations outlined above.

Figure 6.5 Overheating map with public space & drinking fountain distribution
Source City of London Corporation 2020

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6. CLIMATE RESILIENCE

PESTS AND DISEASES

Pest and Diseases

In an urban context, pests can include non-native, established wildlife and invasive plants which can affect the health of people, flora and fauna. Diseases can include human, animal, and plant infections that can be spread through zoonotic, airborne, waterborne and contact based transmission.

Warmer, wetter winters and hotter, drier summers will significantly raise the threat of pests and diseases in the UK, with these conditions facilitating the spread and emergence of vectors like ticks, mosquitoes and rats, and increase both transmission rates and overwinter survival rates.

The UK is currently free of many pests and diseases that afflict plants overseas. However, increasing international movements risk the introduction of new pests and diseases. In urban environments this risk and impact can be greater. Urban trees, which are of significant value to climate change adaptation in urban areas, are at particular risk of new pathogens and pest outbreaks.

The increase in prolonged periods of heat stress and risk of flood events also poses a significant threat to the spread of waterborne and communicable disease.

Key measures

Developments should increase the levels of urban greening and take a landscape-based approach to planting within the development site and the adjacent public realm. Measures to manage the risks of pests and diseases should protect biodiversity, not constrict the growth and management of biodiversity.

Applicants should consider and address biosecurity risk within landscaping proposals, including the selection, procurement and management of a diverse range of resilient species.

For landscaping and public realm interventions, informed decision-making on the selection of species will help develop resilient habitat networks that can help tackle risk of biodiversity loss and spread of ecosystem pests. Species should be diversified and selected for their ability to cope with extreme weather conditions and adapt to the urban landscape. Where possible, native/naturalised species with high biodiversity value, and species not yet affected by pests and diseases in the UK should be prioritised. Species or genera that could be vulnerable to any new diseases that may be introduced in the future should be avoided. The UK Plant Health Database should be consulted during the design process to determine species and genera of higher risk.

Landscaping proposals should not include Invasive Non-Native Species (INNS) listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), the Non-Native Species Secretariat of Great Britain and Ireland, and the London Invasive Species Initiative (LISI). It is illegal to plant Schedule 9 species in the wild, developments should not become a pathway for further spread of these specimens into London's green spaces. Developments should seek to enhance biosecurity through actively taking steps to reduce the spread and impacts of INNS on habitats and species, including water bodies. This should follow the guidance of the Great Britain INNS Strategy, meeting objectives of the National 25-year Environment Plan.

The procurement of trees, plants and other green infrastructure grown in reputable nurseries in the UK should be a priority. Where plants need to be imported, all the relevant biosecurity protocols and import checks should be adhered to. The potential for species to become invasive needs to be assessed by referring to the European Alien Species Information Network (EASIN) notification system for early detection in Europe.

Consideration should be given to how landscaping design, programme and management will reduce biosecurity risk, including future impacts of pests and diseases to occupiers and green infrastructure. Maintenance of green infrastructure should be implemented as necessary for each habitat to ensure that no non-native invasive species settle and spread. Submitted management and maintenance plans should include a process that 'alerts' responsible authorities of any pest or disease outbreaks within new and established green infrastructure.

Case Study:
City of London Emperor House, 35 Vine Street

Public realm planting

London Wall Place planting palette.
Source: Design and Access Statement

Key facts:

- Included two species (Zelkova serrata and Koelreuteria paniculata) that are fast growing and resistant to a range of tree pests and diseases. Once grown, these will provide shade from canopy cover for pedestrians and cyclists along Vine Street to combat street level overheating

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6. CLIMATE RESILIENCE

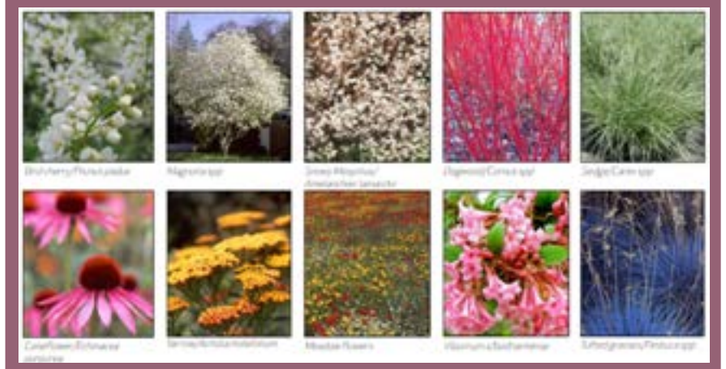
PESTS AND DISEASES

Climate resilient planting

The City Corporation Climate Resilient Planting Catalogue provides guidance on the design of public realm and planting selection including species tolerances, response to pests and diseases and to extreme heat (and other weather events). The function of species (ecosystem services, biodiversity enhancement, cooling, interception, sequestration) and the planting environment (site types and conditions) are also important criteria to be considered.

Case Study: London Wall Place

Public Realm Planting



London Wall Place planting palette. Source: Design and Access Statement

Key facts:

- Use of native species for planting, including silver birch trees, bird cherry and cornelian cherry, hellebore, fern, and foam flowers

Considerations for health and well-being

Management of facilities and open spaces within the development should consider risks to public health through design and relevant protocols. These can include:

- Minimising touch points throughout the design of the building
- Ensuring facilities meet cleaning protocols such as clear desk policies where possible
- Ensuring adequate ventilation and air quality within the building and reducing other respiratory stresses (see BREEAM Hea 02 Indoor Air Quality)
- Ensuring all plant, HVAC and water systems negate the risk of bacterial, viral or fungus growth. Particular consideration should be given to legionnaires disease and the supply of potable water. Applicant teams should plan for future climate scenarios in terms of temperature and humidity ranges, refer to regulation of these systems and ensure there are multiple methods to maintain conditions and reduce contamination risk
- Consider the capacity to provide 100% fresh air and hourly volume charge and air circulation paths from floor to soffit
- Use of CO2 monitoring to control systems
- Planning for effective pest management in the operation of the building, including operational waste, to reduce risk of pests and disease vectors (see BREEAM Wst 03 Operational Waste)
- Providing active transport end of journey provision
- Provision of 'wellbeing' spaces within a development.

London Wall Place. Source: City of London Corporation

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6. CLIMATE RESILIENCE

INFRASTRUCTURE RESILIENCE

Infrastructure Resilience

At a wider level, infrastructure resilience is defined as the ability of infrastructure such as utilities, transport, and digital networks to withstand the potential shocks or stresses faced during its design life, including those that London will experience owing to the inevitable effects of climate change.

At a developmental level, buildings within the City will need to consider how to minimise disruption to building operation during extreme events of flooding, overheating and drought. The aim is to ensure that a building is designed to operate safely and effectively throughout its design life whilst minimising its loads and impact on the City network as a whole.

A risk assessment should determine the level of investment in resilience measures, taking into account climate risks as one set of factors that may affect the asset's performance. Investment in more costly resilient measures may not be justified immediately, and so timing along with any complimentary additional benefits should be weighed in the assessment. To evaluate climate risk consistently across all aspects of the development, resilience-based measurement frameworks and reporting standards should be used. This will enable confidence in adaptive business strategies that are based on robust future scenario modelling of likely climate impacts.

Key measures

Whole building

Buildings should be designed to maintain basic functioning and safety during adverse events wherever possible, but the more critical the function of the building the higher the level of protection should be considered.

Demand reduction for utilities such as water and power will have the triple effect of reducing running costs and operational emissions, as well as reducing the peak strain on the wider city infrastructure networks. Reduced demand from alternative sources or onsite back-up storage will ultimately improve the resilience of the building through an increased level of self-sufficiency.

Multiple and diverse connection points to City networks should be provided, ensuring buildings maintain well-considered back-up supply for critical loads, whilst maximising the level of onsite renewable generation options available. This will ensure the building has a higher level of function during shock events.

Data infrastructure resilience measures should be considered and include: dual connections; careful data centre and plant room positioning in relation to flood risk from overland flow, rising river or groundwater; tanking measures and raised threshold positions as well as the incorporation of cooling plant. Tanked basements that are water and gas-tight should be considered.

Beyond the building

Even within the City, risks will vary with location. Proposals should include an assessment of localised risks to recognise areas of vulnerability and put in place appropriate measures. These could include early warning systems, maintaining evacuation pathways, and establishing community protocols and emergency response plans for extreme climate events such as emergency hubs that would provide access to safe space and services during extreme weather events.

Any building is part of a greater set of networks, so it is crucial that designers consult with all relevant stakeholders (Thames Water, Greater London Authority, Environment Agency, UK Power Networks etc) to understand how the design of the building and its surrounding environs coordinate with, complement and build on city-wide planning that is continuously evolving.

The City is a very dense and highly connected area, so opportunities should be sought to establish local resilience measures between buildings and assets to provide backup power, water or data connectivity beyond plot boundaries during widespread disruption events.

Case Study: 115-123 Houndsditch

Use: Cffice and retail

New build

Typical floor edge section explaining strategy to mitigate overheating.
Source: Design and Access Statement

Key facts:

- Rainwater harvesting and attenuation tanks, with water to be reused for non-potable purposes, basement tank to discharge into public sewer and demarcation chambers suspended from ground floor as high as possible rather than the basement to avoid flooding from sewers
- Exploration to incorporate blue roofs of up to 1,265m2
- Building Management System for water metres and water consuming plant to double up as leak detection
- SUDs to mitigate local flooding

Additional features:

- Waste heat storage and export of heat to the neighbouring residential estate
- Two intake rooms for data connections in the building's basement

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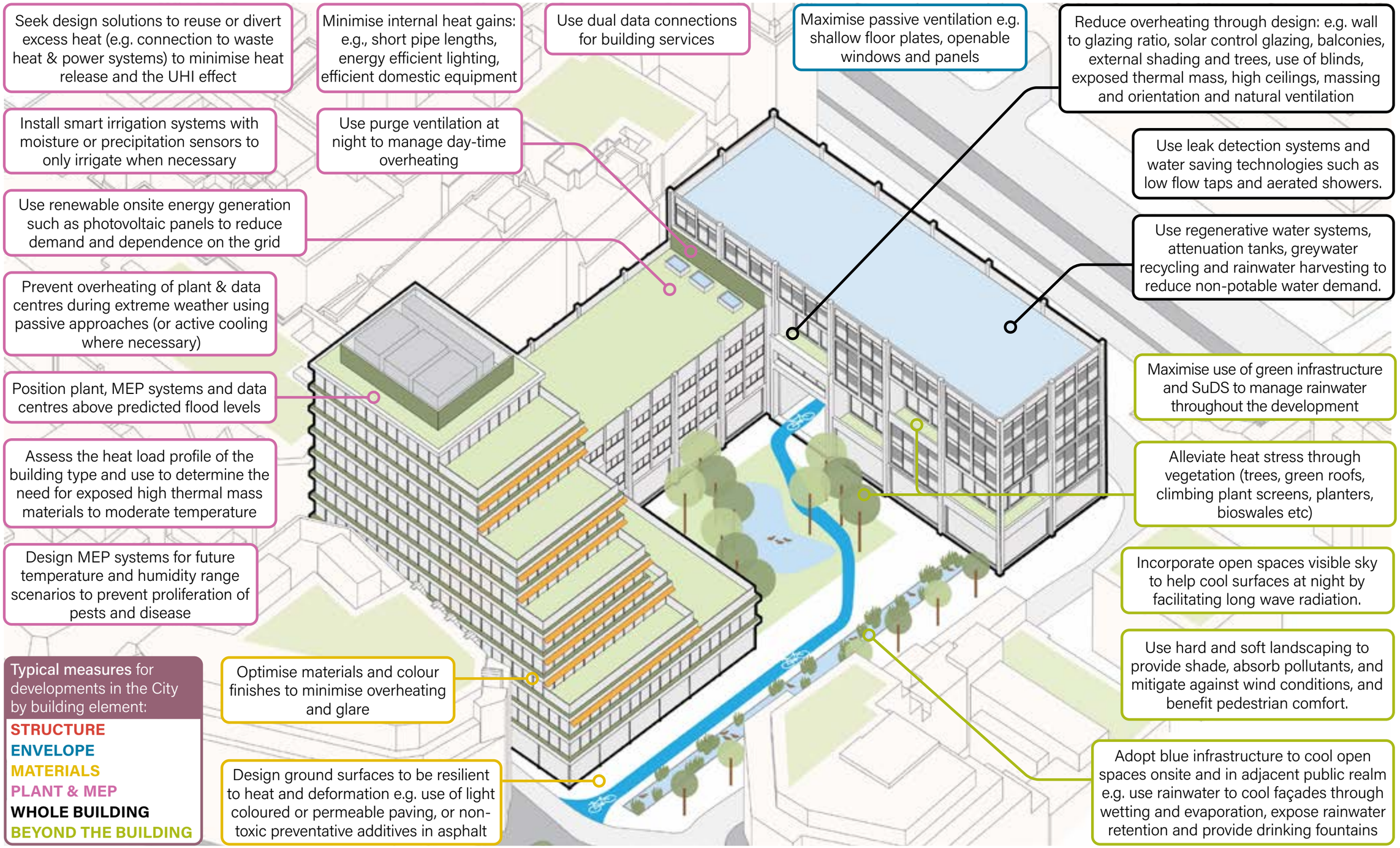
6. CLIMATE RESILIENCE

KEY MEASURES FOR CITY DEVELOPMENTS

This infographic provides a list of potential measures, which is not exhaustive. Applicants are encouraged to propose innovative measures that drive best practice. All measures to be agreed on a case-by-case basis.



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6. CLIMATE RESILIENCE
CASE STUDIES

Case Study: 65 Gresham Street

Use: Commercial office

Refurbishment and extension

Visualisation of the urban greening at 65 Gresham Street
Source: Design and Access Statement

Key facts:

- Enhancement of existing green canopy along Aldermanbury to contribute to a wider network of green corridors and cool routes within the City
- Existing tree canopy to be complemented and enhanced through ground level soft landscaped interventions where currently only hard landscaped exists
- Extrusion of raised planters from the ground plane to shape the public realm, increase the areas of soft landscape and biodiversity, and provide seating and gathering spaces
- Increased soil depths integrated into landscaping to allow additional small trees and multistems to be planted. Together with evergreen shrubs, this will create pocket shelter spaces to locally improve thermal comfort levels, encourage longer term occupation and promote a more climate resilient City
- Promotion of biodiversity through a large percentage of native species, as well as variety in the type of plants proposed

Case Study: New Change Garden

Use: Public space

Relandscaped public garden

New Change Garden
Source: City of London Corporation

Key facts:

- Formerly known as the Sunken Garden, the area has been transformed into an accessible and greener place, with a 25% increase in planting for enhanced biodiversity and climate resilience
- New permeable paving lets rain drain freely into the ground, storing it for trees to use later, and reducing pressure on the sewer system
- New plant species have been selected with local wildlife in mind, combining a range of pollinator-friendly species to help biodiversity and create interest all year round
- Over 150-year-old granite stones salvaged from the Thames River Wall were used to create the new benches, with recycled timber from fallen London Plane trees for the backrests
- Retention of the two existing onsite legacy trees including de-paving around shallow roots to enable their longevity and continued contribution to air quality and shade provision
- Drainage design tailored to site constraints with attenuation chosen over a rain garden approach to protect the legacy trees' roots

URBAN GREENING AND BIODIVERSITY

07

7. URBAN GREENING AND BIODIVERSITY

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Introduction

This chapter provides guidance on how to protect, conserve and enhance biodiversity, habitats, and green infrastructure in the Square Mile, and support Greater London urban greening initiatives. The chapter advises on how to meet and exceed policy targets set out for the London Urban Greening Factor (UGF) and Biodiversity Net Gain (BNG) requirements. It provides suggestions for interventions that can be used in a development and relevant to the City's urban setting.

