City of London Corporation

Planning for Sustainability

Supplementary Planning Document | November 2023

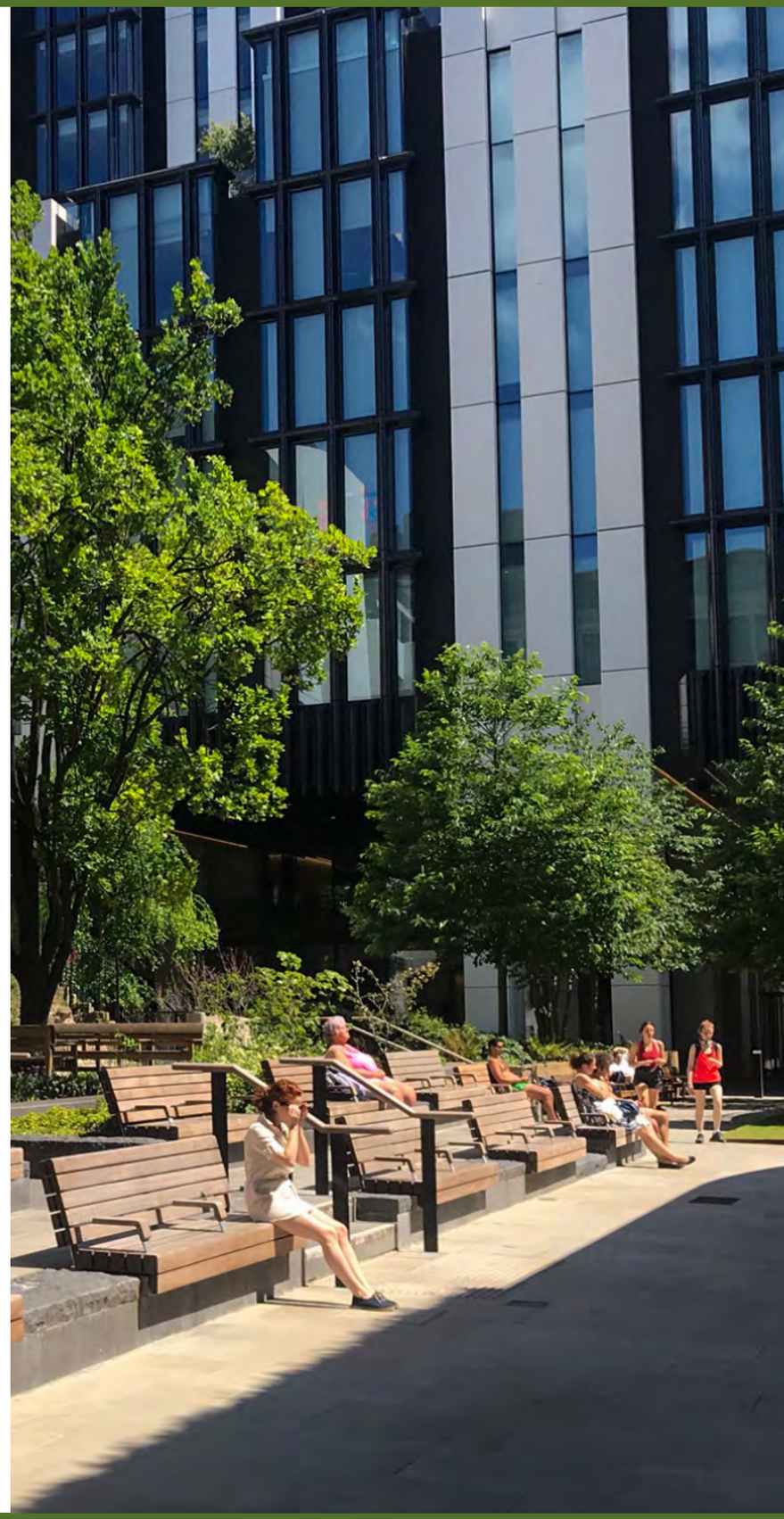
BURO HAPPOLD

CITY OF LONDON

PLANNING FOR SUSTAINABILITY

ABBREVIATIONS

Abbreviation	Definition
AEP	Annual Exceedance Probability
ASHP	Air Source Heat Pump
BGI	(urban) Blue-Green Infrastructure
BNG	Biodiversity Net Gain
BREEAM	Building Research Establishment Environmental Assessment Method
CCAS	Clean City Awards Scheme
CE	Circular Economy
CFD	Computational Fluid Dynamics
CIBSE	Chartered Institution of Building Services Engineers
CIL	Community Infrastructure Levy
CoLC	City of London Corporation
DEFRA	Department for Environment Food and Rural Affairs
DSY	Design Summer Year
EA	Environmental Agency
EAF	Electric arc furnace
ERIC	Eliminate, Reduce, Isolate, Control
GGBS	Ground Granulated Blast-furnace Slag
GHG	Greenhouse Gas
GLA	Greater London Authority
GWP	Global Warming Potential
HVAC	Heating, ventilation, and air conditioning
LAEP	Local Area Energy Plan
LETI	Low Energy Transformation Initiative
LFRMS	Local Flood Risk Management Strategy
LISI	London Invasive Species Initiative
LLC	Life cycle costing
LLFA	Lead Local Flood Authority
MEP	Mechanical, electrical and plumbing
NABERS UK	National Australian Built Environment Rating System (UK version)
NPPF	National Planning Policy Framework
PAN	Planning Advice Note
PV	Photovoltaic
SINCs	Sites of Importance for Nature Conservation(s)
SPD	Supplementary Planning Document
SuDS	Sustainable Drainage Systems
TSE	Treated Sewage Effluent
UGF	Urban Greening Factor
UKBGC	UK Building Green Council
UTCI	Universal Thermal Climate Index
WLC	Whole Life Carbon
WLCA	Whole Life-cycle Carbon Assessment



INTRODUCTION TO THIS DOCUMENT

01

1. INTRODUCTION TO THIS DOCUMENT

City of London context

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 which presents challenges and opportunities to ensure that new development delivers right amount of development in the right places.

The future growth of the City needs to take place in a sustainable and inclusive way, incorporating the principles of Good Growth set out in the London Plan. 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 new Local Plan, called City Plan 2040, sets out the City of London Corporation's 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.

In the context of widespread climate action, the CoLC has adopted an ambitious Climate Action Strategy 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 aim to support, contribute to, and enhance the quality and sustainability of the environment throughout their life-cycle, including demolition, 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.

Source: City of London Corporation

1. INTRODUCTION TO THIS DOCUMENT

The aim of this SPD

The purpose of this Supplementary Planning Document (SPD) is to provide guidance on how applicants should approach 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 current Local Plan, as well as emerging policies. Specifically, this SPD:

- Sets out the key approaches that the City of London Corporation (CoLC) is targeting on different sustainability themes and outlines key actions to be taken into consideration to develop an exemplar scheme
- Identifies a list of key actions to be considered throughout the design process and provides details specific to the City of London for each sustainability theme
- 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 life-cycle of the development, from the pre-application process to post-completion
- Provides a collation of relevant recommended standards, certifications and guidelines.

Applicant teams should work through all topics to reach an optimal package of design bespoke 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 what planning officers expect to see addressed through the design and an indication of what the CoLC is looking for in applications.

This SPD is for the use of applicant teams, CoLC officers and decision makers. The content of this document applies to all development proposals that include building and landscape work. Measures highlighted here are applicable to all major and minor developments to include new buildings, refurbishment or retrofitting of existing buildings, extension and alterations, works to open spaces and landscaped areas on sites, and relate to all types of land uses.

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.

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

1. INTRODUCTION TO THIS DOCUMENT

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 SuDS supporting biodiversity), as well as trade-offs between different sustainability issues. For example, high performing thermal insulation materials improve energy efficiency, however, they contribute to the embodied carbon intensity of a building.

The CoLC 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 must 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 and how to use the information contained.

Chapter 2 – CLIMATE CHANGE MITIGATION AND ADAPTATION

Explains the current policy context and provides an overview of the current strategies adopted by CoLC 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 CoLC'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 - 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 a typical development related to water resource management.

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

Pests & Diseases - defines the risks associated with animals, insects, weeds in an urban context and provides guidance for a typical development in the City.

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

Chapter 7 - BIODIVERSITY

Urban greening - provides guidance on how to connect green spaces and increase biodiversity and amenity value of urban greening in the City. It includes suggestions for interventions that can be used in different areas of a typical development.

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

Biodiversity Net Gain - advice on how to meet and exceed policy targets in a typical development in the City

Chapter 8 – KEY CONSIDERATIONS AND SUBMISSION REQUIREMENTS

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

APPENDICES

A list of recommended standards, certifications, guidelines and further guidance to take into consideration.

CLIMATE CHANGE MITIGATION AND ADAPTATION

02

2. CLIMATE CHANGE MITIGATION AND ADAPTATION

Introduction

Transforming the built environment is fundamental to combating the climate crisis and achieving sustainable development. In 2020, 67% of London's direct carbon emissions were attributable to buildings[1]. This figure does not account for indirect 'embodied' emissions. Embodied carbon makes up 15% of the total direct and indirect emissions in buildings. In the Square Mile, commercial buildings are responsible for the majority of emissions.

National policies

The **National Planning Policy Framework** (NPPF) sets 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 a low carbon future in a changing climate, taking full account of flood risk and coastal change".

The NPPF indicates that local authorities should plan for new development in ways which reduce greenhouse gas emissions consistently with the targets set out in the Climate Change Act 2008 policy and reflect nationally described standards.

Under the Environment Act 2021, all planning permissions granted in England (with a few exemptions) will have to deliver at least 10% biodiversity net gain (BNG) from November 2023. BNG will be measured using DEFRA's biodiversity metric and habitats will need to be secured for at least 30 years from the completion of the development. Secondary legislation from DEFRA will set out the detailed implementation requirements.

Local policies and key guidance

The London Plan (2021) and associated guidance published by the Greater London Authority (GLA) will be used alongside CoLC's policies when determining planning applications. This SPD has been produced in conformity with the policies in the London Plan and these 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 current London Plan is committed to ensuring the capital leads the way in tackling 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 Plan also introduces circular economy principles, with a focus on reducing waste, material re-use and recycling throughout the whole life-cycle of a development. It also requires developments to achieve an urban greening factor score and for major schemes to demonstrate that they are 'Air Quality Neutral' developments. On the public realm side, the Plan also introduces and promotes the Mayor's 'healthy streets' agenda, with a focus on walking and cycling, freight consolidation and green infrastructure.

The **City of London 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 the policies which guide planning decisions within the City. The Plan is currently under review and will be replaced by the new City Plan once it is be adopted in 2025.

The emerging Local Plan, called City Plan 2040 (previously City Plan 2036), is a plan for the future development of the City, setting out what type of development CoLC expects to take place and where. It sets out CoLC's vision, strategy and objectives for planning up to 2040, together with policies that will guide future decisions on planning applications. Climate change mitigation and adaptation are key priorities and threaded throughout the Plan across many policies.

Source: City of London Corporation

1 London Energy and Greenhouse Gas Inventory (LEGGI).

2. CLIMATE CHANGE MITIGATION AND ADAPTATION

Connectivity and the City of London Transport Strategy

The City of London is very well-connected, via sustainable transport modes, with the surrounding London boroughs and the wider regional context having the highest possible Public Transport Accessibility (PTAL) rating 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 the 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 of London Transport Strategy addresses the challenges and opportunities presented by a growing and evolving City. It provides the framework for continuously improving connectivity between places and accessibility of its public realm. Accessibility to individual buildings and public facilities as part of private developments is subject to detailed negotiations with applicants, in particular to:

- Improve quality and permeability of the City's streets and spaces in ways that enhance inclusion and accessibility, and enable more people to choose to walk, wheel and cycle in the City as part of the Healthy Streets Approach that provides the framework for the City of London's Transport Strategy
- Create new pedestrian routes through buildings and development sites, where feasible, and respecting, maintaining and restoring, the City's characteristic network of accessible buildings, streets, courts and alleyways
- 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
- Reduce detrimental impacts, such as severance of amenity spaces and pedestrian routes, through servicing access to buildings, by incorporating flexible and innovative servicing solutions for the design of the public realm

Applicants in the City of London will be required to provide design solutions for improving connectivity and accessibility, thus ensuring the environmental sustainability of the City. In particular, the increasing use of sustainable transport modes by occupiers and visitors will support the transition to net zero carbon.

The topic chapters include recommendations about sustainable design considerations for the public realm, private open spaces and buildings.

Climate Action Strategy 2020-2027

The CoLC has long been a champion of clean air, open space provision, sustainability and, more recently, green finance, recognising that a healthy environment is critical to business and personal well-being.

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

- Achieve net zero carbon emissions from our own operations by 2027
- Achieve net zero carbon emissions across our 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 of London 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 Strategy and the actions outlined in the document will help enable the Square Mile achieve net zero carbon by 2040, tackle climate change, and create opportunities while transitioning to a low-carbon economy.

The CoLC is also enacting a variety of measures to mitigate the impacts of climate change on the Square Mile and to ensure that the City's public spaces and infrastructure are resilient to the effects of climate change. 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 in the City.
- As the local planning authority, the Corporation has adopted a Planning Advice Note on Carbon Options Guidance which seeks to reduce the operational and embodied carbon emissions of schemes in the City
- An Embodied Carbon Action Plan to reduce the built environment's embodied carbon in the Square Mile
- The Skills for a Sustainable Skyline Taskforce established by the Corporation has 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 CoLC's buildings

2. CLIMATE CHANGE MITIGATION AND ADAPTATION

The CoLC 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. This document provides an expanded range of guidance.

Local Area Energy Plan 2023

CoLC's 2023 Local Area Energy Plan sets out the details of what the future energy system could look like in the Square Mile with a view to achieving Net Zero across the Square Mile and CoLC's operations by 2040. It combines robust technical analysis with stakeholder engagement to develop priority action areas.

The Plan sets out actions that need to be taken by key actors in the City, including CoLC 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.

Festival Gardens © Clive Totman, 2023

RETROFIT AND REUSE

03

3. RETROFIT AND REUSE

Introduction

While changes in technology, policy and culture are increasing the number of energy-efficient new buildings, it is critical that the large existing urban building stock is retrofitted in order to meet the UK's net zero carbon targets.

Demolition and new build can be very impactful on the environment, due to the embodied carbon associated with the extraction, transportation, and production of new materials, energy required for the construction work itself and from unrecycled building waste materials. There are also noise, and air quality impacts of construction sites to be considered.

Retrofitting existing buildings is a principal way of reducing the carbon emissions of the construction industry and in the City. Different levels of retrofit can help strike the right balance between a low-carbon project and one that works for final users.

The opportunity to retain and retrofit existing buildings, which follows circular economy principles, must be fully explored and prioritised before a project team considers demolition of any kind. This decision must be explored at the earliest possible stage, ideally brief development stage, to achieve the maximum impact.

CoLC requires the consideration of retrofit as a key means of improving the sustainability of existing buildings, reducing carbon emissions from development and maintaining or introducing a vibrant mix of building types and uses within them, to contribute to future-proofing the City and transitioning to a net zero carbon City by 2040. A retrofit scheme is likely to result in a more sustainable development than new-build when considering the whole-life impact on the environment. This approach is supported by City Plan Strategic Policy S8 which requires applicants to take a "retrofit-first" approach, prioritising the retention and retrofit of existing buildings, informed by an appraisal of the development options

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, creating an architecturally innovative environment, and contributing towards making the City a leading leisure and culture destination. The CoLC will welcome applications that set strong precedents in this regard and that promote new ways of thinking about repurposing buildings as the most effective way to drive down carbon intensity of development 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. CoLC is strongly supporting shifting the creative focus of architects, engineers and designers to the transformation of existing buildings into sustainable, characterful and interesting architecture.

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 retrofitting 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 improving climate resilience, enhancing health and well-being of the occupants, contributing to biodiversity and urban greening and saving water resources.

Further retrofitting guidance including institutional guidance based on best practice as set out by LETI are provided in Appendix A and B.

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

CS12: Historic Environment

- DM12.1: Managing change affecting all heritage assets and spaces

CS15: Sustainable Development and Climate Change

CS17: Waste

- DM17.2: Designing out construction waste

Draft City Plan 2040

S8: Design

- DE1: Sustainable Design

S11: Historic Environment

- HE1: Managing Change to Historic Environment

Additional Guidance

Carbon Options Guidance Planning Advice Note

Key actions to develop an exemplar City scheme

- Adopt a retrofit first approach that is informed by a carbon optioneering assessment (see Carbon Options Guidance Planning Advice Note)
- Consider the optimal use of an existing building that would enable a retrofit approach while supporting strategic land use policies
- 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
- Ensure that retrofit schemes achieve the highest possible level of energy efficiency, climate resilience, health and well-being, and occupier amenity
- Assess the opportunities of the local context and sustainability aspirations for a site to develop the best practice circular economy and low carbon strategy
- Seek specialist heritage expertise for historic buildings to identify sensitive solutions for retrofit

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 the design approach set out in the GLA's Circular Economy Statement Guidance 2022. Ideally, this process occurs at the project definition stage and includes:

1. Undertaking a pre-redevelopment audit to understand the state of repair of existing structures, buildings, infrastructure and public realm on site, and how feasible it is to retain these (see GLA guidance for audit requirements)
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 plans, heritage matters, and sustainability drivers for the whole area (e.g., local plans and community consultations)
    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. Major applications and schemes where demolition of the majority of the existing building structure is proposed must prepare a pre-redevelopment audit that will assess retention and development scenarios in accordance with the Carbon Options Guidance. The number of options are discussed as part of the pre-application stage and include a refurbishment baseline in addition to at least one deep retrofit option (with or without extension, as applicable) and a substantial demolition option where applicable. The options must be evaluated according to whole life-cycle carbon, circular economy and other relevant sustainability criteria.
4. The options assessment and evolving circular economy strategy must be based on a pre-demolition audit to identify salvageable materials for reuse and recycling. This could be developed in the form of a "reuse catalogue" with more in-depth considerations about how materials can be reused at their highest values. This should be supplemented with salvage/demolition drawings from the architects and deconstruction drawings from structural engineers. Materials brokers to claim the salvaged materials, and a storage strategy also need to be identified.

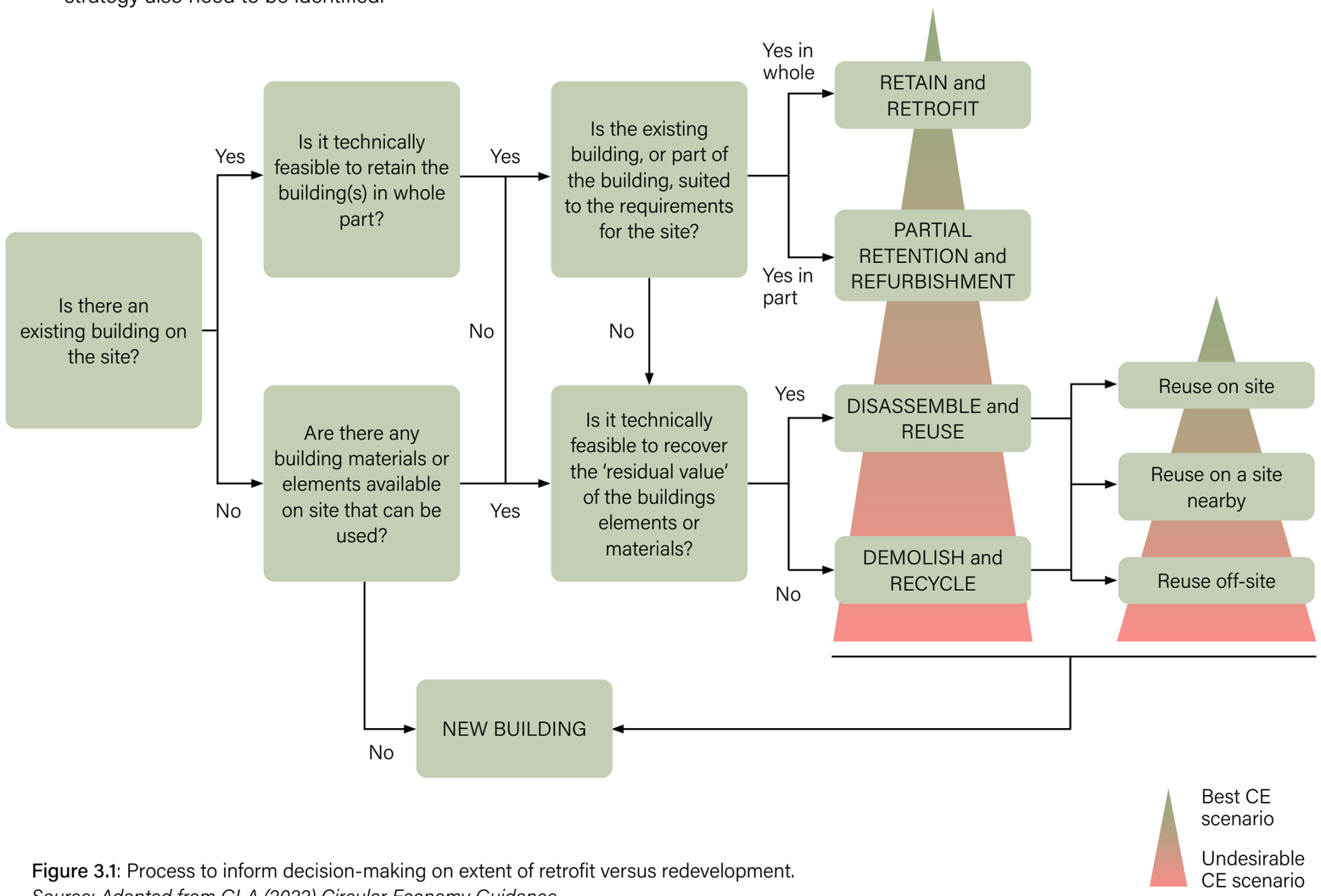


Figure 3.1: Process to inform decision-making on extent of retrofit versus redevelopment.
Source: Adapted from GLA (2022) Circular Economy Guidance.

3. RETROFIT AND REUSE

Types of retrofit

This section defines the different approaches to retrofitting relevant to the City. A range of retrofit interventions may be deployed, typically grouped as 'light', 'deep' and 'retrofit with new-build'. Definitions have been adapted from UKGBC Guidance Delivering Net Zero: Key Considerations for Commercial Retrofit.

