SUSTAINABLE DESIGN AND CONSTRUCTION

DRAFT SUPPLEMENTARY PLANNING GUIDANCE

JULY 2013

PUBLISHED FOR PUBLIC CONSULTATION

LONDON PLAN 2011
IMPLEMENTATION FRAMEWORK

MAYOR OF LONDON

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The Mayor would like to thank those who contributed to this document by sharing case studies, photographs and responding to the consultation.

This guidance will form part of the over-arching Sustainable Design and Construction Portfolio. It is currently envisaged that it will have 2 parts:
A. Sustainable Design and Construction
B. The control of Dust and Emissions During Construction and Demolition

SUSTAINABLE DESIGN AND CONSTRUCTION

JULY 2013

How to give your views

This draft Supplementary Planning Guidance is published for public consultation until 6pm 21st October 2013.

Please send comments to

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Or email to SD&C@london.gov.uk with 'Sustainable Design and Construction SPG' in the subject box.

If you send a response by email it is not necessary to also send a hard copy.

Any representations made in relation to this draft SPG will be made available for public inspection.

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FOREWORD

My 20:20 Vision sets out what is needed for London to remain the best city in the world. The Olympic Park has demonstrated what is achievable in terms of delivering sustainable buildings, infrastructure and a high quality environment. Development at the Olympic Park continues London's tradition of ambition and ingenuity in design and construction.

Development in London needs to continue the city's leading approach so that we can reach my target of reducing London's overall carbon dioxide emissions by 60% by 2025 and reduce pollution across the city. We also need to ensure development supports resilient low carbon infrastructure across London to support a rapidly growing population and economy.

These achievements will be made easier by having clear targets at the very start of the design process. My London Plan sets targets for development across London to facilitate the contribution development can make towards these goals and ensure London remains a great place to live, work and play into the future, as well as to attract further investment.

This draft Supplementary Planning Guidance provides guidance on the easiest and most cost-effective way to achieve these goals.

It provides guidance on what measures developers can include in their building designs and operations to achieve the carbon dioxide and water consumption targets set out in the London Plan.

It also provides guidance on how boroughs can take forward the new approaches set out in the London Plan, such as carbon-dioxide off-setting, retrofitting and 'air quality neutral'.

I have made strong commitments to urban greening and tree planting and this SPG encourages boroughs and developers to do the same by protecting what we have and greening the city.

I am confident that the high quality engineers and architects we have in London can meet this design challenge. Like the Crystal, buildings in London will lead the way in showing how pollution, carbon dioxide emissions and water consumption can be minimised and make a positive contribution to London's built environment.

I encourage you to consider the content of this SPG and provide me with comments on how we can ensure sustainable design and construction in London.

Boris Johnson
Mayor of London

DONNYBROOK
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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

1.1.1 London's size, density and the age of its infrastructure have led to the reliance on resources beyond its borders, incidence of pollution, and the inefficient use of some resources. For example, on average Londoners use approximately 167 litres of water per person per day[1]. This is 14% more than the England and Wales average, despite London already being in one of the driest parts of the country. When it rains heavily, the sewer interceptors overflow 60 times a year, releasing 39 million cubic metres/tonnes of diluted but untreated sewage into the Thames.[2] London continues to exceed EU limit values for nitrogen dioxide and remains at risk of exceeding EU limit values for particulate matter (PM10), which can cause serious health problems and reduces the quality of life of Londoners.[3]

1.1.2 However, London's characteristics have also enabled the efficient use of land and the provision of large scale infrastructure including low carbon public transport. London's carbon dioxide emissions at 5.9 tonnes per person per year are the lowest in the country (on a regional basis), well below the UK average of 7.1 tonnes (2008).[4] This is, in part, due to high usage of public transport compared to the greater reliance on private cars outside the capital.

1.1.3 The use of energy is changing, with a significant growing demand for electricity, including from our homes but especially from large office developments. Reducing unnecessary demand through improving the energy efficiency of existing and new development will be essential to minimise the need for further energy infrastructure to support London's growing population and economy and their increasing demand for energy to run equipment. London is progressing to ensure resilient energy infrastructure, including low carbon energy infrastructure is provided.

1.1.4 Whilst carbon dioxide emissions in London are relatively low, the location, size and development patterns of London make it susceptible to the impacts of climate change. The predicted impacts of climate change, without measures taken to address the anticipated effects, include increased flooding from rivers and because of the increased number of intense storms, overheating within buildings, potentially poorer air quality and greater pressure on building foundations and vegetation due to the shrinkage and swelling of the soil.

1.1.5 With a growing population and economy, it is essential London has sufficient infrastructure and access to resources, whilst considering the potential impacts of a changing climate and the exposure of its residents, workers and visitors to pollution. In addition, these resources need to remain of a sufficient standard for consumption to

1 London's environment revealed. State of the environment report for London June 2011. Greater London Authority, Environment Agency, Natural England, and the Forestry Commission. 2011.

2 Thames Water draft Water Resource Management Plan. Thames Water. 2013.

3 The 2010 Institute of Occupational Medicine's Report on estimation of mortality impacts of particulate air pollution in London commissioned by the Mayor estimated that the equivalent of 4,300 deaths per year in London are attributable to long-term exposure to PM2.5, which is widely acknowledged as being the pollutant which has the greatest effect on human health. The impacts of air pollution are most severely felt by vulnerable people such as children, older people and those with existing heart and lung conditions

4 London's environment revealed. State of the environment report for London June 2011. Greater London Authority, Environment Agency, Natural England, and the Forestry Commission. 2011.

support a growing economy. To ensure a healthy environment, pollution and waste across London needs to be prevented and reduced.

1.1.6 London cannot tackle climate change alone, however it can lead on measures to mitigate and adapt to climate change so that London becomes a world leader in improving the environment, not only ensuring the resilience of London but also demonstrating London's innovation and supporting the green economy.

1.2 SUSTAINABLE DESIGN AND CONSTRUCTION

1.2.1 To support London's resilience to a changing climate and to tackle climate change, the London Plan contains a policy on sustainable design and construction.

POLICY 5.3 SUSTAINABLE DESIGN AND CONSTRUCTION

STRATEGIC

A The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime

PLANNING DECISIONS

B Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

C Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:

a minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
b avoiding internal overheating and contributing to the urban heat island effect
c efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
d minimising pollution (including noise, air and urban runoff)
e minimising the generation of waste and maximising reuse or recycling
f avoiding impacts from natural hazards (including flooding)
g ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
h securing sustainable procurement of materials, using local supplies where feasible, and
i promoting and protecting biodiversity and green infrastructure.

LDF PREPARATION

D Within LDFs boroughs should consider the need to develop more detailed policies and proposals based on the sustainable design principles outlined above and those which are

1.2.2 The London Plan includes a further range of policies, primarily in Chapters 5 and 7 that deal with matters relating to sustainable design and construction. The London Plan policies that relate to sustainable design and construction are summarised in Appendix 1.

1.2.3 Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own social, economic and environmental needs. To achieve sustainable development, the development industry needs to implement sustainable design and construction practices. This is the careful consideration of how the design, building services and project management from inception can influence the amount of resources used during a development's construction, occupation and management.

1.2.4 London imports most of the materials it requires for development and to sustain Londoners and business. However many resources are diminishing or becoming more difficult to access and their use, such as combustion of fuels for energy, has led to local pollution such as poor air and water quality as well as global concerns such as climate change. The reduced use of materials has economic benefits whilst addressing environmental and health concerns.

1.2.5 It is generally acknowledged that designing in sustainability measures at the outset of a development's design can minimise any additional perceived costs. Therefore it is essential designers consider the guidance in this Supplementary Planning Guidance (SPG) at the inception of their development and during procurement and construction stages, setting clear targets from the outset.

1.2.6 An independently verified sustainable building, especially a commercial building can increase its longevity because of its

desirability based on the provision of a pleasant working environment, ability to attract investors, ability to attract higher rents, the longer period that it does not need to be upgraded or refurbished and the corporate social responsibility objectives of potential occupiers. Meeting corporate social responsibility measures can enhance reputation, provide a competitive edge, ensure better risk management and result in a more committed and efficient work force. There is growing demand for corporate social responsibility objectives from shareholders, the government, consumer groups and the public. These issues can no longer be assumed to be covered by standard construction procedures, and should extend to contractors. For example, some companies will not invest in or occupy new buildings without a high sustainability rating such as BREEAM excellent or LEED gold.

1.2.7 Some assessment tools enable a building to be monitored once it has been completed. Various studies[5] have shown that there is often a gap between the predicted energy use (and therefore carbon dioxide emissions) buildings are designed to achieve and how they perform once they are occupied. Various organisations are carrying out research into why there is this gap and whether there are ways to address this. One example of this research is CarbonBuzz[6], which provides a tool that collects anonymous building energy consumption data to highlight the performance gap between design figures and actual readings.

1.3 THE NATIONAL AND LONDON CONTEXT

NATIONAL

1.3.1 Sustainable design and construction also supports London's compliance with international and national legislation that has been introduced to restrict pollution and protect health and the environment. The national legislation and regulations most relevant to new and existing buildings in London are detailed below. Details of further legislation and national policies are provided in Appendix 2.

1.3.2 The National Planning Policy Framework (NPPF) sets the planning context for sustainable design and construction. The NPPF states that the purpose of the English planning system is to contribute to the achievement of sustainable development. It notes that sustainable development comprises three elements - economic, social and environmental, which cannot be considered in isolation as they are mutually dependent. The NPPF states that the planning system should play an active role in guiding development to sustainable solutions.

5 Carbon Compliance for tomorrow's new homes. A review of the modelling tools and assumptions. Topic 4 – Closing the gap between designed and built performance. Zero carbon hub & NHBF. 2010 http://www.zerocarbonhub.org/resourcefiles/topic4_pink_5august.pdf

6 http://www.carbonbuzz.org/index.jsp?homepagetabs=0

CLIMATE CHANGE ACT 2008

The Climate Change Act sets legally binding greenhouse gas emission reductions targets of at least 80% by 2050 (with an interim target of 26% by 2020) against a 1990 baseline, which are to be achieved through action taken in the UK and abroad.

THE PLANNING AND ENERGY ACT 2008

This Act enables a local planning authority in England, through their development plan documents, to include policies imposing reasonable requirements for:

- ◊ a proportion of energy used in development in their area to be energy from renewable sources in the locality of the development;
- ◊ a proportion of energy used in development in their area to be low carbon energy from sources in the locality of the development;
- ◊ development in their area to comply with energy efficiency standards that exceed the energy requirements of building regulations.

ENERGY ACT 2011

The Energy Act includes provisions for the establishment of the Green Deal, which is a new financing framework to fund improvements to the energy efficiency of domestic and non-domestic properties, which is to be paid back through a charge on the energy bill so that there is no upfront cost for consumers.

The Act includes provisions to ensure that from April 2016, private residential landlords will be unable to refuse a tenant's reasonable request for energy efficiency improvements where a finance package such as the Green Deal is available. In addition the Act provides powers to ensure that from April 2018, it will be unlawful to rent out a residential or business property that does not reach a minimum energy efficiency standard (the intention is for this to be set at EPC rating 'E').

BUILDING REGULATIONS

The Building Regulations set out statutory standards developments are to meet. These standards cover measures including energy efficiency, water efficiency, sanitation, fire safety, sound resistance and ventilation. Part L of the Building Regulations covers energy efficiency and sets out the maximum carbon dioxide occupied buildings are to emit. The Government has stated that Part L of the Building Regulations will be tightened in 2013 and again in 2016 when it will set out the requirement for 'zero carbon' residential properties.

Part G of the Building Regulations seeks to limit the domestic use of water. This is assessed using a water calculator, which is the same as that used for the Code for Sustainable Homes[7]

7 http://www.planningportal.gov.uk/uploads/br/water_efficiency_calculator.pdf

LONDON

1.3.3 The draft Revised Early Minor Alterations to the London Plan set out that the London Plan can be seen as the expression of national policy for London, tailored to meet local circumstances and to respond to the opportunities to achieve sustainable development here. This is reflected in the London Plan's spatial vision and its policies on the location of development and on infrastructure, including transport and energy infrastructure.

1.3.4 London Plan policies aim to support developments in meeting national and international policies. The London Plan sets out clear targets for developers in London to meet. Supplementary Planning Guidance provides further details and best practice on how to achieve these targets in the most efficient and effective way.

1.3.5 The Mayor's 2020 Vision sets out the agenda for London, making the case for London to government and to the world. It is a route map and a manifesto, so that government has a clear idea of how investment in London can help drive the rest of the UK economy as well as being a prospectus for investors from around the world. It sets an ambition for a cleaner safer London for healthy and happy Londoners. The document sets out ambitions for high quality housing, sustainable drainage to address sewer flooding, innovative ways to meet increasing demand for fresh water, supporting energy infrastructure, including local generation, increase tree cover and improved air quality.

1.4 THIS SUPPLEMENTARY PLANNING GUIDANCE

THE ROLE OF THIS SPG

1.4.1 The role of planning is to set clear targets and highlight efficient ways to reach these targets. Setting clear sustainability and performance targets prior to the design conception provides a clear goal for the whole design and construction teams. Employing a multi-disciplinary team from the conception of the project, covering design, construction, management and operation will help ensure all the sustainability measures implemented are suitable for the scheme and its occupiers and will be maintained.

1.4.2 This SPG aims to support developers, local planning authorities and neighbourhoods to achieve sustainable development. It provides guidance on to how to achieve the London Plan objectives effectively, supporting the Mayor's aims for growth, including the delivery of housing and infrastructure.

1.4.3 The guidance in this SPG is intended to:

- provide detail on how to implement the sustainable design and construction and wider sustainability policies in the London Plan;
- provide guidance on how to develop more detailed local policies on sustainable design and construction;
- provide best practice guidance on how to meet the sustainability targets set out in the London Plan; and

- provide examples of how to implement sustainability measures within developments.

1.4.4 This guidance relates to the implementation of London Plan Policy 5.3, but also a range of policies on sustainability as well as those that aim to create a pleasant environment to live in (see Chapter 7 of the London Plan). It also builds on the policies set out in the National Planning Policy Framework, providing specific advice for London. Implementing the guidance in this SPG will facilitate the contribution made by development to the Mayor's strategic targets:

- of an overall reduction in London's carbon dioxide emissions of 60 per cent (below 1990 levels) by 2025;
- that 25 per cent of the heat and power used in London is generated through the use of localised decentralised energy systems by 2025;
- to increase the amount of surface area greened in the Central Activities Zone by at least five per cent by 2030, and a further five per cent by 2050;
- increase London's tree cover by 5%;
- to contribute to the achievement of EU limit values for air pollution; and
- that 95% of construction, demolition and excavation waste is recycled/re-used by 2020, and that 80% recycling of that waste as aggregates.

1.4.5 A list of the relevant Mayor's strategies and Supplementary Planning Guidance on this issue is provided in Appendix 3.

1.4.6 This SPG provides more detailed guidance to aid implementation that cannot be covered in the London Plan. It updates the standards that were developed for the Mayor's SPG on Sustainable Design and Construction in 2006 and identifies these as priorities for the Mayor. The guidance provided in the 2006 SPG regarding some of the social sustainability elements and health inequalities are now covered in other SPGs, including the Housing SPG and the emerging Lifetime Neighbourhoods and Neighbourhood Planning SPG and Accessible Environments SPG.

1.4.7 This SPG provides guidance and practical advice for those designing schemes including architects, developers and engineers as well as those developing planning policy and neighbourhood plans. The guidance should also be used by borough planners when considering planning applications. This guidance applies equally to the development of existing, including refurbishments and changes of use as well as new buildings. However, all schemes have unique site conditions and mix of uses resulting in an individual energy demand and design solutions to address climate change.

1.4.8 Whilst the guidance in this SPG should be followed to ensure the design enables the fullest contribution to sustainable design and construction objectives it needs to be tailored to cater for the specific characteristics of the development. The priorities set out in this guidance are flexible enough to be adapted into developments across London and

should be used as a reference to guide boroughs in the adoption of their own local standards. Boroughs may want to supplement any priorities or use their own, based on locally-derived evidence and data to ensure they are deliverable.

1.4.9 This guidance focuses on environmental sustainability, but implementing measures set out in this guidance will also result in social and economic sustainability benefits. Wider benefits of having a sustainable development industry and providing sustainable development include:

- a resilient and competitive London;
- competitive advantage for business and property owners;
- supporting green industries, demonstrating London's innovation and expertise;
- compliance with corporate social responsibility policies;
- making efficient use of existing infrastructure;
- investment in additional infrastructure;
- energy security by reducing the reliance on imported fuels;
- resilient development that needs less or later re-investment;
- compliance with energy legislation[8];
- improved living and working environments, increasing productivity;
- lower fuel and water bills, including reducing fuel and water poverty; and
- contributing to a well-designed city with appealing buildings, spaces and green infrastructure which enhances people's experiences of living and working in London.