Key approaches for the City

The City of London has just under 33 hectares of open space, most of which consists of pocket parks smaller than 0.1 hectares. Although small, these spaces are used intensively and provide an important resource for biodiversity in the Square Mile. Given limited space on the ground, building surfaces such as rooftops and walls are becoming an increasingly important space for cultivating a variety of flora and fauna through interventions such as terrace planting, green roofs and walls.

Proposals should provide high quality greening in open spaces and on buildings within the site to meet policy requirements. UGF is a requirement in the London Plan. BNG is mandated by the Environment Act (2021) for development assessed under the Town & Country Planning Act 1990 and for Nationally Significant Infrastructure Projects. The BNG is a statutory requirement since February 2024 and the City Corporation is introducing a policy requirement with a target score of three Biodiversity Units per hectare (BU/ha)

Improving the connectivity and biodiversity value of green spaces, diversification of habitats, and protection of priority species are the focus of the City Corporation's Biodiversity Action Plan (BAP) and should be considered from the outset of the design process.

Proposals submitted for development in the City should strive for best biodiversity outcomes on individual sites while showing consideration for the wider urban environment. Urban greening and biodiversity key actions and measures should be considered and integrated early in the design development. Applicants should engage with City Corporation officers before, during and after planning application submission to address:

- Context-specific urban greening and biodiversity risks and opportunities
- How high-quality greening, considered and meaningful space for biodiversity can be provided onsite
- How the site connects to wider green infrastructure and nature networks
- How the scheme responds to the BAP, policy, and other biodiversity objectives
- How the scheme can achieve and ideally exceed UGF and BNG requiements
- Ongoing maintenance and management considerations

A biodiversity and ecological survey and report should be included in the planning submission. It should include a survey of existing biodiversity onsite, an assessment of impacts, and proposed measures to protect and enhance biodiversity and greening. An Ecological Impact Assessment is required when a proposal has a potential impact on either protected or priority species, or designated sites and priority habitats.

Key policies and guidance

Table 7.1 Biodiversity & green infrastructure key planning policies

London Plan 2021

G1: Green infrastructure

G5: Urban Greening

G8: Food growing

GG2: Making the best use of land

SI 14: Waterways

SI 17: Protecting and enhancing London's waterways

Mayor's Transport Strategy & Healthy Streets Approach

Local Plan 2015

DM 10.2: Design of green roofs and walls

DM 10.4 Environmental enhancement

CS15: Sustainable Development and Climate Change

DM 15.5: Climate change resilience and adaptation.

CS19: Open Spaces and Recreation

DM 19.1: Additional open space

DM 19.2: Biodiversity and urban greening

Emerging City Plan 2040

S8: Design

DE3: Public Realm

DE5: Terraces and Elevated Public Spaces

S14: Open Spaces and Green Infrastructure

OS1: Protection and provision of open spaces

OS2: Urban Greening

OS3: Biodiversity

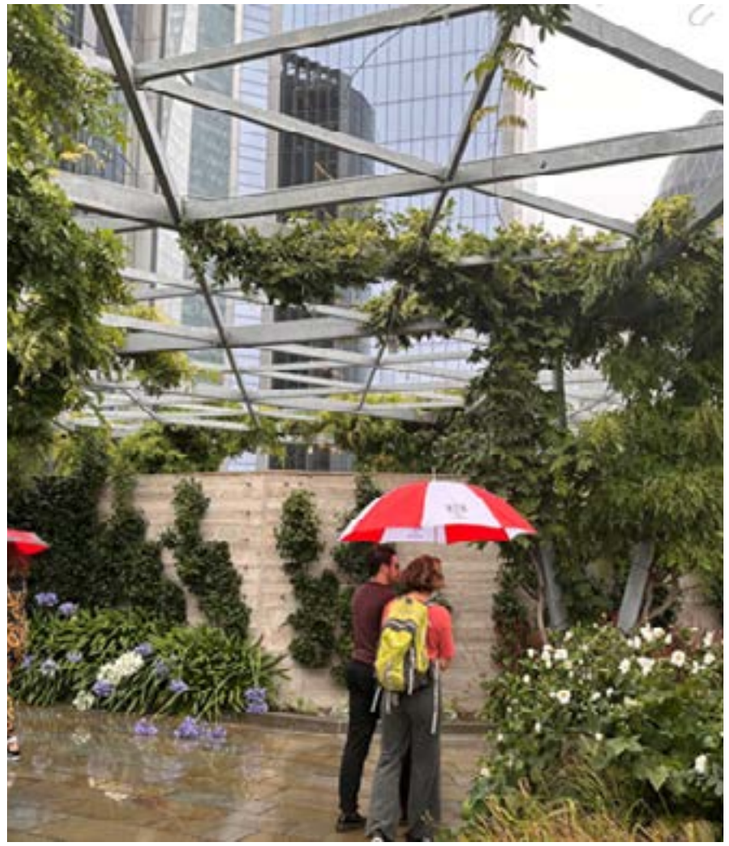
OS4: Biodiversity Net Gain

OS5: Trees

Other Guidance

Riverside Strategy (CoLC)

Sustainable Development Framework (Transport for London)



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7. URBAN GREENING AND BIODIVERSITY

Key actions to develop an exemplar City scheme

The following key actions are required to positively address the City Corporation's policy framework and should be discussed at pre-application stage. Applicants should clearly present the relevant information in the application documents.

- Develop a strategy that maximises the extent and quality of urban greening and biodiversity on a site, complying with, and aiming to go beyond the requirements of the Urban Greening Factor and Biodiversity Net Gain
- Adopt a strategic approach to urban greening and bodiversity enhancements by linking with existing biodiversity corridors, surrounding pockets of green space and cool routes
- Create an urban greening scheme that is resilient to the changing climate and conditions in the City and contributes to the climate resilience of the site and wider context
- Promote the use of native and non-native species that are recognised for their benefit to UK pollinators and climate resilient species planting
- Target priority species set out in the Biodiversity Action Plan (BAP)

Development sites in the City tend to have small footprints, often with densely arranged and stacked building elements. Applicants are therefore challenged to integrate urban greening creatively to achieve the required UGF and BNG.

Experienced landscape practices should be employed to create a design with planting that responds positively to the widely varying conditions on sites relating to shade, noise, wind, altitude, type of ground or building surface and type of open space use. The site context should be assessed to ensure that proposed urban greening links to and extends greening and biodiversity corridors for improved movement of pollinators and other species.

For a successful design, including longevity and reduction in resources and maintenance, urban greening needs to be resilient to the current and predicted climate patterns.

The following key actions are strongly recommended to develop an exemplary scheme that achieves the best balance of planning benefits for the City. Measures should be discussed at pre-application stage and highlighted in the application as sustainability benefits to support the proposals.

- Incorporate nature-based solutions in the development that provide co-benefits for both humans and biodiversity
- Balance amenity requirements with biodiversity benefits in response to the location, development type and use of a site

Nature-based solutions can have effective co-benefits for sustainability and health and well-being, such as cooling, shade, shelter, improved air quality, and biosolar roofs that successfully combine green energy technology with urban greening and cooling on building roofs. Nature-based solutions such as SuDS will contribute to the climate resilience of sites, by providing rainwater attenuation and protecting buildings and open spaces from overheating, and therefore should be prioritised over decorative, ornamental and architectural planting schemes.

Urban greening should be designed to create both amenity and biodiversity focused spaces, and separate or combine them where appropriate to create conditions for biodiversity to thrive while ensuring that users of green spaces can enjoy their well-being benefits.

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7. URBAN GREENING AND BIODIVERSITY

URBAN GREENING

What is urban greening?

Urban greening includes all landscaping, planting, trees and other natural features vital to the sustainability of any urban area. This includes planting in planters, roofs, walls, biodiverse roofs, amenity spaces, green balconies, and terraces. Ideally, all urban greening should be integrated into a network of green infrastructure that forms biodiversity corridors to support diversity and natural habitats.

There are many benefits to green infrastructure including the provision of shade, street cooling, improved air quality, contribution to carbon storage and sequestration and the enhancement of amenity places for residents and visitors alike. A green network will also create walking and cycling routes through the City that are protected from overheating, pollution and noise.

Key measures

Whole building

Urban greening can be incorporated in a variety of ways into buildings, open spaces and public realm, to develop valuable habitats to support biodiversity. Urban greening and biodiversity benefits need to be incorporated into the design concept stage of a project to ensure the highest quality outcome. To incorporate good quality urban greening features, developments should integrate a range of green infrastructure features where possible within the building envelope, including green roofs, terraces and green walls.

Opportunities to integrate urban greening into any type of development should be taken, both on external ground and upper-level surfaces of a building. The location and extent of green spaces within a site should be considered with the end-users in mind to incorporate aspects such as visual amenity, access and maintenance.

Urban greening measures should integrate a diverse range of planting types including, where possible, standard trees, multi-stem trees, shrubs, hedging, flower-rich perennial planting and ground cover planting. Planting should be climate resilient and wildlife friendly.

Urban greening can be positioned to form stepping stones for wildlife and is key for the movement of wildlife across the City landscape. Brownfield sites may not at first glance appear to offer much value to wildlife, however they can develop important habitats on roofs and walls for species such as black redstart and pollinators including bumblebees and solitary bees.

Beyond the building

The City Corporation has a series of area-based public realm strategies that target key green infrastructure locations and climate resilient street greening. It is also implementing a 'Cool Streets and Greening Programme' which involves the planting of designated tree-shaded cool routes, enhancing the climate resilience of the City so that it is better equipped to deal with issues such as overheating, flooding, and new pests and diseases. This strategic approach priorities biodiversity and targets green connectivity around the City.

New developments will be key in expanding the City's green network that allows flora and fauna to flourish. Applicants should actively engage in contributing to the development of green infrastructure, and are encouraged to connect into public realm strategies, integrating and expanding these cool routes. Applicable measures should be discussed and agreed at pre-application stage.

Case Study: 55 Bishopsgate

Use: Office, retail, and cultural and community space including public viewing gallery

Green Wall (New Build)

Visualisation showing the green wall.
Source: Design and Access Statement

Key facts:

- Incorporation of a modular seeded living wall system between the proposed two towers, designed to comply with fire regulations
- Benefits include: mitigating air and noise pollution, capturing CO2 while releasing O2, combating the heat island effect, improving biodiversity
- Additional benefit to making the public realm more attractive and improving the well-being of people
- Targeting a BREEAM 'outstanding' rating and a WELL 'platinum' rating

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7. URBAN GREENING AND BIODIVERSITY

URBAN GREENING FACTOR

What is the urban greening factor?

The Urban Greening Factor (UGF) is a tool that evaluates and quantifies the amount and quality of urban greening that a scheme provides. To ensure schemes contribute to the greening of the City, when required by the Development Plan, major developments must submit an UGF calculation demonstrating how the development will meet the City's target UGF score of 0.3.

The UGF should not be viewed as the sole method of assessing green infrastructure proposed as part of a development scheme. It is not a tool to measure the ecological and biodiversity benefits of greening proposals, and not all urban greening may be inherently good for wildlife. In addition, although the UGF metric increases greening which contributes to biodiversity, certain habitat features and renewables would not contribute towards the UGF target score. BNG is a separate requirement which addresses habitat creation, and it is detailed in a following section.

The emerging City Plan 2040 introduces an adjusted UGF score of 0.3 for all major developments, in comparision to the GLA UGF scores of 0.4 for residential developments and 0.3 for commercial buildings. This is suited to the City's specific context and development typologies. This scoring framework prioritises tree planting and the establishment of high-quality green roofs and green walls. The target scores should be considered as a minimum requirement and seen as part of a wider ecological approach to development.

Key measures

Whole building

The aim for City development is to incorporate high UGF scoring surfaces such as intensive green roofs, trees, extensive green roofs, flower-rich perennial planting and rain gardens wherever possible. Development proposals should demonstrate how different types of urban greening (from water features and green roofs to flower-rich planting), their quality and permeability (for water to filter into the ground or blue infrastructure), have been integrated into the design of buildings and public realm. In consultation with City Corporation officers, landscape experts should lead the valuation of greening options to inform the earliest stages of the design process, accommodate the specification and meet the UGF target score.

Major applications should submit a UGF assessment and a landscape plan in the planning submission, which includes details of species of trees and shrubs, sizes, numbers and densities. An operation and maintenance plan detailing how the greenery will be maintained throughout the building's life-cycle is also required. It's recommended that applicants refer to the City Corporation Urban Greening Factor evidence base study conducted in 2018.

Ground level greening should be maximised. However, underground utilities and tunnels constrain the depth needed for substantial planting. These factors all have a bearing on what can be planted and grown in developments in the City.

In spatially constrained urban environments green roofs are an effective solution to provide co-benefits for people and biodiversity offering enhanced amenity, habitat and food for wildlife, helping attenuate roof run-off, reduce urban heat island effect, and insulate buildings. Green roof proposals should be Green Roof Organisation (GRO) compliant to maximise the benefits delivered.

Where intensive green roofs and green walls require irrigation, it should be provided with the most efficient, water resource saving and low carbon equipment to future proof the installation.

Heavy planting features such as trees may require additional structural support which should be balanced against the associated embodied carbon impact. Maintenance of small-scale food growing and/or public realm greening could be facilitated by a community of volunteers or building occupiers.

Any planting which is fully enclosed and not exposed to the natural elements should not be included in the UGF calculations.

Case Study: 81 Newgate Street

Use: Office and retail

Retrofit and extension

Visual of the extensive greening at 81 Newgate street.
Source: Design and Access Statement

Key facts:

- Extensive landscaping and greening, achieving an urban greening factor of 0.397, above the target 0.3 of the London Plan
- 4,928m2 of planting, including intensive and extensive green roofs, a rooftop wildflower meadow, terraces with trees in planters, as well as clipped yellow hedges, and trees planted directly into soil at the ground level
- A permeable decking area with draining stones to support rainwater attenuation will cover 722m2
- The green roofs will also be publicly accessible, while much of the planting will also be visible from the street, creating social and health benefits for direct users as well as passers-by and contributing to the overall amenity of the neighbourhood

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7. URBAN GREENING AND BIODIVERSITY

URBAN GREENING FACTOR

Green roofs types

Table 7.2 Green roof types, descriptions and specifications (The GRO Green Roof Code (2021)

Green roof type	Description	Weight	Substrate depth	Maintenance	Public Access	Vegetation	UGF Factor	BNG distinctiveness
Extensive green roof	Planted with low maintenance, drought tolerant sedum, grasses, mosses and wildflower species. Can include: ▪ Sedum-only roofs which are drought tolerant, able to withstand extremes in climate and can grow on relatively shallow substrates. ▪ Wild and meadow flower roofs which provide taller plants and flowers suitable for pollinator invertebrates and other insects.	Light weight (typically <250kg/m2 saturated density)	Shallow substrates (80-150mm)	Low maintenance (1-3 visits per annum)	Generally not	Hardy and drought tolerant – sedums and other succulents, wildflowers, small herbs, bulbs, alpines, grasses, as well as mosses, fungi, and lichens.	0.7	Low
Biodiverse extensive roof	Form of extensive roof but designed specifically for habitat creation to aid biodiversity. They have taller features, varied substrate topography, and features such as pebbles, boulders, gravels, sands, branches and logs.	Light weight (typically <250kg/m2 saturated density)	Varied shallow substrates (typically varied from 80 to 150mm)	Generally low maintenance (1-3 visits per annum) but dependent on requirements	No	'Green' biodiverse roofs would be planted with wildflowers, sedums and grasses. A wider range of plants can be included, including shrubs and woody plants. 'Brown' biodiverse roofs are not purposefully planted and allows natural colonisation to a chosen growing medium.	0.7	Medium
Intensive green roof	Principally designed to create recreational and amenity spaces for people and tend to mimic ground-level parks with landscaping including shrubs, trees, lawns, paving and water features, intended for use as a recreational space. They have a deeper substrate, irrigation systems and more frequent maintenance visits	Heavier in weight (typically >250kg/m2 saturated density)	Deeper substrates (>150mm and up to 1000mm)	High maintenance (regular visits), including regular irrigation	Yes	Wider range of vegetation types with shrubs, hedging and trees.	0.8	Low
Blue-green roof	Designed to attenuate rainfall at roof level, releasing it more slowly to reduce pressure on the urban drainage system, typically installed under a green roof.							
Bio-solar roof	A system where the mounting system for photovoltaic (PV) panels is integrated into the green roof.							