Typical interventions required to redevelop a building to meet contemporary market needs include; enlarging cores and lifts, adequate floor-to-ceiling heights, installing amenity terraces, new plant rooms and greening. These alterations can impact the feasibility of retention and thus the type of retrofit pursued.

Light retrofit

Light retrofit involves energy performance optimisation through basic fabric improvements, replacement or adaptation of existing building elements and typically focusses on individual building components. Light retrofit is usually minimally invasive and is 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.

Typical interventions include: 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

Deep retrofit might involve a collection of light retrofit measures and works of a more significant size or scale that result in a fundamental change to the building structure or services, while aiming to retain the existing structure and substructure. The structure of a tall building is usually the most carbon-intensive element and should be retained wherever possible. Although involving greater disruption to building occupants than light retrofit, long term resource efficiency gains of deep retrofit are significant while the approach is also likely to result in less embodied carbon emissions than a new build alternative.

Typical interventions include: adapting the structure to facilitate alterations such as to cores or basements to include end of trip facilities, changes to the building envelope including glazing and openings, façade and roof elements, central MEP upgrades including creating new locations for plant, consolidation of roof areas to include amenity terraces, urban greening and biodiversity.

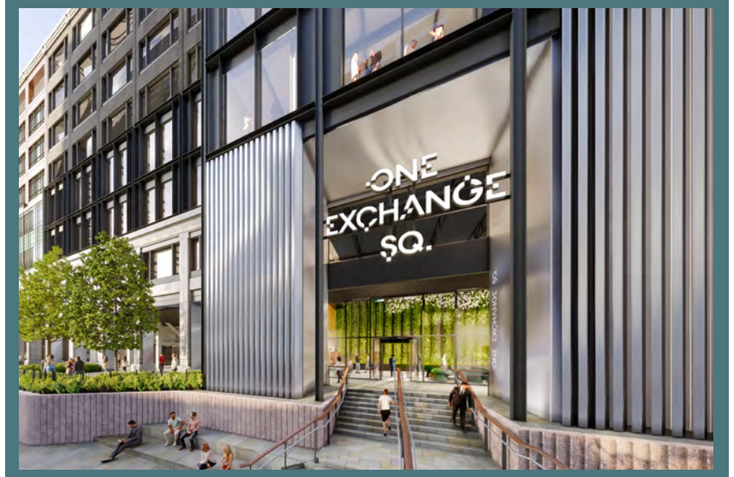
Retrofit with new-build

Retrofit projects may also consider a combined approach with both deep retrofit and new-build elements. In this case, works go beyond extensive refurbishment of existing structures. This combined approach is typically taken where additional floor space is needed 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.

A combined retrofit with new-build approach 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.

Typical 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 including façade and roof elements, central MEP upgrades including creating new locations for plant, creation of terraces with amenities, urban greening, biodiversity and climate resilience measures.

Case Study: One Exchange Square
Major refurbishment and extension



Visual of the proposed main entrance.
Source: Planning Application: DAS, CE Statement

Use: Commercial Office

Key facts:

- 90% retention of existing structure including foundations (no additional substructure)
- 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
- Natural ventilation incorporated as part of mixed mode ventilation system
- 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 targeted to meet and exceed the GLA Aspirational Benchmark
- Incorporation of extensive landscaping on roofs and on the ground to include wildlife habitats and blue roof

3. RETROFIT AND REUSE

Retrofit in historic buildings

The City is home to many 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, CoLC recognises that the Planning (Listed Buildings and Conservation Areas) Act will need to be considered in relation to some improvements to building fabric and thermal performance in particular. Work should not harm the special architectural or historic interest of a building or increase the risk of long-term deterioration to the fabric or fittings.

In many instances, it is possible to make energy efficiency improvements without detriment to the heritage value of a historic building with the support of expert advice. In fact, it may even be possible to enhance heritage value through simultaneous refurbishment, repair or cleaning of historic materials during retrofitting.

In collaboration with Purcell, CoLC has developed 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.

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 of 9 defined steps for undertaking a successful retrofit project in the Square Mile:

1. *Start from a position of knowledge*
2. *Identify the risks*
3. *Evaluate the opportunities:*
4. *Develop a Retrofit Plan*
5. *Build a business case*
6. *Detail design and specification*
7. *Seek relevant approvals*
8. *Installation and work on site*
9. *Testing, evaluation, and feedback*

The toolkit will be accessible at this website:

https://www.cityoflondon.gov.uk/services/environmental-health/climate-action/climate-action-projects/supporting-the-square-mile-achieve-net-zero

Case Study: Museum of London:
Major refurbishment of and alterations to four former Smithfield Market buildings (including Grade II listed Poultry Market)

View from Charterhouse Street. *Source: Design and Access Statement*

Use: Museum and ancillary uses including offices and retail

Key facts:

- High proportion of retention of substructure, superstructure, façades and roof (varies between buildings)
- Incorporating upgrades to windows, roofs and walls
- High level of reuse of salvaged historic deconstruction material
- Incorporating natural ventilation and utilising thermal mass to maintain required conditions
- Overall 72% reduction of carbon emissions over Part L 2013, the majority due to energy efficiency measures, 9% through energy provided by nearby district heat network and 1% through PV panel installation on roofs
- BREEAM "excellent" rating
- Embodied carbon intensity targeted to meet and exceed the GLA Standard Benchmark
- Installation of green roofs and biodiverse landscaping on the roofs
- Incorporation of rainwater harvesting.

3. RETROFIT AND REUSE

KEY MEASURES FOR CITY DEVELOPMENTS

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, winter gardens or collaborative working

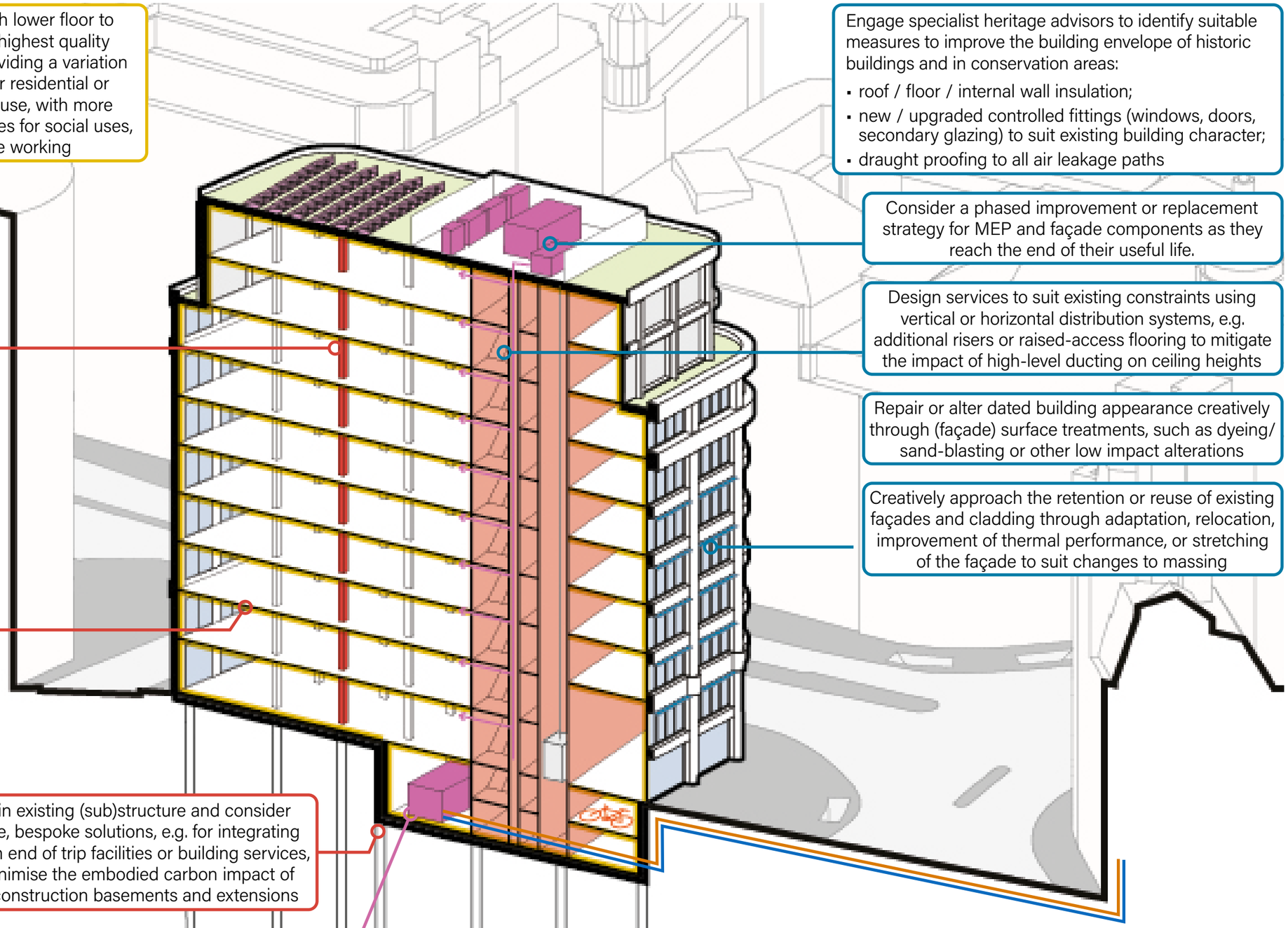
Embrace existing conditions and constraints to create characterful refurbishments, such as by exposing the structure or services

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



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 as they reach 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 or alter dated building appearance creatively through (façade) 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

Detailed measures
Typical approaches 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.

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

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[2] 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 CO2e emissions also arise from the demolition and construction of new buildings, including 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 the 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, to include 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.

Developments are required 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 & 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

GLA Whole Life-cycle Carbon Assessment Guidance

GLA Energy Assessment Guidance

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

Draft 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

Other guidance

CoLC Carbon Options Guidance

Key actions to develop an exemplar City scheme

- Undertake an options appraisal following the CoLC's Carbon Options Guidance Planning Advice Note to develop a low carbon solution that optimises social, economic and environmental sustainability benefits
- Prioritise retrofit over redevelopment solutions
- Pursue best practice in lowest carbon design and construction principles
- Enable attractive, comfortable and inclusive access to and connectivity between public and private realm and within buildings
- Develop a bespoke, optimised energy strategy for a development focussing on adaptable and loose fit, robust and low embodied carbon MEP systems, floorspaces and building envelopes.
- Prioritise the objectives of the City of London Local Area Energy Plan (LAEP) to create or link into local energy networks and waste heat sources, and include opportunities for heat and coolth transfer to/from nearby developments
- Consider testing innovative measures to drive forward best practice in sustainable development

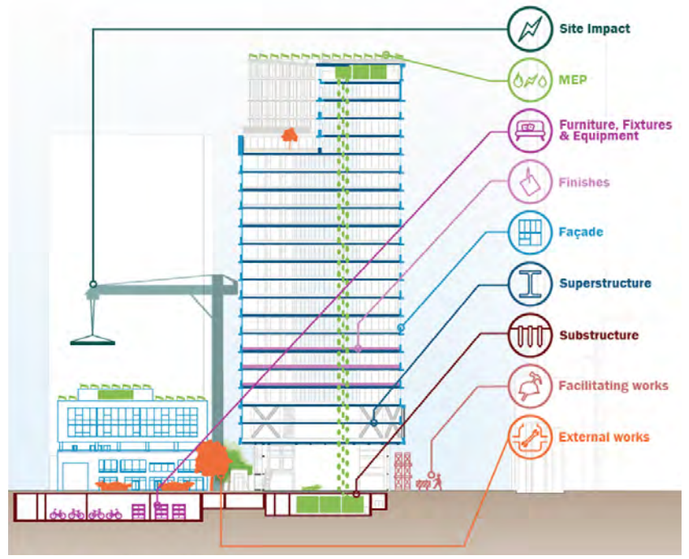


Figure 4.1 Elements of upfront carbon (modules A1-A5)
Source: 55 Old Broad Street, Sustainability Statement

2 UKGBC Net Zero Whole Life Carbon Roadmap

4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

WHOLE LIFE-CYCLE CARBON

What is whole life-cycle carbon?

Whole life-cycle carbon is the total carbon emissions resulting from the construction and use of a building over its entire life, including its construction, demolition 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, manufacture and transport of building materials, the construction process and the emissions associated with maintenance, repair and replacement, as well as dismantling, demolition and eventual material disposal.

Key measures

Whole building

Refurbishment and retrofit are to be prioritised where possible to reduce carbon emissions, especially in the short term. Upfront savings are particularly important to address the Paris Agreement's target of limiting global warming to 1.5 degrees Celsius above pre-industrial levels. Applications should demonstrate how adapting the building rather than demolishing and rebuilding has been fully considered.

Applicants should follow the CoLC's Carbon Options Guidance to conduct a thorough carbon impact assessment of a range of options that include retention, retrofit and development as relevant to the site. This is important for demonstrating that retention options have been thoroughly evaluated and should be given a prominent position within application documents, such as in the Design and Access Statement.

Sustainable Life-Cycle Cost or Life-Cycle costing (LCC) analysis should be conducted to measure the added value of reducing embodied and operational carbon for finances, construction time-frames, management, and occupants. This analysis will provide a robust insight into the long-term costs and savings across the lifetime of different design options.

Whole life-cycle carbon emissions targets and planning stage calculations must be reported against best practice upfront and whole life-cycle carbon benchmarks, as set out by the Greater London Authority guidance, UKGBC Net Zero Carbon Buildings Framework Definition or any new evolving standards such as the UK Net Zero Carbon Buildings Standard, that are appropriate for the typology of a development proposal and which reflect science-based targets for a 1.5 degrees Celsius climate change scenario.

Planning stage whole life-cycle carbon emissions are detailed predictions of the outcome of the subsequent design and procurement stages of the development process. Carbon emissions targets set by applicants initially may change, either positively, such as due to technical advances and improvements to details and manufacture of materials, or negatively, such as due to problems in the supply chains. This may result in an embodied carbon gap between planning stage and practical completion. To manage this process more constructively in collaboration with applicants, the submission of RIBA Stage 4 whole life-cycle carbon data including a review of related details of the proposals will be required for major developments by condition attached to a permission.

Aspects of whole life-cycle carbon emission reduction are covered by certification schemes such as BREEAM and NABERS UK. Applicants are required to carry out a BREEAM assessment that demonstrates the pathway to an 'Outstanding' rating (with the final rating to be confirmed after practical completion), and to commit to a minimum NABERS UK rating of 5 stars.

Lastly, creative thinking and innovation should be applied to all layers of a building design in order to deliver a site- specific solution which exemplifies best practice.

Beyond the building

Large scale new development will result in considerable environmental impacts on the quality of the local context and beyond, ranging from the nearby road network, amenity, the health and well-being-supporting quality of the public realm to urban heat island effects, microclimatic and embodied carbon impacts of the building. Applicants will be expected to mitigate those impacts through incorporating their proposals into the environmental context of existing networks of urban greening, biodiversity, climate resilience, energy exchange and other resources, in accordance with the opportunities of the site and local area.

Given the high number of concurrent developments in the City 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. Particular attention should be given to the ability to exchange thermal load (heating and cooling) via heat networks or otherwise. These synergies could benefit local schools, churches, community facilities and 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.

Case Study: 85 Gracechurch Street -
Redevelopment for a 32-storey tower

View of 85 Gracechurch Street.
Source: Planning Application, DAS

Use: Offices, retail and cultural space

Key facts:

- Re-use of existing 1935 limestone façade with cast iron spandrels and granite portal
- Aiming for low embodied carbon materials such as GGBS cement replacement, façade aluminium made using hydro-electrically produced billets, 15% of structural steel from Electric Arc Furnace (EAF) and raised floors from recycled materials
- Rationalised grid structure to promote pre-fabrication and modularization
- Façades designed to include natural ventilation panels, external shading, and replaceable in component parts
- Full CAT A fit-out only to 3 levels to leave fit-out to incoming tenants' needs and taste
- Supporting the adjacent Grade II* listed Leadenhall Market with future heat network connection and plant rationalisation opportunity
- BREEAM "outstanding" rating
- Embodied carbon intensity targeted to reach close to and meet through detailed design development the GLA Standard Benchmark
- Substantial landscaping incorporated into the public terrace at level 5 and planters integrated into the façades, as well as a blue/green roof.

4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

WHOLE LIFE-CYCLE CARBON - CASE STUDIES

Case Study: 65 Crutched Friars
Redevelopment for mixed-use scheme

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

Use: Student accommodation, museum

Key facts:

- Operational carbon emissions reduction of 70% beyond Part L 2021, due to high proportion of space and water heating of overall energy demand, provided by renewable and low carbon technologies
- Wastewater heat recovery from 770 bedrooms/ bathrooms
- Natural ventilation through openable panels in each bedroom
- Air source heat pumps and PV panels
- BREEAM "outstanding" rating
- Upfront whole life-cycle carbon emissions exceed GLA's standard benchmark (693kgCO2/m2)

Case Study: Ibex House (Grade II listed)
Refurbishment with ground and top-level extensions

Visual showing new Steel Crittall Windows to match original style.
Source: Design and Access Statement.

Use: Offices, retail and cultural space

Key facts:

- Restoration of original fabric and matching repairs
- Minimal demolition, mostly of internal modern partitions and plant installations
- Replacement of balustrades and previous replacement windows with new steel crittal windows
- Gradual phasing out of gas boilers and incorporation of high-performance electric plant
- 35.9% carbon emissions reduction over Part L 2013
- BREEAM "very good" rating
- Installation of green roofs on new built ground level extensions and at upper floor levels

Case Study: 115-123 Houndsditch -
Redevelopment for a 24-storey tower

Street view of 115-123 Houndsditch.
Source: Planning Application, Design and Access Statement.

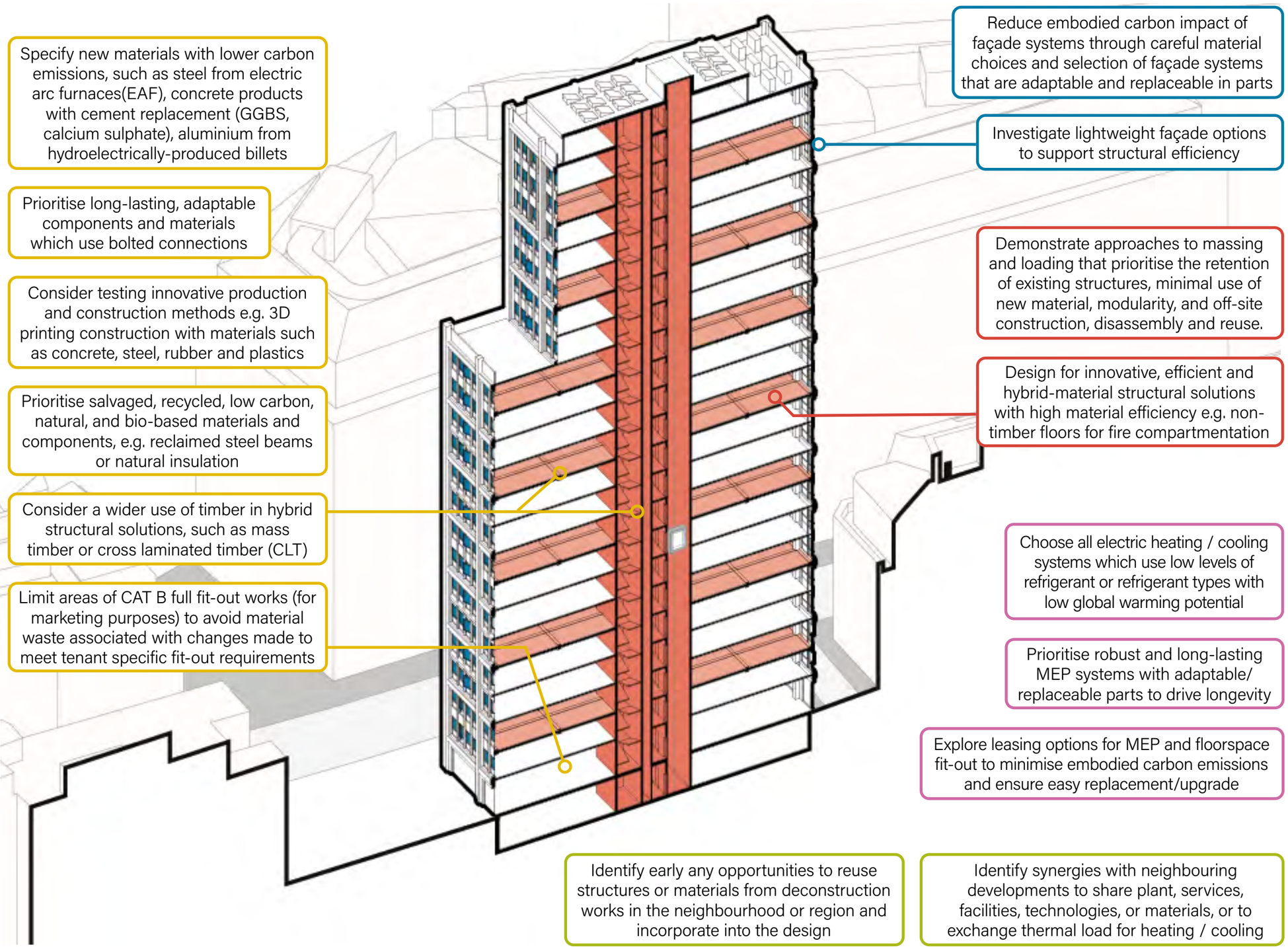
Use: Office, retail, café, community space

Key facts:

- Ambitious circular economy strategy incorporating retention of part basement, low carbon materials with high recycled content, prioritising pre-fabricated products, bolted structural connections (design for eventual deconstruction), design to be adaptable to future needs with flexible floorspace layouts, omission of additional finishes and considering take back schemes for fittings
- Overall reduction of carbon emissions of 44% over Part L 2013, with high level energy efficiency of 17% through envelope performance, solar shading, using thermal mass of exposed concrete slabs, passive ventilation and extensive urban greening on roofs and terraces to provide cooling
- Use of green leases to achieve energy efficient tenant space fit-out and operation
- Waste heat storage and proposal to share heat with neighbouring residential estate
- BREEAM "outstanding" rating, and commitment to highest scores in WELL and LEED standards
- Embodied carbon intensity targeted to meet and exceed the GLA Aspirational Benchmark
- Reduction of water demand through rainwater recycling and harvesting systems
- Incorporation of extensive landscaping on roofs, terraces and at public realm level to include planted balconies, cascading terraces and a "woodland understorey" on the ground.