1.4.10 Developers should set out in their Design and Access Statements or separate Energy and Sustainability statements how their scheme has incorporated the advice set out in this guidance, showing how the Mayor's priorities set out in this SPG have been addressed in the proposed development.

Status of the SPG

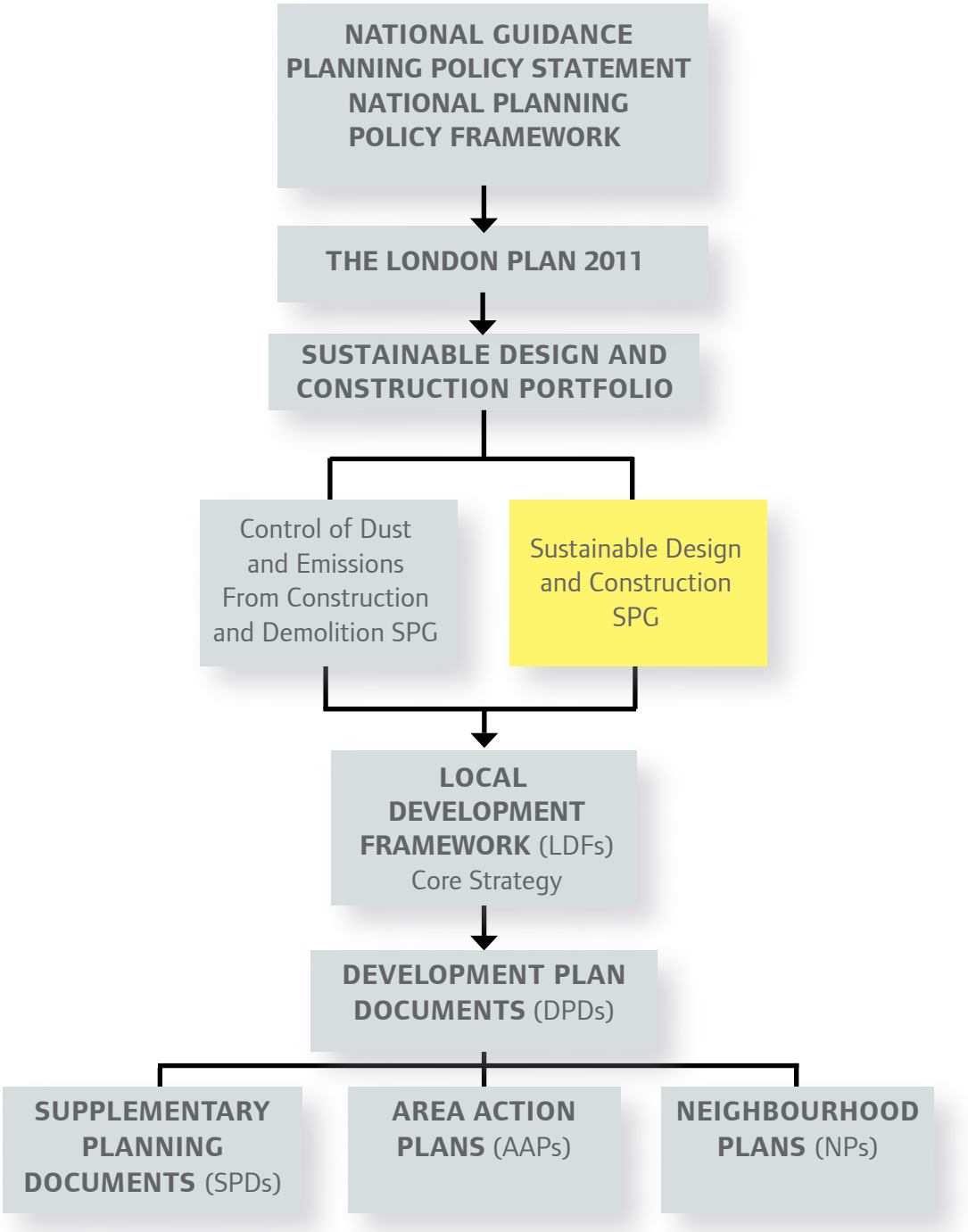
1.4.11 This document sets out guidance supplementary to London Plan policies and forms part of the Implementation Framework to the London Plan. As SPG, this document does not set new policy, but explains how policies in the London Plan should be carried through into action. It will assist boroughs when preparing their Local Plans and will also be a material planning consideration when determining planning applications.

1.4.12 Where the London Plan and this SPG refer to Local Plans it is advice to boroughs in preparing their Local Development Frameworks (what the Government's National Planning Framework terms 'local plans') and to those preparing neighbourhood plans.

1.4.13 This SPG also provides guidance for neighbourhood forums and local communities in shaping their neighbourhood plans.

8 Energy Act 2011, Building Regulations and the EU Directive 2012/27/EU on Energy efficiency

FIGURE 1.1 PLANNING POLICY FRAMEWORK



1.4.14 While this SPG does not have formal development plan status, after its consultation period and when it has been formally adopted by the Mayor as supplementary planning guidance under his powers under the Greater London Authority Act 1999 (as amended) it will be a material consideration in drawing up local and neighbourhood plans and in taking planning decisions.

1.4.15 This draft SPG is for consultation for 12 weeks. Following consultation, it will be revised to take account of comments received and be formally adopted as supplementary planning guidance to the London Plan 2011.

Structure of the SPG

1.4.16 This SPG has the following format:

- **Introduction** – Background, Sustainable design and construction, National and London Context, this SPG, Summary of the Mayor's Priorities and Best practice;
- **Resource management** – land (including basements and lightwells and local food growing), site layout and building design, energy and carbon dioxide emissions, water efficiency, materials (including reuse of waste), nature conservation and biodiversity;
- **Climate change adaptation** – overheating, heat and drought resistant planting, resilient foundations, urban greening, trees, surface water flooding, flooding and risk management;
- **Pollution management** – contaminated land, air pollution, noise pollution, light pollution, water pollution (surface and waste water treatment).

1.4.17 Each section sets out the Mayor's priorities for the particular area, which the Mayor seeks developers to address in all development proposals. Some sections also contain best practice ambitions, which the Mayor strongly encourages be delivered in the appropriate developments. To support this headline approaches, the SPG include detailed guidance for boroughs and developers, signposts to further information and best practise examples.

1.4.18 The following is a summary of the Mayor's priorities and best practice approaches for sustainable design and construction:

SUMMARY OF THE MAYOR'S PRIORITIES AND BEST PRACTICE APPROACHES

Resource management	
Land	
Optimising the use of land	
Mayor's Priority	**London Plan policy**
Through both their Local Plans and planning decisions, boroughs should ensure development patterns reflect the strategic spatial vision for London's growth as set out in Chapter 2 of the London Plan.	1.1, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17, 2.18, 3.3, 6.1
Mayor's Priority	**London Plan policy**
Through both their Local Plans and planning decisions, boroughs should aim for 100% of development to be delivered on previously developed land.	1.1, 3.3
Mayor's Priority	**London Plan policy**
Developers should optimise the scale and density of their development, considering the local context, to make efficient use of London's limited land.	3.4, 4.3, 7.6
Basements and lightwells	
Mayor's best practice	**London Plan policy**
Where there is pressure for basement developments, boroughs should consider whether there are any particular local geological or hydrological issues that could particularly effect their construction, and adopt appropriate policies to address any local conditions.	3.5, 5.12, 5.13, 5.14, 7.13, 7.19, 7.21
Mayor's Priority	**London Plan policy**
When planning a basement development, developers should consider the geological and hydrological conditions of the site and surrounding area, proportionate to the local conditions, the size of the basement and lightwell and the sensitivity of adjoining buildings and uses, including green infrastructure.	5.12, 5.13, 7.13, 7.19
Mayor's Priority	**London Plan policy**
When planning and constructing a basement development, developers should consider the amenity of neighbours.	5.3, 5.18, 6.3, 7.14, 7.15

Local food growing	
Mayor's Priority	**London Plan policy**
To protect existing established food growing spaces.	2.18, 3.2, 5.3, 5.10, 5.11, 7.18, 7.22.
Mayor's best practice	**London Plan policy**
To provide space for individual or communal food growing, where possible and appropriate.	2.18, 3.2, 5.3, 5.10, 5.11, 5.21, 7.18, 7.22.
Mayor's best practice	**London Plan policy**
To take advantage of existing spaces to grow food, including adapting temporary spaces for food growing.	2.18, 3.2, 5.3, 5.10, 5.11, 5.21, 7.18, 7.22.
Site layout and building design	
Mayor's best practice	**London Plan policy**
Any existing buildings that can be practically refurbished, retrofitted, altered, or extended should be retained and reused.	5.3, 5.4
Mayor's best practice	**London Plan policy**
A mix of uses, where suitable should be included to provide a range of services commensurate to the public transport accessibility.	4.3
Mayor's Priority	**London Plan policy**
The design of the site layout, footprint, scale and height of buildings as well as the location of land uses should consider: **EXISTING FEATURES** • the possible retention and reuse of existing buildings and structures; and • the retention of existing green infrastructure, including trees and potential for its improvement and extension; **NEW DESIGN OF DEVELOPMENT** • the existing landform; • the potential to take advantage of natural systems such as wind, sun and shading; • the principles sets out London Plan policies 7.1 and 7.6; • the potential for adaption and reuse in the future; • potential for incorporating green infrastructure; • potential for incorporating open space, recreation space, child play space; • energy demands and the ability to take advantage of natural systems and low and zero carbon energy sources;	2.18, 5.2, 5.3, 5.4, 5.6, 5.7, 5.9, 5.10, 5.11, 5.12, 5.13, 5.16, 5.18, 5.21, 6.1, 6.7, 6.9, 6.10, 7.1, 7.6, 7.14, 7.15, 7.18, 7.19, 7.21, 7.22

<table>
<tr><td>

- site wide infrastructure;
- access to low carbon transport modes;
- potential to address any local air quality, noise disturbance, flooding and land contamination issues; and
- the potential effect on the micro-climate.

</td><td></td></tr>
<tr><td colspan="2">Energy and carbon dioxide emissions</td></tr>
<tr><td>Mayor's Priority</td><td>London Plan policy</td></tr>
<tr><td>The overall carbon dioxide emissions from a development should be minimised through the implementation of the energy hierarchy set out in London Plan policy 5.2.</td><td>5.2, 5.3</td></tr>
<tr><td>Mayor's Priority</td><td>London Plan policy</td></tr>
<tr><td>Developments should be designed to meet the following Regulated carbon dioxide standards, in line with London Plan policy 5.2.

<table>
<tr><th colspan="2">Residential buildings</th></tr>
<tr><td>Year</td><td>Improvements beyond 2010 Building Regulations</td></tr>
<tr><td>2010 - 2013</td><td>25 per cent</td></tr>
<tr><td>1st October 2013 - 2016</td><td>40 per cent</td></tr>
<tr><td>2016 - 2031</td><td>Zero carbon</td></tr>
</table>

<table>
<tr><th colspan="2">Non-domestic buildings</th></tr>
<tr><td>Year</td><td>Improvements beyond 2010 Building Regulations</td></tr>
<tr><td>2010 - 2013</td><td>25 per cent</td></tr>
<tr><td>1st October 2013 - 2016</td><td>40 per cent</td></tr>
<tr><td>2016 - 2019</td><td>As per the Building Regulation requirements</td></tr>
<tr><td>2019 - 2031</td><td>Zero carbon</td></tr>
</table>

</td><td>5.2</td></tr>
<tr><td>Mayor's best practice</td><td>London Plan policy</td></tr>
<tr><td>Developments should contribute to ensuring resilient energy infrastructure and a reliable energy supply, including from local low and zero carbon sources.</td><td>5.1, 5.5, 5.6, 5.7, 5.8, 5.17</td></tr>
</table>

Mayor's best practice	London Plan policy
Developers are encouraged to include innovative low and zero carbon technologies to minimise carbon dioxide emissions within developments and keep up to date with rapidly improving technologies.	5.2, 5.17
Energy demand assessment	
Mayor's Priority	**London Plan policy**
Development applications are to be accompanied by an energy demand assessment.	5.2
Use less energy	
Mayor's Priority	**London Plan policy**
The design of developments should prioritise passive measures.	5.2, 5.3, 5.9
Mayor's best practice	**London Plan policy**
Developers should aim to achieve Part L 2010 Building Regulations requirements through design and energy efficiency alone, as far as is practical.	5.2, 5.3
Efficient energy supply	
Mayor's Priority	**London Plan policy**
Where borough heat maps have identified district heating opportunities, boroughs should prepare more detailed Energy Master Plans (EMPs) to establish the extent of market competitive district heating networks.	5.5, 5.6
Mayor's Priority	**London Plan policy**
Developers should assess the potential for their development to: • connect to an existing district heating or cooling network; • expand an existing district heating or cooling network, and connect to it; or • establish a site wide network, and enable the connection of existing buildings in the vicinity of the development.	5.5, 5.6
Mayor's Priority	**London Plan policy**
Where opportunities arise, developers generating energy or waste heat should maximise long term carbon dioxide savings by feeding the decentralised energy network with low or zero carbon hot, and where required, cold water.	5.5, 5.6

Renewable energy	
Mayor's Priority	**London Plan policy**
Boroughs and neighbourhoods should identify opportunities for the installation of renewable energy technologies in their boroughs and neighbourhoods.	5.4, 5.7
Mayor's Priority	**London Plan policy**
Major developments should incorporate renewable energy technologies to minimise overall carbon dioxide emissions, where feasible.	5.7
Carbon dioxide off-setting	
Mayor's Priority	**London Plan policy**
Boroughs should establish a carbon off-set fund and identify suitable projects to be funded.	5.2, 5.4
Mayor's Priority	**London Plan policy**
Where developments do not achieve the Mayor's carbon dioxide reduction targets set out in London Plan policy 5.2, the developer should make a contribution to the local borough's carbon dioxide off-setting fund.	5.2, 5.4
Retrofitting	
Mayor's Priority	**London Plan policy**
Boroughs should set out policies to encourage the retrofitting of carbon dioxide and water saving measures in their borough.	5.4, 5.15
Mayor's Priority	**London Plan policy**
Where works to existing developments are proposed developers should retrofit carbon dioxide and water saving measures.	5.4, 5.15
Monitoring energy use	
Mayor's best practice	**London Plan policy**
Developers are encouraged to incorporate monitoring equipment, and systems where appropriate to enable occupiers to monitor and reduce their energy use.	5.2, 5.3
Supporting a resilient energy supply	
Mayor's best practice	**London Plan policy**
Developers are encouraged to incorporate equipment that would enable their schemes to participate in demand side response opportunities.	5.2, 5.3
Water efficiency	
Mayor's Priority	**London Plan policy**
Developers should maximise the opportunities for water saving measures and appliances in all developments, including the reuse and using alternative sources of water.	5.3, 5.13, 5.15

Mayor's Priority	London Plan policy
Developers should design residential schemes to meet a water consumption rate of 105 litres or less per person per day.	5.3, 5.15
Mayor's Priority	**London Plan policy**
New non-residential developments, including refurbishments, should aim to achieve the maximum number of water credits in a BREEAM assessment or the 'best practice' level of the AECB (Association of Environment Conscious Building) water standards.	5.3, 5.15
Mayor's Priority	**London Plan policy**
Where a building is to be retained, water efficiency measures should be retrofitted.	5.3, 5.4, 5.15
Mayor's Priority	**London Plan policy**
All developments should be designed to incorporate rainwater harvesting.	5.3, 5.13, 5.15
Mayor's best practice	**London Plan policy**
All residential units, including individual flats / apartments and commercial units, and where practical, individual leases in large commercial properties should be metered.	5.15
Materials and waste	
Design phase	
Mayor's Priority	**London Plan policy**
The design of development should prioritise materials that: • have a low embodied energy, including those that can be re-used intact or recycled; ◊ at least three of the key elements of the building envelope (external walls, windows roof, upper floor slabs, internal walls, floor finishes / coverings) are to achieve a rating of A+ to D in the BRE's The Green Guide of specification; • can be sustainably sourced; ◊ at least 50% of timber and timber products should be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of forestry Certification (PEFC) source; • are durable to cater for their level of use and exposure; and • will not release toxins into the internal and external environment, including those that deplete stratospheric ozone	5.3, 5.20, 7.6, 7.14