In 2020/21 in the Square Mile, approximately 60% of green roofs were categorised as extensive, 30% intensive and 10% a combination of both.

Figure 7.1: Types of greenroofs

Source: Imperial College London/Science Graphic Design

7. URBAN GREENING AND BIODIVERSITY

BIODIVERSITY

Biodiversity in the City

Biodiversity Action Plan

There are many opportunities to protect, conserve and enhance biodiversity in the highly urbanised area of the Square Mile. Any enhancements should be in line with the City Corporation Biodiversity Action Plan 2021-2026 (BAP) which outlines target species and habitats for the City and identifies the locations of designated Sites of Importance for Nature Conservation (SINCs).

Target habitats in the City

There are two target habitats for the City that offer an opportunity to create or enhance space for biodiversity within new or existing green spaces or the built environment:

- Open mosaic habitat on previously developed land – The loss of this priority habitat is likely to require offsetting and is unlikely to be adequately replaced onsite. However, biodiverse roofs can be created to replicate this habitat by establishing a range of conditions to support flora and invertebrate communities. The quality and distinctiveness of new habitats should be equal to, or an improvement on the existing.
- Standing Open Water - create new ponds and incorporate access to water into the design of biodiverse roofs. SuDS can also contribute towards increasing access to water for wildlife including pollinators and bird baths. Standing waters should be carefully designed and monitored to minimise risks of pests and diseases or poor water quality.

Priority Species in the City

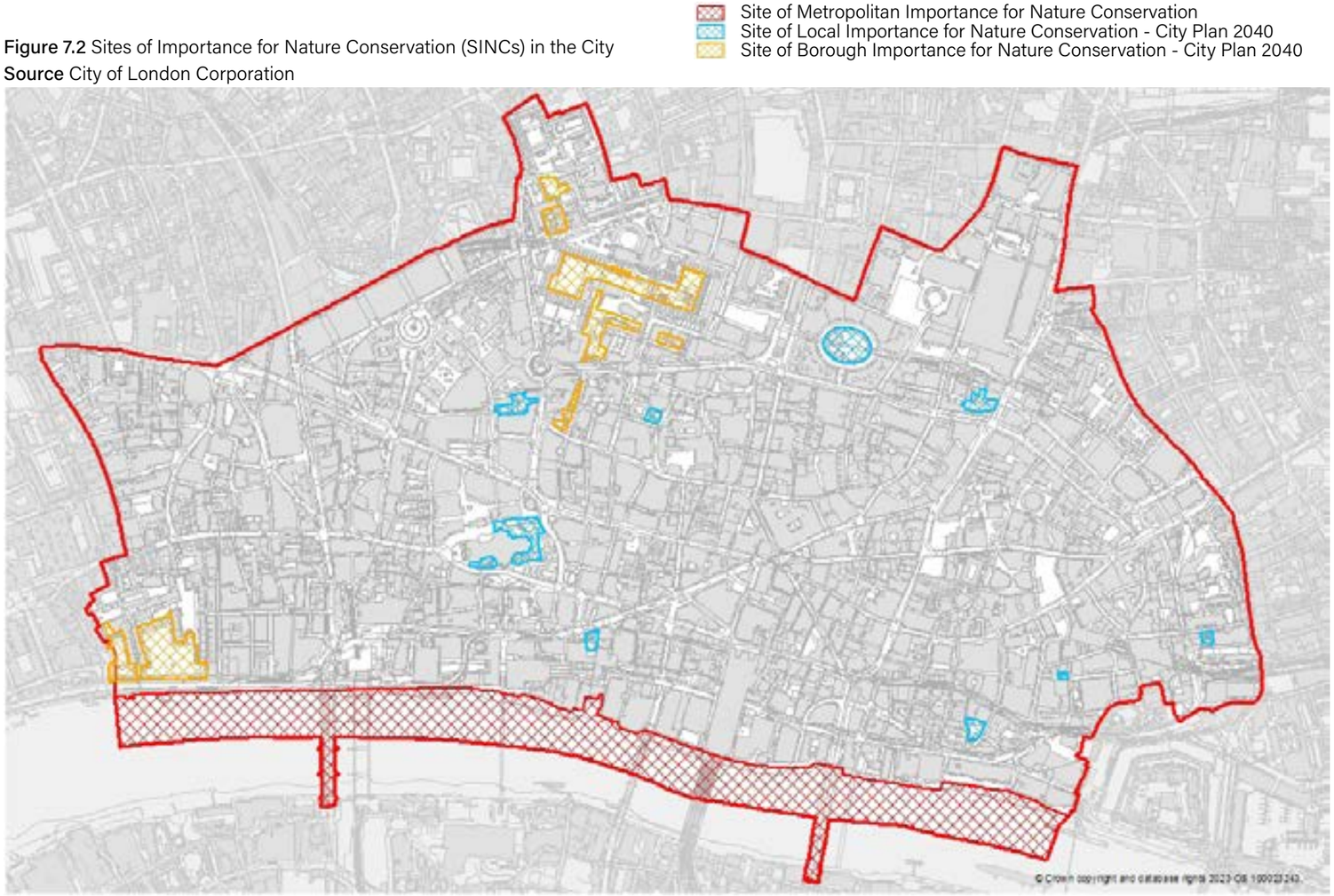
There are seven priority species identified within the BAP which should be considered during biodiversity enhancement design:

- House sparrow Passer domesticus
- Black redstart Phoenicurus ochruros
- Common swift Apus apus
- Peregrine falcon Falco peregrinus
- Bats
- Wild bees (bumblebees and solitary bees)
- Stag beetle Lucanus cervus

Sites of Importance for Nature Conservation (SINCs)

The City does not contain any statutory designated sites for nature conservation, however there are several non-statutory designated sites (SINCs) identified by local authorities and recognised as part of the planning process. In London, sites are categorised by importance at a metropolitan, borough and local level. SINCs identified in the City are shown in Figure 7.1.

Figure 7.2 Sites of Importance for Nature Conservation (SINCs) in the City
Source City of London Corporation



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7. URBAN GREENING AND BIODIVERSITY

BIODIVERSITY

Key measures

Whole building

Developments should use planting, green infrastructure and habitat creation measures to protect and enhance biodiversity across the City. Urban greening measures and biodiversity measures should take into consideration local priorities, such as the BAP, and contribute to the enhancement and extension of green corridors and SINCs.

To understand existing habitats on a site, London's Local Environmental Records Centre (LERC) and Greenspace Information for Greater London (GiGL) should be consulted to provide comprehensive data on London's habitats, species and protected sites, including SINCs.

Urban greening measures should integrate a diverse range of planting types to support year-round forage for pollinators, bats and birds. As well as integrating urban greening measures outlined in previous sections, developments should integrate wildlife-friendly features, including:

- Integral nests boxes (compliant with BS 42021) to provide nesting opportunities for birds, including black redstart, swifts and house sparrows
- Free standing and integrated bat roosting boxes
- Invertebrate habitat features, including as bug boxes, sandy/ stoney mounds, logs piles and standing water
- Wild bee nesting habitats and bee bricks

For all wild-life friendly features, care needs to be taken of siting and positioning in relation to the habitat context, exposure, aspect and height. Planning and installation should be conducted by a qualified ecologist. Potential indirect impacts to species should be considered, such as light pollution for bats and disturbance of nesting birds. In accordance with best practice guidance (City of London Lighting SPD) relating to lighting and biodiversity, any new lighting should be carefully designed to minimise potential disturbance and fragmentation impacts on sensitive receptors, such as bat species, including incorporating dark spaces.

Honeybee hives should not be proposed or consented in the City. This is due to negative impacts on wild pollinators, including bumblebees and solitary bees, which are a target species in the BAP. Wild bee populations are facing serious decline due to a range of pressures including habitat loss, pesticide use and climate change. Honeybees are a major risk to wild bees in the City due to their abundance and competition which limits forage resources.

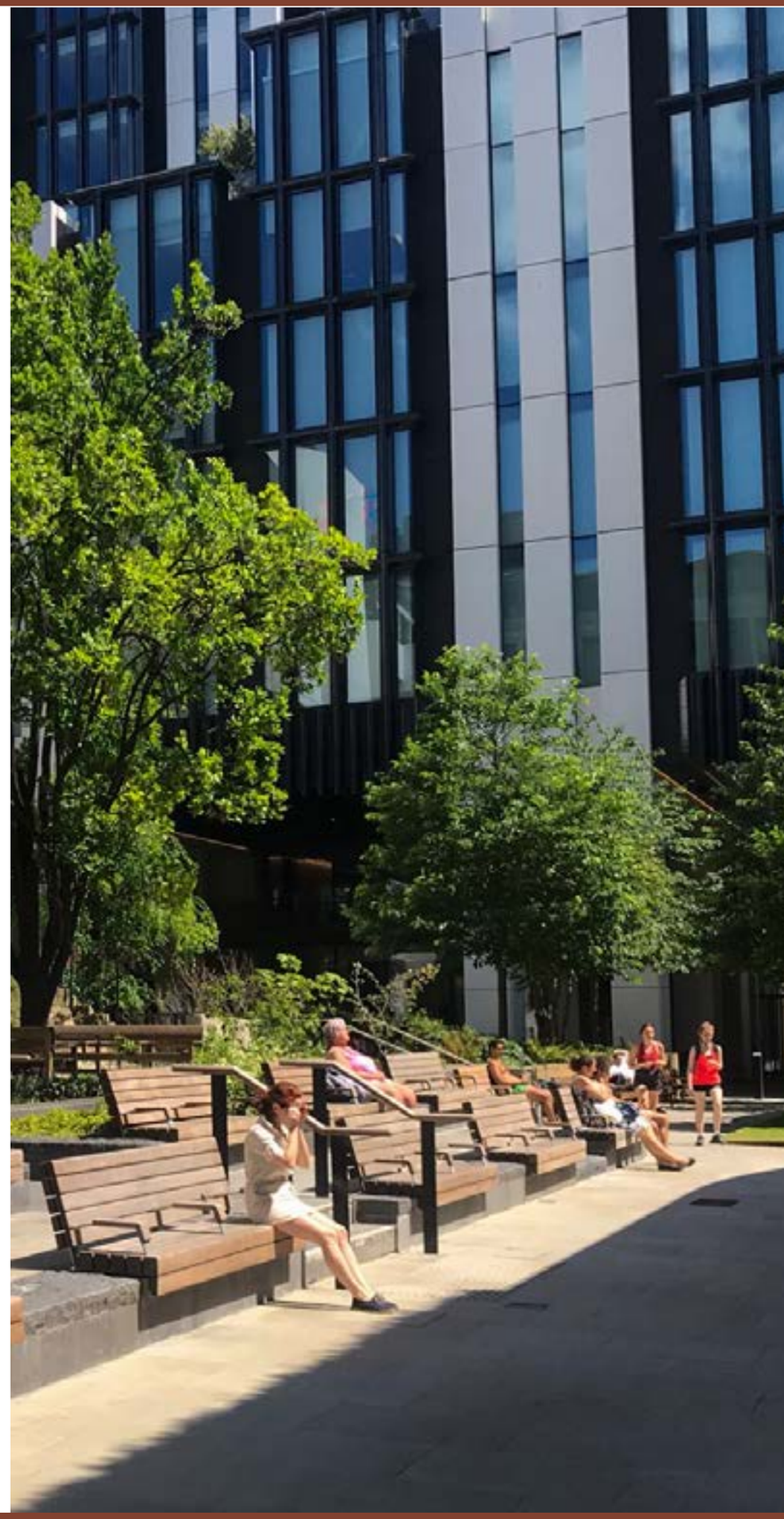
Applicants are encouraged to incorporate educational initiatives in urban greening and biodiversity proposals, particularly in the public realm. Initiatives should provide accessible information, explanation, and/or learnings on what greening and biodiversity processes are present to advocate for the protection and celebration of biodiversity in the City.

Applicants are encouraged to establish good practice in soil protection and the sustainable use of soils. Soil supports biodiversity and plays an important role in climate change mitigation, by storing carbon. Transport for London's Sustainable Development Framework outlines the following actions that could be considered for the management of soil on development sites:

- Carry out an assessment of any existing soils onsite and set out a soil management plan, including a strategy for importing suitable soils and substrates or creating them onsite
- Safeguard areas where existing soils will be retained or reused onsite, and areas where any imported soils will be stored
- Strip soils identified for reuse and retain onsite in heaps no higher than 1.5 metres
- No soil from site is sent to landfill
- Check imported soils are compliant with BS 3882:2015 (Topsoil) and BS8601:2013 (Subsoil)
- Retain crushed concrete or other suitable demolition by-products (to five millimetres sieve size) and add Compost Quality Standard PAS 100 compliant compost (as necessary) to create suitable growing medium.

Beyond the building

Developments in proximity to SINCs need to ensure that nature on these sites is not impacted through development or degraded as a result, but enhanced. Developments within the vicinity of SINCs should contribute financially to maintenance and conservation, and incorporate complementary enhancements to the designated features of the SINC. Where development has a potential impact on designated sites of importance for biodiversity in or near the boundary of the site, the developer should submit an appropriate Ecological Assessment outlining how any impacts will be avoided, minimised or mitigated.



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7. URBAN GREENING AND BIODIVERSITY

BIODIVERSITY

The River Thames provides a significant corridor for movement and foraging across London for a variety of wildlife, including bats which use vegetation and water bodies to commute and forage. The City Corporation's Riverside Strategy highlights opportunities for development to enhance biodiversity through the conservation of existing features and integration of new features for aquatic and terrestrial biodiversity when flood defences are being raised, including utilising the Estuary Edges guidance by the Thames Estuary Partnership.

Ecosystem services

The value of biodiversity extends beyond supporting habitat and species to the provision of ecosystem services such as reduction of the urban heat island effect, flood resilience and improving air quality.

Future-proof the development

Integrating biodiversity measures will help to future-proof the development for climate change. Biodiversity measures should be designed to respond to local species and the surrounding climate to ensure the longevity of the proposed habitats.

Green roofs, green walls, street trees and areas of semi-natural vegetation are all climate positive initiatives and benefit health and well-being.

Embodied Ecological Impacts

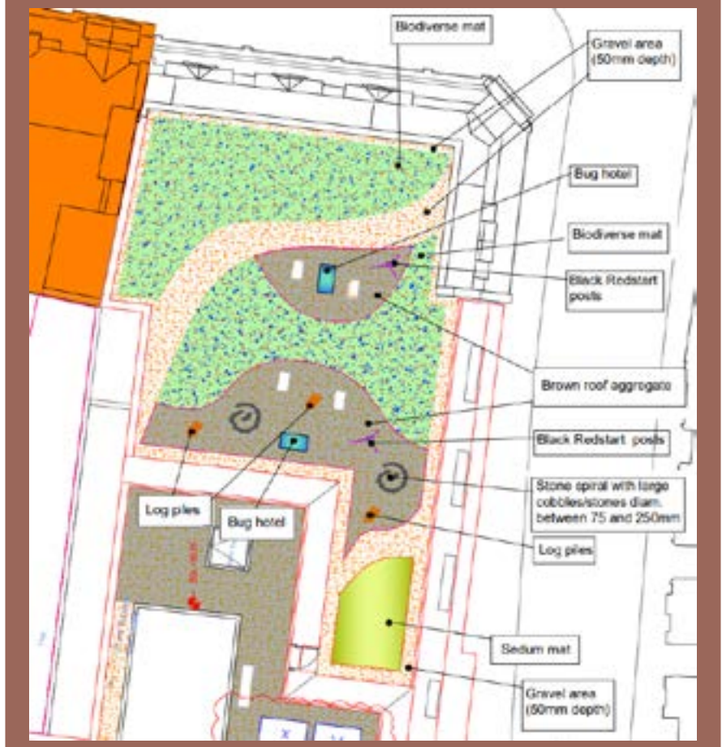
In a global nature and biodiversity crisis, it's important to recognise impacts from the construction industry beyond the Square Mile and UK, on areas such as deforestation, pollution, and water scarcity. Similar to embodied carbon, the City Corporation encourages applicants to consider embodied ecological impacts within their project whole life-cycle: resource extraction, manufacturing process, production and transportation process of new materials, and disposal of unused materials.