4. GREENHOUSE GAS EMISSIONS

KEY MEASURES FOR CITY BUILDINGS - WHOLE LIFE-CYCLE CARBON



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, rubber and plastics

Prioritise salvaged, recycled, low carbon, natural, and bio-based materials and components, e.g. reclaimed steel beams 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 full 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 off-site construction, disassembly and reuse.

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

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

Prioritise 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

Detailed measures

Typical approaches for developments in the City by building element:

STRUCTURE
ENVELOPE
MATERIALS
PLANT & MEP
WHOLE BUILDING
BEYOND THE BUILDING

4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

OPERATIONAL ENERGY USE

What are operational emissions and energy?

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 on-site via gas-burning boilers, refrigeration 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. 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 and renewable energy technologies, including for back-up technologies both for emergencies and fluctuations in grid supply.

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 needs to be assessed prior to the design of any interventions and alterations. The level of energy efficiency should be optimised and at least meet Minimum Energy Efficiency Standards (MEES) Regulations and other drivers such as alignment with Carbon Risk Real Estate Monitor (CRREM) decarbonisation pathways, increasingly being adopted by investors and asset managers in commercial real estate in order to avoid the risk of asset stranding.

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 both heritage and energy efficiency benefits.

The most effective way to reduce operational carbon (and other GHG) emissions is to reduce energy demand and - where possible - move to operations 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 networks, the provision of future connection points is required. Large developments may be able to facilitate new locations for heat and cooling networks (see 'Beyond the building' section). The incorporation of all electric or low-carbon energy technologies into refurbishment schemes can help avoid asset stranding as energy performance requirements increase in the future.

The operational energy performance gap is expected to be addressed by committing to certification schemes such as NABERS UK. The incorporation of climate clauses into commercial agreements and legal documents, 'climate contracting', can also be used. Example clauses can be found from sources such as The Chancery Lane Project.

Beyond the building

The CoLC has identified the development of low-carbon heat networks as a key enabler to reduce operational emissions and enhance energy efficiency in the Square Mile. 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.

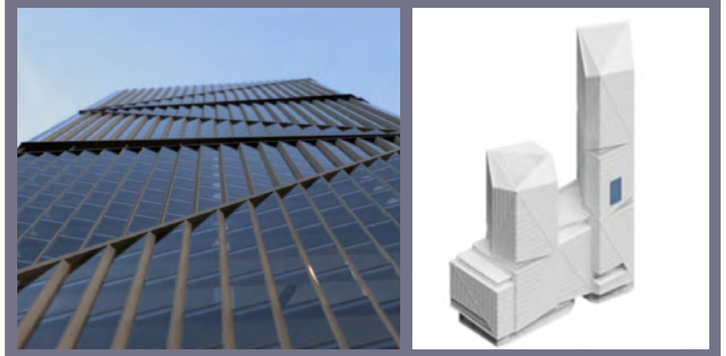
The City's Local Area Energy Plan (LAEP) sets out a route map and actions to transition the Square Mile energy system to net-zero by 2040:

- 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 developments
- Providing locations for network extensions
- Heat capture through circular systems to enable cooling heat recovery and reuse either on-site 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.

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. 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 Local Area Energy Plan (LAEP) as a central route to meeting the City's ambition of a net zero Square Mile by 2040. The CoLC is participating in the Government's Advanced Zoning Programme (AZP) and the Square Mile is expected to be a priority zone for heat networks.

Case Study: 2-3 Finsbury Avenue
Redevelopment for a 38-storey tower



Detail of tower façade with glazed and ventilation panels
Source: Planning application DAS

Use: Commercial office with mixed use including an Open Learning Hub

Key facts:
- Operational carbon emissions reduction of 47% beyond Part L 2013 overall
- Passive design to include a building envelope balancing heat loss, solar gains / glare, maximising daylight, achieving 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%
- Uses heat recovery and air source heat pumps

4. GREENHOUSE GAS EMISSIONS AND ENERGY USE

OPERATIONAL ENERGY USE

Developments in the City should consider the implications of these 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; whereby heat is supplied to the building from the network, and any waste heat is fed back to the network. A body will be designated to a zone coordination role to support management, data collection, delivery and stakeholder engagement.

By preparing in advance, the CoLC is seeking to enable 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 CoLC strongly encourages new developers to take a pro-active approach by:

- Requiring the incorporation of a heat network connection into their development
- Designing in flexibility solutions including smart systems and energy storage technologies
- Engaging with CoLC and district network providers to facilitate extensions to and new networks

There are other opportunities for heat sharing with neighbouring buildings or for the use of heat sources from nearby infrastructure that should be investigated. Major developments may have the potential to share resources and plant installations with neighbouring historic buildings to relieve these from modern plant installations and interventions that are detrimental to their heritage value, and to improve the energy efficiency of historic buildings as a heritage benefit.

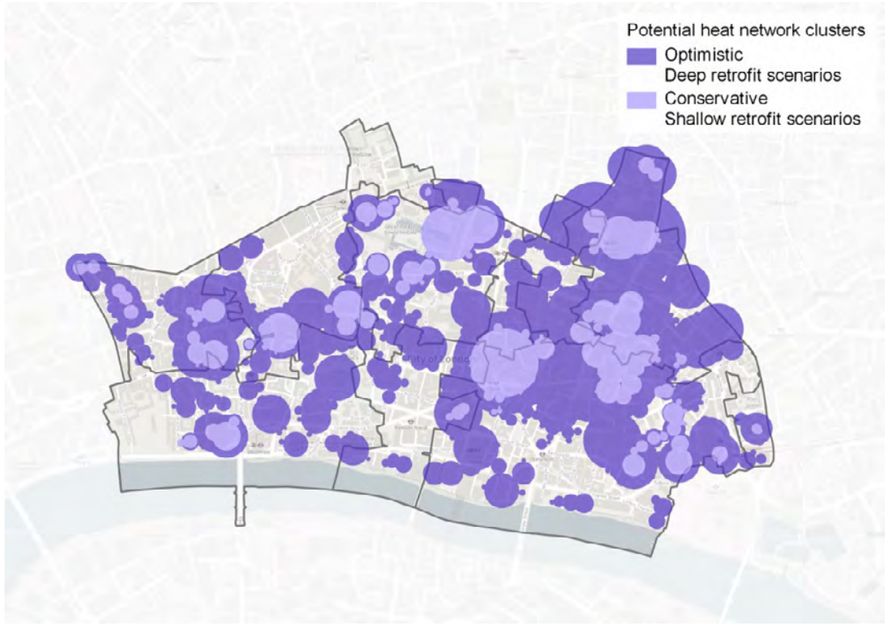
Meeting the increased electricity demand due to growth and a shift to electrified transport and heat is likely to need electrical infrastructure network upgrades. This is identified as a priority action within the LAEP to allow new local renewable assets to connect to the electricity grid. The CoLC will continue to engage and coordinate with 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 CoLC will look to embed flexibility 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

City of London Potential Heat Network Clusters

This map shows potential heat network clusters in the City. 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.

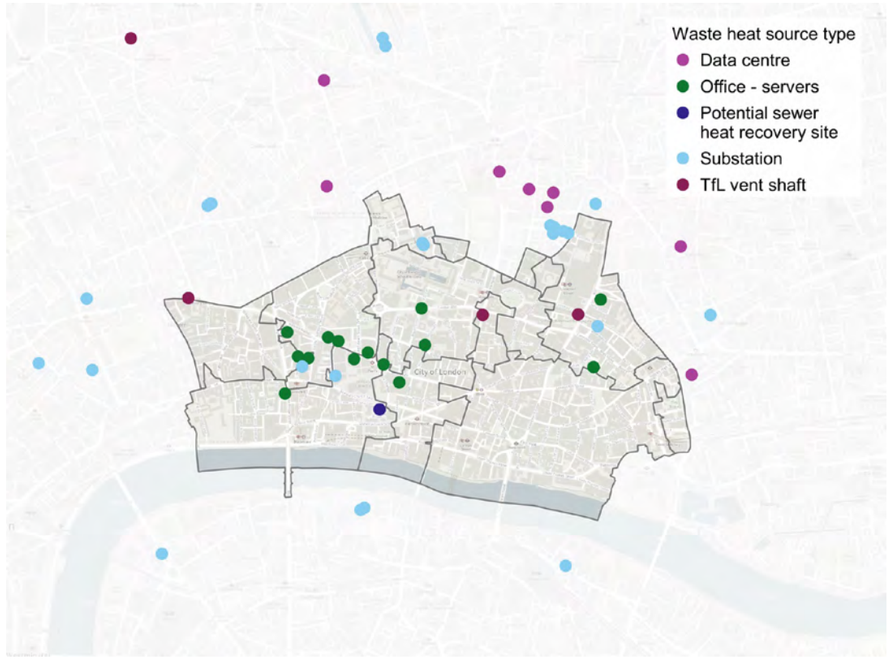
Figure 4.2 Optimistic and Conservative potential heat network clusters. *Source: City of London Local Area Energy Plan – Draft (March 2023)*



City of London Waste Heat Opportunities

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

Figure 4.3 Map of potential waste heat sources. *Source: City of London Local Area Energy Plan – Draft (March 2023)*



4. GREENHOUSE GAS EMISSIONS

KEY MEASURES FOR CITY DEVELOPMENTS - OPERATIONAL ENERGY USE

Design optimised, bespoke solutions for retrofit and new build schemes including flexible solutions for the use of rooftop and basement space for building services

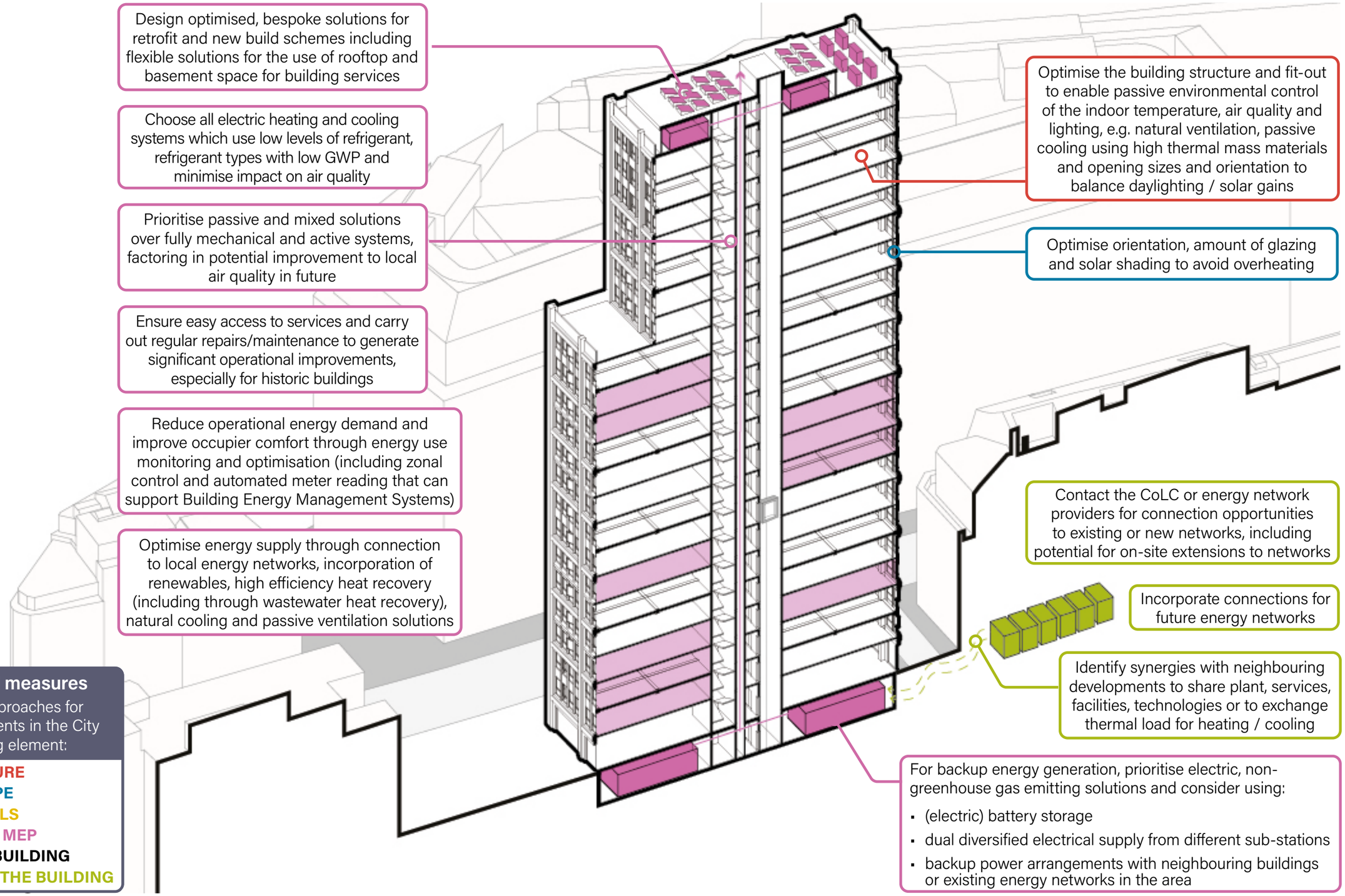
Choose all electric heating and cooling systems which use low levels of refrigerant, refrigerant types with low GWP and minimise impact on air quality

Prioritise passive and mixed solutions over fully mechanical and active systems, factoring in potential improvement to local air quality in future

Ensure easy access to services and carry out regular repairs/maintenance to generate significant operational improvements, especially for historic buildings

Reduce operational energy demand and improve occupier comfort through energy use monitoring and optimisation (including zonal control and automated meter reading that can support Building Energy Management Systems)

Optimise energy supply through connection to local energy networks, incorporation of renewables, high efficiency heat recovery (including through wastewater heat recovery), natural cooling and passive ventilation solutions



Optimise the building structure and fit-out to enable passive environmental control of the indoor temperature, air quality and lighting, e.g. natural ventilation, passive cooling using high thermal mass materials and opening sizes and orientation to balance daylighting / solar gains

Optimise orientation, amount of glazing and solar shading to avoid overheating

Contact the CoLC or energy network providers for connection opportunities to existing or new networks, including potential for on-site extensions to networks

Incorporate connections for future energy networks

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

For backup energy generation, prioritise electric, non-greenhouse gas emitting solutions and consider using:

- (electric) battery storage
- dual diversified electrical supply from different sub-stations
- backup power arrangements with neighbouring buildings or existing energy networks in the area

Detailed measures

Typical approaches for developments in the City by building element:

STRUCTURE
ENVELOPE
MATERIALS
PLANT & MEP
WHOLE BUILDING
BEYOND THE BUILDING

CIRCULAR ECONOMY

05

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 design and designing out waste must begin early in site development and must include all those involved throughout the planning and construction of the development. In the City 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. Where new buildings are constructed, they should prioritise reused materials / materials with high recycled content, and be flexible, adaptable, modular, durable, built in layers and easy to deconstruct.

Development and refurbishment projects within the City should target zero construction waste to land fill and follow the GLA's Circular Economy Hierarchy for Building Approaches (See Design Policy D3 of the London Plan 2021). This prioritises use of existing assets and efficient use of materials, followed by low carbon alternatives.

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

New developments should also encourage reuse and repair of materials and the sharing and exchange of assets, goods, materials and appliances within and between developments, businesses and residents in the City.

The GLA's Circular Economy Guidance (2022) 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."

The circular economy strategy for a development should be updated regularly in line with the stages of the development process. In order to support this process constructively in collaboration with applicants, the submission of a RIBA Stage 4 circular economy update will be required for major developments by condition attached to a permission.

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
Draft City Plan 2040
CE1: Sustainable waste facilities and transport
S8: Design
DE1: Sustainable Design
S16: Circular Economy and Waste

Key actions to develop an exemplar City scheme

- Demonstrate maximum retention and reuse of existing buildings and materials through a Pre-Redevelopment Audit, including the consideration of options (where applicable reference the optioneering carried out as per the Carbon Options Guidance, 2023)
- Incorporate recycled materials and support material efficiency, e.g. optimise structure and floorspaces, in accordance with circular economy principles, into the design of any new development
- In cases of demolition, identify any item, materials, components and fittings for reuse through a Pre-Demolition Audit and feed them into the secondary materials market as early as possible
- Where removal is necessary, deconstruct instead of demolish to maximise the amount and types of items and materials that can be salvaged
- Seek coordination opportunities with nearby development sites and public realm works as well as partnerships with specialist manufacturers for materials exchange, modification of materials for re-use, re-certification and storage of deconstruction materials from an early stage
- Demonstrate flexibility, adaptability and ease of maintenance in the design to support different uses of space, allow adaptive reuse in the future, 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 demolition, retained and new materials; commit to an end-of-life strategy that supports as-built information management and updates, through the life of the development

5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

What is circular economy in construction?

Developments should follow the Circular Economy hierarchy maximising reuse of existing materials and components whilst minimising 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: the measurement of 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. This may be more than one use 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

All major developments must undertake a pre-redevelopment audit to establish whether existing buildings, structures and materials can be retained, refurbished, or incorporated into the new proposal. The Circular Economy Statement and Whole Life-Cycle Carbon Assessment should present the same options, with the former focusing on circular economy principles and retention volumes, and the latter on embodied carbon.

Where substantial demolition is proposed, a pre-demolition audit must be carried out and updated throughout the planning process. It must include a structural survey to support any reasoning for demolition and set out management approaches for demolition material and maximising reuse and recycling.

Developments should identify synergies between waste reduction and whole life-cycle carbon reduction, transitioning towards zero waste construction sites.

All new construction must be designed and built in layers. Each layer should function as a separate system so that 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.

To design for circularity in the City, the following key principles need to be addressed;

- 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: this may involve standardised components, to reduce construction waste and make it easier to adapt the building. Modularity can also be applied to building layers so they can easily be modified. 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.

As part of the development proposal, a maintenance and deconstruction strategy should be developed in close collaboration with the design team at an early stage. This is an important consideration, as the reusability of materials depends on ease of disassembly and on how well they are maintained during the building life-cycle.

Case Study: 100 Fetter Lane

Redevelopment for a 13-storey office

100 Fetter Lane. *Source: Planning Application, DAS*

Use: Commercial office and Public House

Key facts:

- Use of recycled materials, including for the primary façade (rammed concrete with recycled aggregates or bricks to form façade panels)
- Minimising material consumption and incorporating future flexibility in the structure and configuration of internal spaces
- Selecting 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 material passports to facilitate future materials reuse with information, such as a 3D model, contractor's records, products' specifications and certificates, held in a database as part of the online platform 'Circuland'.

5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

Data and Information Management

Design and construction information should be compiled and stored in a single accessible format. Ensure design and construction teams record information on the materials and construction methods used. This includes clear as-built drawings (responsibility of the architects), and deconstruction drawings (responsibility of 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 explored during later stages of design and construction. Passport information would be accessible to building owners, building managers, and occupiers as necessary, so that it can be updated throughout the building's life-cycle.

Case Stud 1 Appold Street

Major Refurbishment

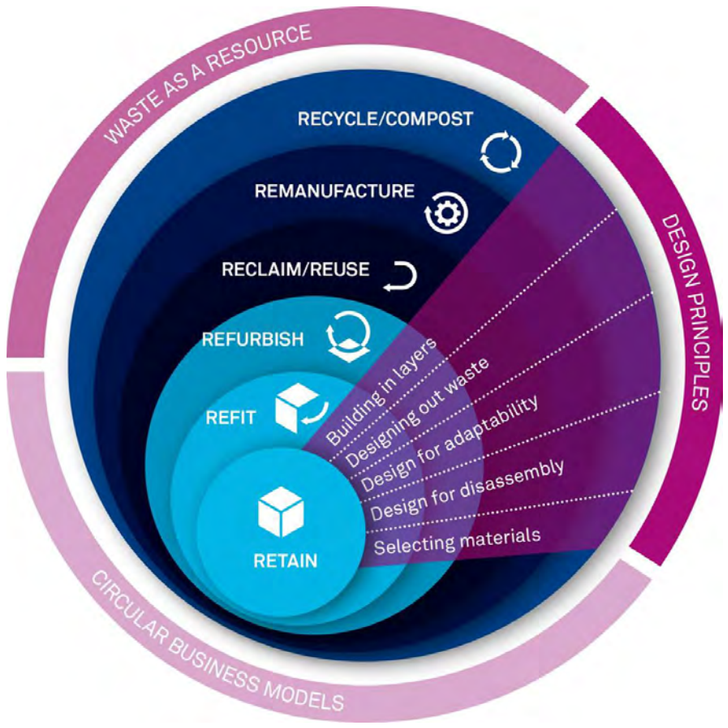
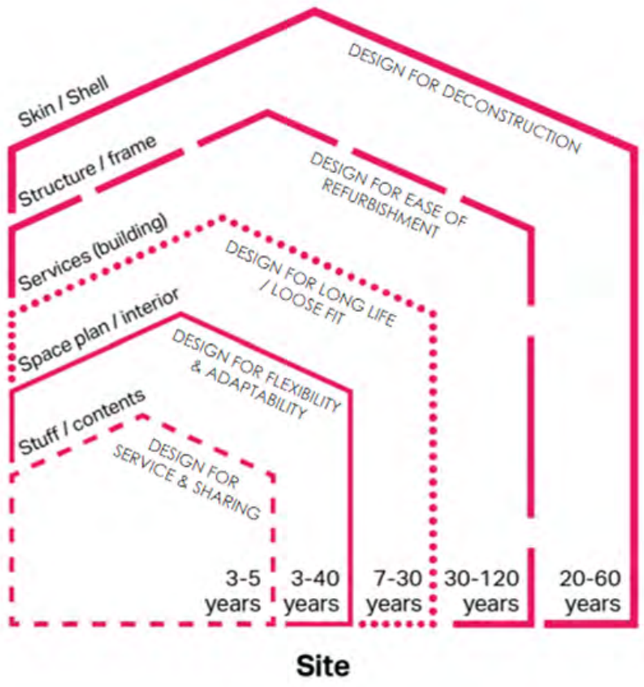
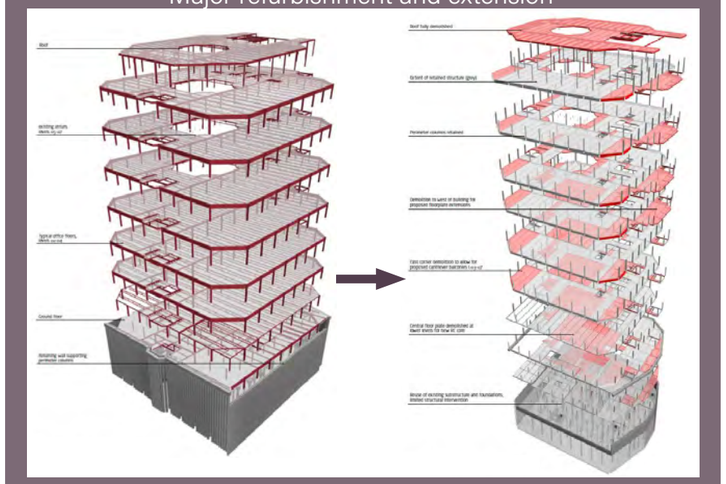


Fig. 5.1 - Circular Economy Hierarchy
Building Revolutions (2016) D. Cheshire, RIBA Publishing



Fi 5.2 - Building layers and their indicative lifespans
Frank Duffy's 'Shearing Layers' concept described in *How Buildings Learn* (1994) S. Brand.