Mayor's best practice	London Plan policy
The design of developments should maximise the potential to use pre-fabrication elements.	5.3, 7.6
Construction phase	
Mayor's Priority	**London Plan policy**
Developers should maximise the use of existing resources and materials and minimise waste generated during the demolition and construction process through the implementation of the waste hierarchy.	5.3, 5.20
Occupation phase	
Mayor's Priority	**London Plan policy**
Developers should provide sufficient internal space for the storage of recyclable and compostable materials and waste in their schemes.	5.3, 5.17
Mayor's Priority	**London Plan policy**
The design of development should meet borough requirements for the size and location of recycling, composting and refuse storage and its removal.	5.3, 5.17
Nature conservation and biodiversity	
Mayor's Priority	**London Plan policy**
There is no net loss in the quality and quantity of biodiversity.	5.3, 7.19
Mayor's Priority	**London Plan policy**
Developers make a contribution to biodiversity on their development site.	5.3, 7.19

Climate change adaptation	
Tackling increased temperature and drought	
Overheating	
Mayor's Priority	**London Plan policy**
Developers should include measures, in the design of their schemes, in line with the cooling hierarchy set out in London Plan policy 5.9 to prevent overheating over the scheme's lifetime.	5.3, 5.9
Heat and drought resistant planting	
Mayor's best practice	**London Plan policy**
The design of developments should prioritise landscape planting that is drought resistant and has a low water demand for supplementary watering.	5.3, 5.15

Resilient foundations	
Mayor's best practice	**London Plan policy**
Developers should consider any long term potential for extreme weather events to affect a building's foundations and to ensure they are robust.	5.3, 7.6
Increasing green cover	
Urban greening	
Mayor's Priority	**London Plan policy**
Developers should integrate green infrastructure into development schemes, including by creating links with wider green infrastructure network.	2.18, 5.3, 5.10, 5.11
Mayor's Priority	**London Plan policy**
Major developments in the Central London Activity Area (CAZ) should be designed to contribute to the Mayor's target to increase green cover by 5% in this zone by 2030.	5.10
Trees	
Mayor's Priority	**London Plan policy**
Developments should contribute to the Mayor's target to increase tree cover across London by 5% by 2025.	5.3, 5.10, 7.21
Mayor's Priority	**London Plan policy**
Any loss of a tree/s resulting from development should be replaced with an appropriate tree or group of trees for the location, with the aim of providing the same canopy cover as that provided by the original tree/s.	5.3, 5.10, 7.21
Flooding	
Surface water flooding and Sustainable drainage	
Mayor's Priority	**London Plan policy**
Through their Local Flood Risk Management Strategies boroughs should identify areas where there are particular surface water management issues and develop policies and actions to address these risks.	5.3, 5.12
Mayor's Priority	**London Plan policy**
Developers should maximise all opportunities to achieve greenfield runoff rates in their developments.	5.12, 5.13
Mayor's Priority	**London Plan policy**
When designing their schemes developers should follow the drainage hierarchy set out in London Plan policy 5.13.	5.13

Mayor's Priority	London Plan policy
Developers should design Sustainable Drainage Systems (SuDS) into their schemes that incorporate attenuation for surface water runoff as well as habitat, water quality and amenity benefits.	5.3, 5.13, 5.14
Flood resilience and resistance of buildings in flood risk areas	
Mayor's Priority	**London Plan policy**
Development in areas at risk from any form of flooding should include flood resistance and resilience measures in line with industry best practice.	5.3, 5.12, 5,13
Flood Risk Management	
Mayor's Priority	**London Plan policy**
Developments are designed to be flexible and capable of being adapted to and mitigating the potential increase in flood risk as a result of climate change.	5.3, 5.12
Mayor's Priority	**London Plan policy**
Developments incorporate the recommendation of the TE2100 plan for the future tidal flood risk management in the Thames estuary.	5.3, 5.12
Mayor's Priority	**London Plan policy**
Where development is permitted in a flood risk zone, appropriate residual risk management measures are to be incorporated into the design to ensure resilience and the safety of occupiers.	5.3, 5.12
Other sources of flooding	
Mayor's Priority	**London Plan policy**
All sources of flooding need to be considered when designing and constructing developments.	5.3, 5.12, 5.13

Pollution management	
Land contamination	
Mayor's Priority	**London Plan policy**
Developers should set out how existing land contamination will be addressed prior to the commencement of their development.	3.2, 5.3, 5.21
Mayor's Priority	**London Plan policy**
Potentially polluting uses are to incorporate suitable mitigation measures.	3.2, 5.3, 5.21

Air quality	
Mayor's Priority	**London Plan policy**
Developers are to design their schemes so that they are at least 'air quality neutral'.	7.14
Mayor's Priority	**London Plan policy**
Developments should be designed to minimise the generation of air pollution.	5.3, 7.14
Mayor's Priority	**London Plan policy**
Developments should be designed to minimise and mitigate against increased exposure to poor air quality.	3.2, 5.3, 7.14
Mayor's Priority	**London Plan policy**
Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7.	7.14
Mayor's Priority	**London Plan policy**
Developers and contractors should follow the guidance set out in the emerging SPG on *The control of dust and emissions from construction and demolition* when constructing their development.	5.3, 7.14
Noise	
Mayor's Priority	**London Plan policy**
Areas identified as having positive sound features or as being tranquil should be protected from noise.	3.2, 7.15
Mayor's Priority	**London Plan policy**
Noise should be reduced at source, then designed out of a scheme to reduce the need for mitigation measures.	3.2, 5.3, 7.6.7, .15
Light pollution	
Mayor's Priority	**London Plan policy**
Developments and lighting schemes should be designed to minimise light pollution.	5.2, 5.3, 6.7
Surface water runoff	
Mayor's Priority	**London Plan policy**
In their aim to achieve a greenfield runoff rate developers should incorporate sustainable urban drainage systems (SuDS) into their schemes which also provide benefits for water quality.	5.3, 5.13, 5.14
Mayor's best practice	**London Plan policy**
Encourage good environmental practice to help reduce the risk from business activities on the London water environment.	5.3, 5.13, 5.14

Mayor's best practice	London Plan policy
Encourage those working on demolition and construction sites to prevent pollution by incorporating prevention measures and following best practice.	5.3, 5.14
Wastewater treatment	
Mayor's Priority	**London Plan policy**
Residential developments discharging domestic sewage should connect to the public foul sewer or combined sewer network where it is reasonable to do so.	5.3, 5.14
Mayor's Priority	London Plan policy
Commercial developments discharging trade effluent should connect to the public foul sewer or combined sewer network where it is reasonable to do so subject to a trade effluent consent from the relevant sewerage undertaker.	5.3, 5.14
Mayor's Priority	**London Plan policy**
Developments should be properly connected and post-construction checks should be made by developers to ensure that mis-connections do not occur.	5.3, 5.14

SOLAR PANELS, CITY HALL

CHAPTER 2

RESOURCE MANAGEMENT

2.1 INTRODUCTION

2.1.1 London is a growing city with a limited supply of land for economic, residential, recreational and natural land uses. Therefore it is essential that developers make the most of the opportunities provided by their site, based on its specific circumstances. Buildings and their surrounding should be designed and built to improve the local and wider environment and minimise their demand on wider resources including land, energy, water and materials. This also helps to minimise the need for expensive physical infrastructure.

2.2 LAND

KEY GUIDANCE AREAS

2.2.1 This section of the SPG provides guidance on the following key areas:

- optimising the use of land, including through optimising density and design, considering the accessibility of the site and its local context;
- the excavation of basements and lightwells, including giving consideration to ground and surface water flooding, land stability, impact on neighbours and the local environment; and
- local food growing.

OPTIMISING THE USE OF LAND

Mayor's Priorities	London Plan policy
Through both their Local Plans and planning decisions, boroughs should ensure development patterns reflect the strategic spatial vision for London's growth as set out in Chapter 2 of the London Plan.	1.1, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17, 2.18, 3.3, 6.1
Through both their Local Plans and planning decisions, boroughs should aim for 100% of development to be delivered on previously developed land.	1.1, 3.3
Developers should optimise the scale and density of their development, considering the local context, to make efficient use of London's limited land.	3.4, 4.3, 7.6

2.2.2 Chapter 2 and 6 of the London Plan include a range of policies on development and transport that set out a hierarchy for spatial growth across London. This hierarchy for growth should be reflected in boroughs' Local Plans as well as neighbourhood plans. In addition, London Plan policy 2.13 identifies the most suitable areas for the intensification of development based on the amount of land available for regeneration and improved local transport capacity. At a local level, boroughs should identify land suitable for intensification and the potential uses for these sites in their Site Allocation Documents, Area Action Plans or Neighbourhood Plans.

2.2.3 Through careful design, developers should ensure their schemes optimise density. The

design should enable the development to sit comfortably within the local context and provide a high quality living or working environment.

SIGNPOSTS

Housing density study. Maccreanor Lavington Architects, Emily Greeves Architects, Graham Harrington Planning Advice. 2011.

This report, using images of real and hypothetical housing schemes, highlights how design and management can help optimise density in different local contexts.

http://www.london.gov.uk/priorities/planning/research-reports/planning-for-housing-publications

BASEMENT AND LIGHT WELLS

Mayor's best practice	London Plan policy
Where there is pressure for basement developments, boroughs should consider whether there are any particular local geological or hydrological issues that could particularly effect their construction, and adopt appropriate policies to address any local conditions.	3.5, 5.12, 5.13, 5.14, 7.6, 7.13, 7.19, 7.21

Mayor's Priorities	London Plan policy
When planning a basement development, developers should consider the geological and hydrological conditions of the site and surrounding area, proportionate to the local conditions, the size of the basement and lightwell and the sensitivity of adjoining buildings and uses, including green infrastructure.	5.12, 5.13, 7.6, 7.13, 7.19
When planning and constructing a basement development, developers should consider the amenity of neighbours.	5.3, 5.18, 6.3, 7.14, 7.15

2.2.4 Basements have formed part of London's built form for centuries and contribute to the efficient use of London's limited land. These older basements, some forming part of the original building, have generally been single storey. As technology has improved, large multi-storey basements have been excavated as part of large commercial developments. More recently basements and lightwells are being excavated below existing residential properties in areas where more visible extensions are not supported by the local planning policies. Whilst new and extended basements to residential properties generally provide additional living space, they generally do not result in additional residential units.

2.2.5 Within certain limits the excavation of basements below the footprint of a dwellinghouse may not need planning permission and therefore the planning system has limited control over these excavations. These basements are allowed by national regulations, the General Permitted Development Order (as amended)[9]. Lightwells are considered an engineering operation and therefore do require planning permission.

2.2.6 Where planning permission is not required there is other legislation that may provide some control over the excavation of a basement. These include:

- The Party Wall Act;
- The Highways Act;
- The Building Regulations; and
- Environmental Pollution and Control legislation.

2.2.7 The excavation of basements below existing properties is generally not a strategic issue due to their limited size. However, the cumulative impact of basement developments could have wider impacts, if they are not designed appropriately.

2.2.8 In some cases the excavation of basements may cause harm to the amenity of neighbours, affect the stability of buildings, cause drainage or flooding problems, or damage the character of an area and the natural environment. Even where planning permission is not required, developers should consider these issues to protect their property as well as their neighbours from any potential adverse effects from the excavation of their basement.

2.2.9 Areas where the excavation of basements could be of particular concern could include:

- where there is a shallow water table or groundwater (either trapped between geological layers or due to historic underground rivers);
- areas subject to surface water flooding;
- where geological layers change;
- where land has been disturbed in the past;
- steep slopes; and
- areas subject to tidal and/or fluvial flooding.

2.2.10 Mitigation measures can be included into basement proposals to address local geological and hydrological conditions as well as to protect the amenity of nearby occupiers. Boroughs can set out in planning guidance what local mitigation measures would be suitable and whether the proposal's ability to implement this mitigation measures needs to be demonstration at planning application stage or can be secured by way of planning conditions. Some potential mitigation measures are outlined in the sections below.

9 Statutory Instrument 2008. No. 2362. The Town and Country Planning (General Permitted Development) (Amendment) (No. 2) (England) Order 2008.

GROUND AND SURFACE WATER FLOODING

Ground water

2.2.11 Some areas of London have geology that can trap water below the surface, for example a permeable gravel layer underlain by impermeable clay. This allows water to infiltrate the gravel until it hits the clay layer. As infiltration through clay is slower, the water may sit on top of the clay layer if it is flat or flow down hill where there is a slope. In addition, the depth of the water table varies greatly across London[10]. See the Mayor's London's Foundations: Protecting the geodiversity of the capital (2012) SPG for some broad information on geology in London. Some of these areas coincide with London rivers that have been enclosed in pipes. Their path can still be traced through the lower ground level or local geology.

2.2.12 In areas where groundwater is close to the surface a basement could potentially displace the groundwater or affect its flow. The displacement or change in flow could affect nearby properties, especially if water is forced to the surface. This effect can be exacerbated by cumulative basement developments as more water is diverted and diverted longer distances around basements, potentially backing up upstream from the basement and rising to the surface, resulting in flooding.

2.2.13 The interruption or diversion of the flow of groundwater can have a detrimental impact on green infrastructure by reducing or removing its supply of water. This effect has be found some distance from the development. For example, basement developments upstream from the springs around Hampstead Heath can affect their flow and ultimately the flow of water into the ponds on the Heath[11].

2.2.14 Mitigation measures could include:

- designing a basement so that a natural or highly permeable drainage route is left around the basement. However setting a basement in from the main walls of building can have technical engineering implications; and
- appropriate drainage, preferably a system that does not require pumping.

Surface water flow and flooding

2.2.15 The construction of a basement under a garden will reduce the infiltration capacity of the ground and could therefore result in additional surface water runoff from a site as well as reduce the capacity of the ground to act as a store for rain water. The latter principle also applies to the soil beneath existing structures.

2.2.16 To construct the basement, ground and surface water may need to be diverted to keep the excavation and construction area dry. The measures implemented to protect the excavation must also prevent detrimental impacts on surrounding or downstream properties.

2.2.17 Basements are vulnerable to all forms of flooding due to their subterranean location. Where there is a known risk of flooding boroughs may consider restricting the use of basement for non-habitable uses. The design of plumbing within a

10 The Environment Agency

11 Camden geological, hydrogeological and hydrological study. Guidance for subterranean development. (Section 5.2)

basement should consider the potential for sewer flooding in the event the local drainage system becomes overwhelmed. Section 3.4 provides further guidance for basements proposed in flood risk areas.

2.2.18 Mitigation measures could include:

- sustainable urban drainage systems, including soft landscaping;
- careful design for flooding, including of the proposed plumbing system;
- adequate drainage, preferably a system that does not require pumping; and
- sufficient escape routes or limiting the land use of basements.

LAND STABILITY

2.2.19 The soil in steep areas[12] or where soil has been disturbed in the past can be less stable and therefore needs additional considerations when excavating a basement. Areas where there is a change in geological layers can also have vulnerable land stability, due to the different way the soils respond under different conditions. However, even a basic excavation will result in some movement of the surrounding soil. Therefore, careful consideration needs to be given to how the existing foundations of both the development and adjoining properties are supported by the soil as well as how the excavation works are supported. Boroughs may seek evidence of this from the developer prior to the commencement of construction works.

12 The Camden geological, hydrogeological and hydrological study. Guidance for subterranean development. (Section 2.7) suggests that on the London Clay a slope of less than 10° is stable and slopes greater than 10° are potentially subject to movement.

2.2.20 In addition to the movement of soil around the excavation area, developers need to carefully consider the interaction between of any adjoining buildings and the development site. Carrying out works to the foundations of the development property could result in long term differential movement of this property and its attached neighbours.

2.2.21 Mitigation measures could include:

- careful design of the shoring up structures to enable safe excavation; and
- careful engineering design of the basement, with special consideration given to the foundations and movement of the adjoining properties.

HISTORIC ASSETS

2.2.22 Where basement works are proposed in conservation areas, to a listed building or adjacent to a listed building, additional protection applies to these buildings. Boroughs may seek a management plan for demolition and excavation works to, or adjacent to a historic asset.

IMPACTS ON NEIGHBOURS FROM DEMOLITION AND CONSTRUCTION

2.2.23 Some of the worst impacts for neighbours during the excavation of a basement, although temporary, can include noise, vibration, dust, air and light pollution, and can last for lengthy periods of time from both the excavation and construction process as well as due to the vehicular movements.