Organisations have committed to TNFDs (Taskforce on Nature-related Financial Disclosures) to shift business and finance flows away from nature-negative outcomes to nature-positive outcomes. The UKGBC is releasing material on embodied ecological impacts. The World Business Council for Sustainable Development (WBCSD) released a Roadmap to Nature Positive: Foundations for the built environment system. Applicants are encouraged to consider and embed embodied ecological impact into existing reporting processes.

Case Study: Creed Court Hotel, 3 Ludgate Hill

Use: Hotel and retail

New build (retained façade)



Plan of the biodiverse roof design
Planning Application drawing – Landscape Areas Roof

Key facts:

- Green roof designed to create habitat that will help support populations of declining species including black redstart, common blue butterfly, toadflax brocade moth and bats
- Key features include sedum, wildflower turf, gravel ballast and crushed aggregate, bug hotels, log piles and black redstart posts

Additional features:

- Achieves a 38.2% reduction in carbon emissions over the Part L 2013 baseline

Case Study: 40 Holborn Viaduct

Use: Office and retail

Retrofit and extension

Visual showing enhanced pocket park and green balconies
Source: Design and Access Statement

Key facts:

- Extensive greening in the form of biodiverse and green roofs, greening on terraces and balconies, and enhancements to a pocket park within the vicinity of the site
- Wildflower areas have also been specified with a diverse range of native flowering plant species at varied depth of 80-150mm

Additional features:

- High levels of retention (99.5% of the substructure, and 75% of the superstructure)
- Installation of PV panels covering an area of 240m2
- Air-source heat pumps share energy between different zones of the building to maximise their efficiency; hot water generated by water-source heat pumps
- Targeting BREEAM 'outstanding', NABERS 5* and WELL 'platinum' ratings

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7. URBAN GREENING AND BIODIVERSITY

BIODIVERSITY NET GAIN

What is Biodiversity Net Gain (BNG)

Biodiversity is the term used to describe the variety of life. The aim of Biodiversity Net Gain (BNG) is to leave the natural environment in a measurably better state than it was prior to development. The Environment Act (2021) requires all new developments to provide a minimum 10% BNG uplift from baseline value of the site. BNG provides the opportunity to unlock additional space for biodiversity by steering associated soft landscaping towards habitat creation, therefore providing more biodiversity onsite and benefitting local wildlife.

Calculating the value of habitats

The Biodiversity Metric (BM) is a statutory tool that calculates changes in the extent and quality of habitats as a proxy for nature. It is used to calculate and compare Biodiversity Units (BU) found on a site before and after development. The metric should be completed by a suitably qualified and experienced ecologist. Four key factors underpin this calculation:

- Habitat size
- Habitat distinctiveness (conservation value)
- Habitat condition, and
- Strategic significance (local priorities for habitat creation/ enhancement)

The metric should be used early on in the design process to evaluate different design options to maximise biodiversity gain within the parameters of the development.

The Mitigation Hierarchy

When applying the Mitigation Hierarchy (Figure 7.3), impacts to sensitive ecological features are avoided and minimised as a priority. This approach reduces risk, and ultimately costs for a project, as compensation and offsetting strategies are more expensive than avoidance.

1. Avoid: retain and protect ecologically valuable or sensitive receptors
2. Minimise: Where avoidance is not possible impacts should be minimised as far as practicable by reducing the area of direct impact or loss
3. Mitigate: Implementing measures to reduce impact through construction, replace lost habitats, and enhance habitats within the development boundary
4. Offset: Only utilised where the previous options have been exhausted.

BNG delivery

Currently all new developments with existing habitats (if applicable) are required to provide a minimum 10% BNG uplift from baseline value of the site. However due to the dense urban nature and high proportion of zero baseline sites within the Square Mile, the mandatory BNG of 10% within the Environment Act 2021 is not considered an appropriate measure for the delivery of meaningful BNG within new developments. The City Corporation commissioned a Biodiversity Net Gain Feasibility Study for the Square Mile to support the City Plan 2040 and ensure BNG was delivered to such sites which would be deemed exempt. When required by the Development Plan, to meet the requirements of delivering BNG in the City, major developments regardless of baseline value are expected to achieve at least 3 BU/ha onsite. The delivery of BNG should be prioritised onsite, but if delivery falls below 3 BU/ha, offsite measures should be agreed with planning officers.

In cases where the biodiversity baseline is zero due to an absence of habitats, the development should still aim to deliver 3 BU/ha to incorporate habitats and green infrastructure of suitable scale into the development design. However, minimum requirements should be agreed in coordination with City Corporation officers during the pre-application process.

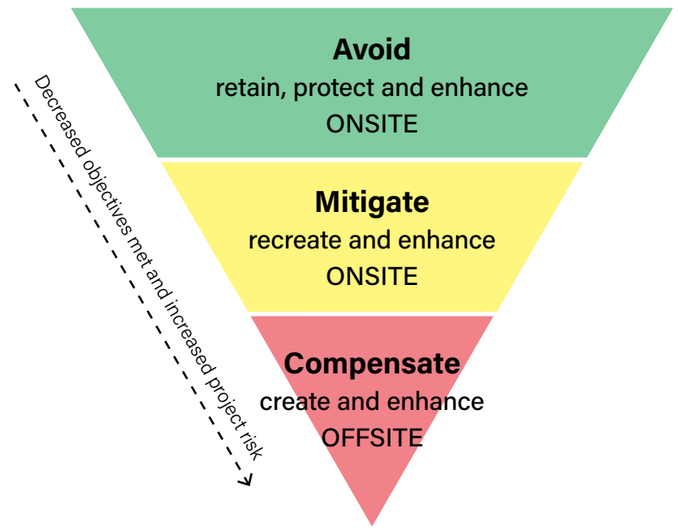

Figure 7.3 Mitigation hierarchy

Case Study: 120 Fleet Street

Use: Office and retail

New Build (including alterations to existing Grade II listed Daily Express building)*

Aerial view visual showing the cascading terraces
Source: Design and Access Statement

Key facts:

- Multiple benefits for native biodiversity planting and habitat creation to provide net gain for biodiversity
- 12 cascading terraces with urban greening and amenity spaces
- Biodiverse and blue roof to provide SUDs and habitats
- Rainwater harvesting for irrigation

Additional features:

- Water efficient fittings targeting a 40% water demand reduction against non-domestic baselines
- Features a mixed mode ventilation strategy, and efficient building services and control systems

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7. URBAN GREENING AND BIODIVERSITY

BIODIVERSITY NET GAIN

Where BNG is being provided and as required by the Development Plan, prior to commencement of development, a Biodiversity Gain Plan (BGP) should be submitted and approved. A draft BGP should be included in the planning submission. The BGP should set out the strategy for achieving BNG, include the Statutory Biodiversity Metric (SBM) spreadsheet and outline habitat enhancements that will be incorporated to meet the BNG score.

As required by the Development Plan, prior to commencement of development, a Habitat Management and Monitoring Plan (HMMP) should be submitted and approved for development providing 'significant' onsite and offsite gains (e.g. a biodiverse green roof). The HHMP should outline how the habitat enhancements will be managed, maintained and monitored for a minimum of 30 years. However, if a development is only providing 'non-significant' onsite gains for example 'planters' then a Landscape and Ecological Management Plan (LEMP) would be required.

Strategic approach

The delivery of BNG will have more strategic significance and provide stronger biodiversity value if it adheres to local priorities, such as those outlined in the City Corporation's Biodiversity Action Plan (BAP). As outlined in the previous 'Biodiversity' section, biodiversity measures that consider priority species and habitats, and integrate with existing green corridors, will have a greater benefit to wildlife in the City.

The Environment Act (2021) has introduced the Local Nature Recovery Strategy (LNRS) to help local authorities to incorporate nature recovery objectives and support delivery of BNG through spatial strategies. Until the London LNRS is in place, strategic significance will be considered to be the habitats set out in the City of London BAP.

Each LNRS must:

- agree priorities for nature's recovery
- map the most valuable existing areas for nature, and
- map specific proposals for creating or improving habitat for nature and wider environmental goals

The existing Biodiversity Action Plan concludes in 2026, at which point the City Corporation may decide to develop and adopt a Local Nature Recovery Plan to replace the BAP, following the framework of the LNRS.

The City Corporation's Climate Resilient Planting Catalogue provides guidance on a variety of parameters that will aid the design of public realm and planting schemes including:

- species tolerances (to pests and diseases, extreme heat and weather events etc.)
- species functions (ecosystem services, i.e. biodiversity enhancement, cooling, interception, sequestration)
- planting environment (site types and conditions)

Applicants are advised to fully consider current GLA and City Corporation guidance for urban greening and biodiversity for the design of development proposals.

Image: Urban greening at St Mary Axe © Clive Totman, 2023

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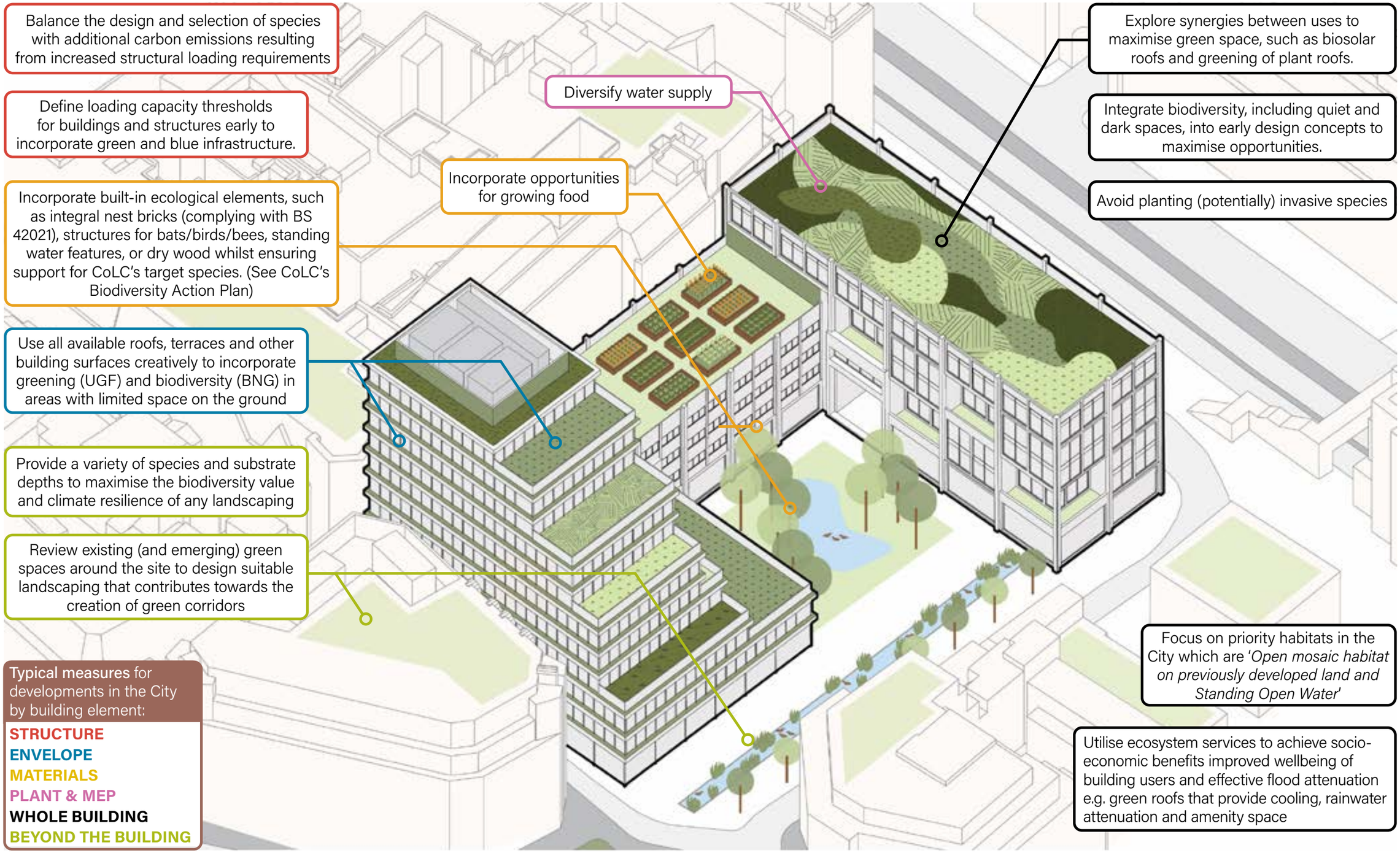
7. URBAN GREENING AND BIODIVERSITY

KEY MEASURES FOR CITY DEVELOPMENTS

This infographic provides a list of potential measures, which is not exhaustive. Applicants are encouraged to propose innovative measures that drive best practice. All measures to be agreed on a case-by-case basis.



SUBMISSION REQUIREMENTS AND CONSIDERATIONS

08

8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

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Introduction

Planning applications pass through a planning process that covers all RIBA stages and can be particularly complex for major applications. The planning application process concentrates on RIBA stages 1-5, however, there are important considerations and actions to be addressed throughout all RIBA stages that impact on the success of both the application and the completed development.

This section outlines key considerations, required application documents and recommended supplementary material to support planning applications in the City of London. The key considerations suggest key actions to ensure sustainability is successfully integrated in the development approach. The required information outlines planning application submission requirements, as prescribed by the Development Plan. In the pre-application stages, the requested material will help proposals demonstrate that application requirements will be satisfied. The recommended material can demonstrate exemplary practice.

The City Corporation Validation Checklists detail all items required to be submitted in a planning application

RIBA Stage 0 - Strategic Definition

Key considerations for all applications proposing building works

- Undertake a building survey to identify opportunities and constraints
- Consider heritage opportunities and constraints
- Assess the local context, including:
  - availability of energy infrastructure and energy sharing opportunities
  - existing and emerging green infrastructure and biodiversity networks
  - local climate resilience opportunities such as SuDS, cool routes, biodiversity
  - other synergy opportunities
  - engage with supporting Business Improvement Districts
- Engage a creative and experienced project team, including a heritage specialist for historic buildings
- Consider sustainability aspirations for the site
- Consider the optimal use of the site to achieve high environmental sustainability aims
- Check out the CoLC's priorities and focus relating to environmental, social and economic sustainability
- Assess opportunities for the retention of buildings or elements, the reuse of materials including from applicant team's other projects or material exchange websites to inform the design of the proposal
- Carry out a site walk about with design team to identify retention and reuse options.

Minor applications should consider the above where applicable to the nature of the proposals.