Case Study: 1 Appold Street -
Major refurbishment and extension



Existing vs. new structure, 1 Appold Street.
Source: Planning Application, Circular Economy Statement

Use: Commercial office with restaurant, gym and pool

Key facts:

- Retention of a minimum of 55% of the existing basement and 8-storey structure
- Addition of 6 floors and some extensions to existing floor plates and new façades
- 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
- Target of use of 20% of recycled and reused building materials by value
- 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)
- Minimising material consumption and incorporating future flexibility in the structure and configuration of internal spaces
- Material passports created to meet client brief requirements.

5. CIRCULAR ECONOMY

CIRCULAR ECONOMY IN CONSTRUCTION

During the design phase, additional future functions of the buildings should be anticipated and tested which may include changes to technology, creation of buffers, or building in 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.

Beyond the building

It is recognised that there is limited space to store recycled building items and materials in the City, however, the CoLC welcomes proposals that consider opportunities to share materials with other ongoing construction and public realm projects in the City or Greater London. This would be expected if the applicant had multiple sites in London. Alternatively, materials should be advertised on material reuse platforms as early as possible to maximise the opportunities for off-site reuse.

Developments should consider facilitating meanwhile use of sites awaiting vacancy or construction such as affordable workspace, cultural / community space, pop-up commercial or green spaces. 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.

Space on construction sites could also be made available to enable the storing of recycled and reusable materials from the site or other sites.

The installation of hard infrastructure that is difficult to adapt should be avoided.

Case Study: City Place House, Aldermanbury Square - Redevelopment of commercial building

Visualisation of main entrance
Source: Planning Application DAS

Use: Offices

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 using recyclable 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 - Major refurbishment and extension

Visualisation of New Bridge Street facade
Source: Planning Application DAS

Use: Commercial office with public house

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 off-site manufacture and minimising waste
- 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.

3 **Meanwhile Use London report** – Arup for the GLA

5. CIRCULAR ECONOMY

OPERATIONAL CIRCULAR ECONOMY

What is 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 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 where organic material is created which can be use on-site, reducing the need for transportation of food waste and the 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. Additionally, 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 must 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 1:20 slope. 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/ library for tools and other appliances to reduce the need for purchasing them individually. Spaces should also be designed with a culture of reuse rather than disposal in mind for example planning in storage space for mugs/glasses and providing a sink or dishwasher. Developments should also provide space for the deposit of unwanted or bulky items in preparation for re-use 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 on-site 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 as new collection contracts are let or in response to 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 which can be used to identify performance issues and evaluate impacts of additional interventions will be also welcomed for both commercial and residential use.

The proposed waste management systems should encourage a sense of personal responsibility for correct segregation of waste and use of waste management service/infrastructure. This could include linking use of 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 on-site 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.

5. CIRCULAR ECONOMY

KEY MEASURES FOR CITY DEVELOPMENTS

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

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

Consider submitting axonometric drawings to clearly visualise which parts of the structure are retained/reused/new

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

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

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 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 off site.
- Provide material and construction information in a building passport for future reuse, including ensuring that any alterations are captured

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

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

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

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

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

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

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

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

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

Incorporate sufficient areas on and off-site for separation and disposal of recycling and waste

Detailed measures

Typical approaches for developments in the City by building element:

STRUCTURE
ENVELOPE
MATERIALS
PLANT & MEP
WHOLE BUILDING
BEYOND THE BUILDING

5. CIRCULAR ECONOMY
CASE STUDIES

1 Broadgate

New build

Use: Office-led mixed use building

Key facts:

- 50,000 sqm
- Generous terraces and balconies provide over 4,000 sqm of amenity and green space
- 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 on site or within the Broadgate campus
- Additionally, 139 tonnes of steel are being reused in two other developments in Southwark
- First NABERS UK Design for Performance registered building
- BREEAM Outstanding and WELL Platinum target ratings

Visualisation of the proposed 1 Broadgate development
Source: Planning Application DAS

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.

55 Old Broad Street

Part refurbishment, part new-build

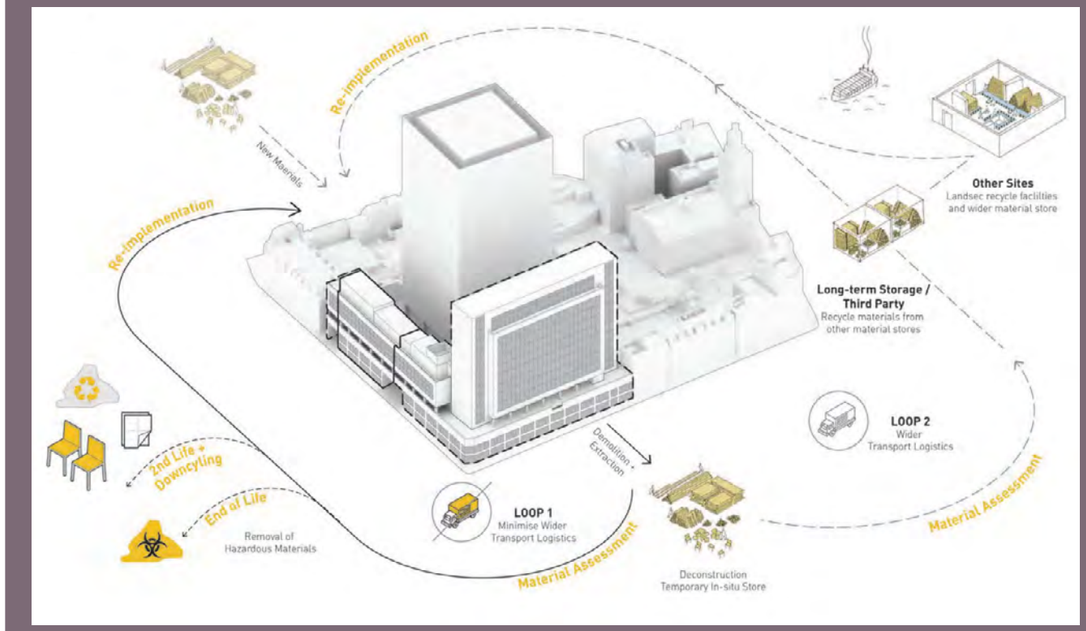


Diagram showing circular flows of materials to and from the development site.
Source: Planning Application Circular Economy Statement

Use: Office-led mixed use development

Key facts:

- 40,584 sqm
- Natural ventilation and passive solar shading will reduce operational energy use
- 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.
- Materials, components and furnishings in the existing building have been painstakingly catalogued, creating an extensive material passport database that will allow their reuse.
- Materials are 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.

5. CIRCULAR ECONOMY
CASE STUDIES

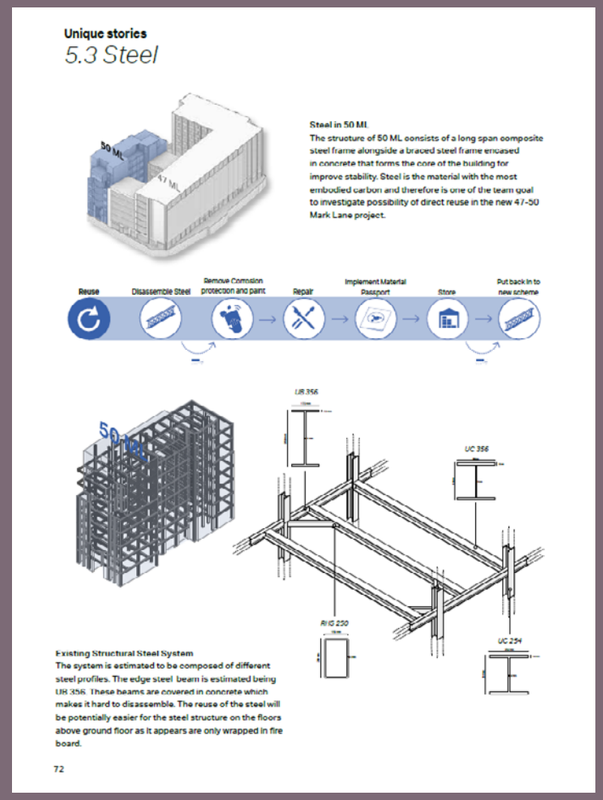
Mark Lane

Refurbishment

Use: Office with cultural space

Key facts:

- 30,000 sqm
- Over 1000sqm of green roof
- The team produced an Upcycling Catalogue, a comprehensive material reuse strategy for materials.
- Worked closely with the appointed demolition contractor and Excess Materials Exchange (EME) to find suitable re-use partners for soft strip materials.
- Soft strip materials have been made available on the EME platform until final demolition.
- BREEAM Outstanding, NABERS 5* and WELL Platinum target ratings



'Unique stories' - an exploration of potential ways to re-use 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.

1 Golden Lane

Alteration and extension

Use: Office with ground floor community space

Key facts:

- 10,725 sqm office space
- Plentiful green terraces, window boxes and a planned green wall on the southern façade.
- 95% retention of the existing building structure
- BREEAM Outstanding, NABERS 5* and WELL Platinum target ratings
- Various products and materials including ceiling / floor finises and light fittings have been made available on reuse marketplace Globechain, with purchasing priority given to developers working within the City

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.

Ribbon cutting (to increase the depth of the sections and give uniformity) enables 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

Introduction

This chapter contains guidance aimed to ensure that climate resilience principles are embedded within the design process of each development in the City.

It includes sections on:

- Flood risk and sustainable drainage systems: management of flood risk through water retention and flow control
- Water resource management: how to effectively manage and optimise the use of the available resources
- Building and urban overheating: preventing overheating in a dense and urbanised environment such as the City
- Pests and diseases: risks associated with animals, insects, weeds etc. in an urban context and guidance for a typical development in the City.
- Infrastructure resilience: key considerations for designing efficient and resilient infrastructure for a building and its external plot interface with the city.

Key approaches for the City

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

It is important to design developments with built-in resilience to these changes and disruptions, anticipating future climate changes throughout the design life of sites and buildings. Many of these solutions can simultaneously deliver a range of wider benefits which address climate change mitigation, enhance biodiversity and improve health.

Proposals within the City must consider this guidance from an early stage of the design and use it as a checklist when submitting a planning application and/or during any pre- and post-application discussions with the council.

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 roofs 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

Draft City Plan 2040

- S7: Infrastructure and Utilities
  - IN1: Infrastructure provision and connection
- 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

Key actions to develop an exemplar City scheme

- Avoid urban heat island effects and the risk of overheating in the building by incorporating passive solar shading and by minimising the need for active cooling
- Reduce the risk of local flooding by attenuating water on-site and controlling the run-off rate
- Incorporate an integrated potable water management system
- Design green spaces, building spaces and services with a focus on nature, health and well-being to reduce the risk of emerging pests and diseases to develop and spread

Source: City of London Corporation

6. CLIMATE RESILIENCE

The City's climate resilience risks

There are six key areas of climate-related risk identified for the City as part of the Adaptive Pathways Study carried out by Buro Happold for the development of the City of London Climate Action Strategy 2020-27. These risks need to be addressed within development and other planning processes to ensure that the City is resilient to climate change.

Flooding

It is anticipated that the City 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.

Water stress

Changes in rainfall patterns will impact on 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.

Overheating

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.

Pests and diseases

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.

Trade, food and infrastructure

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

Biodiversity losses

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.

Figure 6.1 CoL Climate Resilience Risks wheel
Source City of London Corporation

6. CLIMATE RESILIENCE

FLOOD RISK MANAGEMENT AND SUSTAINABLE DRAINAGE SYSTEMS

What is flood risk management

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.

What are Sustainable Drainage Systems (SuDS)

SuDS are designed to manage surface water volumes and pollution risks locally by mimicking natural processes as far as practicable. When done well this results in reduced runoff, improved water quality, amenity benefits and enhanced biodiversity and habitat.

Sources of flood risk

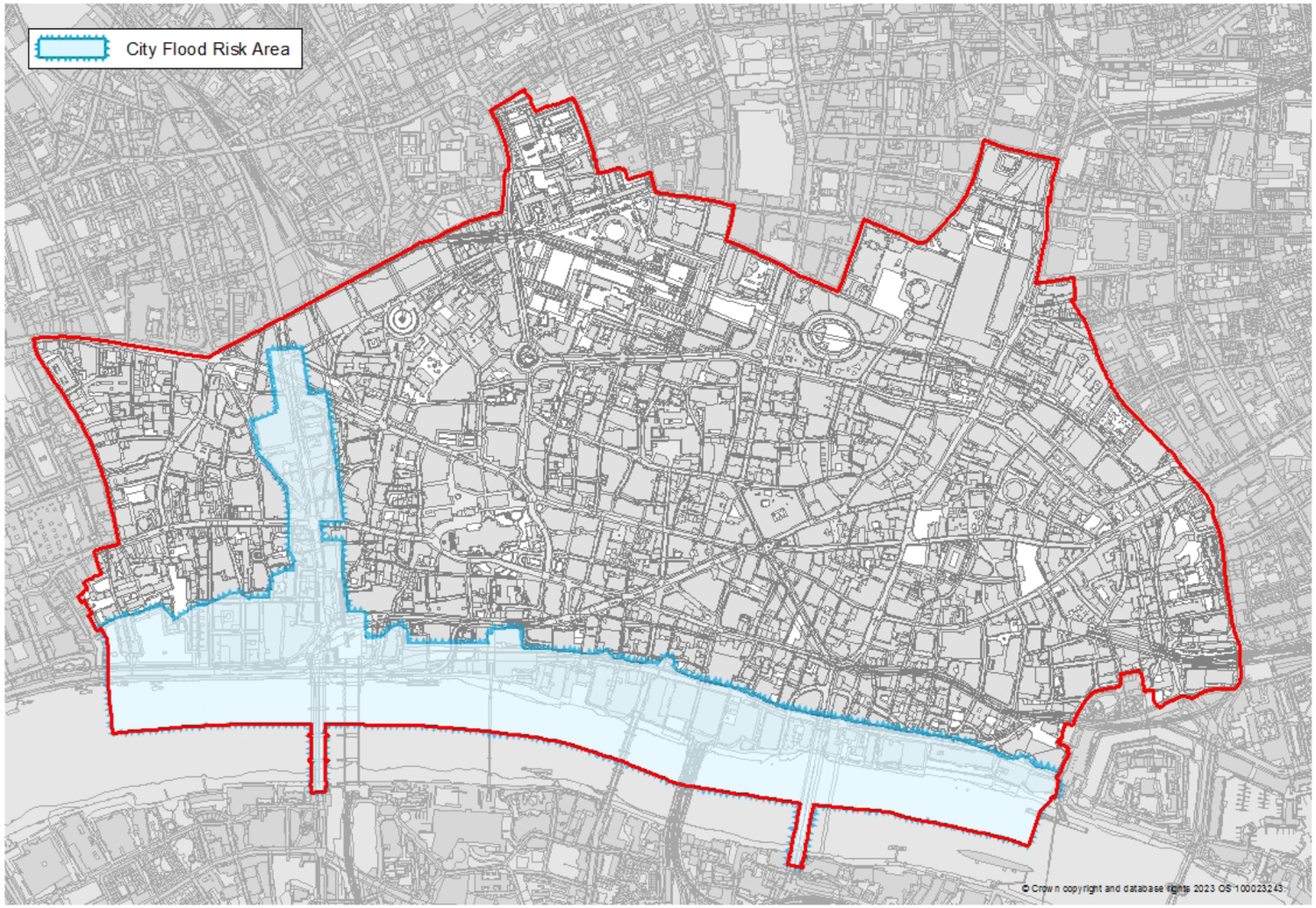
The risk of flooding from all sources, including fluvial, tidal, surface water, sewer, groundwater and other artificial sources must be assessed. In the City of London, the primary sources of flood risk are fluvial/tidal flood risk along the riverside and surface water/sewer flooding in the surface water hotspots identified around Farringdon Street and New Bridge Street areas.

Flood 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 is available in the City of London Strategic Flood Risk Assessment.

- 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 may include, but will not be restricted to, measures such as raising flood defences in accordance with Thames Estuary 2100 Plan measures, ensuring no critical infrastructure is located at basement level, podium levels are set above breach levels, a Flood Emergency Plan is in place.
- It is vital that the information within and the limitations of the EA maps are fully understood.
- 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.

Figure 6.2 City Flood Risk
Source City of London Corporation



6. CLIMATE RESILIENCE

FLOOD RISK MANAGEMENT AND SUSTAINABLE DRAINAGE SYSTEMS

Approach to flood risk management

Flood risk must be assessed on a site-specific basis. Management measures must appropriately mitigate the risk, whilst considering the wider impacts to flooding elsewhere. Flood risk can be managed sustainably by utilising the following steps:

- Assess the risk to the site from each source of flooding
- Understand the flood mechanisms for each source of flooding. This could include the location, speed and consequence of flooding on a site
- Establish an acceptable risk threshold. This should be done in conjunction with interested parties including future occupants and with reference to relevant flood risk policy
- Mitigate the risks to an acceptable level. This could include moving vulnerable uses to less vulnerable areas, utilising sustainable drainage features or providing flood resistance and flood resilience measures
- Prepare in advance for the consequence of flooding and develop procedures to enable recovery. 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

Proposals should consider solutions that combine sustainability and flood risk management measures, for example; solar panels that double up as water collectors during rainfall or green roof features that provide biodiversity and flood risk benefits. Surface water attenuation may provide an opportunity for greywater reuse.

Drainage for all developments must have separate foul and surface systems. As far as practicable the systems must not be reliant on pumping. If pumping is required, such as from basements, then appropriate backup systems must be provided.

Critical infrastructure

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

Safe egress and access must be provided in the event of a flood event, ideally to a safe area offsite.

Most buildings in Flood Zone 2 or Flood Zone 3 must have a bespoke Flood Emergency Plan in place. This is a requirement of the Lead Local Flood Authority (LLFA).

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

Key Measures

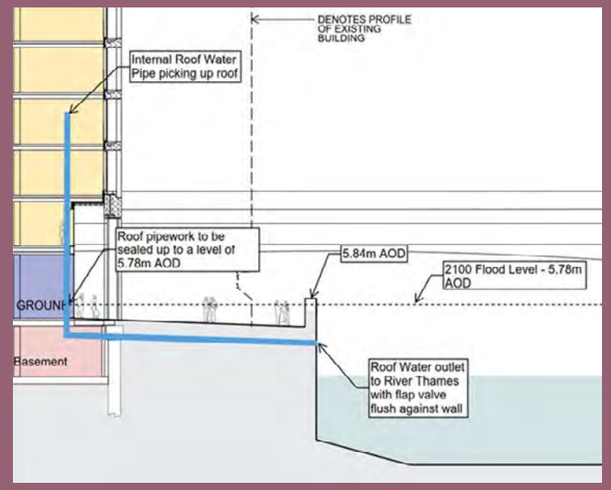
Whole building

Flood risk management vision and objectives

All developments must aim to 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 must:

- Ensure that the development is suitable for the flood zone it is situated in and its defined land use vulnerability
- Ensure that the development does not increase flood risk off site and, if possible, achieve a reduction in this risk
- Respect the inherent flooding pathways and make space for water within the proposed development as far as practicably possible
- Assess all sources of flood risk and provide mitigation as required
- Maximise the use of green infrastructure and SuDS to manage flood volumes throughout the development. Make use of available public realm to accommodate stormwater, improve water quality and provide amenity
- Ensure the safety of building occupants during flood events through the identification of suitable access and egress routes

Case Study: Seal House



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

Use: Commercial Office, retail, restaurant

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

6. CLIMATE RESILIENCE

FLOOD RISK MANAGEMENT AND SUSTAINABLE DRAINAGE SYSTEMS

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 tree planting, swales, natural detention basins, or soakaways and can play a key role in supporting the urban ecosystem.

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

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.

CoLC will develop a Climate Resilient Planting Catalogue which will include advice on the best planting species and solutions for water attenuation and drainage.

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.

Local flood risk management strategy

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

- Implementing procedures to maximise the use of 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

Where space or other constraints mean that urban blue-green infrastructure are 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 on site.

Source: City of London Corporation

6. CLIMATE RESILIENCE
WATER RESOURCE MANAGEMENT

What are water resources and water resource management?

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 other greywater sources, as well as recycled water from within the development.