2.2.24 Developers should give full care and consideration to occupants of nearby

properties. The Considerate Constructors Scheme can be used to ensure that contractors carry out their operations in a safe and considerate manner, with due regard to local residents and businesses, passing pedestrians and road users. Boroughs may also seek to secure Demolition / Construction Management Plans, especially where a proposal is particularly large, or has access or other constraints. The Mayor's SPG on *The control of dust and emissions from construction and demolition* sets out ways to minimise dust and noise generated from development sites.

TREES, LANDSCAPE AND BIODIVERSITY

2.2.25 In line with London Plan policy 3.5 to protect back gardens, boroughs may consider requiring a proportion of any basement that extends beyond the footprint of the existing building to be covered by soft landscaping to compensate for the loss of soil permeability, water storage capacity and biodiversity. Measures could include sufficient margins left between the site boundaries and any basement construction to enable natural processes to occur and for vegetation to grow naturally, including trees that reflect the local vegetation (London Plan policy 7.21). For developments in the Central Activities Zone, developers should consider the Mayor's target to increase proportion of green infrastructure (London Plan policy 5.10). See section 3.3 for more details.

SIGNPOSTS

Camden geological, hydrogeological and hydrological study identifies the specific local ground and water conditions and the implication of these for basement developments. The report recommends an assessment methodology for basement applications which has informed Camden's SPD on Basements and Lightwells.
http://camden.gov.uk/ccm/content/environment/planning-and-built-environment/two/planning-policy/local-development-framework/core-strategy/evidence-and-supporting-documents.en
http://camden.gov.uk/ccm/content/environment/planning-and-built-environment/two/planning-policy/supplementary-planning-documents/camden-planning-guidance.en

Royal Borough of Kensington and Chelsea Residential basement study identifies the specific local ground and water conditions and the implication of these for basement developments for the Borough. This report provides recommendations for basement design and construction and informs RBKC's revised Core Strategy policy.
http://www.rbkc.gov.uk/planningandconservation/planningpolicy/corestrategy/basements.aspx

The Town and Country Planning (General Permitted Development) (Amendment) (No. 2) (England) Order 2008
http://www.legislation.gov.uk/uksi/2008/2362/pdfs/uksi_20082362_en.pdf

LOCAL FOOD GROWING

Mayor's Priority	London Plan policy
To protect existing established food growing spaces.	2.18, 3.2, 5.3, 5.10, 5.11, 7.18, 7.22.

Mayor's best practice	London Plan policy
To provide space for individual or communal food growing, where possible and appropriate.	2.18, 3.2, 5.3, 5.10, 5.11, 5.21, 7.18, 7.22.
To take advantage of existing spaces to grow food, including adapting temporary spaces for food growing.	2.18, 3.2, 5.3, 5.10, 5.11, 5.21, 7.18, 7.22.

2.2.26 The Mayor's Capital Growth programme[13] has shown the potential for growing food locally in London with the associated health and community benefits that it can bring. Local food growing can encompass a range of activities including back garden food growing, roof top gardening, education and health gardens, allotment cultivation, community gardening projects, bee keeping, planting orchards and fruit trees on public land, city farms, urban fringe farms and market gardens.

2.2.27 Even in commercial schemes, lower maintenance herbs and other edible plants have been incorporated into roof gardens or landscaping schemes.

2.2.28 In certain circumstance the non-active parts of large construction sites have been used for food growing with temporary growing containers and skips brought on-site. It is essential that growers are certain the land used for growing is not contaminated. See section 4.2 for further details on land contamination.

2.2.29 Prior to designing a scheme's landscape or green infrastructure plan developers should investigate the demand and opportunities for providing food growing space on their site. Developers should contact the relevant borough or Capital Growth to determine whether there is demand for food growing space in the vicinity of the application site. Where opportunities arise, especially where there is an organisation willing to manage and maintain the space, food growing space should be secured through the planning application process. For phased schemes this can be temporary growing space until that area of the site is developed or permanent space provided on the final developed site.

2.2.30 Where boroughs are aware of a demand for food growing space they can secure landscape designs within developments that provide flexible open spaces which may be adapted for food growing to be undertaken in the future, should there be demand from the local community. Consideration at the design stage will include:

- safeguarding south facing spaces;
- availability of water, incorporating rain water harvesting ;

13 http://www.capitalgrowth.org/

- loading capacity of green roofs and balconies;
- planting walls with espaliers or climbing plants;
- integrating edible plants with ornamental plants;
- planters that can be easily converted for food growing; and
- management.

2.2.31 Where provided, it may be appropriate to secure (through condition or s106 agreement) the identified space for food growing, as opposed to wider open space uses.

SIGNPOSTS

Capital Growth is a partnership initiative that provides practical help, training and support to people wanting to grow their own food, whether at home, on an allotment or as part of a community group and supported the creation of 2012 new community food growing spaces across London by the end of 2012.
http://www.capitalgrowth.org/

BEST PRACTICE EXAMPLES

Capital Growth
http://www.capitalgrowth.org/spaces/?id=745&postcode=&borough=24&limit_start=0&#info

2.3 SITE LAYOUT AND BUILDING DESIGN

KEY GUIDANCE AREAS

2.3.1 This section of the SPG provides guidance on the following key areas:

- reuse of buildings;
- existing landform;
- mix of land uses;
- site layout; and
- micro-climate, include local wind conditions.

SITE LAYOUT AND DESIGN

Mayor's Priority	London Plan policy
The design of the site layout, footprint, scale and height of buildings as well as the location of land uses should consider: Existing features • the possible retention and reuse of existing buildings and structures; and • the retention of existing green infrastructure, including trees and potential for its improvement and extension; New design of development • the existing landform; • the potential to take advantage of natural systems such as wind, sun and shading; • the principles sets out London Plan policies 7.1 and 7.6; • the potential for adaption and reuse in the future; • potential for incorporating green infrastructure; • potential for incorporating open space, recreation space, child play space; • energy demands and the ability to take advantage of natural systems and low and zero carbon energy sources; • site wide infrastructure; • access to low carbon transport modes; • potential to address any local air quality, noise disturbance, flooding and land contamination issues; and • the potential effect on the micro-climate.	2.18, 5.2, 5.3, 5.4, 5.6, 5.7, 5.9, 5.10, 5.11, 5.12, 5.13, 5.16, 5.18, 5.21, 6.1, 6.7, 6.9, 6.10, 7.1, 7.6, 7.14, 7.15, 7.18, 7.19, 7.21, 7.22

Mayor's Best practice	London Plan policy
Any existing buildings that can be practically refurbished, retrofitted, altered, or extended should be retained and reused.	5.3, 5.4
A mix of uses, where suitable should be included to provide a range of services commensurate to the public transport accessibility.	4.3

2.3.2 The key role of planning is to ensure appropriate land use and that developers optimise the layout and design of their schemes. Prior to the redevelopment of any site, developers should consider the existing features and constraints. Constraints include legally protected biodiversity and nature conservation, risk of flooding and land contamination. For further details on nature conservation and biodiversity see section 2.7, for flooding see section 3.4 and for land contamination see section 4.2.

Reuse of existing building

2.3.3 Existing buildings have a significant amount of embodied carbon. In addition, the construction of new buildings is a major consumer of resources and can produce large quantities of waste and carbon dioxide emissions as well as contribute towards poor air quality. Developers should carefully consider the potential to retain existing buildings, including through their conversion, refurbishment and extension. Where possible, sustainable measures should be retrofitted into existing buildings[14]. Where the demolition of a building cannot be avoided the resulting materials should be reused or salvaged in accordance with the waste hierarchy. See section 2.6 for more details. Measures to minimise air pollution during the demolition and construction process in accordance with the Mayor's SPG on Minimising emissions from demolition and construction should also be implemented.

Landform

2.3.4 The design of new developments should take into account the existing landform and take advantage of any opportunities the landform presents to contribute to the sustainability of the development. For example dips in the topography could be used to incorporate a natural sustainable drainage system.

Mix of land uses

2.3.5 Where appropriate boroughs should encourage a mix of land uses to reduce the need for local residents and visitors to travel. A range of complementary uses will promote vibrant communities. A mix of uses with varying energy demands can also support decentralised energy generation and networks.

Site layout

2.3.6 The location of uses across a site and the orientation and design of individual buildings have an important role in minimising energy demand. Measures to minimise carbon dioxide emissions include

14 Some boroughs have local policies and targets regarding the retrofitting of existing buildings where development works are proposed.

enabling access to daylight and sunlight for uses that require heat and light. Site planning can minimise the impact of the shadow created by the new buildings to protect existing features such as open space and renewable solar technologies on roofs. Developers should ensure the layout of their site and buildings maximises the opportunities provided by natural systems, such as light and wind.

Micro-climate

2.3.7 Large buildings have the ability to alter their local environment and affect the micro-climate. For example, not only can particularly tall buildings cast a long shadow effecting buildings several streets away, they can influence how wind travels across a site, potentially making it unpleasant at ground level or limiting the potential to naturally ventilate buildings. One way to assess the impact of a large building on the comfort of the street environment is the **Lawson Comfort Criteria**. This tool sets out a scale for assessing the suitability of wind conditions in the urban environment based upon threshold values of wind speed and frequency of occurrence. It sets out a range of pedestrian activities from sitting through to crossing the road and for each activity defines a wind speed and frequency of occurrence. Where a proposed development is significantly taller that it's surrounding environment, developers should carry out an assessment of its potential impact on the conditions at ground level, and ensure the resulting design of the development provides suitable conditions for the intended uses.

2.3.8 Other effects buildings can have on the local climate include:

- overshadowing and reducing access to sunlight;
- making it warmer, either through the heat released from any operating plant or as it cools down at night; and
- making it cooler through the effects of including vegetation or water.

2.3.9 These effects should be considered during the design of a development and assessed once the designed is finalised.

SIGNPOSTS

National Planning Policy Framework. Department for Communities and Local Government, 2012.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Housing density study. Maccreanor Lavington Architects, Emily Greeves Architects, Graham Harrington Planning Advice. 2011.
This report, using images of real and hypothetical housing schemes, highlights how design and management can help optimise density in different local contexts.
http://www.london.gov.uk/priorities/planning/research-reports/planning-for-housing-publications

Meeting the Carbon Reduction Targets through Design and Fabric. AECOM. 2013.
www.london.gov.uk

2.4 ENERGY AND CARBON DIOXIDE EMISSIONS

KEY GUIDANCE AREAS

2.4.1 This section of the SPG provides guidance on the following key areas:

- preparing energy demand assessments;
- using less energy, including through both passive and active design measures;
- planning for, using or installing an efficient energy supply, including developing energy master plans, facilitating district heating networks through development, and by installing site wide energy networks and communal heating;
- planning for and installing renewable energy;
- carbon dioxide off-setting, including setting a price for carbon dioxide, setting up a fund, delivery of measures and monitoring; and
- retrofitting energy and water saving measures.

2.4.2 This SPG applies equally to residential and non-residential development. The Mayor's Housing SPG includes residential standards for specific design elements that will have a positive effect on energy use as well as internal comfort. These standards include minimum floor to ceiling heights, access to daylight and sunlight as well as standards for energy and water use, overheating, materials and ecology. The most relevant standards in the Mayor's Housing SPG to the objectives of this SPG are attached in Appendix 4.

ENERGY AND CARBON DIOXIDE EMISSIONS

<table>
<tr><th>Mayor's Priorities</th><th>London Plan policy</th></tr>
<tr><td>The overall carbon dioxide emissions from a development should be minimised through the implementation of the energy hierarchy set out in London Plan policy 5.2.</td><td>5.2, 5.3</td></tr>
<tr><td>Developments should be designed to meet the following Regulated carbon dioxide standards, in line with London Plan policy 5.2.

<table>
<tr><th colspan="2">Residential buildings</th></tr>
<tr><td>Year</td><td>Improvements beyond 2010 Building Regulations</td></tr>
<tr><td>2010 - 2013</td><td>25 per cent</td></tr>
<tr><td>1st October 2013 - 2016</td><td>40 per cent</td></tr>
<tr><td>2016 - 2031</td><td>Zero carbon</td></tr>
</table>

<table>
<tr><th colspan="2">Non-domestic buildings</th></tr>
<tr><td>Year</td><td>Improvements beyond 2010 Building Regulations</td></tr>
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<tr><td>1st October 2013 - 2016</td><td>40 per cent</td></tr>
<tr><td>2016 - 2019</td><td>As per the Building Regulation requirements</td></tr>
<tr><td>2019 - 2031</td><td>Zero carbon</td></tr>
</table>
</td><td>5.2</td></tr>
</table>

Mayor's best practice	London Plan policy
Developments should contribute to ensuring resilient energy infrastructure and a reliable energy supply, including from local low and zero carbon sources.	5.1, 5.5, 5.6, 5.7, 5.8, 5.17
Developers are encouraged to include innovative low and zero carbon technologies to minimise carbon dioxide emissions within developments and keep up to date with rapidly improving technologies.	5.2, 5.17

ENERGY DEMAND ASSESSMENTS

Mayor's Priority	London Plan policy
Development applications are to be accompanied by an energy demand assessment.	5.2

2.4.3 The 40 per cent carbon dioxide improvement target beyond Part L of the Building Regulations 2010 set out in London Plan policy 5.2 will be applied to Stage 1 applications received by the Mayor on, or after 1st October 2013 and should also be applied to all major applications determined by the boroughs. The target will remain 40% beyond 2010 Building Regulations until the Part L 2013 Regulations are published along with any new modelling considerations and have been reviewed by the Mayor to determine the implications for development and the need to standardise this target.

2.4.4 The specific implementation dates for the later targets will be dependent on the Government's timetable for the changes to the Building Regulations and its implementation of the 'zero carbon' target. This issue will be addressed in further alterations to the London Plan or through Supplementary Planning Guidance.

2.4.5 The document **Guidance for developers on preparing Energy Assessments** provides detailed guidance on what information regarding design and energy is required to support a planning application referred to the Mayor and how carbon dioxide emissions are to be calculated. Boroughs may use this guidance to support borough planning applications. This document is available on the Mayor's web-site[15] and is regularly updated to take into account the changes in the above carbon dioxide targets and changes to Part L of the Building Regulations. Boroughs should be satisfied that the proposed energy strategy is satisfactory for the intended use of the building and secure the overall energy strategy, by condition or s106 agreement, to ensure the identified carbon dioxide savings are achieved. Where schemes will be delivered over a long period of time developers are encouraged to review their strategy to determine whether technological improvements will enable them to achieve their targets more easily. Any substantial changes are to be agreed by the GLA.

2.4.6 Where a planning application includes refurbishment or retrofitting works, applicants should summit energy strategies which benchmark the existing development from Part L 2010 Building Regulations. Improvements should be measured from this baseline and show further reductions in carbon dioxide emissions. See paragraphs 2.4.53 to 2.4.57 for further details on retrofitting.

15 http://www.london.gov.uk/priorities/planning/strategic-planning-applications/preplanning-application-meeting-service/energy-planning-gla-guidance-on-preparing-energy-assessments

USE LESS ENERGY

Mayor's Priority	London Plan policy
The design of developments should prioritise passive measures.	5.2, 5.3, 5.9

Mayor's best practice	London Plan policy
Developers should aim to achieve Part L 2010 Building Regulations requirements through design and energy efficiency alone, as far as is practical.	5.2, 5.3

2.4.7 London Plan policy 5.2 sets out an energy hierarchy that developers are to followed when designing their scheme and its building services. Whilst the constraints of some sites limit the potential to alter a building's orientation, careful design, including the location, size and depth of windows and choice of materials can all influence the carbon dioxide emissions from a development. The design of the building envelope can have the greatest influence in the energy demands of a building. Further information can be found in the GLA report on *Meeting the Carbon Reduction Targets through Design and Fabric*.

2.4.8 Designing carbon dioxide saving measures into a development from the start is the most cost effective way to ensure developers can minimise these emissions. To facilitate this early consideration, developers should set clear carbon dioxide targets (based on the London Plan and this SPG) for their scheme from the outset and employ a multidisciplinary team to ensure the design and mechanical services can together achieve the set target, both at the design stage and whilst occupied.

2.4.9 Following are some of the easiest and cost-effective ways to reach the London Plan carbon dioxide targets. Some measures can be directly influenced through design and therefore are direct planning matters. Other internal design features and mechanical systems are influenced by the Building Regulations. Both types of measures will need to be implemented to reach the London Plan carbon dioxide targets. In their energy assessment developers should demonstrate how they have considered and where practical included the following measures:

Passive and design measures:

- optimise **natural daylight** – including through dual aspect, optimal window size, higher floor to ceiling heights, shallow floorplates, the use of lightwells and rooflights;

- optimise **solar gain** - depending whether heat is required – by altering the size and depth of windows on the north and south elevations. To retain heat, providing a thermal buffer will provide a transition area between entry/exit areas.