Recommended material research

Information being assembled to include:

National Planning Policy Framework	CoL Carbon Options Guidance PAN	Existing building information, surveys and material audits	Case studies and precedents
London Plan	CoL Climate Action Strategy	UK Net Zero Carbon Building Standard	Other relevant industry standards and guidance
Other London Plan Guidance (LPGs)	Other CoL policies and guidance, maps	Low Energy Transformation Initiative	Greenspace Information for Greater London

8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

CONTENTS

RIBA Stage 1 - Pre-application

Key considerations for all applications proposing building works

- Enter into a Planning Performance Agreement or arrange a series of pre-application meetings covering all relevant sustainability topics. Recommended for major applications are 2 workshops on optioneering, and 2 meetings on the sustainability strategy, one early and one towards the end of this stage. For minor applications, a meeting combining sustainability and other planning considerations is recommended.
- Align proposed sustainability inspirations with planning and specialist officer recommendations relating to the site, its context, and the City as a whole. This includes identifying opportunities for wider environmental sustainability benefits
- Discuss development optioneering requirements and carry out optioneering in line with Carbon Options Guidance, including 3rd party review process
- Consider a whole building retrofit plan for historic buildings
- Prepare pre-redevelopment and pre-demolition audits in line with details set out in the Circular Economy chapter
- Consider all circular economy principles to inform optioneering and the strategy for the site
- Consider climate resilience measures to be integrated into design through a draft Climate Change Resilience Sustainability Statement (CCRSS)
- Develop the application scheme following optioneering and identify site-specific sustainability issues to be addressed in more detail
- Adopt whole life-cycle carbon targets (e.g. LETI, UKGBC EUI targets, UK Net Zero Carbon Buildings Standard) to demonstrate commitment to reducing carbon emissions
- Deliver the objectives of the Biodiversity Action Plan
- Achieve high quality balance between amenity, urban greening, biodiversity and climate resilience
- Integrate collective infrastructure, such as climate resilience measures or energy networks
- Integrate construction methods, innovative technologies or materials to reduce carbon emissions (e.g. use of timber or CLT elements)
- Engage with relevant certification schemes (BREEAM; NABERS UK)
- Discuss public consultation, engagement arrangements and content
- Confirm required application documents.

Minor applications should consider the above where applicable to the nature of the proposals.

Requested material

Design documents & vision | Sustainability vision & strategy | Carbon Options Assessment | Draft pre-redevelopment audit | CCRSS considerations | Other specialist material upon request

Recommended material

Draft pre-deconstruction audit | Building survey & analysis | Public engagement material | Ideas for innovative solutions | Preliminary Ecological Appraisal | Historic Building Retrofit Plan | Onsite & wider environmental sustainability benefits study

8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

CONTENTS

RIBA Stage 2-3 - Planning application

Key considerations for all applications proposing building works

- Incorporate refinements and amendments into the proposals, resulting from the pre-application process, including carbon optioneering and public consultation responses
- Support the 3rd party review process for the whole life-cycle carbon assessment of the application proposal
- Ensure the 3rd party review for the optioneering has been carried out and concludes that the options assessment complies fully with the Carbon Options Guidance PAN
- Ensure all identified issues are comprehensively addressed and prominently presented in the application documents
- Incorporate any identified wider environmental sustainability benefits for the local area and City as a whole, clearly laid out and demonstrated in the application documents, that have been negotiated with officers to mitigate high embodied carbon impacts of the proposed development in support of the application
- For exemplary initiative, when there is no expectation to mitigate high embodied carbon impacts, incorporate any identified wider environmental sustainability benefits for the local area and City as a whole, clearly laid out and demonstrated in the application documents, to support the application
- Generally, deep retrofits can be expected to be designed to perform operationally like new builds and the need for separate assessments for the retrofit and the extension should be discussed with planning officers
- Include green leases/clauses for tenanted floorspace to ensure energy efficiency design and low carbon fit-out and operation across the whole development
- Include a commitment to a NABERS UK rating of 5 stars for new builds and 4 stars for retrofits
- Include the BREEAM pre-assessment along with the pre-assessment tracker, identifying achievable and potential credits and reasons where credits cannot be achieved, in particular in the City Corporation's priority categories Energy, Materials, Pollution, Water and Waste
- Prepare a deconstruction audit that includes 'passport-style' details of carbon intensive deconstruction materials suitable for use on material exchange platforms as early as possible in order to support efficient reuse through marketplaces
- Demonstrate future proof design that provides loose fit (to enable easy repair, maintenance and replacements), flexibility and adaptability of floorspaces and building elements including opportunities to retrofit new, leaner technologies when required, to extend the lifetime of a building. This could be outlined in an Access, maintenance and deconstruction strategy.
- Consider an end-of-life strategy, including design for disassembly and material passports
- Develop opportunities for innovative measures to be tested, in particular where they can provide solutions for site specific constraints, e.g. mitigation measures such as material optimisation through design of building elements to perform multiple functions, design for deconstruction strategies, renewable energy generation, energy storage solutions and testing new materials, building element systems and services
- Demonstrate that the proposed development is climate resilient and mitigates any detrimental environmental impacts on the surrounding City context
- Provide Urban Greening Factor and Biodiversity Net Gain documentation as required
- Ensure that GiGL data search reports inform urban greening and biodiversity proposals and upload any new biodiversity data gathered as part of the planning application to GiGL
- Consider details that potentially can be addressed more holistically and optimised at later design stages, and that can be confirmed through appropriate conditions, allowing for flexibility, improvements and incorporation of available materials and building parts, latest technologies and services systems into the design

Minor applications should incorporate the above where applicable to the nature of the proposals.

8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

CONTENTS

RIBA Stage 2-3 - Planning application

Required information

- Sustainability Statement – summary of all relevant topics incl. CCRSS
- Energy Assessment
- GLA Carbon emissions reporting spreadsheet
- BREEAM Pre-assessment
- NABERS UK DfP confirmation
- Carbon Options Assessment & spreadsheet tool
- Pre-redevelopment audit, inc. circular economy options
- Circular Economy Statement
- Pre-deconstruction audit
- GLA Circular economy statements reporting spreadsheet
- Whole Life-Cycle Carbon Assessment
- GLA Whole life-cycle carbon assessment reporting spreadsheet
- Landscape Strategy
- UGF Assessment and Landscape Plan
- UGF operation and maintenance plan
- Biodiversity and ecological survey
- Habitat and Ecological Management Plan
- Flood risk assessment & emergency plan
- SuDS and drainage plan

Drawings to be approved should include:

- Proposed or future connection to energy network, or spaces for networks or extensions
- Details of urban greening and biodiversity measures including type and extent of proposed greening
- Green/biosolar and blue roofs
- Heat pump locations and ventilation surfaces
- Photovoltaic panel installations
- Natural ventilation intake areas / ventilation panels

Required for minor applications

Design & Access Statement, to include a Sustainability section, or a separate Sustainability Statement, covering all topics relevant to the proposal.

Recommended material to demonstrate exemplary practice

- Historic Building Retrofit Plan
- Opportunities study
- Information on feasible innovative solutions
- Reuse or upcycling catalogue
- Material passport style information (existing)
- Access, maintenance & deconstruction strategy
- Axonometric drawings to demonstrate relevant measures, e.g. retained and new building elements, UGF, BNG, landscape strategy
- Draft tenancy agreement/green lease
- Draft Biodiversity Gain Plan
- Material passport style information (proposed)
- Complete sustainability form and submit updates as applicable

8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

CONTENTS

RIBA Stage 4
Post application conditions (detailed design)

Key considerations for all applications proposing building works

- Enter into a Conditions Planning Performance Agreement to ensure resources are available to discharge conditions relating to relevant details to ensure the highest sustainable design quality
- Demonstrate how further details have been developed, to include reasons for changes to details or performances in relation to whole life-cycle carbon and circular economy considerations and confirmation of reuse and recycling initiatives
- Develop the energy strategy in accordance with up-to-date technologies and insights, to achieve the best outcome for energy efficiency and carbon emissions, and to reduce offsetting requirements as much as possible. Consider providing a tenant manual or drafting a tenant agreement to optimise the system operation and tenant-related carbon emissions
- Review the extent and quality of urban greening, biodiversity and climate resilience measures onsite in accordance with updated opportunities and constraints

Required information

- Detailed drawings & studies as required by planning conditions
- Biodiversity Gain Plan (BGP)
- Habitat Management & Monitoring Plan (HMMP)
- Whole life-cycle Assessment
- Circular Economy Statement
- Energy Assessment
- 'Be Seen' Energy Monitoring
- Confirmation of maintenance requirements for urban greening, rainwater collection & other relevant installations
- Pre-deconstruction audit
- Habitat management & monitoring plan
- NABERS DfP (offices only)
- Biodiversity Gain Plan (BGP)
- Climate Change Resilience Sustainability Statement (CCRSS)

Recommended material to demonstrate exemplary practice

- Confirmation of availability/performance of materials and components (e.g. recycled content of steel products, associated emissions, test certificates), such as an EPD (Environmental Product Declaration) certification
- Evidence confirming method for overcoming regulatory, insurance or other issues outside planning required for development proposals
- Submission to Built Environment Carbon Database (BECD)

8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

RIBA Stage 6-7
Post application conditions (completion/in use)

Key considerations for all applications proposing building works

- Review and prepare all post completion information and certificates requested by condition
- Provide a case study of, or a report setting out the lessons learnt from, the scheme to share important insights and contribute to the promotion of best practice in the City
- Engage with the City's Clean City Awards Scheme (CCAS) to drive sustainability amongst member businesses in key areas related to waste, such as communication and engagement, resource efficiency and circular economy practices and reducing plastic waste. The scheme hosts Environmental Best Practice meetings and workshops and awards are given for best performances.

Required information

- 'Be Seen' Energy Monitoring - update contextual data & upload energy performance predictions
- Post completion Climate Change Resilience Sustainability Statement (CCRSS)
- NABERS UK final certificate
- Post completion Circular Economy Statement
- Post construction Whole Life-Cycle Carbon Assessment
- BREEAM final assessment and certificate

Recommended material to demonstrate exemplary practice

- Material passport style information (existing) or use of material exchange platform
- Material passport style information (proposed)
- Case study for publication
- Submit project information to the Built Environment Carbon Database (BECD)

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8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

Major application submission documents

RIBA Stage 0	RIBA Stage 1	RIBA Stage 2-3	RIBA Stage 4	RIBA Stage 6-7
Strategic Definition	Pre-application	Planning-application	Post application (detailed design)	Post application conditions (completion/occupancy)

Requested

- Existing building information
- Surveys
- Material audits
- Draft pre-redevelopment audit
- Case studies / precedents
- Design documents & vision
- Sustainability vision & strategy
- Carbon Options Assessment
- Draft pre-redevelopment audit
- CCRSS considerations
- Other specialist material upon request

Required

- Drawings to be approved
- Sustainability statement
- Energy Assessment & reporting spreadsheet
- Carbon Options Assessment sheet
- WLC Assessment speadsheet
- Circular Economy Statement spreadsheet
- Pre-redevelopment audit
- Pre-deconstruction audit
- BREEAM pre-assessment
- NABERS DfP confirmation (offices only)
- Biodiversity and ecological survey
- Landscape Strategy
- UGF Assessment and Landscape Plan
- UGF operation and maintenance plan
- SuDS & drainage plan
- Flood risk assessment & emergency plan
- Detailed drawings
- WLC Assessment
- Energy Assessment
- Circular Economy Statement
- 'Be Seen' Energy Monitoring
- Pre-deconstruction audit
- Biodiversity Gain Plan (BGP)
- NABERS DfP (offices only)
- CCRSS
- Habitat management & monitoring plan
- 'Be Seen' Energy Monitoring
- WLC Assessment
- BREEAM final assessment and certificate
- Circular Economy Statement
- NABERS UK final certificate
- Pre-deconstruction audit
- CCRSS

Recommended

- Ideas for innovative solutions
- Draft pre-deconstruction audit
- Public engagement material
- Preliminary ecological appraisal
- Building survey & analysis
- Onsite & wider opportunities study
- Heritage building retrofit plan
- Innovative solutions
- Reuse or upcycle catalogue
- Heritage building retrofit plan
- Access, maintenance & deconstruction strategy
- Axonometric drawings
- Draft Biodiversity Gain Plan (BGP)
- Confirmation of materials and components
- Other details on request
- Submission to BECD
- Materials passports
- Case study
- Submission to BECD

Appendix A:
RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

A

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
RETROFIT AND REUSE

Document	Key Considerations
GLA Circular Economy Statement Guidance (March 2022 or latest version)	Guidance on how to pursue the waste hierarchy and set out Circular Economy Statements required by the GLA for referable developments. Provides the circular economy principles that all developments should be encouraged to incorporate
City of London Carbon Options Guidance (COG) Planning Advice Note (PAN) (March 2023 or latest version)	Guidance on how applicants should demonstrate that development options including refurbishment and retrofit and their carbon impacts have been considered and evaluated. Options should be well-considered, realistic and feasible.
GLA Whole Life-Cycle Carbon Assessment Guidance (March 2022 or latest version)	Guidance on how to complete a WLCA and demonstrate consideration of whole life-cycle carbon in the Design and Access Statement
Arup & the Ellen MacArthur Foundation's Realising the value of the circular economy in real estate' (February 2020 or latest version)	Guidance on how to integrate circular economy principles into the real estate business model, but also provides circular economy principles that all developments should be encouraged to incorporate.
Greater London Authority -Whole Life-Cycle Carbon Assessment Guidance	While not mandatory for non-referable development, strong recommendation to either complete WLCA or demonstrate consideration of whole life-cycle carbon in Design and Access Statement

Reference and further guidance

City of London (2022) Planning Advice Note. Whole Life-cycle Carbon Optioneering. City of London Corporation

City of London & Purcell (2024). Heritage building retrofit toolkit. City of London Corporation

C40 Cities (2020). The Multiple Benefits of Deep Energy Retrofits: A Toolkit for Cities. C40 Cities Climate Leadership Group

Acharya, D., Boyd, R., & Finch, O. (2020). From Principles to Practices: Realising the value of circular economy in real estate. Ellen MacArthur Foundation & Arup.

GLA (2022) London Plan Guidance. Circular Economy Statements. Greater London Authority

GLA (2022) London Plan Guidance: Whole Life-Cycle Carbon Assessment Guidance. Greater London Authority.

LETI (2020) LETI Climate Emergency Design Guide. How New Buildings can Meet UK Climate Change. Low Energy Transformation Initiative

LETI (2021) Climate Emergency Retrofit Guide. Low Energy Transformation Initiative

UKGBC (2022) Delivering Net Zero: Key Considerations for Commercial Retrofit. UK Green Building Council

Guidance related to historic building retrofit

Balson, K., Summerson, G., and Thorne, A. (2014) Sustainable Refurbishment of Heritage Buildings BREEAM

Grosvenor (2013) Sustainable Refurbishment: a Toolkit for Going Green Grosvenor Estates

Historic England (2018) Energy Efficiency and Historic Buildings English Heritage

Miles, N (2013) Retrofitting Historic Buildings for Sustainability Westminster City Council

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
GREENHOUSE GAS EMISSIONS AND ENERGY USE

Whole life-cycle carbon

Document	Key Considerations
LETI Embodied Carbon Primer (January 2020 or latest version)	Staggered emissions targets between now and 2030 for residential, commercial and educational buildings with emphasis on material reuse
BREEAM	Exceeding excellent, aim to achieve 'Outstanding' Strong recommendation to achieve: ▪ Man03 –minimum 2 credits rather than 1 ▪ Mat01 –maximise the credits under this criteria
GLA Whole Life-Cycle Carbon Assessment Guidance (March 2022 or latest version)	Guidance on how to complete a WLCA and demonstrate consideration of whole life-cycle carbon in Design and Access Statement
City of London Carbon Options Guidance (COG) Planning Advice Note (PAN) (March 2023 or latest version)	Guidance on how applicants should demonstrate that development options including refurbishment and retrofit and their carbon impacts have been considered and evaluated. Options should be well-considered, realistic and feasible.