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

Key measures

Whole building

Water resources must be reliable, sustainable, secure and safe. To achieve this, a development should aim to:

- Reduce per capita consumption water demands through the smart optimisation of water usage and specifying water efficient devices
- Ensure that per capita consumption water demand in residential developments is 105 litres per day or less
- Forecast supply and demand to avoid inefficiencies
- Ensure that distribution is efficient and effective throughout the development by optimising systems and minimising leaks
- Where possible, make use of alternative water sources
- 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
- Minimise sewage outflow through efficient flushing, this prevents obstructions and helps avoid overwhelming the sewage systems

Measures for the management of potable water

- Measure and record usage in order to identify water and energy saving opportunities
- The use of leak detection technology to improve the performance of networks and reduce wastage
- Water saving technologies within the building such as low flow taps and aerated showers
- Ensure supply network has sufficient capacity
- Use of timed-release systems to reduce usage
- Incorporate rainwater and greywater recycling to reduce the demand of potable water

Measures for the management of rainwater

- Optimise collection opportunities for recycling. This includes irrigation and non-potable uses
- Make use of recycled water in heating and cooling system

Measures for the management of wastewater

- Minimise volumes of water required to be treated. Measures include ensuring effective flushing
- Ensure a network has sufficient capacity
- Consider the use of recycled water for toilet flushing. For example, in a large development, capturing water from one third of a building's showers could meet the toilet flushing demand of the entire development

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
- 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 - Major refurbishment and extension

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

Use: Office, retail, leisure

Key facts:

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

6. CLIMATE RESILIENCE

WATER RESOURCE MANAGEMENT

Beyond the Building

To lower the need for potable water for irrigation, the possibility of harvesting and reusing rainwater in the public realm or using rainwater collected from a building for nearby public realm planting should be explored. Any opportunities to combine SuDS with water recycling and to use climate resilient planting types with low water demand must also be considered.

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 also be considered with buildings of different roof size and demand profiles, right-sizing of on-site storage, and shared storage facilities.

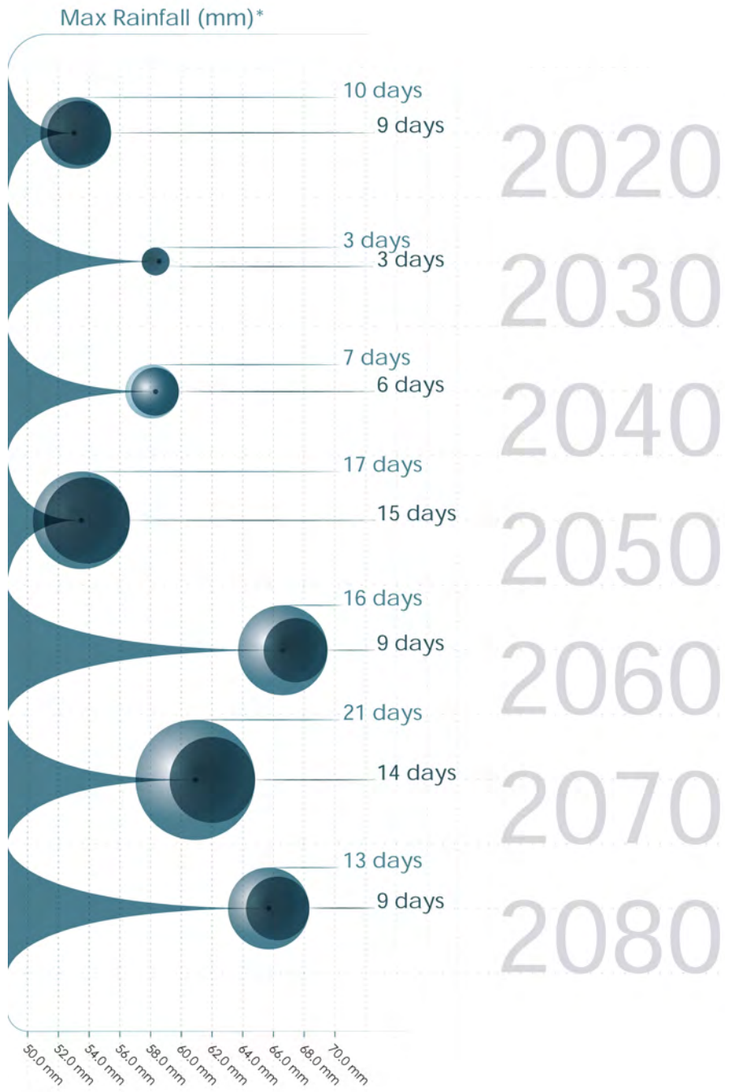


Figure 6.3 Anticipated days and periods of drought per year, 2020 – 2080, compared to anticipated monthly maximum rainfall (mm)
Source: Buro Happold

**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

Redevelopment for a 12-storey office

View of 100 Fetter Lane.
Source: Planning Application Design & Access Statement

Use: Commercial office with public house

Key facts:

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

6. CLIMATE RESILIENCE
BUILDING AND URBAN OVERHEATING

What is 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 Urban Heat Island

An Urban Heat Island (UHI) 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 Urban Heat Island 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.

Key measures

Whole building

The City's dense and urbanised environment is at high risk of extreme heat. It is therefore important that all development actively contributes to reducing the heat island effect and improving thermal comfort within the City by utilising green and blue infrastructure, and design optimisation, as well as avoiding the expulsion of waste heat into the environment.

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

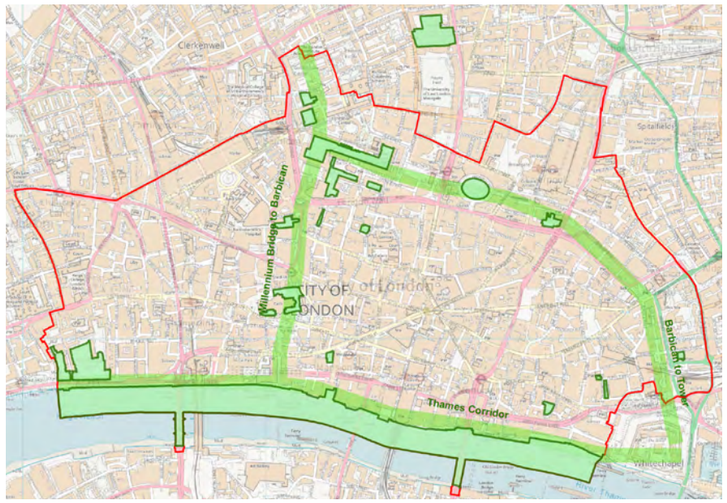
All developments, must assess the impact of current and future weather data (for example by using CIBSE Design Summer Year weather datasets), alongside local acoustic and air pollution levels.

Beyond the Building

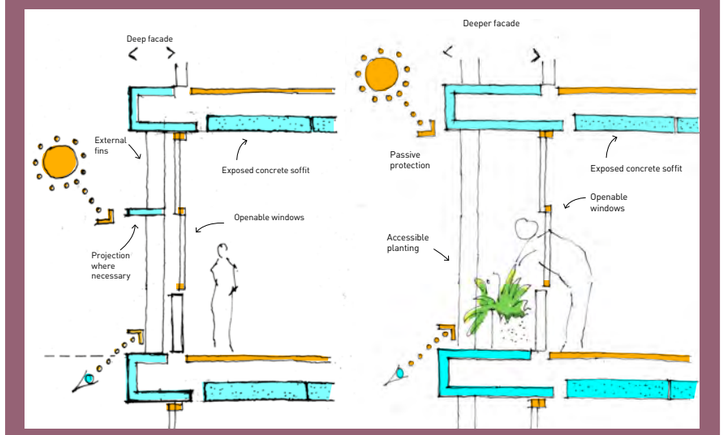
Development proposals must provide measures to alleviate heat stress on the ground, within the site and around the building. Blue and green infrastructure and shade can cool open spaces and offer respite during heat waves.

Applicants are advised to incorporate interventions recommended as part of The City of London's Cool Streets and Greening Programme.

Figure 6.4 Cool Streets and Greening 'green corridors' and SINCs (current & proposed)
Source: City of London Corporation



Case Study: 100 Fetter Lane -
Redevelopment of commercial building



View of new publicly accessible link access.
Source: Planning Application, Design & Access Statement

Use: Office and public house

Key facts:

- Exposed soffits to allow cooling
- Deep reveals in the building fabric to create shade
- Landscaping to include multiple green terraces with edgeplanting at eight different levels and a shaded sunken garden open to the public
- Mixed mode ventilation that combines natural ventilation and automated windows to enable night purging

6. CLIMATE RESILIENCE

BUILDING AND URBAN OVERHEATING

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

What is 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.

City of London strategy

CoLC is using a one-to-one virtual model of the City, a 'digital twin', to simulate the impacts of extreme heat events and the ideal placement of green roofs. This model is being integrated with CoLC's ground-breaking Thermal Comfort Guidelines. These guidelines – believed to be the first of their kind globally - provide a unique technical tool which enhances the understanding of the microclimatic qualities of the City's public spaces (by merging wind, sunlight, temperature and humidity data). They include a methodology to assess the potential impact of new developments and can serve as an additional reference to help mitigate overheating risk.

CoLC is leading by example through the implementation of its Cool Streets and Greening Programme, as part of which it has begun planting tree-shaded cool routes. In some cases this has reduced air temperatures between 3-8°C during heatwaves.

Figure 6.2 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)

6. CLIMATE RESILIENCE

BUILDING AND URBAN OVERHEATING

City of London overheating map

Figure 6.2 shows which areas of the City 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 Heat Wave Average Max Temperatures taken from the GLA 2016 study on the London Urban Heat Island Effect.

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 days on heatwaves 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 health adults can begin to experience heat stroke risk.

Impact of future weather files

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 numerous global climate models for various scenarios of greenhouse gas emissions, future weather files can be utilised in building energy modelling to get insights into future energy requirements.

The design approach for any development in the City must take into consideration the future weather file and their impact as recommended by BREEAM 2018 Hea 04: Thermal Comfort.

CIBSE Design Summer Year (DSY) for London is the most appropriate year of weather data to assess the summertime cooling needs of buildings in London. It enables designers to analyse the summer performance of their buildings and investigate the impact of urban macroclimatic factors and climate change when carrying out overheating risk assessments for buildings in London.

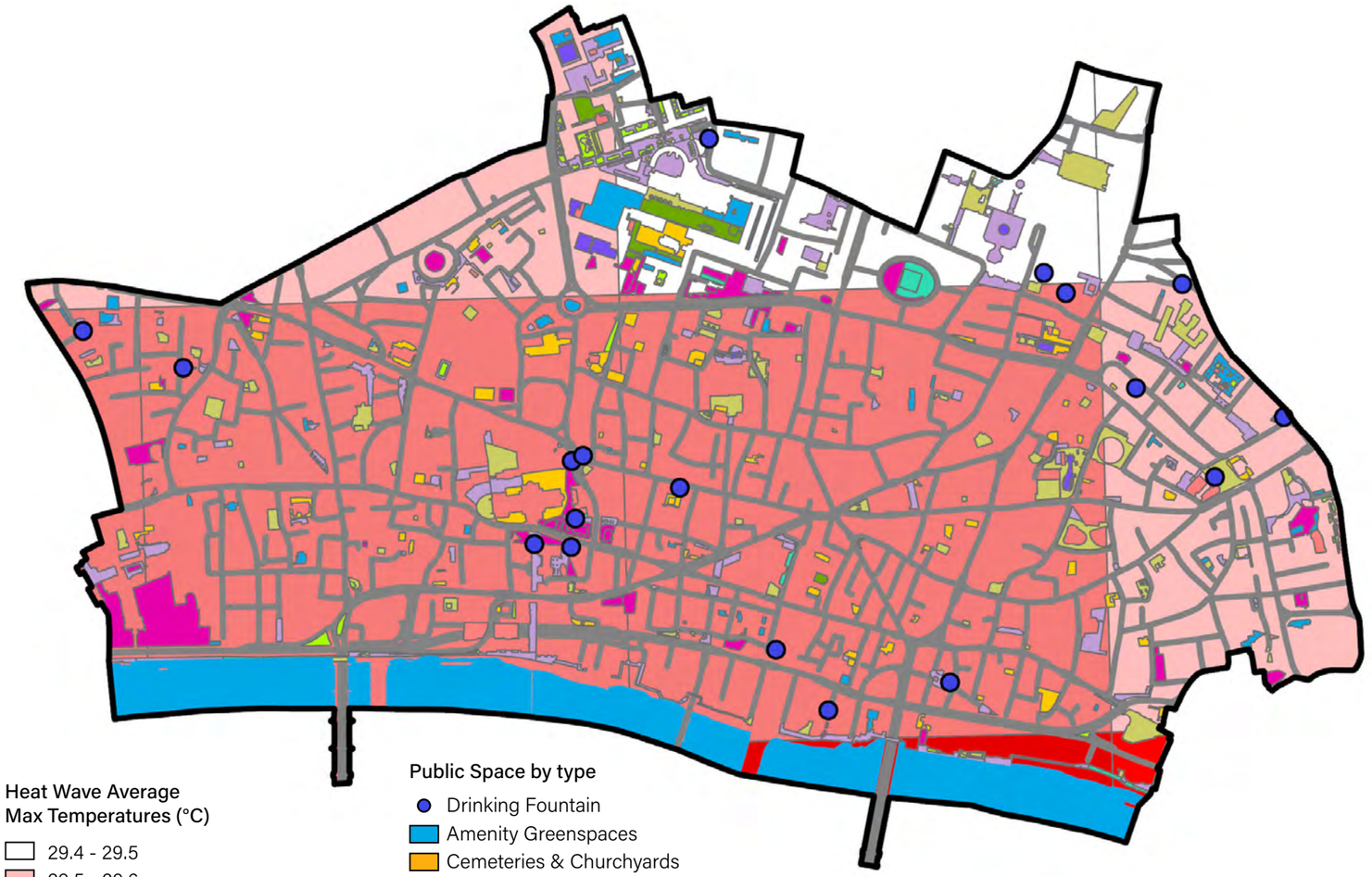


Figure 6.5 Overheating map with public space & drinking fountain distribution
Source: City of London Corporation 2020

6. CLIMATE RESILIENCE
PESTS AND DISEASES

What are pests and 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, 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, international movements are an identified pathway in which new pests and diseases are introduced. In urban environments this can be a particular risk to green infrastructure.

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 spread of waterborne and communicable disease.

Key measures

Whole building

Developments must increase the levels of urban greening and take a landscape-based approach to developing habitat networks of resilient species that can help to tackle risk of biodiversity loss and spread of ecosystem pests. Proposals should consider solutions able to increase the resilience of the treescape on site and the wider area.

Design should discourage disease-carrying fauna and ensure biological security through procurement and management of trees and other green infrastructure, to avoid introduction of new plant pests and diseases.

Species should be selected for their ability to cope with extreme weather conditions and adapt to the urban landscape. Applicants must consider biosecurity within their proposals including how they will procure a diverse range of species, use resilient plants, their choice of supplier and how they will deal with imported plants when they arrive into their care.

Considerations for health and well-being

Management of the facilities and open spaces within in the development should consider the risk 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)
- Effective management of operational waste to reduce risk of pests and disease vectors (see Wst 03 Operational Waste).

Beyond the building

Care must be taken to avoid planting non-native invasive species listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and in the London Invasive Species Initiative (LISI). It is illegal to plant these species in the wild and we should aim to prevent development becoming a pathway for further spread of these specimens into London's green spaces.

If present within or around the development site suitable specialists to remove non-native invasive species if these are found on site such as Japanese knotweed (Fallopia japonica) and Himalayan balsam (Impatients glandulifera) should be employed.

Consideration should be given to how the development will reduce biosecurity risk in its landscaping programme and manage future impacts of pests and diseases to occupiers and green infrastructure.

Plan for future climate scenarios in terms of temperature and humidity ranges, ensuring all plant, HVAC and water systems negate the risk of bacterial, viral or fungus growth. Particular consideration must be given to legionnaires disease and the supply of potable water. Applicant teams should refer to regulation of these systems and ensure there are multiple methods to maintain conditions and reduce contamination risk.

Case Study: City of London, Vine Street
Public realm planting

Vine Street tree planting. *Source: Planning Application, DAS*

Use: Public realm

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.

6. CLIMATE RESILIENCE

PESTS AND DISEASES

A landscape-based approach to planting should be adopted within the development site and the adjacent public realm. Informed decision-making on the selection of species should ensure cohesion with and support for local habitat networks. For landscaping and public realm interventions, species should be diversified and, where possible, native/naturalised species with high biodiversity value are encouraged to support ecological functions. Species or genera that could be vulnerable to any new diseases that may be introduced in the future should be avoided, and species not yet affected by pests and diseases present in the UK are to be prioritised. The UK Plant Health Database should be consulted during the design process to determine species and genera of higher risk.

To avoid importing pests and diseases from abroad, the procurement of plants 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 must 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.

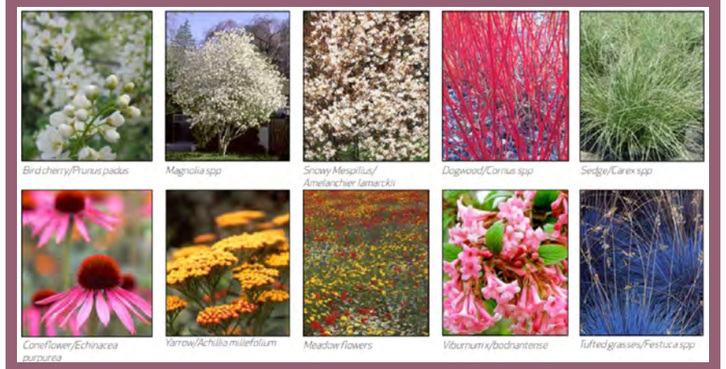
Soft landscaping proposals for a new development must not include non-native invasive species - further information can be found in Schedule 9 of the Wildlife and Countryside Act 1981(as amended), the Non-Native Species Secretariat of Great Britain and Ireland, and the London Invasive Species List.

Maintenance of green infrastructure should be implemented as necessary for each habitat to ensure that no non-native invasive species settle and spread. Within the management and maintenance plans to be submitted to the City of London before implementation there should be a process in place to 'alert' responsible authorities of any pest or disease outbreaks within new and established green infrastructure.

Advice about climate resilience planting

CoLC is preparing a Climate Resilient Planting Catalogue, which will provide 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, i.e. biodiversity enhancement, cooling, interception, sequestration) and the planting environment (site types and conditions) are also important criteria to be included.

Case Study: London Wall Place
Commercial redevelopment offering an acre of landscaped public gardens



London Wall Place planting palette. *Source: Planning Application, DAS*

Use: Commercial office, retail

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

Source: City of London Corporation

6. CLIMATE RESILIENCE

INFRASTRUCTURE RESILIENCE

What is 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 of London will need to consider how to minimise disruption to building operation during extreme events of flooding, high heat 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 that should be considered appropriate.

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. This would permit reduced supply from alternative sources or on-site back-up storage to go further, which 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 on-site 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.

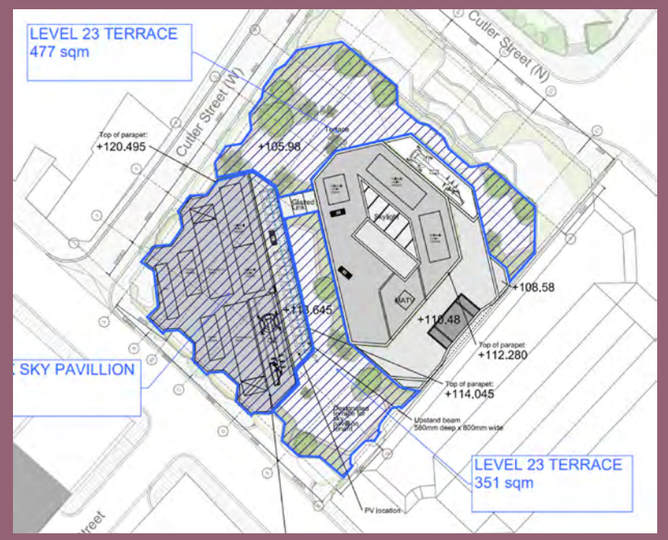
Beyond the building

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 -
Redevelopment for a 24-storey tower



Proposed Blue Roofs.