If heat is not required include shading devises, low g-value glazing;

- limit **overshadowing** - of windows to areas that require daylight or could benefit from solar gain; or of the roof if solar renewable technologies are planned;

- optimise **insulation** - the level will vary to limit overheating, depending on solar gain and internal heat gains as well as air tightness;

- minimise **cold bridging** – to prevent the loss of heat and to prevent the development of cold spots which can lead to mould;

- optimise **air tightness** - based on heating or cooling requirements;

- optimise **thermal mass** – which can help retain heat, or if exposed, lose heat to the cooler external environment;

- use **light coloured materials** - to avoid the absorption of heat resulting in overheating;

- incorporate **green roofs, green walls** and **other green infrastructure** which can keep buildings warm or cool and improve biodiversity and contribute to sustainable urban drainage; and

- maximise the potential for **natural ventilation** – including through openable windows, shallow floorplates, dual aspect units, passive ventilation with heat recovery, designing in the 'stack effect' system where pressure differences are used to draw air through a building and double façade where the inner façade has openings to release heat without occupants being exposed to external wind and noise.

cold bridging – occurs on a surface where one material looses heat faster than another

air tightness - the control of air leakage from a building measured in m3/m2/h

thermal mass - the ability of a material to store heat

g-value - the extent that glazing blocks the heat from sunlight. The lower a glazing's G-value, the less solar heat is transmitted through it.

Active measures

- include carbon dioxide efficient heating systems – such as community heating systems, low temperature heating eg underfloor, combined heat and power plants for large schemes, boilers fed with a renewable fuel, efficient ultra low NOx gas boilers for small schemes, solar thermal for small schemes. Careful consideration needs to be given to the air quality implications of heating plant, especially those burning solid or liquid fuel. See section 4.3 for emissions standards for CHP and biomass;

- include **heat recovery** – collecting waste heat from domestic and commercial activities to pre-heat air or water for heating or hot water systems. Basic systems include plumbing that enables the warm waste water from showering to

pre-heat the water for the remainder of that shower.

- maximise **natural cooling** and efficient cooling systems, where required – including chilled beams, evaporation cooling;

- select **efficient ventilation systems**, where required – including ventilation with heat recovery, which is a growing requirement due to the increased air tightness of buildings. Passive ventilation with heat recovery units, that do not require electricity, are now available;

- incorporate **low energy mechanical services**;

- maximise **energy efficient lighting** systems, such as LEDs; and

- incorporate **other energy efficient and saving equipment** such as heating controls, individual controls, zoning, movement sensors, photo sensors, timers, metering, building management and monitoring systems. Energy efficient appliances generally generate less heat and can help minimise the build up of heat within buildings.

2.4.10 Careful consideration needs to be given to what areas of the building are likely to need light, need to be warm or cool and the activities that will generate their own heat such as the use of IT. The design should also include measures to prevent the development from overheating in the future, ideally without the need for active measures. Further details on measures preventing overheating are provided in section 3.2. Active measures should be designed to meet the needs of the building so that plant can run efficiently. Oversized plant can lead to the inefficient use or unnecessary use of the equipment. Boroughs should be satisfied that the proposed design and energy strategy is satisfactory for the intended use of the building and should secure the appropriate design and technological measures as part of a development's energy strategy.

SIGNPOSTS

AECB Energy standards – provide reaching performance standards for various building elements and a commentary on how to achieve them
http://www.aecb.net/standards_and_guidance.php

Meeting the Carbon Reduction Targets through Design and Fabric. AECOM. 2013.
www.london.gov.uk

BEST PRACTICE EXAMPLE

Low energy building database
http://retrofitforthefuture.org/projectbrowser.php

Nash Terrace
http://www.passivhaus.org.uk/page.jsp?id=94

EFFICIENT ENERGY SUPPLY

Mayor's Priority	London Plan policy
Where borough heat maps have identified district heating opportunities, boroughs should prepare more detailed Energy Master Plans (EMPs) to establish the extent of market competitive district heating networks.	5.5, 5.6
Developers should assess the potential for their development to: connect to an existing district heating or cooling network; expand an existing district heating or cooling network, and connect to it; or establish a site wide network, and enable the connection of existing buildings in the vicinity of the development.	5.5, 5.6
Where opportunities arise, developers generating energy or waste heat should maximise long term carbon dioxide savings by feeding the decentralised energy network with low or zero carbon hot, and where required, cold water.	5.5, 5.6

ENERGY MASTER PLANS

2.4.11 London Plan policy 5.5 sets out how boroughs, in conjunction with land owners, heat suppliers and developers should identify the opportunities for district heating networks in their areas. London boroughs have prepared borough wide heat maps. Details of these can be found on the London Heat Map web-site[16]. These heat maps should feed into boroughs' Local Plans and, where appropriate, neighbourhood plans.

2.4.12 Where borough heat maps show potential for a district heating network, more detailed energy master plans should be prepared for these areas by local authorities or, in an area of growth, the landowners. The preparation of a more detailed energy master plan is especially encouraged where an Opportunity Area Action Plan or the Area Action Plan or Site Allocations element of a Local Plan are being prepared. Where indicated by a borough's energy master plan, boroughs should cooperate with adjoining boroughs to prepare an area wide energy master plan. As a minimum energy master plans should identify:

- the extent of the potential market competitive district heating network;
- the potential phasing for the delivery / construction of the network;
- existing and potential sites with sufficient high heat demand to justify connection;
- sites and undertakings that generate waste heat that could be supplied to the district heating network over time;
- known sites to be redeveloped;

16 http://www.londonheatmap.org.uk/Content/home.aspx

- areas of growth;
- potential locations for energy centres; and
- pipes routes for the purposes of safe-guarding and future-proofing their later installation where other works take place in the meantime ie road improvements, public realm works, etc.

Neighbourhood Plans

2.4.13 At a neighbourhood scale, where there is no proposed major development and there are no significant heat loads, plans can still be developed to highlight the potential for smaller energy generating or retrofitting opportunities. For example, neighbourhood energy plans could identify properties suitable for various types of insulation or micro-renewables based on access to sunlight. Local planning authorities should support local communities in developing their energy plans[17].

FACILITATING DISTRICT HEATING NETWORKS THROUGH DEVELOPMENT

2.4.14 London Plan policy 5.6 sets out a hierarchy for developing a scheme's heating network, and where required, cooling systems. This section of the guidance is likely to be relevant to larger schemes with a substantial heat load comprising two or more buildings. However, there may be specific circumstances where it could be applied to smaller schemes, for example, where development sites are adjoining, so an initial heat network is created to allow developments to share energy production plant. The connection would be a relatively short pair of pipes across the site boundary.

Feasibility and viability

2.4.15 When determining whether it is feasible to connect to an existing district heating network, developers should consider the following measures, as appropriate:

- the size of the development, and the heat load and energy demands throughout the year;
- the distance of the development to the district heating network or proposed networks;
- the presence of physical barriers such as major roads or railway lines in making a connection to the network; and
- the cost of connection and the impact this has on financial viability of the heat supply.

2.4.16 When determining whether it is feasible to install an energy centre and establish a heating and/or cooling network, the following measures should be considered, as appropriate:

- the size of the development, and the heat load and energy demands throughout the year;
- the heat load and energy demands throughout the year and density of surrounding built environment.
- the proximity of and potential supply to any public sector estates and buildings with communal heating systems,

17 As outlined in the National Planning Policy Framework (paragraph 97) and the draft Revised Early Minor Alterations to the London Plan (paragraph 5.41)

especially use such as swimming pools, hospitals and large housing estates; and

- the ability to secure agreements for the connection of nearby buildings or estates.

2.4.17 The economic evaluation of the heat supply option should be carried out on whole life costing over a 25 year period. It should note the Mayor's strategic target for local energy generation across London and the potential wider contribution the scheme would make to this target. The viability should be compared with the case where an energy centre and decentralised energy network is not installed. Developers should discuss with the relevant borough the appropriate considerations prior to submitting their planning application, and their feasibility assessment should form part of the energy strategy submitted with the planning application.

2.4.18 Where the heating plant proposed is CHP and a development proposal consists of a number of buildings or where a borough is considering which site should house the plant, consideration should be given to making the best financial use of the electricity generated. For example, if a building has a high electrical demand then placing the CHP plant within this building will enable that scheme to make the greatest financial savings from the use of the electricity as opposed to exporting the electricity to the national distribution network for a nominal price. An alternative solution could be to sell the electricity output under a Licence Lite[18] arrangement.

18 A project to enable London boroughs and their energy services companies to supply electricity they generate retail to their housing tenants and others. http://www.london.gov.uk/mayor-assembly/gla/governing-organisation/executive-team/directors-decisions/DD640

Timing of connection

2.4.19 One of the key challenges of developing a new district heating network is the timing between the delivery of the new network and the completion of new developments which are to be connected to the network. Paragraph 8.2.2 of the Mayor's District Heating Manual for London sets out the three most likely scenarios where development precedes the expansion of a district heating network and the preferred design responses for each. In summary these are as follows:

2.4.20 1. Where an Energy Master Plan or similar studies identify the feasibility of an area-wide heat network but no firm plans exist as to who will build the network or by when. Design responses should include:

- be 'future proofed' to enable connection - provision of a single plant room producing all hot water, including engineering measures to facilitate the connection of an interfacing heat exchanger;
- space identified for the heat exchanger;
- provisions made in the building fabric such as soft-points in the building walls to allow pipes to be routed through from the outside to a later date; and
- external pipework routes identified and safeguarded.

2.4.21 2. Where there is a district heating network being delivered but there is no programme to connect the development as it would not be viable to connect. Design responses should include:

- the development should be designed on the basis of its own efficient heating plant, such as CHP, where appropriate, and 'future-proofed', as above;

- where it has been identified in the district heating master plan that there is potential for the district heating network to be extended towards the development, allowance could be made to defer investment (installation) in the plant for a specified period. This would enable a further viability study to be carried out, say, five years after the original permission to determine whether it is now feasible to connect to the extended district heating system; and

- during the 'deferred' period, the development will be supplied with heat from its own heat only boilers.

2.4.22 3. Where there are firm plans to connect the development to the heat network, but the network build-out will not reach the new development until some years after the development is complete. Design responses should include:

- the development should design for a district heating connection from the outset; and

- heat should be provided by temporary local heat-only boiler.

2.4.23 Where the scheme is to connect to a district heating system, designers should ensure the design of the heating system is compatible with the district heating system. Boroughs should secure the appropriate measures by condition or s106 agreement as part of any planning permission. Further details on what should be secured at planning stage for these scenarios are provided in the Mayor's District Heating Manual for London. The Manual also provides advice for designing, constructing and managing district heating networks, as well as potential ways to manage the sale of heat and heat contracts.

Site wide heating network and communal heating

2.4.24 In accordance with London Plan policy 5.6, where a development consists of several buildings, a site wide heating network should be considered and established, where appropriate. In addition to the strategic advantages of district heating, the main benefit of district heating is expected to be the carbon savings they can deliver[19] by accessing sources of waste heat e.g. industrial waste heat, heat generated from municipal waste, etc. As such, communal heating schemes are not installed to achieve carbon dioxide savings compared to individual boilers in the short term, but to maintain the ability of buildings to be supplied by low carbon, waste heat sources in the future.

2.4.25 Even where the development may not connect to a wider district heating network, individual buildings should consider communal heating systems, and installed where appropriate. This approach enables the whole development to convert to new low and zero carbon heating technologies at the same time in the future, making it easier and more economically viable to upgrade plant. However, in lower density development

19 Poyry report for DECC 2009 The potential and costs of district heating network

consideration needs to be given to the size, density and heating demands of the occupiers to balance the financial costs of the heating network and any heat distribution losses and the overall carbon dioxide savings. The Mayor is carrying out further research on these issues.

2.4.26 Where it is considered the additional cost to residents does not out-weigh the long term carbon dioxide savings, the development should still be designed to enable the retrofit of an alternative heating system in the future. Further details on how this can be accommodated in a scheme can be found in the Mayor's District Heating Manual for London.

Energy from waste

2.4.27 Every opportunity should be taken to utilise waste heat or generate energy and heat from waste. For some types of heat generation mitigation measures may be required to ensure the scheme minimises any harmful effects of emissions into the air. See Section 4.2 for more details on protecting air quality.

SIGNPOSTS

The Mayor's Energy Supply web page provides information on delivering low carbon energy for London and the decentralised energy for London programme.
http://www.london.gov.uk/priorities/environment/tackling-climate-change/energy-supply

Mayor's District Heating Manual for London. Greater London Authority. 2013
http://www.londonheatmap.org.uk/Content/uploaded/documents/DH_Manual_for_London_February_2013_v1.0.pdf

Community Energy: Urban Planning for a Low Carbon Future. TCPA, CHPA, LDA Design. 2008
http://www.tcpa.org.uk/pages/community-energy-urban-planning-for-a-low-carbon-future-.html

Community Energy: Planning, development and delivery. TCPA, CHPA, LDA Design. 2010
http://www.tcpa.org.uk/pages/community-energy-urban-planning-for-a-low-carbon-future-.html

BEST PRACTICE EXAMPLE

London Olympic Park Energy Centre
https://www.cibseknowledgeportal.co.uk/london-olympic-park-energy-centre
http://www.cofely-gdfsuez.co.uk/media/focus/a-green-legacy-for-the-queen-elizabeth-olympic-park/

7 More London
http://www.building4change.com/page.jsp?id=506
http://www.dresser-rand.com/literature/CHP/2259_CHP_CS12.pdf
http://www.code-project.eu/wp-content/uploads/2011/04/CODE_CS_Handbook_Final.pdf

RENEWABLE ENERGY

Mayor's Priorities	London Plan policy
Boroughs and neighbourhoods should identify opportunities for the installation of renewable energy technologies in their boroughs and neighbourhoods.	5.4, 5.7
Major developments should incorporate renewable energy technologies to minimise overall carbon dioxide emissions, where feasible.	5.7

Local Plans

2.4.28 Boroughs should refer to the Mayor's London Decentralised Energy Capacity Study Phase 1: Technical Assessment to help them assess the potential for renewable energy technologies in their boroughs. This report provides a methodology for assessing the potential for renewable energy technologies and the broad potential locations for some technologies in London.

Neighbourhood plans

2.4.29 Neighbourhoods can identify in more detail opportunities for renewable energy schemes in their area, including community projects. This is encouraged by the National Planning Policy Framework (paragraph 97) and the draft Revised Early Minor Alterations to the London Plan (paragraph 5.41). Outside London, projects have included a community wind turbine and hydro-electric schemes. In London measures have included a ground source heating and cooling project from a communal open space and collective buying of solar panels to retrofit onto local houses and schools.

Developments

2.4.30 Although the final element of the Mayor's energy hierarchy, major developments should make a further reduction in their carbon dioxide emissions through the incorporation of renewable energy technologies to minimise overall carbon dioxide emissions, where feasible. Boroughs should secure measures as a part of the development's overall energy strategy.

2.4.31 Renewable energy can provide heat or electricity. It is essential that the renewable energy technology incorporated into a scheme complements the primary heating or cooling equipment. For example, where combined heat and power is proposed, electricity generating technologies such as photovoltaics would complement the heat generating technology. The London Plan (paragraph 5.39) lists a few priority technologies for strategic development.

2.4.32 Developers should ensure that the renewable energy technology chosen will result in lower carbon dioxide emissions than traditional technologies.

SIGNPOSTS

London Decentralised Energy Capacity Study Phases 1 - 3
http://www.london.gov.uk/priorities/environment/tackling-climate-change/energy-supply

Energy Savings Trust
http://www.energysavingtrust.org.uk/Generating-energy

BEST PRACTICE EXAMPLES

7 More London – Biodiesel CHP, fed with waste cooking oil sourced within the M25. Bi-product used to create soap and used within the building.