Operational emissions and energy

Document	Key Considerations
BREEAM	Exceeding excellent, aim to achieve 'Outstanding' Ene01 credits targeted to be in line with BREEAM outstanding minimum requirements where feasible
RIBA Climate Challenge (Version 2 2021 or latest version)	Incrementally increasing energy use intensity standards to 2030 for domestic and non-domestic buildings Domestic buildings GIA: (current- business as usual) <120kWh/m2/y, (2025) <60 kWh/m2/y, (2030) <0 to 35 kWh/m2/y Non-Domestic buildings GIA(new build offices): (current- business as usual) <130 kWh/m2/y DEC D (90) rating, (2025) <75kWh/m2/y or DEC B rating and/or NABERS Base Build 5, (2030) < 55 kWh/m2/y DEC B (40) and/or NABERS Base build 6

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
GREENHOUSE GAS EMISSIONS AND ENERGY USE

Operational emissions and energy (continued)

Document	Key Considerations
NABERS UK	Commit to design and build development to achieve a rating of 5 or more stars (or 4 stars for retrofit), nominate target at outset and rating achievement plan, post-construction quarterly reports on performance during occupational period
Historic England Advice Note 18: Adapting historic buildings for energy and carbon efficiency (July 2024, or latest version)	Guidance on approaches to improve the energy efficiency and support carbon reduction of historic buildings, whilst conserving their significance.
GLA Housing Design Standards (June 2023, or latest version)	▪ Use local energy resources (such as secondary heat and local heat networks) and supply energy efficiently and cleanly using efficient low carbon heating solutions, such as heat pumps. (All development) ▪ Appraise and optimise network efficiency by minimising distribution heat losses and by locating vertical risers within buildings in positions that reduce horizontal pipe runs to a practical minimum. (New Builds, Change of Use) ▪ Onsite renewables: developments should be designed to maximise renewable energy by producing, storing and using renewable
Levitt Bernstein – Passivhaus Easi Guide	Space Cooling Demand <15 kWh/m2/yr Primary Energy Demand (PER) including all energy uses <60 kWh/m2.yr Air tightness: <0.6 ACH
UKGBC Renewable Energy Procurement Part 2 (August 2023, or latest version)	Key aspects within the guidance: ▪ Principles for good quality renewable energy procurement ▪ Tooklike to engage with energy supplies ▪ Rating system for assessing the performance of a building ▪ Procurement routes available in the market

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

GREENHOUSE GAS EMISSIONS AND ENERGY USE

Reference and further guidance

AHMM, IEDE (2022) Delivering Net Zero In Use. A guide for architects. The Bartlett Institute for Environmental Design and Engineering & Allford Hall Monaghan Morris

City of London (2022) Planning Advice Note. Whole Life-cycle Carbon Optioneering. City of London Corporation

Clark, G. (2019). RIBA Sustainable Outcomes Guide. Royal Institute of British Architects

DGBC(2021) Whole Life Carbon Position Paper. Dutch Green Building Council

GLA (2018) Energy, Daylight and Overheating Study in Tall Buildings. Greater London Authority

GLA (2021) London Plan Guidance Documents. 'Be Seen' energy monitoring guidance. Greater London Authority

GLA (2022) Energy Assessment Guidance. Greater London Authority

GLA (2023). London Plan Guidance. Housing Design Standards. Greater London Authority

GLA (2022) London Plan Guidance. Whole Life-Cycle Carbon Assessment. Greater London Authority

GLA (2023) Air Quality Neutral (AQN) guidance. Greater London Authority

GLA (2021) London Heat Network Manual II - Guidance for planners, designers & developers. Greater London Authority

Historic England (2023) Adapting historic buildings for energy and carbon efficiency: Historic England advice note 18

IEMA, ARUP (2017) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance. IEMA

LETI (2020) LETI Climate Emergency Design Guide. How New Buildings can Meet UK Climate Change. Low Energy Transformation Initiative

LETI (2020) LETI Embodied Carbon Primer. Supplementary guidance to the Climate Emergency Design Guide. Low Energy Transformation Initiative

LETI (2023) LETI Unpicker. Retrofit vs rebuild: Unpicking the carbon argument Retrofit vs rebuild unpicker. Low Energy Transformation Initiative

Levitt Bernstein (n.d) Easi Guide to Passivhaus Design. Levitt Bernstein

NABERS UK (2021) Guide to Design for Performance. NABERS United Kingdom

RIBA (2021) RIBA 2030 Climate Challenge v2. Royal Institute of British Architects

UK Net Zero Carbon Buildings Standard (2024) Pilot version rev1 UK Net Zero Carbon Buildings Standard,

UKGBC (2019) Net Zero Carbon Buildings: A Framework Definition. UK Green Building Council

UKGBC (2023) Renewable Energy Procurement Part 2 UK Green Building Council

WPA (2021) Zero Carbon Westminster: A Focus on Retrofit in Historic Buildings. Westminster Property Association

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
CIRCULAR ECONOMY

Circular Economy in construction and operation

Document	Key Considerations
City of London Carbon Options Guidance (COG) Planning Advice Note (PAN) (March 2023 or latest version)	Evaluate development options with regard to their opportunities to incorporate circular economy principles.
The Chancery Lane Project – Sustainable and Circular Economy Principles in Leasing Arrangements for Repairs and Alterations (June 2022 or latest version)	Committing to green leases as a way to ensure fit-out stages and post-occupation building work support circular economy objectives, see The Chancery Lane Project for useful green contract clauses and templates.
GLA Circular Economy Statement Guidance (March 2022 or latest version)	Guidance on how to pursue the waste hierarchy and set out Circular Economy Statements required by the GLA for referable developments, but also provides circular economy principles that all developments should be encouraged to incorporate.
UK Green Buildings Council: Building Glass into a Circular Economy	Guidance for buildings involving glass being disassembled, demolished, or recycled. This requires early engagement; to enable quality control, remove the glazing units from the building site to a factory environment for disassembly; seal skips and train staff around contamination issues
Living Building Challenge	Progressive targets and guidance for construction material use

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

CIRCULAR ECONOMY

Reference and further guidance

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APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

CLIMATE RESILIENCE

Flood Risk and SuDS

Document	Key Considerations
National Planning Policy Framework (National Planning Practice Guidance: Flood risk and coastal change)	The framework defines the type of infrastructure that is permitted within Flood Zones across the city. Infrastructure is divided according to its vulnerability. Some examples are shown below: ▪ **Essential Infrastructure:** essential transport infrastructure, essential utilities, wind turbines and solar farms. ▪ **Highly vulnerable:** Emergency service stations and basement dwellings. ▪ **More Vulnerable:** Hospitals, residential units, health services and educational services. ▪ **Less Vulnerable:** Commercial units, waste treatment and water and sewage treatment works ▪ **Water compatible:** Water and sewage transmission infrastructure, docks and marinas and open space. Where development is required within an area of high risk, guidance on how to ensure safety is provided.
EA Flood Guidance (including TE2100 plan)	Committing to green leases as a way to ensure fit-out stages and post-occupation Guidance to indicate risk of flooding across the City and what is required to secure the planning of the development. Guidance is also provided regarding the developments design including and not restricted to set backs from river walls, freeboard allowances and habitat creation. All development proposals must comply with the requirements of TE2100. As well as following EA guidance, it is recommended that any project engages with the EA technical experts as early as possible.
City of London Strategic Flood Risk Assessment (SFRA) (April 2023 or latest version)	Provides local, tailored guidance on all the likely sources of flooding within the City and acts as an evidence base in development planning, defining local flood risk policies and emergency planning procedures.
DEFRA Non-statutory technical standards for SuDS (2015 or latest version)	Development shouldn't increase flooding elsewhere, structurally sound to the lifetime of the building and seek to control discharge levels.
London Plan Drainage Hierarchy from London Plan (2021 or latest version)	A Development should utilise Sustainable Drainage Systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the SuDS hierarchy.

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

CLIMATE RESILIENCE

Water Resource Management

Document	Key Considerations
RIBA Sustainable Outcomes Guide 2019	Potable water use targets ▪ For domestic buildings: (current) <110L/p/day, (2025) <95L/p/day, (2030) <75L/p/day ▪ For non-domestic buildings: (current) <16/L/p/day, (2025) <13L/p/day, (2030) <10l/p/day
BREEAM	Wat 01 Water consumption. Reducing the demand for potable water through the provision of efficient sanitary fitting, rainwater collection and water recycling systems Wat 02 Water monitoring. Specification of a water meter/s on the mains water supply to encourage water consumption management and monitoring to reduce the impacts of inefficiencies and leakage. Wat 03 Leak detection. Recognition of leak detection systems capable of detecting a major water leak on the mains water supply. Flow control devices that regulate the supply of water to each WC area/facility to reduce water wastage. Wat 04 Water efficient equipment. Identifying a building's total unregulated water demand and mitigating or reducing consumption through systems and/or processes.
GLA London Plan Policy 5.15 Water use and supplies (2021 or latest version)	Development should minimise the use of mains water by: ▪ incorporating water savings measures and equipment ▪ designing residential development so that mains water consumption would meet a target of 105 litres or less per head per day ▪ New development for sustainable water supply infrastrucrure, which has been selected within water companies' Water Resourse Management Plans, will be supported
Environment Agency Water Resource Planning Guideline (2023 or latest version)	Guidance for the development of a Water Resource Management Plan for the development that complies with all relevant statutory requirements and governments policy.
Building regulations Part G: Sanitation, hot water safety and water efficiency (2024 or latest version)	Reasonable provision must be made by the installation of fittings and fixed appliances that use water efficiently for the prevention for the consumption of undue consumption of water. The potential consumption of wholesome water by persons occupying a new dwelling must not exceed 125 litres per person per day.

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

CLIMATE RESILIENCE

Building and Urban Overheating

Document	Key Considerations
GLA Housing Design Standards (June 2023, or latest version)	Reduce the risk of overheating, through orientation, layout, the natural cross-ventilation afforded by dual aspect, window design, and shading devices; active cooling should be a last resort. Daylight and overheating assessments should be analysed together to determine the optimal balance. South and west facing façades are most at risk to overheating, and the use of shading should be used to prevent direct sunlight from entering the home during at risk periods. Maximise the benefit of passive ventilation by providing a variety of window opening options that allow controlled ventilation through smaller openings and purge ventilation through larger windows and/or doors.
GLA Energy Assessment Guidance – Cooling Hierarchy	Minimise the amount of heat entering the building, minimise heat generation, manage heat through exposed internal mass and high ceilings, adopt passive ventilation prior to mechanical ventilation and active cooling systems.
BREEAM	Hea 04 Thermal comfort. ▪ Thermal modelling carried out to appropriate standards. ▪ Projected climate change scenarios considered as part of the thermal model. ▪ The thermal modelling analysis has informed the temperature control strategy for the building and its users.
DEFRA Building regulations Part O: Overheating (2021 or latest version)	Reasonable provision must be made to residential properties to limit unwanted solar gains in summer and provide an adequate means to remove heat from the indoor environment.
BCO Guide to Specification 2019, to be read in conjunction with the Position Paper Guide to Specification Key Criteria Update – February 2023	<40 W/m2, averaged over the 4.5 m deep perimeter zone for each façade When averaged over the perimeter zones, the peak solar + fabric gain must not exceed 40 W/m2 ▪ The worst performing space must not exceed 50 W/m2 (BCO limit) ▪ The percentage of time a space spends above 40 W/m2 for any given space should not exceed 3% of occupied hours for example (07:00 – 19:00) for all days The methodology of testing should be in line with BREEAM Hea-04 thermal comfort looking at current and future weather files (DSY1, DSY2 and DSY3) – for both 2020 and 2050 as per CIBSE TM46 – current and new BCO are not providing any clarity around this at the moment.

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
CLIMATE RESILIENCE

Pests and Diseases

Document	Key Considerations
BREEAM	Health and Wellbeing -ventilation and air circulation - for reducing the spread of airborne diseases.
WELL	22 Pest Control – follow pest reduction and inspection measures
GiGL London Invasive Species Plan	List of species of concern in London with a LISI designation category assigned, and action plans
GLA London Urban Forest Plan (2020) and Forestry Commission London Urban Forest Resilience Project (2024)	Ensure tree planting within development and public realm contributes towards the objectives of the plan and considers the resilience of species selected and the urban forest.

Infrastructure Resilience

Document	Key Considerations
IEMA EIA Guide to Climate Change Resilience	A project's ability to adapt to climate change should: ▪ Consider the whole life of the project ▪ Have a win-win outcome that can provide economic, social and environmental benefits ▪ Favour flexible future options rather than being too prescriptive and specific ▪ Delay details that are subject to the greatest risk and uncertainty from climate change until more evidence is collected ▪ Follow a hierarchy: avoid, control then manage risk
BREEAM	Wst 05 Adaptation to climate change. Encourage consideration and implementation of measures to mitigate the impact of more extreme weather conditions arising from climate change over the lifespan of the building.

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

CLIMATE RESILIENCE

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APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
URBAN GREENING AND BIODIVERSITY

Green Infrastructure

Document	Key Considerations
Natural England - Green Infrastructure Framework	Provides a list of principles to develop stronger Green Infrastructure policy and delivery and a mapping database which bringing together data from over 40 individual environmental and socio-economic datasets
UKGBC Principles for Delivering Urban Nature Based Solutions	Key recommended interventions include SuDS, street trees, green roofs, green walls, urban parks & green space Quality of Nature Based Solutions is important – e.g. level of biodiversity enhancement, weighted against capacity for local economic uplift or contribution to operational efficiencies. Encourage developers to use existing frameworks for context-specific appraisal of multifunctional NBS quality in projects – assessment of climate resilience, wellbeing, water, wildlife. 'Building with Nature' standards and accreditation 'Wildlife Trust 'Biodiversity Benchmark'
UKGBC Practical how-to guide: Developing and implementing a green infrastructure strategy	A practical guide for the formulation of a Green Infrastructure strategy for projects
IGNITION Project	Use of nature-based solutions across the built environment. Key nature-based benefits include climate change mitigation and adaptation, resource use (circular economy), nature and biodiversity, health and wellbeing, and socio-economic impact. Developed a range of tools, evidence and resources to help better understand and implement nature-based solutions.
ILP Guidance Note 08/18 – Bats and artificial lighting in the UK	This document outlines the impacts of artificial lighting on bats and recommends mitigation for various scenarios within the built environment. The presence, or potential for, roosts, commuting habitat and foraging habitat should be determined and categorised on importance. Lighting on key habitats and features should be avoided and existing dark corridors protected. Mitigation methods to reduce lighting should be applied. These include dark buffers, illuminance limits, zonation, appropriate luminaire specifications, screening, sensitive site configuration, applying glazing treatments, creation of alternative valuable bat habitat on site, and dimming and part-night lighting. Compliance with illuminance limits and buffer is required to be demonstrated at the designing and pre-planning phase, baseline and post-completion light monitoring surveys, and post-construction/operational phase compliance-checking.

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
URBAN GREENING AND BIODIVERSITY

Green Infrastructure (continued)

Document	Key Considerations
CIEEM Guidelines for Preliminary Ecological Appraisal (GPEA)	Preliminary Ecological Appraisal and/or Ecological Impact Assessment (EcIA) where required including any protected species survey recommended in the PEA or required by the LPA. When assessing the impacts of a development on biodiversity it is essential to first examine the current status of biodiversity onsite and the surrounding areas. A desk study by an ecological consultant, which should include a background data search, is therefore the first step towards understanding whether a development can potentially have an adverse effect on biodiversity and can highlight the need for further site-based assessments.
Tree planting and species selection	Additional guidance to support tree planting and species selection are provided by BS5837:2012 Trees in relation to design, demolition and construction – Recommendations ▪ Arboricultural Tree Survey ▪ Arboricultural Impact Assessment ▪ Arboricultural Method Statement Planting pit design should be designed for the specific location and for resilience – large rooting area, gaseous exchange and water availability. Forest Research - Right Trees for Changing Climate Database: www.righttrees4cc.org.uk/ TDAG documentation: www.tdag.org.uk/our-guides.html

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
URBAN GREENING AND BIODIVERSITY

Urban Greening Factor

Document	Key Considerations
Urban Greening Factor for London, The Ecology Consultancy, 2017	London Plan Policy G5 requires all major developments to include urban greening as a fundamental element of site and building design. A UGF calculator has been prepared to help applicants calculate the UGF score of a scheme and present the relevant information as part of their application. Policy G5 recommends a target score of 0.4 for developments that are predominately residential, and a target score of 0.3 for predominately commercial development.
City of London Urban Greening Factor Study	A total of nine schemes were analysed using the GLA's UGF method. The study recommends to operate a UGF scheme in the City to promote green infrastructure and increase the quantity and quality of green infrastructure. Green roofs and green walls are encourages to be incorporated in taller buildings. The UGF study proposes a revised scoring system specific for the City of 0.3 UFH for all major developments, and to encourage certain categories, particularly tree planting, green roofs and green walls.
City of London Local Plan	Policy DM19.2 states that development should contribute to UGF by incorporating green roofs and walls, soft landscaping and trees. The planting should be resilient to a range of climate conditions and suitable for local conditions, pollution and wind effects. Additionally, good urban greening should be applied to replace any green infrastructure disturbed, removed or damaged as a result of a development.
City of London Biodiversity Action Plan 2021–2026	Section 3 (Local policy context) of the City of London Biodiversity Action Plan highlights the importance of urban greening as natural carbon sinks, and their contribution to biodiversity and overall wellbeing. Major development proposals will be required to include a UGF score of 0.3 as a minimum.