Source: Planning Application, Flood Risk and Drainage Strategy

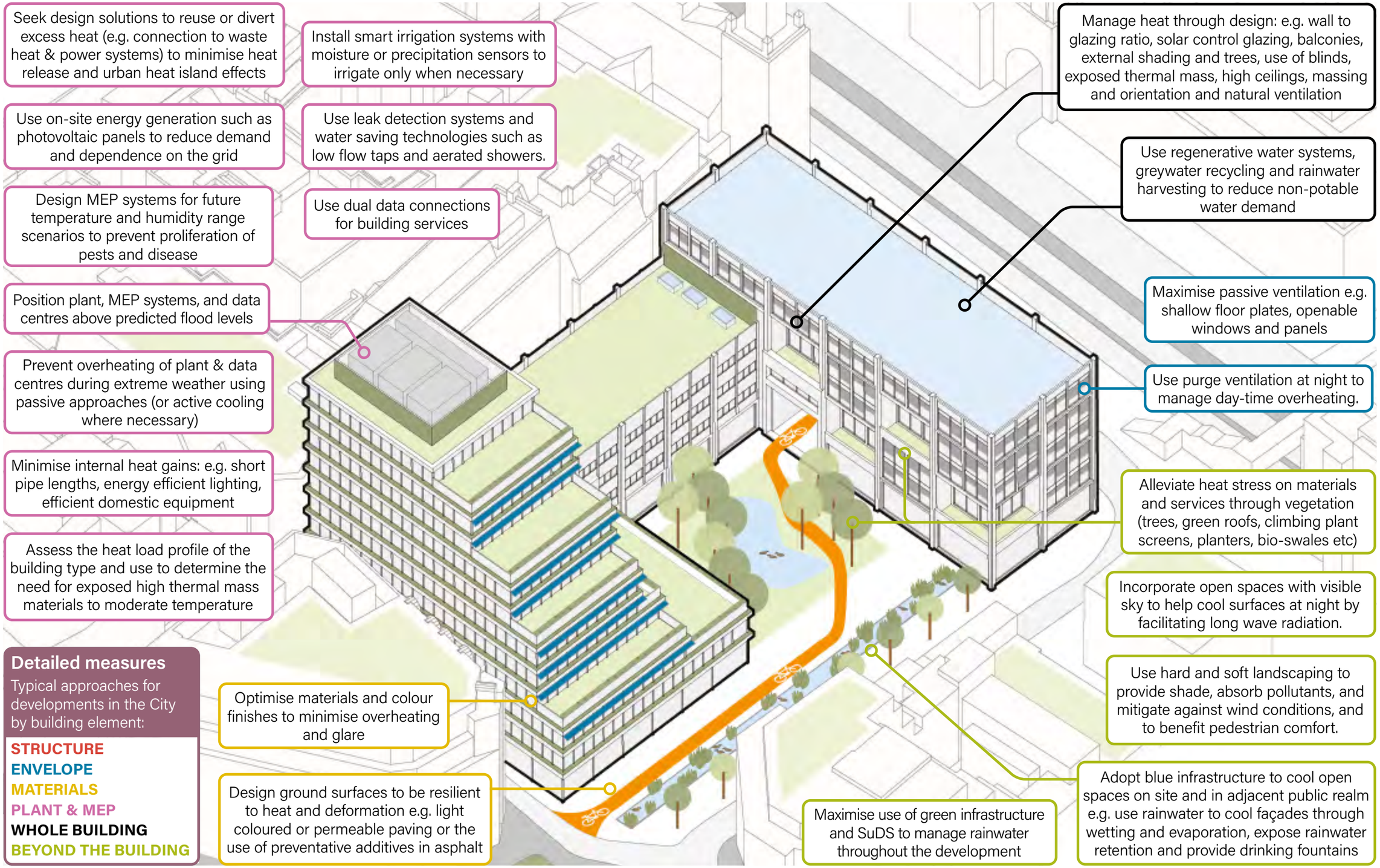
Use: Commercial office

Key facts:

- Site located in Flood Zone 1
- Rainwater harvesting and attenuation tanks, with water to be re-used for non-potable purposes, basement tank to discharge into public sewer with 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 1,265m^2
- Building Management System for water metres and water consuming plant to double up as leak detection
- SuDS to mitigate flooding
- Energy centre incorporates thermal storage and plate heat exchangers to facilitate connection to a district heating or cooling network
- Two intake rooms for data connections in the building's basement

6. CLIMATE RESILIENCE

KEY MEASURES FOR CITY DEVELOPMENTS



Seek design solutions to reuse or divert excess heat (e.g. connection to waste heat & power systems) to minimise heat release and urban heat island effects

Use on-site energy generation such as photovoltaic panels to reduce demand and dependence on the grid

Design MEP systems for future temperature and humidity range scenarios to prevent proliferation of pests and disease

Position plant, MEP systems, and data centres above predicted flood levels

Prevent overheating of plant & data centres during extreme weather using passive approaches (or active cooling where necessary)

Minimise internal heat gains: e.g. short pipe lengths, energy efficient lighting, efficient domestic equipment

Assess the heat load profile of the building type and use to determine the need for exposed high thermal mass materials to moderate temperature

Install smart irrigation systems with moisture or precipitation sensors to irrigate only when necessary

Use leak detection systems and water saving technologies such as low flow taps and aerated showers.

Use dual data connections for building services

Manage heat through design: e.g. wall to glazing ratio, solar control glazing, balconies, external shading and trees, use of blinds, exposed thermal mass, high ceilings, massing and orientation and natural ventilation

Use regenerative water systems, greywater recycling and rainwater harvesting to reduce non-potable water demand

Maximise passive ventilation e.g. shallow floor plates, openable windows and panels

Use purge ventilation at night to manage day-time overheating.

Alleviate heat stress on materials and services through vegetation (trees, green roofs, climbing plant screens, planters, bio-swales etc)

Incorporate open spaces with visible sky to help cool surfaces at night by facilitating long wave radiation.

Use hard and soft landscaping to provide shade, absorb pollutants, and mitigate against wind conditions, and to benefit pedestrian comfort.

Adopt blue infrastructure to cool open spaces on site and in adjacent public realm e.g. use rainwater to cool façades through wetting and evaporation, expose rainwater retention and provide drinking fountains

Maximise use of green infrastructure and SuDS to manage rainwater throughout the development

Optimise materials and colour finishes to minimise overheating and glare

Design ground surfaces to be resilient to heat and deformation e.g. light coloured or permeable paving or the use of preventative additives in asphalt

Detailed measures

Typical approaches for developments in the City by building element:

STRUCTURE
ENVELOPE
MATERIALS
PLANT & MEP
WHOLE BUILDING
BEYOND THE BUILDING

URBAN GREENING AND BIODIVERSITY

07

7. URBAN GREENING AND BIODIVERSITY

Introduction

This chapter provides guidance on how to incorporate habitats that enhance biodiversity, and support Greater London urban greening initiatives, including green infrastructure, into developments in the Square Mile. The chapter advises on how to meet and exceed policy targets set out for the London Urban Greening Factor and the national Biodiversity Net Gain. It provides suggestions for interventions that can be used in different areas of a development that are relevant to the City's urban setting.

Key approaches for the City

The City 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 submitted for development in the City should strive for the best biodiversity outcomes on individual sites, while showing consideration for the wider urban environment including providing external amenity spaces. This will require biodiversity risks and opportunities to be discussed with CoLC before, during and after planning application submission.

Proposals must provide high quality greening in open spaces and on buildings within the site and include an Urban Greening Factor calculation. Biodiversity Net Gain (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 from January 2024 and requires a minimum of 10% biodiversity net gain.

Improving the connectivity and biodiversity value of green spaces and enhancing the habitats of priority species are the focus of the CoLC's Biodiversity Action Plan (BAP) and must be considered from the outset of the design process; informing design decisions including potential opportunities to link on-site greening into the wider green infrastructure network.

Key policies and guidance

Table 7.1 Biodiversity & green infrastructure key planning policies

London Plan 2021

- D8 Public realm 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

Local Plan 2015

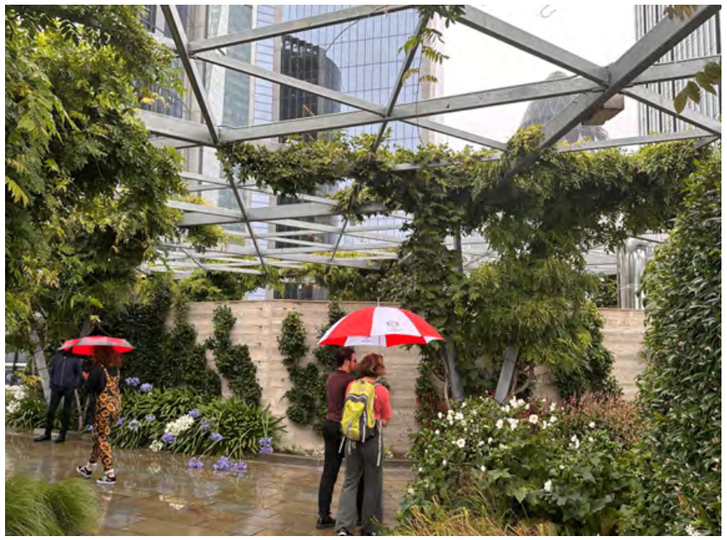
- CS10: Design
  - DM 10.2: Design of green roofs and walls
  - DM 10.4 Environmental enhancement
- CS15: Sustainable Development and Climate Change
  - DM 15.5: Climate change resilience and adaptation
- CS19: Open Spaces and Recreation
  - DM 19.1: Additional open space
  - DM 19.2: Biodiversity and urban greening

Draft 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

Key actions to develop an exemplar City scheme

- Develop a strategy that maximises the extent and quality of urban greening and biodiversity on a site
- Adopt a strategic approach to urban greening and biodiversity enhancements by linking with existing biodiversity corridors, surrounding pockets of green space and cool routes
- Incorporate nature-based solutions in the development that provide co-benefits for both humans and biodiversity such as bio-solar roofs, Sustainable Drainage Systems (SuDS) and green amenity spaces
- 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)
- Balance the amenity requirements with biodiversity benefits in response to the location, development type and use of a site



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 and walls as part of biodiverse roofs, in amenity spaces and green balconies, terraces and walls. Ideally, all urban greening should be integrated into a network of green infrastructure that forms biodiversity corridors to support diversity and natural habitats. A green network will also create walking and cycling routes through the City protected from overheating, pollution and noise.

Key measures

Urban greening and biodiversity benefits will need to be incorporated into the design concept stage of a project to ensure the highest quality outcome.

CoLC has a series of area-based public realm strategies that target key green infrastructure locations. A range of projects across the City have been identified through the 'Cool Streets and Greening Programme', funded by CoLC. These projects aim to enhance 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. The 'Cool Streets and Greening Programme' has taken a strategic approach by targeting the green connectivity around the City's Sites of Importance for Nature Conservation. This includes managing a network of over 200 green spaces in the Square Mile. Applicants will be supported in connecting and growing this network as part of their schemes.

CoLC is looking to establish additional green infrastructure in the Square Mile through climate resilient street greening to address the current lack of open space. New developments will be key in creating a wider green network that allows flora and fauna to flourish, and applicants should actively engage in contributing to its development. 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.

Wider species context

Green infrastructures are key for the movement of wildlife across the City landscape. 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.

Urban greening can be positioned to form stepping stones for wildlife and it can be developed into green infrastructure to support species and maximise benefits to wildlife. 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.

Opportunities to integrate urban greening into any type of development should be taken, both on external ground and upper-level surfaces of a building.

Whole 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.

Potential indirect impacts to species using green pockets and corridors should be considered, such as light pollution for bats and disturbance of nesting birds. In accordance with best practice guidance 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.

Case study: 55 Bishopsgate - Green wall

View from Bishopsgate. *Source: DAS*

Use: Commercial office with mixed use (retail, culture, learning, community use, public viewing gallery)

Key facts:

- Incorporation of a modular seeded living wall system between the proposed two towers
- 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
- Fire safety measures to be incorporated in collaboration with the GLA and the London Fire Brigade.

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, the London Plan 2021 (Policy G5) introduced the requirement for major development proposals to submit an UGF calculation that meets a minimum target of 0.4 for developments that are primarily residential, and 0.3 for predominantly commercial buildings. The use of the London target was supported by a Local Plan evidence base study conducted in 2018.

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. Biodiversity Net Gain (BNG) is a separate requirement, which provides the opportunity to unlock additional space for biodiversity by steering associated soft landscaping towards habitat creation, therefore providing more biodiversity on-site which is of benefit to local wildlife.

The CoLC has provided adjusted scoring metrics for the GLA's UGF that 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.

The Square Mile is a unique environment that is affected by a combination of conditions such as heat island effects, wind tunnels, rain shadows from tall buildings, mild winters and increasing summer temperatures. By 2080 it is predicted that there will be an average of 56 days of heatwave at 39.0 C. In addition, 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.

Key measures

Whole building

Development proposals must 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. Evaluation of greening options should inform the earliest stages of the design process to accommodate the required specification and meet the UGF target score.

Major applications should employ landscape experts who prepare a landscape plan as part of the planning documents that includes details of species of trees and shrubs, sizes, numbers and densities. An operational maintenance plan that details how the greenery will be maintained throughout the building's life-cycle is also required.

The aim for City development is to incorporate high scoring surfaces such as intensive green roofs (typically with a minimum substrate depth of 80mm), flower-rich perennial planting and rain gardens wherever possible.

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, and helping to 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 resources 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.

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

Case Study: 81 Newgate Street - Major refurbishment and extension

Visualisation showing green walls and terraces
Source: Planning Application: DAS, Landscape Statement, Sustainable Development Report

Use: Mixed-use Office

Key facts:

- Extensive landscaping and greening, achieving an urban greening factor of 0.397, above the target 0.3 of the London Plan
- 4928m2 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

7. URBAN GREENING AND BIODIVERSITY

BIODIVERSITY

Biodiversity in the City

A Tailored approach

There are many opportunities to enhance biodiversity in the highly urbanised area of the Square Mile. Urban greening can be incorporated in a variety of ways into buildings, open spaces and public realm and develop into valuable habitats to support biodiversity. Any enhancements should be in line with the CoLC Biodiversity Action Plan 2021-2026 (BAP) which outlines the target species and habitats for the City and identifies the locations of designated Sites of Importance for Nature Conservation (SINCs).

Priority habitats in the City

There are two priority habitats for the City that offer an opportunity to create or enhance biodiversity in new or existing green spaces:

- 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 on site. 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 provide valuable wetland habitat for wildlife if sensitively designed. 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

Artificial nests and bird boxes can be used to provide nesting opportunities for swifts and house sparrows, with tailor-made nest boxes to encourage usage. For all nests and boxes, care needs to be taken for siting and positioning in relation to the habitat context, exposure, aspect and height. Planning and installation should be conducted by a qualified ecologist.

Designated sites for conservation in the City

The City does not contain any statutory designated sites for nature conservation, however there are several non-statutory designated sites 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.

Developments in the City will need to ensure that nature on these sites is not damaged but enhanced to develop core green infrastructure across the borough. Developments within the vicinity of Sites of Importance for Nature Conservation (SINCs) should contribute financially to the maintenance of the conservation sites and incorporate complementary enhancements to the designatory features of the SINC.

As part of the data search, London's Local Environmental Records Centre (LERC) Greenspace Information for Greater London (GiGL) should be consulted for comprehensive data on London's habitats, species and protected sites, including SINCs.

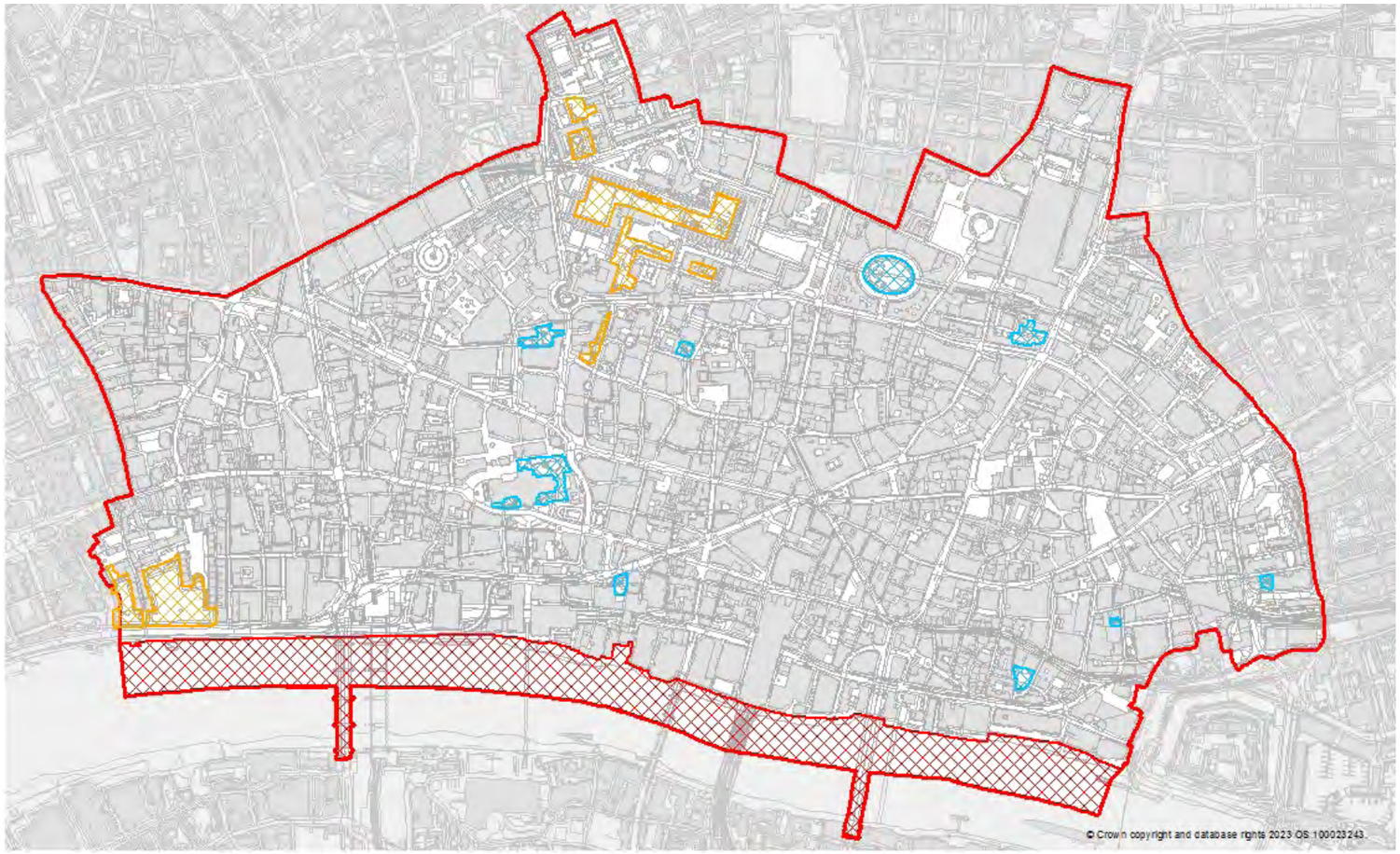


Figure 7.1 Sites of Importance for Nature Conservation (SINCs) in the City
Source: City of London Corporation

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. BNG will be measured using Defra's biodiversity metric and habitats will need to be maintained for a minimum of 30 years. This would apply to all off-site and significant on-site development. Provision on smaller sites through the Small Sites Metric will be required from 2024.

Calculating the value of habitats

The biodiversity metric is a tool that calculates changes in the extent and quality of habitats as a proxy for nature and compares the habitat found on a site before and after development. This tool should be used by a suitably qualified and experienced ecologist. Four key factors underpin this comparison:

- 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 and providing the replacement of lost habitat and features within the development boundary.
4. Offset: Only utilised where the previous options have been exhausted.

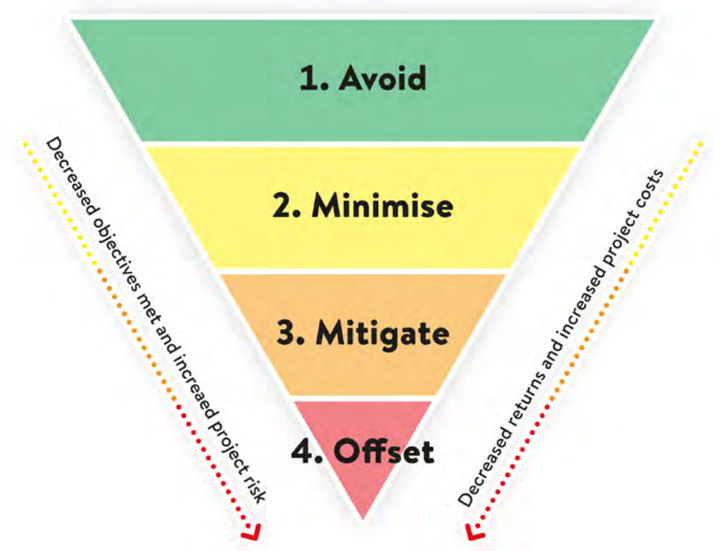


Figure 7.3 Mitigation hierarchy diagram
Source: Buro Happold

Case Study: 120 Fleet Street
Redevelopment for a 21-storey tower

Visualisations capturing the extent of terraces
Source for both images: Planning Application townscape views

Use: Retail, commercial, office and service

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
- 1 bio-solar roof
- Rainwater harvesting for irrigation
- Biodiverse, blue roof to provide SuDS and habitats

7. URBAN GREENING AND BIODIVERSITY

BIODIVERSITY NET GAIN

Biodiversity net gain delivery

The CoLC commissioned a Biodiversity Net Gain Feasibility Study for the Square Mile. 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. To meet the requirements of delivering BNG in the City, developments are expected to achieve at least 3.0 BU/ha on site. Where development falls short of the 3 BU/ha target, offsetting measures should be agreed with planning officers.

A Preliminary Ecological Appraisal Report (PEAR) needs to be submitted at planning application stage, along with the Defra Biodiversity Metric (DBM) spreadsheet. Prior to commencement, a Biodiversity Net Gain Plan will need to be submitted that will set out the strategy for achieving BNG, including information not captured in the biodiversity metric such as species factors, as well as a Habitat Management Plan that outlines how the net gains will be managed and maintained for a minimum of 30 years.

In cases where the biodiversity baseline is zero due to an absence of habitats, the development should still demonstrate a BNG process whereby habitats and green infrastructure of suitable scale are incorporated into the development design - minimum requirements are to be agree in coordination with the CoLC.

Ecosystem services

The value of biodiversity extends beyond supporting the thriving of habitat and species to the provision of ecosystem services such as reduction of the 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.

Strategic approach

Any created or enhanced habitats will have more strategic significance and therefore a higher value in the metric if they adhere to local priorities such as those outlined in the CoLC's Biodiversity Action Plan (BAP). By focusing on target species and habitats and linking up with existing green spaces, enhancements will have a greater benefit to the wildlife of 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.

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.

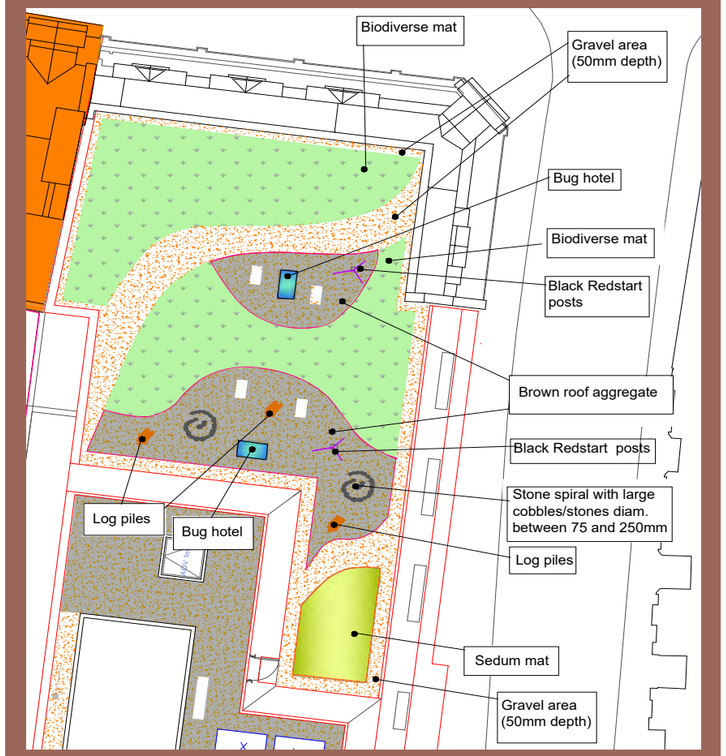
The CoLC will be developing a Nature Recovery Strategy following implementation of the Mayor of London's LNRS. This strategy complements the City's Biodiversity Action Plan. By 2026 the City of London will report on its biodiversity duties and strategies through a Biodiversity Report.