Grosvenor Estate – ground source heat pump installed in Eaton Square Gardens to providing heating and cooling to three buildings on the square

Buckingham Palace – borehole cooling
http://www.royal.gov.uk/TheRoyalHousehold/TheRoyalHouseholdandtheEnvironment/TheBuckinghamPalaceborehole.aspx

Muswell Hill Sustainability Group and social enterprise **EN10ERGY** promote and invest in local renewable energy and encourage and facilitate the reduction in carbon emissions and waste by households, businesses and community buildings in Muswell Hill and surrounding areas.
http://mhsgroup.org/
http://en10ergy.co.uk/

CARBON DIOXIDE OFF-SETTING

Mayor's Priorities	London Plan policy
Boroughs should establish a carbon dioxide off-set fund and identify suitable projects to be funded.	5.2, 5.4
Where developments do not achieve the Mayor's carbon dioxide reduction targets set out in London Plan policy 5.2, the developer should make a contribution to the local borough's carbon dioxide off-setting fund.	5.2, 5.4

2.4.33 London Plan policy 5.2 sets out that where the target percentage improvements beyond Part L of the Building Regulations, also set in this policy, cannot be met on-site, any short fall should be provided off-site or through a cash in lieu contribution to the relevant borough. This is to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

Off-site provisions

2.4.34 Boroughs may agree with a developer for the developer to directly off-set any shortfall in carbon dioxide reductions from a scheme by installing a carbon dioxide saving project off-site. Measures could include directly funding or installing community energy and retrofitting projects. For example, a developer could install

photovoltaics on a nearby school. The CIL regulations need to be taken into account when securing these arrangements. The borough should ensure that the off-setting measure provides added value - that is the measure would be unlikely to be funded through another means. Boroughs should secure off-setting measures through s106 agreements.

2.4.35 An assessment should be made by the Council or beneficiary of the off-setting measure so that the off-setting measures either have carbon dioxide or financial equivalence to the carbon dioxide saving that would otherwise be required on the development site.

Cash in-lieu payment

2.4.36 To maximise the reduction in carbon dioxide emissions across London boroughs should establish a planning related carbon dioxide reduction fund and set a price at which the carbon dioxide short fall will be calculated. The price should be published in a Supplementary Planning Document and contributions secured by a s106 agreement.

1. Calculating the price of carbon

2.4.37 Boroughs should develop and publish a price for carbon dioxide based on either:

- a nationally recognised carbon dioxide pricing mechanism; or
- the cost of reducing off-setting carbon dioxide emissions across the borough.

2.4.38 The price set should not put an unreasonable burden on development and must enable schemes to remain viable.

Nationally recognised price for carbon dioxide

2.4.39 Nationally recognised prices for carbon dioxide include:

- the Zero Carbon Hub price, currently £46 per tonne[20], and
- the non-trading price of carbon.

2.4.40 The overall contribution should be calculated over 30 years[21]. For example, using the Zero Carbon Hub price equates to £46 x 30 years = £1,380 per tonne of carbon dioxide to be off-set.

The cost of off-setting carbon dioxide emissions

2.4.41 This approach could include an assessment of the carbon dioxide off-setting measures possible in the borough and dividing it by the anticipated amount of development coming forward over the next 30 years.

2.4.42 When assessing which off-setting measures are possible in the borough consideration needs to be given to the real potential to deliver these measures, once adequate funding is available. For example, measures in conservation areas on listed buildings may have to be limited or there may be other barriers to delivery other than finance. Consideration also needs to be given to the CIL regulations to ensure that measures that cannot be secured through a s106 agreement are not included in the price and that measures covered in the CIL Regulation 123 list are not double counted.

20 Allowable solutions for tomorrow's new homes. Zero Carbon Hub. 2011.
21 Zero carbon homes impact assessment. Department for Communities and Local Government. 2011.

2. The off-setting fund and projects

Spending the fund

2.4.43 Unless the price set for carbon dioxide fully reflects the delivery of the identified carbon dioxide reduction projects, it is not considered necessary that the ratio of carbon dioxide saving to the off-setting price has to be 1:1. That is, the cost of the measure to save one tonne of carbon dioxide does not have to be equal to the off-set price per one tonne of carbon dioxide. This is because the off-set price set generally does not fully cover the cost of saving carbon dioxide in order to ensure the price is viable for development to proceed.

2.4.44 The benefit of the fund is in unlocking carbon dioxide saving measures. If a 1:1 ratio is set, only the simplest retrofitting measures are likely to be carried out. This would potentially still leave the more complicated measures without adequate funding and could result in a property requiring further retrofitting works in the future, resulting in further disturbance to the occupier.

The projects

2.4.45 It is essential that boroughs identify a suitable range of projects that can be funded through the carbon dioxide off-set fund. Consideration needs to be given to the CIL regulations regarding the funding of infrastructure and the restriction on the use of s106 agreements.

2.4.46 Preference should be given to retrofitting publicly owned property as this would provide wider community benefit. Initial discussions suggest that schools, council buildings and social housing are the buildings that could be retrofit most readily. Another option could be establishing a borough wide revolving energy fund, where a loan is provided to local residents or businesses wanting to retrofit energy and water saving measures.

2.4.47 For more costly measures boroughs may wish to seek additional funding from other sources, including:

- SALIX
- Green Deal
- Energy Company Obligations (ECO)
- London Energy Efficiency Fund (LEEF)

3. Delivery

2.4.48 It may be possible to use the Mayor's RE:FIT[22] and RE:NEW[23] procurement programmes to secure contractors to carry out the carbon dioxide saving projects.

4. Monitoring

2.4.49 Where a nationally recognised price of carbon dioxide has been used as the local off-setting price, the carbon dioxide savings of each identified off-setting measure should be calculated to demonstrate carbon dioxide savings and enable auditing of the fund.

2.4.50 Where a study has been carried out to establish a carbon dioxide off-setting price, boroughs should monitor against the

22 http://www.london.gov.uk/priorities/environment/tackling-climate-change/energy-efficiency/refit-putting-our-energy-reducing-yours and http://www.refit.org.uk/
23 http://www.london.gov.uk/priorities/environment/climate-change/energy-efficiency/implementing-renew-locally

measures identified in this study as well as the anticipated carbon dioxide savings.

2.4.51 Where other sources of funding have made a contribution this should be identified.

2.4.52 It may be important for the borough or the contributor to be able to account for the carbon dioxide emissions, especially as carbon reporting becomes mandatory. Therefore the borough may need to consider how the carbon dioxide savings will be measured and apportioned. Options include:

- in proportion to the capital funding provided by each party; or
- in entirety to the off-set funder on the basis that the funding 'unlocked' the carbon dioxide saving project.

SIGNPOSTS

SALIX - Salix Finance Ltd is an independent, not for profit company funded by The Department for Energy and Climate Change, The Welsh Assembly Government and The Scottish Government via The Carbon Trust. Salix provide funding in various forms for the public sector to implement energy efficiency measures. It also provides an opportunity for information sharing on measures implemented through its funding.
http://www.salixfinance.co.uk/

The Green Deal - is a financing framework to fund improvements to the energy efficiency of domestic and non-domestic properties, which is paid back through a charge on the energy bill so that there is no upfront cost for consumers.
https://www.gov.uk/green-deal-energy-saving-measures/how-the-green-deal-works

Energy Company Obligation (ECO) - replaces previous obligations on energy companies to finance energy efficiency measures in domestic properties. It will operate in conjunction with the Green Deal to support householders (eg the poorest and most vulnerable) and those types of property (eg hard to treat) which cannot achieve financial savings that meet the criteria set out for the Green Deal, including that the cost savings from the energy saving measure will be paid back within the lifetime of that measure or technology.
https://www.gov.uk/government/policies/helping-households-to-cut-their-energy-bills/supporting-pages/energy-companies-obligation-eco

LEEF - The London Energy Efficiency Fund invests in energy efficiency retrofit to public / voluntary sector buildings, for example: universities, museums, hospitals, schools, local authorities, social housing in order to make them more energy efficient, sustainable and environmentally friendly. LEEF is an 'Urban Development Fund' (UDF) procured by the European Investment Bank (EIB) on behalf of the London Green Fund.
http://www.leef.co.uk/

RE:FIT - is the Mayor of London's scheme that provides a commercial model for public bodies wishing to achieve cost savings, improve the energy performance of their buildings and reduce their carbon dioxide emissions. The scheme uses an Energy Service Company (ESCo) to install energy efficiency measures and guarantee

annual energy savings over an agreed payback period, thus offering a secure financial saving over the period of the agreement.

This Energy Performance Contracting model transfers the risk of performance to the ESCos, as they must guarantee the energy savings to be made over the agreed payback period. The process is supported by the RE:FIT Programme Delivery Unit (PDU), which is funded by the Greater London Authority and the European Commission under the ELENA (European Local ENergy Assistance) programme.
http://www.london.gov.uk/priorities/environment/tackling-climate-change/energy-efficiency/refit-putting-our-energy-reducing-yours
http://www.refit.org.uk/

RE:NEW - is a London wide energy efficiency retrofitting scheme for residential properties funded by the Greater London Authority. This is an area-based, whole house approach that includes a range of free-of-charge, easy-to-do measures, from changing to low energy light bulbs to installing stand-by switches and giving energy saving advice. Delivery is led by the boroughs.

A framework of 12 organisations, capable of delivering both the entire RE:NEW package or discrete packages of work within it, has been appointed so as to avoid buyers needing to go through lengthy procurement exercises themselves. Any London borough or housing association with the majority of their homes in London is able to run a mini-competition to call off the framework.
http://www.london.gov.uk/priorities/environment/climate-change/energy-efficiency/implementing-renew-locally

BEST PRACTICE EXAMPLES

Milton Keynes has had a **carbon offset fund** in operation since 2006. Planning policy seeks developments of 5 dwellings or 1,000sqm to be carbon neutral or they will be expected to make a contribution into the Milton Keynes Offset Fund at a rate of £200 per tonne CO2 emitted over one year. The contributions are used to off-set carbon emissions in existing developments through measures including improved insulation and contributions towards renewable energy.
http://www.energysavingtrust.org.uk/Publications2/Local-delivery/New-build/Energy-in-Planning-and-building-control-Case-study-Milton-Keynes

Islington's off-setting policy is set out in its core strategy (CS10). Further details including the price are set out in its Environmental Design Supplementary Planning document.
http://www.islington.gov.uk/services/planning/planningpol/pol_supplement/Pages/Environmental-Design.aspx?extra=9

RETROFITTING

Mayor's Priorities	London Plan policy
Boroughs should set out policies to encourage the retrofitting of carbon dioxide and water saving measures in their borough.	5.4, 5.15
Where works to existing developments are proposed developers should retrofit carbon dioxide and water saving measures.	5.4, 5.15

2.4.53 The majority of the buildings existing in London today will still be in use in 2050, therefore it is essential that the carbon dioxide emissions resulting from the use of these buildings is also addressed. In the home 17% of carbon dioxide emissions arise from hot water use[24], so it also important to ensure water is used efficiently. The Government's Green Deal has set up a mechanism to fund the retrofit of energy saving measures. Upgrading works may be compulsory for those wishing to lease poor performing properties from 2018[25].

2.4.54 Boroughs should also include policies encouraging retrofitting measures, especially where other works are to be carried out to a property.

2.4.55 Some retrofitting measures require planning permission. To facilitate the application process boroughs are encouraged to give consideration to what measures will be acceptable for various development types and set these out in a guidance document for residents and developers.

2.4.56 The Government has clarified[26] that solid wall insulation is an 'alteration' for the purposes of the General Permitted Development Order 1995, as amended. Therefore where it is proposed to be applied to a dwellinghouse, outside a conservation area it will constitute permitted development subject to it meeting specific height and floorspace requirements and that the finish is of a similar appearance to the existing external appearance[27].

2.4.57 Where developers are calculating carbon dioxide savings for retrofitting works to buildings, the carbon dioxide emissions should be compared to a comparable building compliant with Part L 2010 Building Regulations. Improvements should be measured from this baseline and show further reductions in carbon dioxide emissions. If the refurbishment process fails to achieve the Building Regulations standard or improvements towards the London Plan carbon dioxide reduction targets (London Plan policy 5.2) through energy efficiency and generation, then justification should be provided.

24 Great Britain's housing energy fact file. Department of Energy and Climate Change. 2011
25 Energy Act 2011

26 Permitted development for householders. Technical guidance. DCLG. 2013 (Page 13) http://www.planningportal.gov.uk/uploads/100806_PDforhouseholders_TechnicalGuidance.pdf
27 Permitted development for households. Technical guidance. Department for Communities and Local Government. 2013

SIGNPOSTS

Existing buildings survival strategies. ARUP. 2009.
A guide, with case studies which sets out the challenges for non-domestic existing buildings and opportunities for their upgrade giving consideration to cost, level of refurbishment, value to the owners and benefit to the occupants and environment

An introduction to low carbon domestic refurbishment. Construction Products Association. 2010
A guide with case studies, which sets out how to refurbish in a way that improves the energy efficiency of buildings.

BEST PRACTICE EXAMPLES

Camden Planning Guidance 3 - Sustainability sets out an approach to securing carbon dioxide saving retrofitting measures where works are proposed to existing buildings.
http://camden.gov.uk/ccm/content/environment/planning-and-built-environment/two/planning-policy/supplementary-planning-documents/camden-planning-guidance.en

Low energy building database, including retro-fitted schemes
http://www.retrofitforthefuture.org/projectbrowser.php

HERITAGE ASSETS

2.4.58 Various organisations including English Heritage, the Victorian Society and the Energy Saving Trust all provide detailed information on suitable carbon dioxide saving measures that can be retrofit into historic buildings, including those in a conservation area or with a Listed Building designation.

2.4.59 In order to identify the most appropriate retrofit energy saving measures to install in historic assets which takes into account the potential measures best suited to individual buildings, the following approach is recommended:

- assess the heritage values of the building;
- assess the condition of the building fabric and building services;
- assess the effectiveness of measures to improve energy performance;
- assess their impact on heritage values; and
- assess the technical risks.

2.4.60 A range of thermal efficiency measures can then be implemented, which avoid harm to the historic environment. Ranked according to their impact on heritage and the technical risks, these include:

1. Minor interventions - upgrade the easier and non-contentious elements:

- insulate roof spaces and suspended floors;

- provide flue dampers - (close in winter, open in summer);
- use curtains, blinds and window shutters;
- provide energy efficient lighting and appliances;
- draught-seal doors and windows;
- provide hot water tank and pipe insulation.

2. Moderate interventions - upgrade vulnerable elements:

- install secondary (or double) glazing (if practicable).

3. Upgrade building services and give advice to building users on managing them efficiently:

- install high-efficiency boiler and heating controls;
- install smart metering;
- install solar panels, where not visible from the street or public spaces.

4. Major interventions - upgrade more difficult and contentious elements (where impact on heritage values and level of technical risk shown to be acceptable)

- provide solid wall insulation.

SIGNPOST

A Guide to Energy Conservation in Traditional Buildings English Heritage
http://www.englishheritage.org.uk/publications/energy-conservationin-traditional-buildings
Investigates a range of improvements that can be made to reduce the heat lost through a building's walls, windows, floor and roof. This guide is one of a series looking at reducing energy consumption in traditionally constructed homes.

Sustainable Refurbishment: a Toolkit for Going Green. Grosvenor Estate. 2013
http://www.grosvenor.com/NR/rdonlyres/449F83D7-2FB3-41ED-B48B-69DDC47C0DB2/13171/SustainableRefurbishmentAToolkitForGoingGreen.pdf

BEST PRACTICE EXAMPLES

Camden Dartmouth Park Guidance
http://camden.gov.uk/ccm/navigation/environment/planning-and-built-environment/planning-policy/supplementary-planning-documents--spds-/

Old home super homes – Older homes that have be retro-fit to significantly reduce carbon dioxide emissions
http://www.superhomes.org.uk/

MONITORING ENERGY USE

Mayor's best practice	London Plan policy
Developers are encouraged to incorporate monitoring equipment, and systems where appropriate to enable occupiers to monitor and reduce their energy use.	5.2, 5.3

2.4.61 Various studies[28] have shown that there is often a gap between how buildings are designed and modelled to perform and how they perform once they are occupied. Various organisations are carrying out research into why there is this gap and whether there are ways to address this, so it possible for developers to learn from the experience of others.

2.4.62 It is important that the original design considers how the development is likely to be occupied, and that measures, including Smart Meters[29] are installed to enable the monitoring of the energy and water use. This is already common practice in commercial buildings to enable landlords to monitor and reduce energy use. Displayed energy use in residential developments will enable occupiers to better understand the energy implications of the way they occupy and use their buildings. Even where energy costs are covered by the service charge, such as in student housing, monitoring can still be helpful to identify excessive use of energy.

2.4.63 When negotiating with developers on planning applications, boroughs should encourage them to install smart metering in their scheme. Comprehensive metering will assist occupiers and future proof the scheme for changes in the energy and water market in the future, including enabling occupiers and landlords to take advantage of demand side response. See paragraphs 2.4.64- 2.4.66 below for more information on demand side response.