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
URBAN GREENING AND BIODIVERSITY

Biodiversity Net Gain

Document	Key Considerations
City of London Biodiversity Action Plan 2021-2026	The Biodiversity Action Plan provides a strategic focus to ensure species and habitats are understood and considered throughout the decision-making process. See Biodiversity Action Plan for further information on key local priorities.
Natural England Biodiversity Metric	Minimum of 10% Biodiversity Net Gain achieved throughout site as calculated via the Natural England Biodiversity Metric from November 2023 onwards. On sites with little or no biodiversity features, aim for a meaningful amount of biodiversity and not focus on the minimum.
RIBA Sustainable Outcomes Guide (5. Sustainable Land Use & Ecology)	Leave site in better 'regenerative' ecological condition than before development Carry out sustainable remediation of site pollution Retain existing natural features Create mixed use development with density appropriate to local context Create 'productive' landscapes for urban food production Zero local pollution from the development
Biodiversity Net Gain. Good practice principles for development.	Sets out the UK principles on good practice to achieve BNG. It includes a series of Technical Notes to support the document which includes, but not limited to, aligning BNG with BREEAM and Environmental Impact Assessments and achieving BNG on sites with limited or no impact on biodiversity.
Wildlife Trust - Building with Nature (BwN)	The 12 BwN Standards define "what good looks like" by offering a set of quality standards for placemaking and place-keeping, covering the themes of Wellbeing, Water and Wildlife. Accreditation is likely to be most applicable to larger sites incorporating areas of public realm. The BwN Standards support cross-disciplinary decision making about the master-planning and detailed design, implementation and construction, or management and maintenance of green infrastructure in development.
Wildlife Trust - Building with Nature (BwN)	Where possible make connections between wild spaces
UKGBC Innovation Insights – NBS to Climate Resilience	Recommends using digital tools such as NATURE Tool, ENVI-met, GREENPASS, GI-VAL, EcoservR, iTree Eco to assess optimal natural capital interventions at the project scale and their economic value

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
URBAN GREENING AND BIODIVERSITY

Biodiversity Net Gain (continued)

Document	Key Considerations
BREEAM Land Use and Ecology (LE01 – LE05)	The Land Use and Ecology category encourages sustainable land use, habitat protection and creation, and improvement of long term biodiversity for the building's site and surrounding land. The category has two routes. Route 2 is the Ecologist route, which comprises a more detailed assessment of the ecological approach. Biodiversity Net Gain is used as evidence to support LE03 (Managing impacts on ecology) and LE04 (Ecological change and enhancement).
Pollinating London Together - Valuing the importance of green spaces and suggested pollinator-friendly trees	There are pollinator friendly trees and shrubs which are suitable for urban London settings, including certain plants for transitional points between seasons that ensure a year round availability of pollinating plants.
London Biodiversity Partnership – Guide to Living Roofs	Designers should ensure that the existing waterproofing is sound and that the structure can support the load. To make the most of a living roof, designers should incorporate a range of microhabitats, use native seeds or plug plants, and ensure safety measures are in place.

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

URBAN GREENING AND BIODIVERSITY

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Appendix B:
LETI RETROFIT PROCESS

B

APPENDIX B LETI RETROFIT PROCESS

Retrofitting guidance

This section introduces the LETI's Climate Emergency Retrofit Guide which illustrates best industry practices to retrofit existing buildings and make them fit for the future while supporting UK's Net Zero targets.

LETI has set out best practice targets for retrofit, which can be easily achieved in the vast majority of buildings within the City. CoLC strongly encourages to follow this approach when retrofitting existing building within the City.

The diagrams on this page depict the LETI Retrofit Process which provide a simple, widely applicable framework to help guide building owners, developers, designers, and contractors through the stages of their retrofit project.

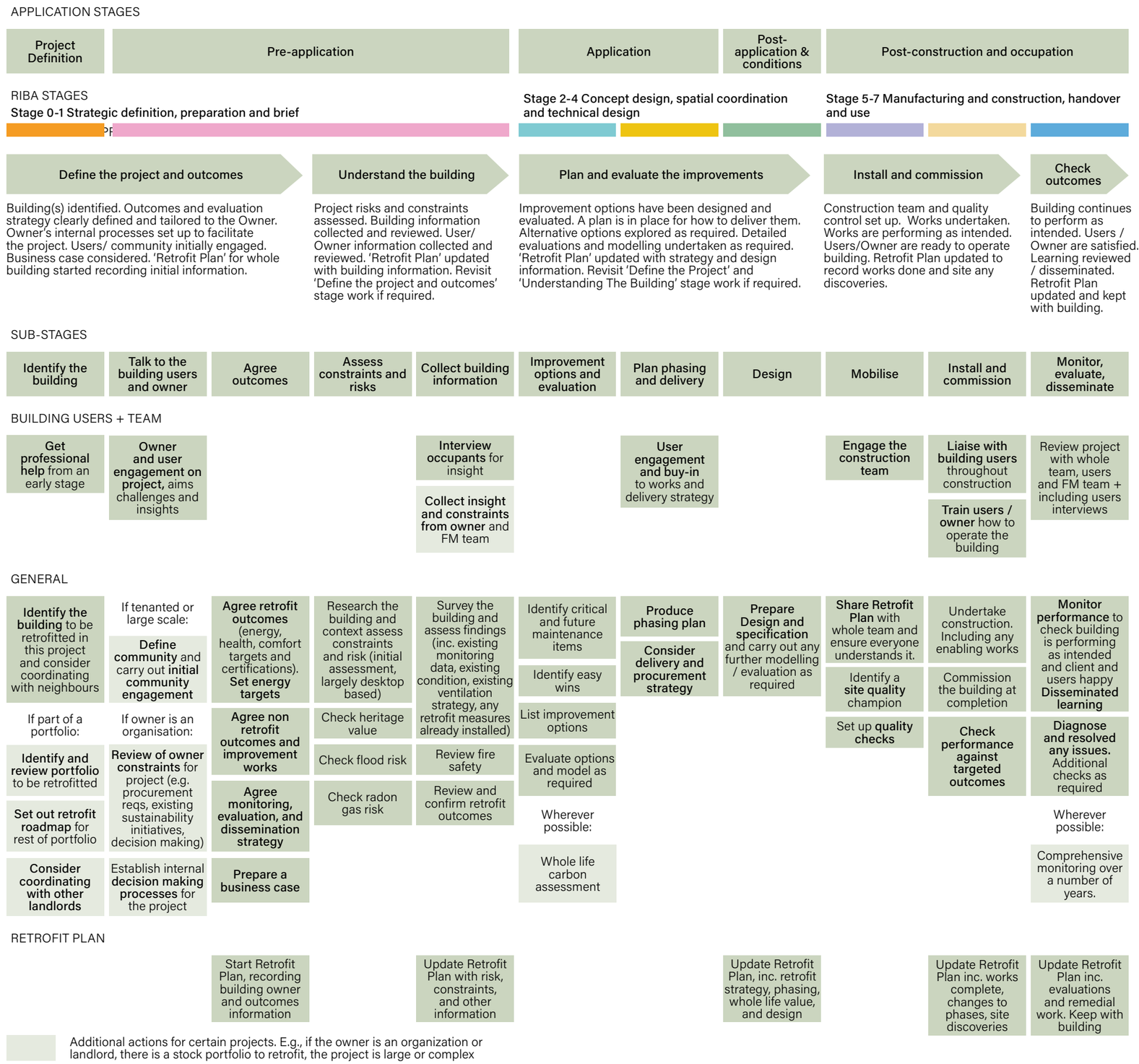

Figure B1 LETI Retrofit Process flowchart mapped onto RIBA work stages and CoLC planning application stages.
Source: adapted from LETI (2021) Climate Emergency Retrofit Guide.

Appendix C:
GLOSSARY

C

APPENDIX C GLOSSARY

A

Air Quality Neutral An Air Quality Neutral development is one that meets, or improves upon, the air quality neutral benchmarks published in guidance from the GLA. The benchmarks set out the maximum allowable emissions of NOx and Particulate Matter based on the size and use class of the proposed development. Separate benchmarks are set out for emissions arising from the development and from transport associated with the development. Air Quality Neutral applies only to the completed development and does not include impacts arising from construction, which should be separately assessed in the Air Quality Assessment.

Amenity Element of a location or neighbourhood that helps to make it attractive or enjoyable for residents and visitors.

B

Beneficial use (excavation waste) The placement of excavation waste to land in a way that provides environmental benefits, particularly through the restoration of priority habitat, flood alleviation or climate change adaptation/mitigation; or contributes towards the restoration of landfill sites and mineral workings while minimising adverse impacts to the environment or communities (for example transport, air quality and other considerations); and demonstrating that the waste cannot be recycled or treated and managed in a more sustainable way.

Biodiversity This refers to the variety of plants and animals and other living things in a particular area or region. It encompasses habitat diversity, species diversity and genetic diversity. Biodiversity has value in its own right and has social and economic value for human society.

Biodiversity offsets Measures to improve existing or create replacement habitat where there are unavoidable impacts on wildlife habitats resulting from development or change of land use.

Blue and water space Areas covered by water including the River Thames and other rivers, canals, reservoirs, lakes and ponds.

Blue roofs Attenuation tanks at roof or podium level.

C

Carbon dioxide (CO2) Principal greenhouse gas related to climate change.

Circular economy An economic model in which resources are kept in use at the highest level possible for as long as possible in order to maximise value and reduce waste, moving away from the traditional linear economic model of 'make, use, dispose'.

Circular economy in construction The London Plan 2021 defines a circular economy as 'one where materials are retained in use at their highest value for as long as possible and are then reused or recycled, leaving a minimum of residual waste.' It is a move away from the current linear economic model, where materials are mined, manufactured, used and discarded. The primary focus when applying circular economy principles in building design and construction should be on working with existing and avoiding new materials as far as possible to reduce waste, environmental impacts and excessive carbon emissions from manufacturing. Circular economy principles can also be applied to the life-cycle of the building by designing materials and structural elements to be adaptable and flexible (to extend a building's useful life) , an approach which must be carefully weighed up against additional carbon emissions it might produce.

Commercial waste Waste arising from premises which are used wholly or mainly for trade, business, sport, recreation or entertainment as defined in Schedule 4 of the Controlled Waste Regulations 1992.

Communal heating systems A communal heating system supplies heat to multiple properties from a common heat source. It may range from a district system heating many buildings to a system serving an individual block of flats.

Conservation (heritage) The process of maintaining and managing change to a heritage asset in a way that sustains and, where appropriate, enhances its significance.

Construction, demolition and excavation waste This is waste arising from the excavation, construction, repair, maintenance and demolition of buildings and structures, including roads. It consists mostly of brick, concrete, hardcore, subsoil and topsoil, but it can contain quantities of timber, metal, plastics and occasionally special (hazardous) waste materials.

D

Decentralised energy A range of definitions exists for decentralised energy. In the context of the London Plan, it refers to low- and zero-carbon power and/or heat generated and delivered within London. This includes microgeneration, such as photovoltaics on individual buildings, through to large-scale heat networks.

Design and access statement A statement that accompanies a planning application to explain the design principles and concepts that have informed the development and how access issues have been dealt with. The access element of the statement should demonstrate how the principles of inclusive design, including the specific needs of disabled people, have been integrated into the proposed development and how inclusion will be maintained and managed.

Designated heritage asset A World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area designated under the relevant legislation.

Development This refers to development in its widest sense, including buildings, and in streets, spaces and places. It also refers to both redevelopment, including refurbishment, as well as new development.

Development proposal This refers to development that requires planning permission.

Digital infrastructure Infrastructure, such as small cell antenna and ducts for cables, that supports fixed and mobile connectivity and therefore underpins smart technologies.

Display Energy Certificate Display Energy Certificates (DECs) are designed to show the energy performance of public buildings. They use a scale that runs from 'A' to 'G' – 'A' being the most efficient and 'G' being the least.

District Heating Network (DHN) A network of pipes carrying hot water or steam, usually underground, that connects heat production equipment with heat customers. They can range from several metres to several kilometres in length.

Drainage hierarchy Policy hierarchy helping to reduce the rate and volume of surface water run-off.

APPENDIX C GLOSSARY

E

Embodied carbon/energy/emissions The total life cycle carbon/energy/greenhouse gases used in the collection, manufacture, transportation, assembly, recycling and disposal of a given material or product.

Embodied ecological impacts are the effects on ecosystems when resources for the built environment are extracted or manufactured. They represent the changes imposed on our natural environment by international building supply chains associated with new construction projects. These impacts occur offsite, primarily due to raw material extraction.

Energy efficiency Making the best or most efficient use of energy in order to achieve a given output of goods or services, and of comfort and convenience.

Energy hierarchy The Mayor's tiered approach to reducing carbon dioxide emissions in the built environment. The first step is to reduce energy demand (be lean), the second step is to supply energy efficiently (be clean) and the third step is using renewable energy (be green).

Energy masterplanning Spatial and strategic planning that identifies and develops opportunities for decentralised energy and the associated technical, financial and legal considerations that provide the basis for project delivery.

Environmental assessments In these assessments, information about the environmental effects of a project is collected, assessed and taken into account in reaching a decision on whether the project should go ahead or not.

Environmental statement This statement will set out a developer's assessment of a project's likely environmental effects, submitted with the application for consent for the purposes of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999.

F

Flood risk management and sustainable drainage systems The term 'flood risk' refers to the probability of flooding within an area and the associated consequences. The likelihood is based on historical and forecast data. Flood Risk Management identifies how the risk of flooding can be reduced and managed sustainably.

Fuel cell A cell that acts like a constantly recharging battery, electrochemically combining hydrogen and oxygen to generate power. For hydrogen fuel cells, water and heat are the only by-products and there is no direct air pollution or noise emissions. They are suitable for a range of applications, including vehicles and buildings.

Future-proofing Ensuring that designs are adaptable and take account of expected future changes. For example, ensuring a heating system is designed to be compatible with a planned district heat network to allow connection in future.

G

Green corridors Stepping stones of open and green space through the built environment, which link to one another. They often consist of riverbanks, parks, church gardens, and areas of private gardens. They may create routes for biodiversity and connect habitats.

Green cover The total area covered by vegetation and water across London. It not only includes publicly accessible and publicly managed vegetated land (i.e. green space) and waterways, but also non-accessible green and blue spaces, as well as privately owned vegetated land including private gardens and agricultural land, and the area of vegetated cover on buildings and in the wider built environment such as green roofs, street trees and rain gardens.

Green infrastructure Comprises the network of parks, rivers, water spaces and green spaces, plus the green elements of the built environment, such as street trees, green roofs and sustainable drainage systems, all of which provide a wide range of benefits and services.