The CoLC's Climate Resilient Planting Catalogue will provide 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 CoLC guidance for urban greening and biodiversity for the design of development proposals.

Case study: Creed Court Hotel, 3 Ludgate Hill
Redevelopment with retained facade



Biodiverse Roof

Source: Planning Application, Drawing – Landscape Areas Roof

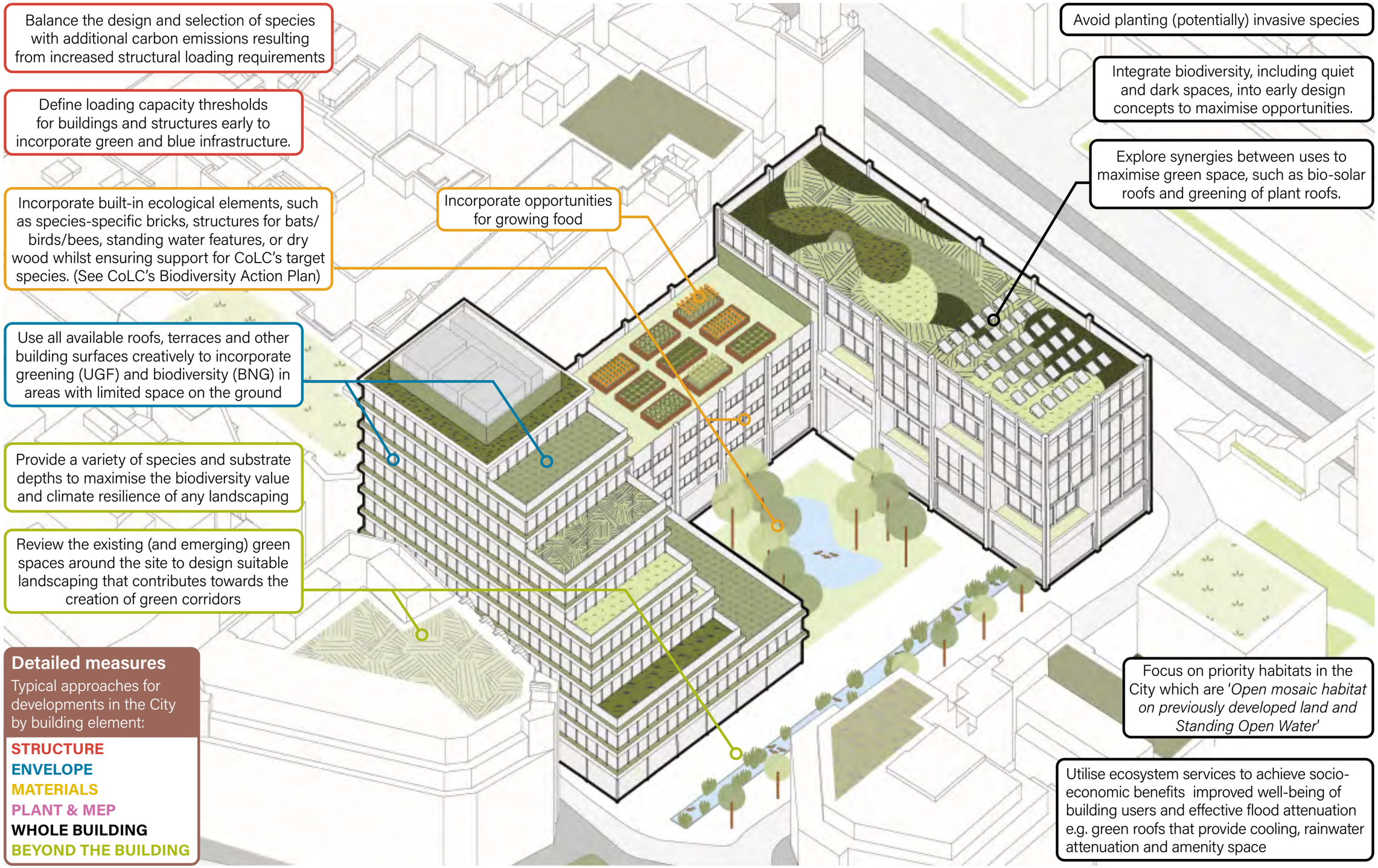
Use: 7-storey Hotel, restaurant, services

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.

7. URBAN GREENING AND BIODIVERSITY

KEY MEASURES FOR CITY DEVELOPMENTS



Balance the design and selection of species with additional carbon emissions resulting from increased structural loading requirements

Define loading capacity thresholds for buildings and structures early to incorporate green and blue infrastructure.

Incorporate built-in ecological elements, such as species-specific bricks, structures for bats/ birds/bees, standing water features, or dry wood whilst ensuring support for CoLC's target species. (See CoLC's Biodiversity Action Plan)

Use all available roofs, terraces and other building surfaces creatively to incorporate greening (UGF) and biodiversity (BNG) in areas with limited space on the ground

Provide a variety of species and substrate depths to maximise the biodiversity value and climate resilience of any landscaping

Review the existing (and emerging) green spaces around the site to design suitable landscaping that contributes towards the creation of green corridors

Incorporate opportunities for growing food

Avoid planting (potentially) invasive species

Integrate biodiversity, including quiet and dark spaces, into early design concepts to maximise opportunities.

Explore synergies between uses to maximise green space, such as bio-solar roofs and greening of plant roofs.

Focus on priority habitats in the City which are '*Open mosaic habitat on previously developed land and Standing Open Water*'

Utilise ecosystem services to achieve socio-economic benefits improved well-being of building users and effective flood attenuation e.g. green roofs that provide cooling, rainwater attenuation and amenity space

Detailed measures

Typical approaches for developments in the City by building element:

STRUCTURE
ENVELOPE
MATERIALS
PLANT & MEP
WHOLE BUILDING
BEYOND THE BUILDING

KEY CONSIDERATIONS AND SUBMISSION REQUIREMENTS

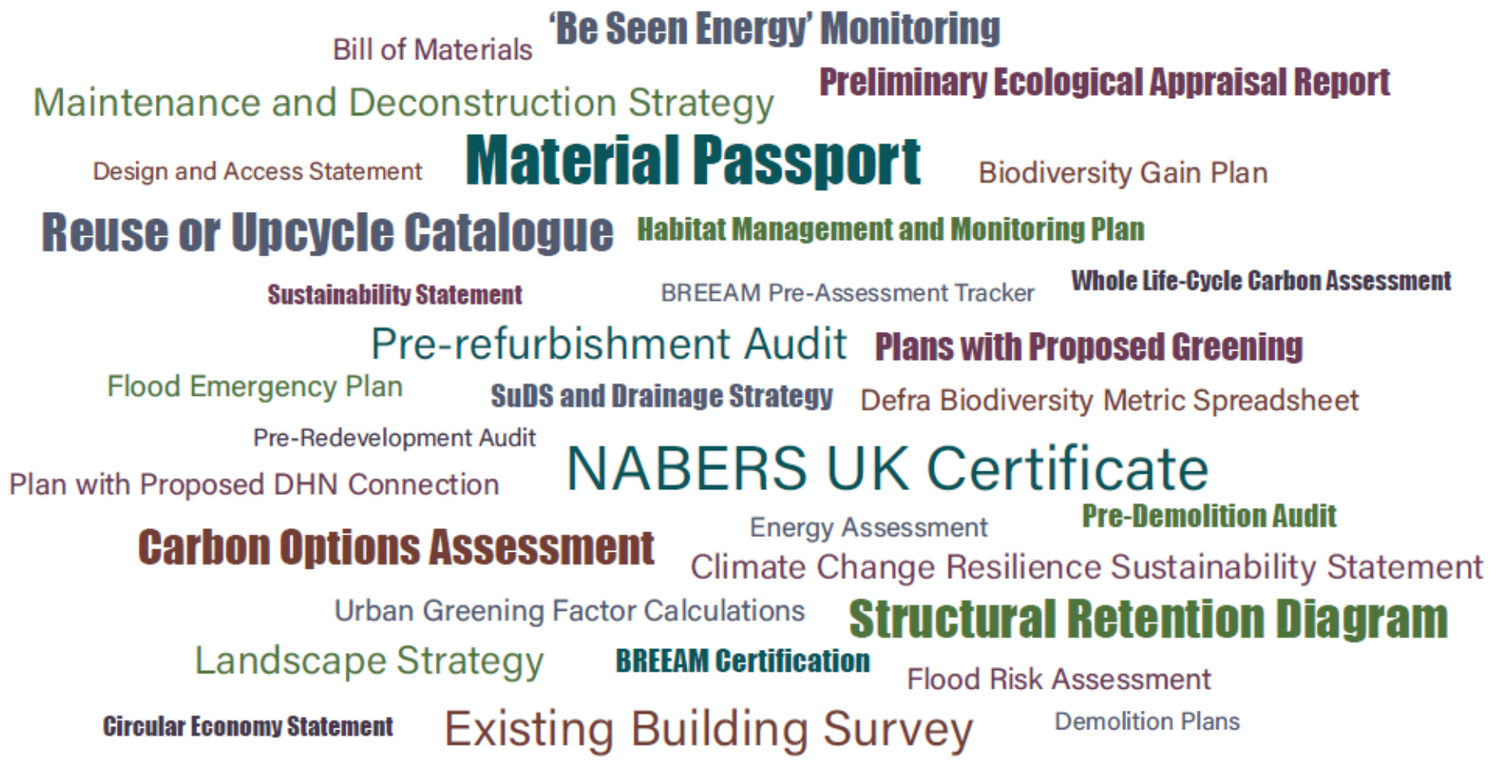
08

8. KEY CONSIDERATIONS AND SUBMISSION REQUIREMENTS

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 provides details and examples of those considerations and actions that are recommended for applications in the City of London. The following pages outline the required application documents and recommended supplementary information to demonstrate exemplary practice that would support an application and contribute to a high quality outcome.



Source: City of London Corporation

8. KEY CONSIDERATIONS AND SUBMISSION REQUIREMENTS

CONCEPTION / RIBA STAGE 0

Application stage	Key considerations	Submission requirements and recommendations

Conception/ RIBA Stage 0	▪ Detailed building survey to assess the opportunities and constraints of the existing structure and fabric
	▪ Applicant's sustainability aspirations for the City location
	▪ Engaging creative and experienced architects, engineers and designers that can develop the optimal sustainable, attractive and bespoke solution for a site
	▪ The City's priorities and focus relating to environmental, social and economic sustainability aims
	▪ Opportunities and constraints from heritage and townscape impacts on the proposed design
	▪ Local context, such as relating to
	  ▪ availability of energy infrastructure and energy sharing opportunities
	  ▪ contact with supporting Business Improvement Districts
	  ▪ existing and emerging green infrastructure and biodiversity networks
	  ▪ local climate resilience measures to include SuDS, urban greening and cool routes
	  ▪ requirements for on-site climate resilience measures
	  ▪ other synergy opportunites
	▪ Opportunities for the re-use of materials and building elements from applicant's/ construction company's other projects or material exchange websites to inform the design of new building elements
	▪ Expert audit of existing biodiversity value and safeguarding existing on-site habitats	

8. KEY CONSIDERATIONS AND SUBMISSION REQUIREMENTS

CONCEPTION / PRE-APPLICATION / RIBA STAGE 1

Application stage	Key considerations	Submission requirements and recommendations

Conception / Pre-application / RIBA Stage 1	▪ Entering into a Planning Performance Agreement, or a series of relevant pre-application meetings relating to the topics Carbon Optioneering, Sustainability, and Climate Resilience (to be agreed with planning officers).
	▪ Alignment of the proposal with planning officers' recommendations on:
	  ▪ priorities relating to the locality, the City as a whole and connectivity within the City and with the wider London context
	  ▪ specific environmental sustainability policies and the CoLC's vision
	  ▪ the contributions to the environmental quality of the site context and expected public benefits from the proposals (see application stage below)
	  ▪ health and well-being issues
	▪ Development of the concept options, application proposal and identification of sustainability issues to be developed in more detail and, if applicable, those that need to be mitigated to achieve solutions of the highest quality
	▪ Discussion of the requirements of optioneering in accordance with the Carbon Options Guidance Planning Advice Note (2023). In order to make informed decisions about the proposed circular economy and whole life-cycle carbon strategy, development options must be tested for carbon impacts and evaluated in terms of alignment with the CoLC's vision, the applicant's brief, and potential viable alternatives to the brief
	▪ Design to be informed by a pre-redevelopment audit (aligned with the carbon options) exploring opportunities for maximum retention and material use
	▪ Development of a circular economy strategy, prioritising the retention, re-use and recycling of building elements, materials and fit-out items, to include for example deconstruction strategies and including fit-out take-back schemes, before designing any new build elements for maximum flexibility and adaptability
	▪ Adopting an embodied, operational or whole life-cycle carbon standard, such as LETI's embodied carbon primer, the UKGBC's EUI targets or the UK Net Zero Carbon Buildings Standard to demonstrate commitment for exemplary net zero performance
	▪ Prioritising the objectives of the City of London Local Area Energy Plan (LAEP) to include creating links to or extensions of local energy networks and waste heat sources; and consider waste heat transfer from commercial to other uses nearby.
		All development
		▪ **Pre-application documents** on topics such as:
		  ▪ Existing site and buildings analysis
		  ▪ Site context – opportunities
		  ▪ Project aspirations on sustainability
		  ▪ Technical solutions
		  ▪ Others as required depending on site
		
		Major development (including applications referable to the Mayor):
		▪ **Carbon options assessment and Excel tool** as required by Carbon Options Guidance Planning Advice Note 2023 to carry out 3rd party review.
		▪ **Draft pre-redevelopment audit** & **pre-demolition audit** in line with GLA guidance 2022
		▪ Study of opportunities to incorporate collective infrastructure such as energy networks, smart grids and energy storage (e.g. batteries) where possible
		
		Recommended material to demonstrate exemplary practice:
		▪ **Existing building survey** and analysis of context in as much detail as possible to inform opportunities and constraints
		▪ **Public engagement material**

8. KEY CONSIDERATIONS AND SUBMISSION REQUIREMENTS

CONCEPTION / PRE-APPLICATION / RIBA STAGE 1 (CONTINUED)

Application stage	Key considerations	Submission requirements and recommendations

Pre-application/RIBA Stage 1 (continued)	▪ Consultation with specialist officers as required, such as with regard to
	  ▪ environmental resilience
	  ▪ biodiversity
	  ▪ building services and structural engineers
	  ▪ circularity principles
	  ▪ air quality
	This will be particularly advisable where bespoke and innovative solutions are sought, e.g. initiatives to
	  ▪ deliver the objectives of the biodiversity action plan
	  ▪ achieve the highest quality balance between benefits of amenity, urban greening, biodiversity and climate resilience
	  ▪ integrate climate resilience and energy infrastructure (to include solutions for non-combustible fuel energy back up technologies). The CoLC will support developers in implementing proposals and interventions to support heat networks in the City, including through meetings, initiatives and further City-specific guidance.
	  ▪ drive forward low embodied carbon design and construction such as timber/CLT building elements (or other bio-based materials) and construction methods
	▪ Commitment to certification schemes and targeted ratings
	▪ Discussion about public consultation and engagement arrangements and content
	▪ Confirmation of required application documents	

8. KEY CONSIDERATIONS AND SUBMISSION REQUIREMENTS

PLANNING APPLICATION / RIBA STAGE 2-3

Application stage	Key considerations	Submission requirements and recommendations

Planning application / RIBA Stage 2-3	▪ Incorporation of refinements and amendments into the proposals, resulting from the:
	  ▪ carbon optioneering process
	  ▪ pre-application process
	  ▪ public consultation responses
	▪ Ensuring all issues identified in the pre-application, carbon optioneering process and public engagement phase are comprehensively and prominently covered in the application documents
	▪ Ensure that any public benefits of the development include environmental benefits for the local area and City as a whole. These should be clearly laid out and demonstrated in the application documents
	▪ Designing for loose fit - Identification of opportunities of the application design for future proofing of the proposed development including improvements to the sustainability performance before and after practical completion, such as from the design, fit-out, repair and maintenance and end of life phases of a development.
	
	Future proofing in this context is designing in flexibility and adaptability to incorporate measures or to alter development details as easily as possible to improve its environmental performance. Examples are replacing proposed materials or building element systems, enabling natural ventilation at a later date, adapt the building services strategy for new, leaner technologies.
	▪ Further development of an offer for innovative measures to be tested, in particular where they can provide solutions for site specific issues and concerns. This could include mitigation measures, 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.
	▪ Include separate operational carbon emissions for refurbishments with new build extensions over 1,000m2. For deep refurbishments, also provide calculations using a new build baseline for the whole development.
	▪ Include green leases/clauses for tenanted floorspace to ensure energy efficiency design and low carbon fit-out and operation across the whole development
	▪ Publication of pre-demolition audits in suitable online databases and other media as early as possible in order to support reuse marketplaces
		Major development (including applications referable to the Mayor):
		▪ **Sustainability Statement** to include a summary of all relevant separate technical assessments, and detailed information on how the development addresses climate resilience risks
		▪ **Carbon Options Assessment** (standalone document preferred) - clearly labelled and presented
		▪ **Whole Life-Cycle Carbon Assessment** (in accordance with GLA guidance and including **spreadsheet**) (standalone document preferred), to include provision of data through the GLA WLCA template and including updates where applicable
		▪ **Energy Assessment** (in accordance with the GLA guidance, and including **spreadsheet**) (standalone document preferred)
		▪ **'Be Seen' Energy Monitoring**- upload information and performance data and confirmation of subsequent metering plan and portal updates
		▪ **BREEAM pre-assessment** – minimum 'Excellent' rating, expected 'Outstanding' rating, with maximum credits for the Energy, Materials, Waste, Pollution and Water categories including credit Wst05 'Adaptation to climate resilience'. To include a BREEAM pre-assessment tracker indicating achievable, possible and non-achievable credits and rationale
		▪ Commitment to a minimum **NABERS UK 5 Star certification**
		▪ **Circular Economy Statement** (in accordance with GLA guidance), to include:
		  ▪ **pre-redevelopment audit** with options appraisal
		  ▪ **pre-demolition audit**
		  ▪ the exploration of options (agreed as part of the Carbon Options Assessment) with regard to optimising circularity principles
		▪ **Preliminary Ecological Appraisal Report (PEAR),** including details of biodiversity baseline assessments, and **Defra Biodiversity Metric (DBM) spreadsheet**
		▪ **Landscape Strategy**, including details of proposed greening, irrigation system, and other supporting measures to enhance biodiversity, and **Urban Greening Factor** (UGF**) plans and calculations**
		▪ SuDS and Drainage Plan
		▪ Flood Risk Assessment
		▪ Flood Emergency Plan, where applicable

8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

PLANNING APPLICATION / RIBA STAGE 2-3 (CONTINUED)

Application stage	Key considerations	Submission requirements and recommendations
Planning application / RIBA Stage 2-3 (continued)	▪ Considerations of development details that potentially can be optimised at later design stages and confirmed through appropriate conditions that allow for flexibility, improvements and incorporation of latest technologies, materials and building element and services systems into the design ▪ Make use of GiGL data search reports to inform urban greening and biodiversity proposals and upload any new biodiversity data gathered as part of the planning application to GiGL	**Recommended material to demonstrate exemplary practice:** ▪ Presentation of **innovative solutions** and best practice outcomes to reduce energy use, carbon emissions, demolition and construction waste and other exemplary sustainability features under the relevant topics ▪ **Maintenance and Deconstruction Strategy,** to demonstrate how waste is reduced during the lifetime of the building, and how material recovery is maximised at end of life ▪ **Reuse or Upcycle Catalogue**, to demonstrate material resource efficiency ▪ **Axonometric drawings** to clearly visualise which parts of the structure are retained/reused/new **Minor Development** ▪ **Design & Access Statement** to include a Sustainability section for all relevant design measures and actions to address the sustainability issues as listed in the list of documents for major applications, to include carbon optioneering as required Or alternatively ▪ **Sustainability Statement** with all information relevant to the proposed works **Recommended material to demonstrate exemplary practice for applications where carbon optioneering is not required:** ▪ Demonstrate consideration of **different development options** and their carbon impacts, with prioritisation of lower whole life-cycle carbon options wherever possible. **All applications:** **List of approved drawings**, to include (where applicable): ▪ (Future) connection to a heat network ▪ Details of urban greening and biodiversity measures including type and extent of proposed greening ▪ Green/bio-solar and blue roofs, green walls ▪ Heat pump ventilation surfaces ▪ PV panels ▪ Natural ventilation intake areas and ventilation panels

8. SUBMISSIONS REQUIREMENTS AND CONSIDERATIONS

POST APPLICATION CONDITIONS / POST OCCUPANCY / RIBA STAGE 4-7

Application stage	Key considerations	Submission requirements and recommendations
Post application, conditions / Post occupancy / RIBA Stages 4-7	▪ Entering into a Conditions Planning Performance Agreement to ensure resources are available to discharge conditions relating to details of the highest quality ▪ Demonstrating 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 of building elements and materials on site and in other construction projects. This should include actions to limit carbon emissions from unnecessary extent of CAT B fit out needed for marketing. ▪ Developing 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. ▪ Reviewing extent and quality of urban greening, biodiversity and climate resilience measures on site in accordance with updated opportunities and constraints ▪ Provision of 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 ▪ Engaging 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. Best performances are awarded and Environmental Best Practice meetings and workshops are hosted.	**All developments** ▪ **Detailed drawings and studies** as required by planning conditions ▪ **'Be Seen' Energy Monitoring** – update contextual data and upload energy performance predictions ▪ Post completion **Climate Change Resilience Sustainability Statement** (CCRSS) ▪ Post completion **Circular Economy Statement** ▪ Post construction **Whole Life-Cycle Carbon assessment** ▪ **BREEAM assessment final certificate** ▪ **NABERS UK final certificate** ▪ **Biodiversity Gain Plan** (BGP) ▪ **Habitat Management and Monitoring Plan** (HMMP) ▪ Confirmation of maintenance requirements for urban greening, rainwater collection and other relevant installations **Recommended material to demonstrate exemplary practice, to include:** ▪ **Material passports** e.g. via the Circuland platform ▪ 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 ▪ Case study for publication. ▪ Submit project information to the **Built Environment Carbon Database** (BECD)

Appendix A:
RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

A

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
RETROFIT AND REUSE

Document	Key Considerations
The GLA's 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 the circular economy principles that all developments should be encouraged to incorporate
City of London Carbon Options Guidance Planning Advice Note (May 2023 or latest version)	Pre-applications should show that both minor and major refurbishment options and their carbon impacts have been considered. Options should be well-considered, realistic and feasible. Where substantial refurbishment or demolition is not being considered, an options appraisal is not required, but a WLCA is required.
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 the circular economy principles that all developments should be encouraged to incorporate.