SIGNPOSTS

Carbon Compliance for tomorrow's new homes. A review of the modelling tools and assumptions. Topic 4 – Closing the gap between designed and built performance. Zero carbon hub & NHBF. 2010
http://www.zerocarbonhub.org/resourcefiles/topic4_pink_5august.pdf

BEST PRACTICE EXAMPLES

CarbonBuzz - provides a tool that collects anonymous building energy consumption data to highlight the performance gap between design figures and actual readings.
http://www.carbonbuzz.org/index.jsp?homepagetabs=0

28 Carbon Compliance for tomorrow's new homes. A review of the modelling tools and assumptions. Topic 4 – Closing the gap between designed and built performance. Zero carbon hub & NHBF. 2010 http://www.zerocarbonhub.org/resourcefiles/topic4_pink_5august.pdf

29 Smart meters collect information about energy use in the building/unit electronically and have a communication capability that allows data to be read remotely and displayed on a device inside the building/unit, or transmitted securely externally. Smart meters can also receive information remotely.

Environmental Design Planning Guidance 2012. Islington Council – requires major development to submit a green performance plan to monitor the environmental performance of the building against key sustainability indicators. http://www.islington.gov.uk/services/planning/planningpol/pol_supplement/Pages/default.aspx?extra=6

SUPPORTING A RESILIENT ENERGY SUPPLY

Mayor's best practice	London Plan policy
Developers are encouraged to incorporate equipment that would enable their schemes to participate in demand side response opportunities.	5.2, 5.3

Demand side response

2.4.64 Demand side response (DSR) covers a range of measures such as smart metering and selecting smart appliances that enable a building's energy demand to respond to the wider availability of energy in the network, that is, the wider energy demand and generation across the network. Managing energy demand enables more stable energy generation and over the long term should enable the cost effective management and investment in infrastructure.

2.4.65 The response generally involves turning off non-essential equipment or running some equipment at a lower capacity, perhaps with the equipment having been fully charged during a time of lower energy demand across the network. There is generally a financial arrangement to incentivise the occupier for using less energy during high periods of demand. Planning these measures into a scheme at the initial stage of designing and selecting the engineering services is the easiest way to facilitate DSR.

2.4.66 When negotiating with developers on planning applications, boroughs should encourage them to install systems that would enable the development to take advantage of demand side response. Developers of large commercial schemes should be encouraged to speak to the district network operator. In London this is UKPN. This will assist occupiers and future proof the scheme for changes in the energy and water market in the future.

2.4.67 The Mayor has set up a permanent working interface with UK Power Networks to identify initiatives that each might take to support the development of demand side response measures within the UKPN network. The work will also look to optimise the opportunities for connecting decentralised energy systems to the distribution network and with that, the

opportunities for them to support resilience of the electricity distribution network and support demand side response measures.

2.5 WATER EFFICIENCY

KEY GUIDANCE AREAS

2.5.1 This section of the SPG provides guidance on the following key areas:

- water saving measures, including through appropriate landscape design;
- residential and non-domestic water consumption targets;
- using alternative sources of water;
- reusing water;
- metering; and
- retrofitting measures.

WATER EFFICIENCY

Mayor's Priorities	London Plan policy
Developers should maximise the opportunities for water saving measures and appliances in all developments, including the reuse and using alternative sources of water.	5.3, 5.13, 5.15
Developers should design residential schemes to meet a water consumption rate of 105 litres or less per person per day.	5.3, 5.15
New non-residential developments, including refurbishments, should aim to achieve the maximum number of water credits in a BREEAM assessment or the 'best practice' level of the AECB (Association of Environment Conscious Building) water standards.	5.3, 5.15
Where a building is to be retained, water efficiency measures should be retrofitted.	5.3, 5.4, 5.15
All developments should be designed to incorporate rainwater harvesting.	5.3, 5.13, 5.15

Mayor's best practice	London Plan policy
All residential units, including individual flats / apartments and commercial units, and where practical, individual leases in large commercial properties should be metered.	5.15

WATER SAVING MEASURES

Residential water saving targets

2.5.2 The London Plan states that residential schemes should be designed to meet a water consumption rate of 105 litres or less per person per day. This is based on the Water efficiency calculator[30], which is used by both the Code for Sustainable Homes and the Building Regulations (Part G). The Water efficiency calculator measures anticipated average water consumption by adding up flow rates, for example, of taps and showers as well as the size of devises such as baths, cisterns and washing machines. Assumptions are included in the model on how often devises will be used.

2.5.3 For residential developments that are not required to carry out a Code for Sustainable Homes assessment, The Sustainable Building Association also known as the AECB has developed a simple table that developers / contractors can use to specify water efficient appliances. Developers should aim for the 'best practice' standards. The AECB Water Standards can be found here http://www.aecb.net/publications/aecb-water-standards/

Non-domestic water saving targets

2.5.4 Many non-domestic developments carry out BREEAM assessments and should aim to achieve the maximum water credits. Where a BREEAM assessment is not carried out developers could instead aim to achieve the 'best practice' AECB Water Standards.

Overall water saving measures

2.5.5 The Water efficiency calculator allows off-setting in its calculation. For example, if rainwater harvesting is included for the flushing of toilets, the amount of water reused can be deducted from the water efficiency calculation enabling additional consumption through another appliance. Maximum water efficiency can be achieved by including as many of the following measures as practical:

- water saving appliances;
- water reuse appliances;
- alternative water sources; and
- low water use landscaping and gardens.

2.5.6 Water efficiency measures can also save energy - on a macro scale by reducing the volume of water that needs to be treated to drinking quality and pumped around London; and for the individual through the need to heat less water, for hot water needs.

2.5.7 Many water saving measures are internal the building and therefore the planning system has limited practical control over the retention of the individual measures. However, tools like BREEAM, the Code and the AECB water standard can be used to secure a range of measures. Development wide measures such as rainwater harvesting system are more likely to be retained, but need to be maintained. Boroughs should negotiate with and secure from developers as many of the water saving measures outline below as is practical in development schemes. Boroughs and developers should be satisfied that the

30 https://www.gov.uk/government/publications/the-water-efficiency-calculator-for-new-dwellings

appliances specified are appropriate for the development and their anticipated use. This is to limit the desire for occupants to substitute them for more water intensive appliances.

Water saving appliances

2.5.8 The simplest way of reducing water consumption is through the installation of water efficient fittings and plumbing. The AECB water standards[31] set out Good and Best practice standards for selecting water fittings and designing plumbing systems.

2.5.9 Measures can include:

- **low and dual flush toilets** - new toilets have a maximum flush of 6 litres. The lowest full flush toilets have a flush of 4 litres. Best practice are dual flush toilets of 4/2 litres;

- **waterless urinals** - new urinals are limited to a maximum water use of between 7.5 litres to 10 litres an hour. Therefore waterless urinals can save significant amounts of water and money for businesses. Buildings with high occupancy rate such as schools, hotels and offices can particularly benefit from waterless urinals which can be retro-fitted to replace existing systems. Having no flushing mechanism means that these systems can be easier to maintain and the lack of water can reduce hygiene and odour concerns;

- **taps** – water efficient options include spray, aerated, low flow self-closing and infrared controlled appliances as well as the installation of flow restrictors;

- **bathing** - showering, excluding with power showers generally uses less than half the water than having a bath. Aerated and low flow showerheads can further reduce water consumption. Where it is likely to be retained and use regularly, the installation of a low volume bath can be an alternative;

- **white goods** - washing machines can vary from between 6 litres and 20 litres of water per kilogramme of washing and dishwashers can use as little as 10 litres of water per wash[32]; and

- **swimming pools** and other high water consuming systems - these can generally be provided with water re-circulation, recycling and water recovery systems rather than backwashing or rejecting water to waste. Waste water from swimming pools can be re-used by re-circulating the backwash water to the balance tank, diluting with fresh water and making use of the treatment systems that exist for the pool.

Low water use landscaping

2.5.10 Designers should consider the following measures to reduce the demand for water from external activities:

- cleaning needs of large surfaces as this could result in significant water use;

- designing dry gardens or low water use gardens/landscaping by:

  ◊ imitating the conditions and attributes of London's vegetated brownfield sites;

31 http://www.aecb.net/PDFs/waterstandards/1503_AECB_Water_Vol_1_V3.pdf

32 http://www.waterwise.org.uk/pages/indoors.html

- ◊ working with the existing natural vegetation;
- ◊ selecting drought-resistant plants; and
- ◊ using water-retaining mulches;

- using automatic drip irrigation systems which are also cost-effective solutions that provide regular watering as required depending upon weather conditions;

- designing closed system recycling water features such as fountains, where included; and

- using rainwater harvesting techniques such as installing water butts to collect water from rainwater downpipe outlets to use on gardens. See section 3.2 on heat and drought resistant planting for further details

MAKING USE OF ALTERNATIVE SOURCES OF WATER

2.5.11 A large proportion of water used does not need to be of drinking quality, therefore capturing and using rainwater, recycling waste water and extracting ground water, where possible and permitted by the Environment Agency, can reduce the use of potable water.

2.5.12 Developments with intensive water use such as offices, buildings used by the public and schools should demonstrate they have actively considered using alternative sources of water.

Rainwater harvesting

2.5.13 Where practical rainwater should be collected from all suitable roofs and impermeable surfaces and stored for re-use. Depending on the size and nature of the development the rainwater harvesting system should be designed to water landscaping and top up water features, flush toilets, general cleaning and clothes washing. Rainwater harvesting systems can be integrated with sustainable urban drainage systems, however an allowance has to be made in the storage capacity for the additional water capacity to cater for both general rainfall (minus what is used regularly), and for a potential storm event that the sustainable urban drainage system is to cater for.

Abstraction of groundwater

2.5.14 Abstraction of groundwater in London is limited and is generally of poor quality. Where ground water is available it can provide an important alternative source to potable water, especially for industrial purposes, watering landscaping or flushing toilets. The consistent ground temperature means that ground water can be used for low energy cooling. See section 2.4 on renewable energy for more details.

Water re-use

2.5.15 **Grey water** (used water from sinks, baths and showers) can be filtered, disinfected and stored then re-used for toilet flushing, laundry, general cleaning and watering of landscaping. **Black water** (sewage from toilets) requires more intensive filtering and therefore is more resource intensive.

METERING

2.5.16 Meters can encourage people to monitor and reduce their water consumption by an

average of 10% to 15%[33]. Water companies have targets to meter existing properties to help reduce water consumption. Although all new homes are metered, often flats are not metered individually. Individual metering will have the greatest effect on reducing water consumption and should be included in all new developments, and ideally per floor for non-residential developments.

RETROFITTING MEASURES

2.5.17 Where buildings are to be retained, water efficiency and saving measures can be retrofitted. Simple measures include:

- products that reduce the volume of cisterns;
- flow restrictors and aerators for taps;
- individual grey water recycling systems; and
- water butts.

33 Push, pull, nudge – how can we help customers save water, energy and money? OFWAT. 2011

SIGNPOST

The Code for Sustainable Homes, BREEAM and the Building Regulations (Part G) contain water appliances standards and water calculators for developments.

AECB water standards – provide best practice standards for water appliances and plumbing. The standards can be used as part of a developers specifications package.
http://www.aecb.net/standards_and_guidance.php

Waterwise in conjunction with other organisations – provide information on water efficiency for planners, developers and consumers including a calculation tool and case studies.
http://www.water-efficient-buildings.co.uk/ and http://www.waterwise.org.uk/

BEST PRACTICE EXAMPLE

The Olympic Park
http://www.wrap.org.uk/content/water-efficiency-case-study-london-2012-olympic-park-0

2.6 MATERIALS AND WASTE

2.6.1 The careful choice and use of building materials can save developers money as well as reduce the generation of waste and ensure a high quality external environment and a healthy internal environment.

KEY GUIDANCE AREAS

2.6.2 This section of the SPG provides guidance on the following key areas:

- the design stage, including designing to use pre-fabrication elements, choosing materials that minimise the use of resources, are sustainably sourced, do not cause harm to health and are robust;
- the construction phase, including how to manage materials resulting from demolition through the waste hierarchy; and
- ensuring development contain sufficient and well designed storage for recyclables, organic material and waste.

DESIGN STAGE

2.6.3 The design and choice of materials for a development will influence the construction process and the embodied carbon of the development.

Mayor's Priority	London Plan policy
The design of development should prioritise materials that: • have a low embodied energy, including those that can be reused intact or recycled; ◊ at least three of the key elements of the building envelope (external walls, windows roof, upper floor slabs, internal walls, floor finishes / coverings) are to achieve a rating of A+ to D in the BRE's The Green Guide of specification; • can be sustainably sourced; ◊ at least 50% of timber and timber products should be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of forestry Certification (PEFC) source; • are durable to cater for their level of use and exposure; and • will not release toxins into the internal and external environment, including those that deplete stratospheric ozone	5.3, 5.20, 7.6, 7.14

Mayor's best practice	London Plan policy
The design of developments should maximise the potential to use pre-fabrication elements.	5.3, 7.6

PRE-FABRICATION

2.6.4 The fabrication of elements of a building off-site can reduce the generation of waste due to the controlled manufacturing process. For example, most bathrooms for student housing and some for hotels are constructed off-site and simply installed in their entirety within the development.

2.6.5 Most elements, at varying proportions, of a development can be manufactured off-site. The manufacture and pre-assembly in controlled conditions and improved accuracy of building elements can significantly reduce the time required to construct a development as well as improve a building's environmental performance. Developers are encouraged to design their schemes to incorporate as many pre-fabricated buildings elements as possible.

DECONSTRUCTION

2.6.6 When designing their schemes and selecting materials, developers should consider designing for deconstruction, rather than demolition. Deconstruction is the dismantling of a structure in the reverse order in which it was constructed, which means that the materials that were put on last are removed first. From the outset, new buildings should be designed with the prospect of future deconstruction being implementable. This process will facilitate the segregation and extraction of materials that could be carefully removed intact during redevelopment, and then reused/recycled wherever possible.

THE CHOICE OF MATERIALS

2.6.7 Developers can limit the environmental impact of their developments by selecting construction materials that are the least resource intensive, in both their composition and manufacturing process. This can be achieved through the sustainable (re)use of existing materials as far as possible before considering introducing new materials. Following are five key ways to achieve these objectives:

1. Managing existing resources;
2. Specifying materials using the Building Research Establishment's Green Guide to Specification;
3. Ensuring that materials are responsibly sourced;
4. Minimising the harmful effects of some materials on human health; and
5. Ensuring that specified materials are robust and sensitive to the building type and age.

1. Managing existing resources

2.6.8 Most development sites have existing materials which can be reused or recycled. Developers should always look for options to sensitively reuse, refurbish, repair and convert buildings, rather than wholesale demolition. This will reduce the amount of resources used and will help reduce construction waste.

2.6.9 Where the retention of a building or part of a building is not possible, developers should have measures to reduce the quantity of waste produced - from the demolition phase through to the construction phase – through the use of the waste hierarchy. More details on the

waste hierarchy can be found below at paragraph 2.6.17.

2. Using the BRE Green Guide to Specification

2.6.10 Developers and designers are encouraged to use the BRE Green Guide which provides guidance on how to make the best environmental choices when selecting construction materials and building components. The Green Guide ranks materials and components on an A+ to E rating scale – where A+ represents the best environmental performance / least environmental impact, and E the worst environmental performance / most environmental impact.

3. Ensuring that materials are responsibly sourced;

2.6.11 Developers and designers should specify materials from suppliers who participate in responsible sourcing schemes such as the BRE BES 6001:2008 Responsible Sourcing Standard. All timber specified should be sourced from schemes supported by the Central Point of Expertise for Timber Procurement such as Forest Stewardship Council (FSC) accreditation (which ensures that the harvest of timber and non-timber products maintains the forest's ecology and its long-term viability). The Timber Supply Panel set up to facilitate the use of only sustainable timber during the delivery of the Olympic and para Olympic Games provides an exemplar. http://learninglegacy.london2012.com/documents/pdfs/sustainability/425009-188-timber-aw.pdf

2.6.12 The use of responsible sourcing can contribute towards attaining the BREEAM/Code for Sustainable Homes credits but a clear audit trail will need to be provided to gain these credits. For further guidance on responsible sourcing of materials see http://www.bre.co.uk/

4. 'Healthy' materials

2.6.13 Internally it is recommended that environmentally sensitive (non-toxic) building materials are used and the use of materials or products that produce VOC (volatile organic compounds and formaldehyde) which can affect human health are avoided. The use of 'healthy' material options can contribute towards attaining the BREEAM/Code credits but a clear audit trail will need to be provided to gain these credits.