Green lease A lease agreement that incorporates clauses whereby the owner and the occupier undertake specific responsibilities/obligations to manage and improve the sustainable (and social) operation/occupation of a property, Examples include energy efficiency measures, waste reduction/management and water efficiency.

Green roofs/walls Planting on roofs or walls to provide climate change, amenity, food growing and recreational benefits.

Green space All vegetated open space of public value (whether publicly or privately owned), including parks, woodlands, nature reserves, gardens and sports fields, which offer opportunities for sport and recreation, wildlife conservation and other benefits such as storing flood water, and can provide an important visual amenity in the urban landscape.

Greenfield runoff rates The Greenfield runoff rate is the runoff rate from a site in its natural state, prior to any development. This should be calculated using one of the runoff estimation methods set out in Table 24.1 of CIRIA C753 The SuDS Manual.

Greenhouse gas Any gas that induces the greenhouse effect, trapping heat within the atmosphere that would normally be lost to space, resulting in an increase in average atmospheric temperatures, contributing to climate change. Examples include carbon dioxide, methane and nitrous oxides.

Greening The improvement of the appearance, function and wildlife value of the urban environment through use of vegetation or water.

Health Impact Assessment (HIA) Health Impact Assessment (HIA) is used as a systematic framework to identify the potential impacts of a development proposal, policy or plan on the health and wellbeing of the population and highlight any health inequalities that may arise. HIA should be undertaken as early as possible in the plan making or design process to identify opportunities for maximising potential health gains, minimising harm, and addressing health inequalities.

H

Health inequalities Health inequalities are systematic, avoidable and unfair differences in mental and/or physical health between groups of people. These differences affect how long people live in good health and are mostly a result of differences in people's homes, education and childhood experiences, their environments, their income, jobs and employment prospects, their access to good public services and their everyday opportunities to live healthier lives.

Heritage assets Valued components of the historic environment. They include buildings, monuments, sites, places, areas or landscapes positively identified as having a degree of historic significance meriting consideration in planning decisions. They include both designated heritage assets and non-designated assets where these have been identified by the local authority (including local listing) during the process of decision-making or plan making.

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Historic environment All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora.

Household waste This includes waste from collection rounds of domestic properties (including separate rounds for the collection of recyclables), street cleansing and litter collection, beach cleansing, bulky household waste collections, hazardous household waste collections, household clinical waste collections, garden waste collections, and any other household waste collected by the waste authorities.

I

Impermeable surface Mainly artificial structures (such as pavements, roads, driveways, parking areas and rooftops) that are covered by materials impenetrable to water (such as asphalt, concrete, brick and stone). Impermeable surfaces also collect solar heat in their dense mass. When the heat is released, it raises air temperatures (see 'Urban heat island').

Industrial waste Waste from any factory and any premises occupied by industry (excluding mines and quarries) as defined in Schedule 3 of the Controlled Waste Regulations 1992.

Infrastructure Includes transport, energy, water, waste, digital/ smart, social and green infrastructure.

Infrastructure resilience At a wider level, infrastructure resilience is defined as the ability for infrastructure such as utilities, transport, and digital networks to withstand the potential shocks or stresses that it my face during its design life including those that London will experience through the inevitable effects of climate change.

Innovation The creation of new products and services, technologies, processes, or business models.

M

Major development For a full definition, see Part 1 of The Town and Country Planning (Development Management Procedure) (England) Order 2015. Generally, major developments are: Development of dwellings where 10 or more dwellings are to be provided, or the site area is 0.5 hectares or more;Development of other uses, where the floor space is 1,000 square metres or more, or the site area is 1 hectare or more.

Municipal solid waste It includes all household waste, street litter, waste delivered to council recycling points, municipal parks and gardens wastes, council office waste, Civic Amenity waste, and some commercial waste from shops and smaller trading estates where local authorities have waste collection agreements in place. It can also include industrial waste collected by a waste collection authority with authorisation of the waste disposal authority. Waste under the control of local authorities or agents acting on their behalf is now better known as 'Local Authority Collected Waste'.

N

Nature conservation Protection, management and promotion for the benefit of wild species and habitats, as well as the human communities that use and enjoy them. This also covers the creation and re-creation of wildlife habitats and the techniques that protect genetic diversity and can be used to include geological conservation.

O

Open space All land in London that is predominantly undeveloped other than by buildings or structures that are ancillary to the open space use. The definition covers the broad range of types of open space within London, whether in public or private ownership and whether public access is unrestricted, limited or restricted.

Operational circular economy Operational circular economy is the application of circular economy principles to the operational period of a building's life-cycle. This means anticipating future occupant needs such avoidance of waste generation and designing for flexibility to allow for asset sharing to maximise use and considering requirement for materials for maintenance and repair during the life of the building.

Operational emissions & energy Operational emissions are generated from the operation of a development once it has been constructed. This includes both the emissions of electricity from the National Grid as well as emissions generated onsite via gas-burning boilers and other emitting processes. Operational emissions are largely a result of energy consumption. There will be increasing demand for electric power as fossil fuels are phased out in favour of electric heating, vehicles and other technologies. Proposals need to consider how to transition from reliance on fossil-fuel to electric and low-carbon alternatives.

P

Pests & diseases In an Urban context, pests can include non-native and established wildlife and invasive plants which can affect the health of people and other flora and fauna. Diseases can include human and plant infections that can be transmitted through zoonotic, airborne, waterborne and contact based transmission.

Photovoltaics (PV) The direct conversion of solar radiation into electricity by the interaction of light with electrons in a semiconductor device or cell.

Pre-redevelopment Audit A detailed assessment conducted before the redevelopment of a site containing existing buildings. The audit evaluates whether current structures and materials can be retained, refurbished, or incorporated into the new development. The goal is to maximize the reuse of materials, reduce waste, and lower the project's environmental impact. Guidance on audits for developments in the City can be found on pages 35-36.

Pre-deconstruction Audit (Pre-demolition Audit/Pre-refurbishment Audit) is a detailed quantitative and qualitative data inventory of existing materials on site to identify potential for reclamation, reuse or recycling. The City Corporation has adopted the term Pre-deconstruction Audit in place of Pre-demolition Audit to drive recovery and reuse. Guidance on audits for developments in the City can be found on page 37.

Priority habitat London's priority habitats are those areas of wildlife habitat which are of most importance in London. Most areas of priority habitat are protected within Sites of importance for Nature Conservation.

Priority species These are species that are a conservation priority because they are under particular threat, or they are characteristic of a particular region.

Protected species Certain plant and animal species protected to various degrees in law, particularly the Wildlife and Countryside Act, 1981 (as amended).

Public realm Publicly accessible space between and around buildings, including streets, squares, forecourts, parks and open spaces.

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R

Recovery Refers to "forms of recovery other than energy recovery and other than the reprocessing of waste into materials used as fuels or other means to generate energy. It includes preparing for re-use, recycling and backfilling and other forms of material recovery such as the reprocessing of waste into secondary raw materials for engineering purposes in construction of roads or other infrastructure. Depending on the specific factual circumstances, such reprocessing can fulfil the definition of recycling if the use of materials is based on proper quality control and meets all relevant standards, norms, specifications and environmental and health protection requirements for the specific use" – EU Directive 2018/851.

Recycling Involves the reprocessing of waste, either into the same product or a different one. Many non-hazardous wastes such as paper, glass, cardboard, plastics and metals can be recycled. Hazardous wastes such as solvents can also be recycled by specialist companies, or by in-house equipment.

Renewable energy Energy derived from a source that is continually replenished, such as wind, wave, solar, hydroelectric and energy from plant material, but not fossil fuels or nuclear energy. Although not strictly renewable, geothermal energy is generally included.

Retrofit The upgrading of a building in relation to the installation of new building systems or building fabric to improve efficiency, reduce environmental impacts and/or adapt for climate change. A range of interventions may be deployed, from 'light retrofit' to 'deep retrofit'. The City Corporation considers that a retrofit should retain and reuse at least 50% of the existing building(s)' superstructure (by mass).

Re-use The operation or process of checking, cleaning or repairing materials that have been discarded and are waste so that they can be used again for their original purpose as non-waste without any other pre-processing. Adapted from Environment Agency, Guidance – Decide if a material is waste or not: general guide, May 2016.

S

Secondary heat To recover useful energy, in the form of heat, from sources where processes or activities produce heat which is normally wasted (for example recovering heat from the Underground network) or from heat that exists naturally within the environment (air, ground and water).

Secondary materials (waste) Waste materials that can be used in reuse, recycling and re-manufacturing processes instead of or alongside virgin raw materials. This can include waste materials from demolition and excavation, or discarded items such as furniture and electrical products.

Self-sufficiency In relation to waste, this means dealing with wastes within the administrative region where they are produced.

Significance (heritage) The value of a heritage asset to this and future generations because of its heritage interest. The interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting. For World Heritage Sites, the cultural value described within each site's Statement of Outstanding Universal Value forms part of its significance.

Site of Importance for Nature Conservation (SINC) Areas of land chosen to represent the best wildlife habitats in London and areas of land where people can experience nature close to where they live and work. Sites are classified into Sites of Metropolitan, Borough and Local Importance depending on their relative value. Unlike SSSIs, SINCs are not legally protected, but their value must be considered in any land use planning decision. Procedures for the identification of SINCs are set out in Appendix 5 of the Mayor's London Environment Strategy.

Special Areas of Conservation Designated under the EC Habitats Directive (1992), areas identified as best representing the range and variety within the EU of habitats and (non-bird) species.

Special Protection Areas Designated under the EC Birds Directive (1979), areas of the most important habitat for rare and migratory birds within the EU.

Strategic developments (applications referable to the Mayor) The planning applications that must be referred to the Mayor under the Town and Country Planning (Mayor of London) Order 2008 and any amendments thereto.

Sustainability Appraisal A process of considering ways by which a Development Plan can contribute to improvements in environmental, social and economic conditions, as well as a means of identifying and mitigating any potential adverse effects that the plan might otherwise have. Sustainability Appraisal is required by the Planning and Compulsory Purchase Act 2004.

Sustainable drainage systems Using sustainable drainage techniques and managing surface water run-off from buildings and hardstandings in a way that reduces the total volume, flow and rate of surface water that runs directly into drains and sewers.

T

Thames Policy Area A special policy area to be defined by boroughs in which detailed appraisals of the riverside will be required. A land-use planning tool to help determine the amount of greening required in new developments.

U

Urban greening Urban greening describes the act of adding green infrastructure elements Due to the morphology and density of the built environment in London, green roofs, street trees, and additional vegetation are the most appropriate elements of green infrastructure in the city.

Urban heat island The height of buildings and their arrangement means that while more heat is absorbed during the day, it takes longer to escape at night. As a result, the centre of London can be up to 10°C warmer than the rural areas around the city. The temperature difference is usually larger at night than during the day. The Urban Heat Island effect is noticeable during both the summer and winter months.

W

Water resource management Water resources are the various types of water which are used or pass through a development. This can include a potable supply from utilities systems, rainwater and other greywater sources, as well as recycled water from within the development.Water resource management identifies how to effectively manage and optimise the use of the available resources.

Whole life-cycle carbon Whole life-cycle carbon emissions are the total greenhouse gas emissions arising from a development over its lifetime, from the emissions associated with raw material extraction, the manufacture and transport of building materials, to installation/construction, operation, maintenance and eventual material disposal.

Appendix C:
CASE STUDY INVENTORY

APPENDIX D CASE STUDY INVENTORY

Case Study	Topic	Description of works	Use Type	Application number
One Exchange Square	Retrofit and reuse	Retrofit and extension	Office and retail	21/00930/FULMAJ
Museum of London (including Grade II Listed Poultry Market)	Retrofit and reuse	Refurbishment, retrofit and extension	Museum and ancillary uses including office and retail	19/01343/FULEIA
Chancery House	Retrofit and reuse	Retrofit and extension	Office	20/00845/FULL (main extension) Other associated applications: 20/00837/FULL 20/00909/FULL 20/00910/FULL
55 Gracechurch Street	Greenhouse gas emissions and energy use	New build	Office and mixed-use	20/00671/FULEIA
65 Crutched Friars	Greenhouse gas emissions and energy use	New build	Student accommodation and museum	22/00882/FULMAJ
Ibex House (Grade II listed)	Greenhouse gas emissions and energy use	Refurbishment and extension	Office, retail and cultural space	21/00793/FULMAJ
115-123 Houndsditch	Greenhouse gas emissions and energy use	New build	Office, retail, community space	21/00622/FULEIA
2-3 Finsbury Avenue	Greenhouse gas emissions and energy use	New Build	Commercial office with mixd-use including an Open Learning Hub	20/00869/FULEIA
London Wall West	Greenhouse gas emissions and energy use	New build	Office and cultural space	23/01304/FULEIA
100 Fetter Lane	Circular economy, Climate resilience	New build	Office and retail	21/00454/FULMAJ
1 Appold Street	Circular economy	Retrofit and extension	Office and retail	22/01200/FULMAJ
City Place House, 55 Basinghall Street	Circular economy	New build	Office and retail	21/00116/FULMAJ
Fleet House, 8-12 New Bridge Street	Circular economy	Retrofit and extension	Office and retail including public house	22/00622/FULMAJ
St Magnus House	Circular economy	Retrofit and extension	Office and retail	23/01078/FULL
75 London Wall	Circular economy	Retrofit and extension	Office and retail	23/01270/FULMAJ
1 Broadgate	Circular economy	New build	Office and retail	18/01065/FULEIA
55 Old Broad Street	Circular economy	New build	Office and retail	23/00469/FULEIA
47-50 Mark Lane	Circular economy	New build	Office, retail, and cultural learning centre	22/01245/FULMAJ
1 Golden Lane (Grade II Listed)	Circular economy	Retrofit and extension	Office with ground floor community space	22/00202/FULMAJ
Salisbury Square	Circular economy	New build	Courts, police station, retail, and office	20/00997/FULEIA
Seal House	Climate resilience	New build	Office and retail	18/01178/FULMAJ
20 Giltspur Street	Climate resilience	Retrofit and extension	Office and retail	22/00867/FULMAJ
100 Liverpool Street	Climate resilience	Retrofit and extension	Office, retail, and leisure	14/01285/FULEIA
Emperor House, 35 Vine Street	Climate resilience	Public realm planting	Public realm planting	18/00193/FULMAJ 21/00021/MDC - Submission of details of hard and soft landscaping
London Wall Place	Climate resilience	New build	Office and retail	10/00832/FULEIA
65 Gresham Street	Climate resilience	Refurbishment and extension	Mixed-use office	23/00752/FULMAJ

APPENDIX D CASE STUDY INVENTORY

Case Study	Topic	Description of works	Use Type	Application number
New Change Garden	Climate resilience/urban greening and biodiversity	Public space	Relandscaped public garden	
55 Bishopsgate	Urban greening and biodiversity	New build (green wall)	Office, retail, and cultural and community space including public viewing gallery	14/00300/FULMAJ
81 Newgate Street	Urban greening and biodiversity	Retrofit and extension	Office and retail	23/00752/FULMAJ
21 Lombard Street	Urban greening and biodiversity	Retrofit and extension (historic building)	Office and retail	24/00126/FULMAJ
40 Holborn Viaduct	Urban greening and biodiversity	Retrofit and extension	Office and retail	23/00867/FULMAJ
120 Fleet Street	Urban greening and biodiversity	New build (includes alterations to existing Grade II* listed Daily Express building)	Office, retail, cultural and flexible learning space	21/00538/FULEIA
Creed Court Hotel, 3-5 Ludgate Hill	Urban greening and biodiversity	New Build (retained facade)	Hotel and retail	14/00300/FULMAJ

Planning for Sustainability

This Supplementary Planning Document was written by City of London Corporation Planning Officers in collaboration with Buro Happold.

CITY OF LONDON