Reference and further guidance

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

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

LETI (2021) Climate Emergency Retrofit Guide. London 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 Embodied Carbon Best Practice Targets	Staggered emissions targets between now and 2030 for residential, commercial and educational buildings with emphasis on material reuse
Exceeding BREEAM v6 'Excellent' (v6)	Aim to achieve 'Outstanding' Strong recommendation to achieve: ▪ Man03 –minimum 2 credits rather than 1 ▪ Mat01 –maximise the credits under this criteria
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
City of London Carbon Options Guidance Planning Advice Note (May 2023 or latest version)	All major developments must assess both operational and embodied carbon emissions over a whole life-cycle. Non-major developments should align with the GLA guidance and pre-application reporting

Operational emissions and energy

Document	Key Considerations
Exceeding BREEAM 'Excellent'	Ideally, target 'Outstanding' Ene01 credits targeted to be in line with BREEAM outstanding minimum requirements where feasible
RIBA Sustainable Outcomes Guide v2 2021, 2030 Climate Challenge Targets	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 Design for Performance Certification (New office development and major refurbishments) Historic England: Energy Efficiency in Historic Buildings Guidelines	Commit to design and build development to achieve Rating of 5 or more stars, nominate target at outset and rating achievement plan, post-construction quarterly reports on performance during occupational period Traffic-light coded interventions according to combined cost and impact levels
London Plan Guidance - Housing Design Standards - Consultation Draft February 2022	▪ 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) ▪ On-site 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 & Carbon Offsetting: Guidance for net zero carbon buildings	For existing buildings: create plan to phase out fossil fuels as primary energy source for heating, hot water and cooking by next system replacement cycle. For new and existing buildings: ▪ Prioritise on-site renewables (e.g. PVs) wherever possible ▪ Procure minimum 15 year Power Purchase Agreement (PPA) with new, unsubsidised renewable generation (including private wire) ▪ Procure minimum 15 year PPA with new, unsubsidised renewable generation ▪ Procure electricity through a high quality green tariff supplier that is 100% renewable sourced only (providing future additionality) New UKGBC guidance on green energy procurement and offsetting expected in 2023.

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

City of London (2023) City of London Lighting, Supplementary Planning Document. City of London Corporation

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

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 (2022) Housing Design Standards LPG Consultation Draft. 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

https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/energy/london-heat-network-manual-ii

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

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. London Energy Transformation Initiative

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

LETI (2023) LETI Unpicker. Retrofit vs rebuild: Unpicking the carbon argument Retrofit vs rebuild unpicker (leti.uk). London 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) Sustainable Outcomes Guide v2. Royal Institute of British Architects

UK Net Zero Carbon Buildings Standard (online) UK Net Zero Carbon Buildings Standard

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

UKGBC (2021) Renewable Energy Procurement & Carbon Offsetting Guidance for net zero carbon buildings. 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

Document	Key Considerations
City of London Carbon Options Guidance Planning Advice Note	Align development/demolition/construction options between both the Whole Life Carbon Optioneering process and Circular Economy Statement
The Chancery Lane Project – Sustainable and Circular Economy Principles in Leasing Arrangements for Repairs and Alterations	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.
The GLA's 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 the circular economy principles that all developments should be encouraged to incorporate
UK Green Buildings Council: Building Glass into a Circular Economy	Ensure that in buildings involving glass being disassembled or demolished, glass is 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

Operational circular economy

Document	Key Considerations
BREEAM Waste Credits	Achieve maximum credits
Living Building Challenge	Includes a series of progressive targets in the materials section

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES

CIRCULAR ECONOMY

Reference and further guidance

Arup (online) Circular Buildings Toolkit

C40 (2016) Sustainable Solid Waste Systems. C40 Cities Climate Leadership Group

Cheshire, D. (2016) Building Revolutions: Applying the Circular Economy to the Built Environment. Royal Institute of British Architects

City of London (2014) Waste Strategy 2013-2020. Planning a sustainable future for the City of London. City of London Corporation

City of London (2019) Code of Practice for Deconstruction and Construction Sites. City of London Corporation

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

City of London (online) Clean City Awards Scheme. City of London Corporation

NetPositive Solutions (online) Excess Materials Exchange Enfield Council

GLA (2020) Design for a Circular Economy. Primer. Greater London Authority

GLA (2022) Circular Economy Statement Guidance. Greater London Authority

Heyne Tillett Steel, HTS Stockmatcher. A tool to help procure reclaimed steel for use in new construction projects

International Living Future Institute (2019) Living Build Challenge 4.0. A visionary path to a regenerative future. International Living Future Institute

LETI (2020)Circular Economy 1-Pager. London Energy Transformation Initiative

Living Future (2019) Living Building Challenge International Living Future Institute

NLA(2023) Circular London, Building a renewable city, Circular-London-Report-6.pdf (nla-production-media.s3.eu-west-2.amazonaws.com), New London Architecture

Material Reuse Portal (online) Material Reuse Portal Circuit Project

OPDC (2018) Waste in Tall Buildings Study Final Report. Old Oak and Park Royal Development Corporation

The Chancery Lane Project (2022) Sustainable and Circular Economy Principles in Leasing Arrangements for Repairs and Alterations (online resource)

UKGBC (2018) Building glass into the circular economy How to guide. UK Green Building Council

UKGBC (2019) Circular economy actor and resource map. UK Green Building Council

UKGBC (2019) Circular economy guidance for construction clients: How to practically apply circular economy principles at the project brief stage. UK Green Building Council

UKGBC (2022) How Circular Economy Principles can impact carbon and value. UK Green Building Council

UKGBC (2022) System Enablers for a Circular Economy UK Green Building Council

UKGBC (online) Circular Economy Implementation Packs for Reuse and Products as a Service. UK Green Building Council

University of Sheffield (online) Regenerate Toolkit

WBCSD (2021) The business case for circular buildings. World Business Council for Sustainable Development

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
CLIMATE RESILIENCE

Flood Risk and SuDS

Document	Key Considerations
National Policy Planning Framework	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	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.
Lead Local Flood Authority (LLFA) Strategic Flood Risk Assessment (SFRA)	Provide local, tailored guidance on how to develop, maintain, apply and monitor a strategy for local flood risk management. The LLFA will conduct a SFRA that demonstrates area of localised flooding therefore guiding projects and designs.
London Plan Drainage Hierarchy from London Plan (2021)	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. Designs should make use of CIRIA design guides.

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.
Water Resource Planning Guideline	Guidance for the development of a Water Resource Management Plan for the development that complies with all relevant statutory requirements and governments policy: Water resources planning guideline - GOV.UK (www.gov.uk)

APPENDIX A RECOMMENDED STANDARDS, CERTIFICATIONS AND GUIDELINES
CLIMATE RESILIENCE

Building and Urban Overheating

Document	Key Considerations
London Plan Guidance Housing Design Standards - Consultation Draft February 2022	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.
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 Well-being -ventilation and air circulation - for reducing the spread of airborne diseases.
WELL	22 Pest Control – follow pest reduction and inspection measures.
LISI species of concern and action plan	List of species of concern in London with a LISI designation category assigned, and action plans. (LISI species of concern and action plan Excel)

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

Reference and further guidance

BCO (2019) Guide to specification. Best practice for offices. British Council for Offices

BCO (2023) BCO Guide to Specification Key Criteria Update – February 2023. British Council for Offices

BREEAM (2022) UK New Construction v6.

CIBSE (2014) TM49 Design summer years for London (2014). Chartered Institution of Building Services Engineers

CIBSE (2014) TM49 Design summer years weather data for London. Chartered Institution of Building Services Engineers

CIBSE (2017) TM59 Design methodology for the assessment of overheating risk in homes. Chartered Institution of Building Services Engineers

CIBSE (2017) TM59 Design methodology for the assessment of overheating risk in homes. Chartered Institution of Building Services Engineers

CIBSE (2020) Guide L Sustainability. Chartered Institution of Building Services Engineers

CIBSE (2020) Guide L Sustainability. The Chartered Institution of Building Services Engineers

CIRIA (2015) The SuDS Manual (C753). Construction Industry Research and Information Association

City of London (2020) Strategic Flood Risk Assessment. City of London Corporation

City of London (2021) Flood Risk Management Strategy. City of London Corporation

City of London (2021) Riverside Strategy. City of London Corporation

City of London (2022) Biodiversity Action Plan 2021-2026. City of London Corporation

City of London (2022) Thermal comfort guidelines. City of London Corporation

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

Code for Sustainable Homes (online) Code for Sustainable Homes: Technical Guide. November 2010 (publishing.service.gov.uk)

DEFRA (2015) Non-Statutory Technical Guidance. Department for Environment Food and Rural Affairs

DEFRA (2018) Tree Health Resilience Strategy 2018. Department for Environment, Food and Rural Affairs

DEFRA (online). UK Plant Health Information Portal. Department for Environment, Food and Rural Affairs

DLUHC (2022) Overheating: Approved Document O. Department for Levelling Up, Housing and Communities

DLUHC (2023) Building Regulations: Approved Document L. Conservation of fuel and power. Department for Levelling Up, Housing and Communities

EA (2022) Flood Risk Assessment Standing Advice. Environment Agency

EA (2023) Water resources planning guideline. Environmental Agency

EASIN. European Alien Species Information Network. European Commission

Estuary Edges (online) Design Principles.

Forest Research (online). Pest and disease resources.

GLA (2016) London's Urban Heat Island. Greater London Authority

GLA (2021) London Plan. Greater London Authority

GLA (2022) Housing Design Standards LPG Consultation Draft. Greater London Authority

GLA (online) Sustainable Drainage Action Plan and Sustainable Drainage Guidance. Greater London Authority

Greater London Authority (2021)Urban Greening for Biodiversity Net Gain: A Design Guide

HM Government (2021) Overheating: Approved Document O. Department for Levelling Up, Housing and Communities

HM Government (2021) The Future Homes Standard: changes to Part L..

HR Wallingford (online) Greenfield Runoff Rate Estimation Tool.

HR Wallingford (online) Surface Water Storage Volume Estimation Tool.

HR Wallingford (online)Water Quality Assessment for SuDS Developments Tool.

ICE (2022) ACO SuDS Route Map. Institute of Civil Engineers

IEMA (2020) IEMA EIA Guide to: Climate Change Resilience and Adaptation. Institute of Environmental Management and Assessment

International Living Future Institute (online) Living Building Challenge Resources

LASOO (2016) Non Statutory suds standards for sustainable drainage. Local Authority SuDS Officer Organisation

NNSS (online) Non Native Species Secretariat. GB,

MHCLG (2021) National Planning Policy Framework. Ministry of Housing, Communities & Local Government

Passivhaus (online resource) www.passivhaustrust.org.uk

RELi (2021) Resilience Action List + Credit Catalog. The RELi Collaborative

TDAG (2021). First Steps in Urban Heat: For Built Environment Practitioners. Trees and Design Action Group, UK

UKGBC (2022) A Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets. UK Green Building Council

UKGBC (2022) Climate Change Resilience In The Built Environment: Principles for adapting to a changing climate. UK Green Building Council

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

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

Green Infrastructure

Document	Key Considerations
Natural England - Green Infrastructure Framework	Natural England's Framework provides a list of principle to develop stronger GI 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, well-being, water, wildlife. 'Building with Nature' standards and accreditation 'Wildlife Trust 'Biodiversity Benchmark'
UKGBC Practical how-to guide: Developing and implementing a green infrastructure strategy	The guide provides a practical guide for the formulation of 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 well-being, 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 on site 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.
GLA 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 CoL 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 CoL, to encourage certain categories, particularly tree planting, green roofs and green walls.
CoL 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 well-being. 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 or latest version)	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 Well-being, 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

Reference and further guidance

Bat Conservation Trust (online). Bat Boxes - Buildings, planning and development. Bat Conservation Trust, UK.

Bat Conservation Trust (online). Artificial Lighting Guidance. Bat Conservation Trust, UK.

British Standards Institution (2012) BS5837:2012 Trees in relation to design, demolition and construction

British Standard Institution (2013) BS42020:2013: Biodiversity. Code of Practice for Planning and Development

British Standard Institution (2021) BS8683:2021: Process for designing and implementing Biodiversity Net Gain

British Standard Institution (2022) BS42021:2022: Integral nest boxes - selection and installation for new developments. Specification

CIEEM, IEMA, CIRIA (2016). Biodiversity Net Gain. Good practice principles for development. Chartered Institute of Ecology and Environmental Management. UK

CIEEM, IEMA, CIRIA (2019). Biodiversity Net Gain. Good practice principles for development. A practical Guide. Chartered Institute of Ecology and Environmental Management. UK

City of London (2021). Biodiversity Action Plan 2021-2026. Corporation of the City of London, London, UK.

City of London (2015) Open Space Strategy. City of London Corporation, UK.

City of London (2015). Local Plan. Corporation of the City of London, London, UK.

City of London (2015). City of London Open Space Strategy SPD. London, UK

City of London (2023) City of London Lighting, Supplementary Planning Document. City of London Corporation

City of London (2012) Tree Strategy Part 1 (SPD) & Part 2. City of London Corporation, UK.

City of London (2018). Urban Greening Factor Study. Corporation of the City of London, London, UK.

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

DCLG (2014) Tree Preservation Orders and trees in conservation areas - GOV.UK (www.gov.uk)

DEFRA (2022) Policy Paper: Nature Recovery Network. Department for Environment, Food and Rural Affairs. UK.

DEFRA (2022). Biodiversity Metric Milestone. Department for Food and Rural Affairs: UK

Forest Research (online) The Right Trees for Changing Climate Database. Forest Research

GLA & Design for London (2008) Living Roofs and Walls - Technical Report: Supporting London Plan Policy. London, UK.

GLA & Design for London (2008) Living Roofs and Walls - Technical Report: Supporting London Plan Policy. UK.

GLA (2018). London Environment Strategy. Greater London Authority

GLA (2023). London Plan Guidance. Urban Greening Factor. Greater London Authority

GMCA (2021). IGNITION Project. Greater Manchester Combined Authority. UK

GRO (2021). The Gro Green Roof Code Anniversary Edition 2021. Green Roof Organisation, UK.

GiGL, Foui (2020). Biodiversity Evidence - Better Outcomes from Planning Policies and Legislation Related to biodivserity and planning in London. Greenspace Information for Greater London CIC. UK

GiGL, Foui (2022). Biodiversity Evidence - Better Outcomes from Planning Final Report. Greenspace Information for Greater London CIC. UK

GiGL (online) Biodiversity Hotspots for Planning. Greater London Authority, UK

ILP (2018) Guidance Note 08/18. ILP Guidance Note 08/18 – Bats and artificial lighting in the UK. ILP Guidance Note 08/18 – Bats and artificial lighting in the UK

London Biodiversity Partnership (n.d.) Guide to living roofs

Natural England (2023) Green Infrastructure Framework. Online resource

Pollinating London Together (online). Pollinating London Together

RIBA (2019) Sustainable Outcomes Guide 2019. Royal Institute of British Architects. UK.

TDAG (online). Our Guides. Trees and Design Action Group, UK

The Ecology Consultancy, (2017). Urban Greening Factor for London. Greater London Authority, London ,UK

The Wildlife Trust (2020) Nature Recovery Network Handbook. The Wildlife Trusts

UK Government (2020). Nature Recovery Network.UK

UKGBC (2020) Practical how-to guide: Developing and implementing a green infrastructure strategy. UK Green Building Council

UKGBC (2021) Principles for delivering urban Nature-based Solutions. UK Green Building Council

UKGBC (2022) Innovation Insights: Nature-Based Solutions & Climate Resilience. UK Green Building Council

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.

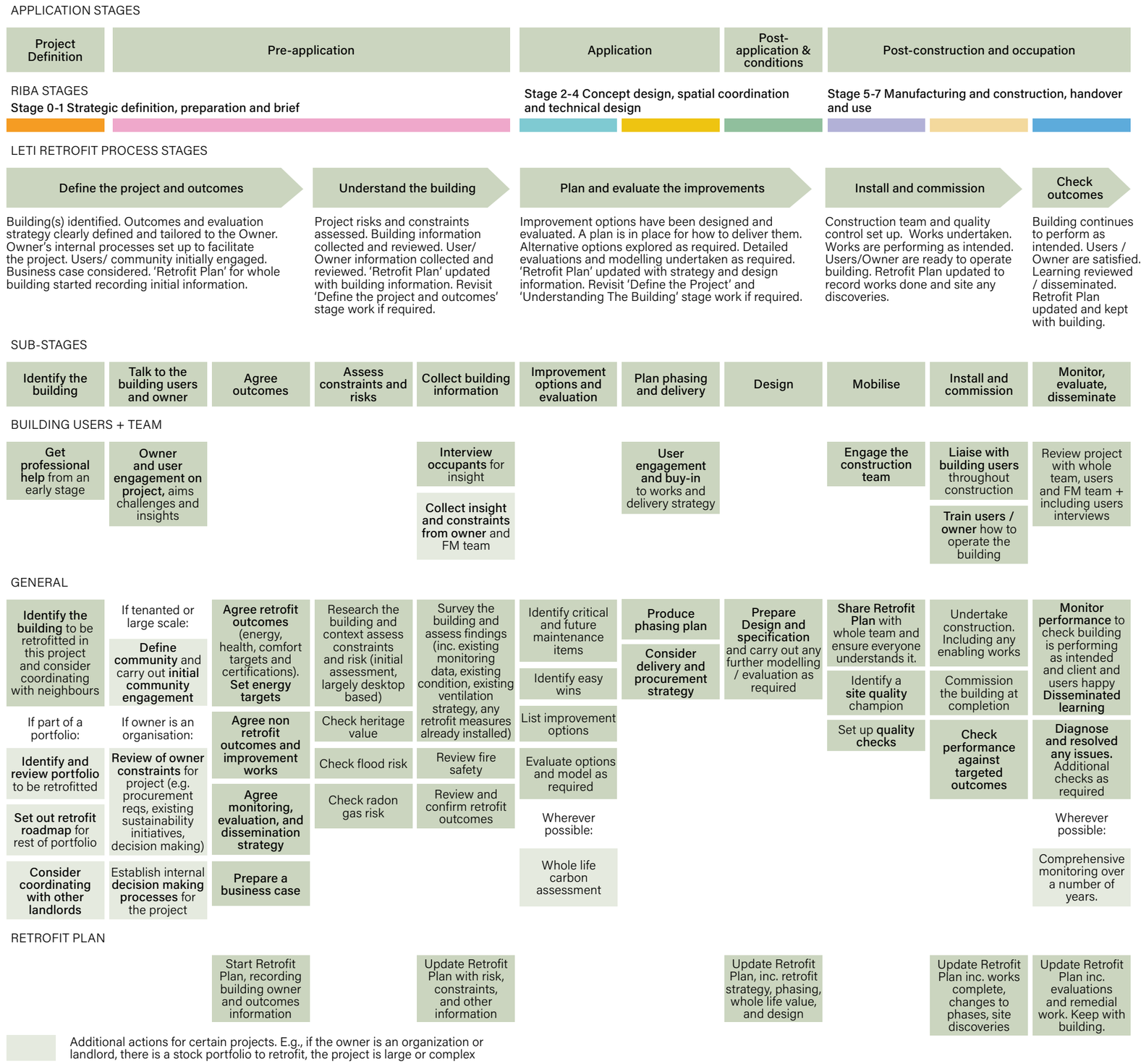


Figure B1 LETI Retrofit Process flowchart mapped onto RIBA work stages and CoLC planning application stages.
Source: adapted from LETI (2021) Climate Emergency Retrofit Guide.

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-green infrastructure - see Urban blue-green infrastructure.

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 Plan The London Plan, Local Plans, other Development Plan Documents and Neighbourhood Plans.

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.

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 Relatively continuous areas of open space leading through the built environment, which may link to each other and to the Green Belt or Metropolitan Open Land. They often consist of rivers, railway embankments and cuttings, roadside verges, canals, parks, playing fields and extensive areas of private gardens. They may allow animals and plants to be found further into the built-up area than would otherwise be the case and provide an extension to the habitats of the sites they join.

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 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 well-being 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.

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.

APPENDIX C GLOSSARY

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.

Material Passport A digital document listing all the materials that are included in a product or construction during its life cycle in order to facilitate strategising circularity decisions in supply chain management. Passports generally consist of a set of data describing defined characteristics of materials in products, which enables the identification of value for recovery, recycling and re-use.

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 on-site 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.

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.

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.

APPENDIX C GLOSSARY

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.

Refurbishment The process of improvement by cleaning, decorating and re-equipping. It may also include elements of retrofitting with the aim of making a building more energy efficient and sustainable.

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 addition of new components, features or technology not fitted during manufacture or during initial construction. It is often used in relation to the installation of new building systems or building fabric, such as heating systems, insulation or double glazing added in order to improve efficiency and/or reduce environmental impacts.

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 blue-green infrastructure Network of nature-based features situated in built-up areas, either based on vegetation (green), water (blue), or both. Green roofs and walls, grassed areas, rain gardens, swales (shallow channels, or drains), trees, parks, rivers and ponds are all examples of this type of architecture.

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.

WELL Standard Wellness-focused certification scheme, ratings level range from 'silver' to 'platinum'

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.

Planning for Sustainability - Rev 01

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

CITY OF LONDON