5. Robust materials

2.6.14 Materials chosen should be robust, low maintenance and long lasting to suit the location and intended use.

2.6.15 When negotiating the design of schemes, boroughs and developers should consider the above objectives and not specify unsustainable materials. Boroughs can secure appropriate materials from developments through BREEAM or Code assessments, where they are required.

CONSTRUCTION PHASE

Mayor's Priority	London Plan policy
Developers should maximise the use of existing resources and materials and minimise waste generated during the demolition and construction process through the implementation the waste hierarchy.	5.3, 5.20

2.6.16 The section above sets out how careful consideration to design can reduce the need for large scale demolition. This section sets out how to minimise waste by maximising the use of the existing materials on-site and through good site management during construction. Boroughs may want to secure appropriate waste minimisation measures through construction management or site waste management (see below) plans.

DEMOLITION MATERIAL

2.6.17 Where the demolition of a building cannot be avoided developers should either reuse materials on-site or salvage appropriate materials to enable their reuse or recycling off-site. Where materials cannot be salvaged whole, and where aggregate is required on-site, this demolished material should be crushed on-site for reuse, with measures taken to minimise dust and noise. See the waste hierarchy below and the Mayor's SPG on *The control of dust and emissions during construction and demolition*.

THE WASTE HIERARCHY

2.6.18 The 'waste hierarchy' ranks the different ways in which waste can be treated so that it limits the amount of resources used and waste generated. Developers should maximise the (re)use of existing resources and materials and minimise waste generated during the demolition and construction process through the implementation the following waste hierarchy:

1. Reduce;
2. Reuse (prioritise on-site reuse of demolition materials, followed by off-site reuse);
3. Recycle (prioritise on-site recycling, then off-site recycling);
4. Resource recovery (for energy generation processes – fuels, heat and power); and
5. Disposal.

2.6.19 In line with the waste hierarchy, when selecting materials, the preferred approach should be:

1. the use of reclaimed materials;
2. the use of materials with higher levels of recycled content; and
3. the use of new materials.

1. Reduce

2.6.20 Reducing waste, which is at the top of the waste hierarchy, should be developers' preferred option. This means, it is better to prevent waste being produced in the first place rather than to recycle or dispose of waste that is produced. Developers should focus on opportunities for waste reduction

from the outset, at the earliest stages of design, as well as through better methods of purchasing and ways of working, for example by purchasing pre-used materials and monitoring over-supply to better inform future procurement of materials.

2.6.21 Where demolition is necessary, developers are encouraged to:

- safely remove the most valuable or more contaminating materials and fittings for later reuse or processing before work commences;

- optimise the reuse and recycling of demolition materials. Developers are encouraged to use the **Demolition Protocol**[34] where substantial demolition is proposed (over 1,000 square meters). In general the protocol is a 'demolition waste audit' - a process that describes the percentage of the materials present on a site which can be reused/recycled (either in the development site or one nearby);

- demonstrate that the most significant opportunities to increase the value of materials derived from recycled and reused content have been considered. A good way of achieving this aim at no additional construction cost is to use the Waste and Resources Action Programme (WRAP)[35] by selecting the **top ten WRAP Quick Wins** or equivalent, and implement the good practice guidance;

- building contractors are legally required to produce **Site Waste Management Plans** (SWMP) for all projects with an estimated construction cost of over £300,000. A Site Waste Management Plan provides a framework for managing waste in line with the hierarchy by identifying types and quantities of materials for reuse/recycling to reduce the amount of waste produced by construction projects. For further guidance see the WRAP NetWaste tool which has a site waste management plan function;

- design for **deconstruction** (as explained above); and

- incorporate a 'material salvage phase', in which construction and surplus materials are recovered from the site. Additionally, materials should be segregated into categories, e.g. timber waste, metal waste, concrete waste and general waste – to aid reuse or recycling.

2. Reuse

2.6.22 Once the demand for building materials has been reduced developers should reuse and prepare for the reuse of materials, either on-site/off-site. This can be done during the design, procurement and construction phases of a development by, for example:

- identifying and segregating materials already on-site for reuse in the new development. Materials that potentially be reused include:

  ◊ bricks, concrete,
  ◊ internal features – historic fireplaces, timber floorboards, doors,
  ◊ metal frames, plastics, granite, and
  ◊ sub-soil, top soil;

34 For further detailed guidance on the Demolition Protocol (2003), refer to: Institute of Civil Engineers (ICE) and London Remade www.londonremade.com
35 http://www.wrap.org.uk/

- using the BRE Smart Waste[36] management plan tool. This is an on-line template contractors can use to input data on the amount and type of waste and have it sorted by the management tool; and

- making the materials not (re)used on-site available for reuse elsewhere. Consider the exchange/sale/donation of construction site materials to waste recovery businesses, such as: BRE Materials Information Exchange; waste exchanges such as recipro[37] or the waste change.com[38] etc. These specialists can sort, clean, repair and refurbish the waste materials and then find businesses that can reuse/ recycle them.

3. Recycling

2.6.23 Recycling materials (either on-site/off-site), is the preferable solution only when waste minimisation 'reduce' or reuse are not feasible. The recycling of materials enables them to be made into something new. Every opportunity should be taken to recycle materials in the most cost and carbon dioxide efficient way. This can be done by, for example:

- identifying and segregating materials to promote closed loop recycling where materials are recycled back into the same material (for example recycling glass back into glass containers instead of aggregate.) This includes:

  ◊ metals and high value materials,

  ◊ timber, plasterboard, packaging, and

  ◊ concrete crushed and re-used for concrete aggregate;

- using the BRE Smart Waste www.smartwaste.co.uk mentioned above;

- considering 'take-back' schemes with suppliers for materials and packaging. This where suppliers take back any materials not used as well as any packaging the materials are delivered in; and

- making materials not reused on-site available for reuse elsewhere, as discussed above.

4. & 5. Other Recovery and Disposal

2.6.24 Disposal is the least preferred waste management approach. Developers should only consider disposal of materials and waste after all of the above approaches have been carried out. Disposal generally involves burying the materials in a landfill. Waste materials from construction and demolition activities are generally not suitable for energy generation and generally require burning at high temperatures in an incinerator. Where disposal is the only option for the materials developers should:

- identify materials that are contaminated and cannot be reused or recycled and arrange for their safe and legal disposal by the authorised waste management;

- remove all toxic and hazardous materials from a development site in accordance with any relevant legislation, unless they are integral to the structure or a

36 www.smartwaste.co.uk
37 http://www.recipro-uk.com/
38 http://www.wastechange.com/

feature to be retained, and any harm to environmental or public health should be mitigated; or

- limit waste disposal to minimise the amount of land fill tax that needs to be paid.

Historic materials

2.6.25 In projects that involve the refurbishment of historic assets, materials should be specified in line with the following principles:

- reclaimed materials should be matching and appropriate to the building type/area (original construction time/period) and sufficiently robust in their performance not to compromise building function;

- materials with a low environmental impact as determined by the BRE Green Guide to Specification subject to approval from Conservation Officers and provided those materials do not compromise the performance (thermal, structural or otherwise) of the existing building; and

- when selecting insulation materials for older buildings, preference should be given to natural fibre based materials that prevent moisture retention in the building fabric.

SITE WASTE MANAGEMENT PLAN (SWMP)

2.6.26 Where a 'site waste management plan' (SWMP) is required (in projects with an estimated construction cost of over £300,000) it should include a pre-demolition audit of materials completed by a qualified professional and submitted with an application, in accordance with the Demolition Protocol. The audit must show what materials can and will be reused. If a full audit cannot be provided with the application, one should be secured by condition by the local planning authority and submitted to and approved by the Council prior to commencement of works on-site.

OCCUPATION

Mayor's Priority	London Plan policy
Developers should provide sufficient internal space for the storage of recyclable and compostable materials and waste in their schemes.	5.3, 5.17
The design of development should meet borough requirements for the size and location of recycling, composting and refuse storage and its removal.	5.3, 5.17

Storage for recyclables, organic material and waste

2.6.27 Developers should ensure sufficient internal and external space is provided to facilitate recycling and composting and the good management of waste. The Code for Sustainable Homes has standards for the storage of recyclable and waste materials. It also allows compliance with the local borough's requirements for local collection. The design of waste storage should ensure it is as convenient to recycle as it is to manage waste.

2.6.28 In all developments the location of external storage areas should consider the noise generated from the frequency of use of this area and its servicing as well as the requirements of the serving operator to pick up the materials. This is especially important in dense mixed use areas with residential occupiers as commercial recycling and waste services may occur at night.

SIGNPOSTS

Design for deconstruction – principles of design to facilitate reuse and recycling. CIRIA Best Practice Guidance C607. B Addis. 2003.

BEST PRACTICE EXAMPLES

Olympic Park
http://learninglegacy.independent.gov.uk/documents/pdfs/sustainability/16-const-waste-aw.pdf

2.7 NATURE CONSERVATION AND BIODIVERSITY

KEY GUIDANCE AREAS

2.7.1 This section of the SPG provides guidance on the following key areas:

- protecting species;
- protecting habitats; and
- designing development proposals.

Mayor's Priority	London Plan policy
There is no net loss in the quality and quantity of biodiversity.	5.3, 7.19
Developers make a contribution to biodiversity on their development site.	5.3, 7.19

2.7.2 Developments should be sensitively designed to enhance biodiversity and increase connectivity between patches of urban habitat, and contribute to conservation at the development site scale.

Protected species

2.7.3 Certain species are protected under UK and European legislation. Natural England provides a list of protected species as well as guidance relating to these protected species.

2.7.4 Certain development activities within the vicinity of protected species and their habitats require a licence from Natural England. It is the developer's responsibility to ensure that they have complied with all legislation with regards to protected species when developing their site. The most common protected species found in London include wild birds, bats, badgers, deer, water vole, great crested newt, reptiles, stag beetles and bluebells.

Protected sites

2.7.5 Certain sites are protected by UK and European legislation. Sites include those designated as:

- **International**[39] - special areas of conservation (SACs), special protected areas (SPAs) and Rasmar sites;
- **National** - Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs)
- **London wide -** sites of metropolitan importance for nature conservation; and

39 The sites in and around London are identified in the London Plan. Habitats Regulations Assessment - Screening Report http://www.london.gov.uk/shaping-london/london-plan/docs/hra-final-report-oct09.pdf

- **Local** - sites of borough and local importance for nature conservation.

2.7.6 Where proposals are in the vicinity of these sites developers will have to carry out an assessment of the potential impacts the scheme could have on these sites, including the connectivity of this site with other nature conservation sites. The assessment should be commensurate to the scale of the development and the legal protection awarded to the site. The assessment needs to have informed the design of the development, along with any mitigation required during the construction and occupation stage. The assessment needs to be submitted alongside the planning application.

2.7.7 The development of land use policy documents and some large development proposals or projects will need to be informed by **Appropriate Assessments** under the European Union Habitats Directives. This assessment is the responsibility of the determining authority.

Biodiversity Action Plans

2.7.8 Developers and local planning authorities should have regard to additional species and habitats that are identified at the national, London or local level as priorities for protection and enhancement.

Development proposals

2.7.9 In accordance with London Plan Policy 7.19 developers should adhere to the following hierarchy when considering biodiversity on their development site:

1. **avoid adverse impact** to the biodiversity interest by:

- considering the particular structure of landscape or vegetation required by any important plant or animal species;
- carefully considering the location, design, form and foundation requirements for the development to protect existing biodiversity; and
- considering the implications of the development on changes to the local natural environment over time, for example space required for maturing trees.

2. **minimise impact and seek mitigation,** biodiversity impacts should be reduced as far as reasonably possible. This can be achieved by undertaking appropriate ecological surveys in advance of any planning application to guide and inform the design of the development. These steps should be followed and an explanation provided with planning applications:

- give priority to retaining any existing valuable vegetation or features;
- provide connectivity to existing green and nature conservation spaces by contributing to 'buffer habitat', 'stepping stones' and 'corridors; and
- provide new habitat within the development including for example, ecologically appropriate landscaping, green walls, green roofs or roof gardens, ponds and wetlands (potentially incorporated with SuDs), artificial roosts and nest boxes for birds, bats, and insect.

3. **only in exceptional cases where the benefits of the proposal clearly outweigh the biodiversity impacts, seek appropriate compensation** which could include:

- provision of off-site replacement habitat; and
- provision of a financial contribution or other resources to enable adjacent land managers to improve the quality of their ecological resource.

2.7.10 Where required, an assessment needs to be submitted alongside a planning application. It should be noted that for important species or habitat, surveys can take a year to capture an annual cycle. Also any mitigation or compensation measures need to be identified at planning application stage and secured by condition or s106 agreement. All compensation habitat should be maintained to ensure its establishment and long term survival. This could include a management plan.

2.7.11 New habitat provision can be provided as part of a development's urban greening measures. Significant new habitat can be provided on buildings, however this cannot fully replace habitat lost at ground level.

SIGNPOSTS

Natural England list of European and UK legislation on wildlife management and licensing.
http://www.naturalengland.org.uk/ourwork/regulation/wildlife/policyandlegislation/legislation.aspx#eu

Wildlife management and licensing
http://www.naturalengland.org.uk/ourwork/regulation/wildlife/default.aspx

Standing advice for protected species
http://www.naturalengland.org.uk/ourwork/planningdevelopment/spatialplanning/standingadvice/default.aspx

Disturbance to London's wildlife and the law. Metropolitan Police
http://content.met.police.uk/cs/Satellite?blobcol=urldata&blobheadername1=Content-Type&blobheadername2=Content-Disposition&blobheadervalue1=application%2Fpdf&blobheadervalue2=inline%3B+filename%3D%22527%2F443%2Fdisturbance_leaflet_text_only.pdf%22&blobkey=id&blobtable=MungoBlobs&blobwhere=1283546910476&ssbinary=true

Planning for a healthy natural environment: good practice for green infrastructure and biodiversity
http://www.tcpa.org.uk/pages/planning-for-a-healthy-environment-good-practice-for-green-infrastructure-and-biodiversity.html

Biodiversity for Low and Zero Carbon Buildings: A Technical Guide for New Build
http://www.ribabookshops.com/item/biodiversity-for-low-and-zero-carbon-buildings-a-technical-guide-for-new-build/70194/

BEST PRACTICE EXAMPLES

Barking Riverside
http://barkingriverside.co.uk/

55 Broadway green roof
http://livingroofs.org/20101110262/single-articles-on-green-roofs/55-broadway-london.html

THE HAMPTONS, SUTTON
©JONATHAN FINCH

CHAPTER 3

ADAPTING TO CLIMATE CHANGE AND GREENING THE CITY

3.1 INTRODUCTION

3.1.1 This section provides further guidance on how developers should incorporate climate change adaptation and greening priorities outlined in the London Plan. Successful delivery of measures to meet these priorities will help ensure that London is resilient to current and future weather and also that the capital remains an inviting environment in which to invest, work and live.

3.1.2 The London Plan[40] sets out the latest projections of what the climate is likely to be in the future due to the effects of climate change. In summary, on average it is anticipated that in the future[41] London will experience:

- hotter summers;
- milder winters;
- increased periods without rain;
- increased intensity in rainfall; and
- more extreme weather events.

3.1.3 Some climate change is now inevitable. We are already committed to experiencing some changes to our climate due to the legacy of past greenhouse gas emissions and the length of time they persist in the atmosphere. It will take time for the actions we are currently taking to reduce emissions to have an effect. We therefore need to prepare for the changes to our climate that are being anticipated.

3.1.4 Climate change will affect the quality of life of all Londoners both positively and negatively. However climate change is more likely to affect vulnerable people with poor health, which is also the group least able to implement adaptation measures. This will disproportionately affect those already experiencing health inequalities.

3.1.5 Climate change adaptation measures will improve the resilience to changing climate already in the system as well as improve the quality of Londoners' lives, reduce carbon dioxide emissions, improve water and energy security, tackle social inequality and boost the 'green' economy.

3.1.6 It is important that the buildings and spaces built today are suitable for occupation and use for their anticipated lifetime. Potential responses can include:

Potential impact	Potential adaptation measure	SPG guidance
hotter summers	design to prevent overheating	Section 2.4 Section 3.2
	design for heat resistant landscaping	Section 2.5 Section 3.2
milder winters		
increased periods without rain	design more resilient foundations	Section 3.2
	water efficiency	Section 2.5
	drought resistant planting	Section 3.2
increased intensity in rainfall	designing for flooding	Section 3.4

40 Paragraph 5.5
41 Based on UKCIP 2009 Scenarios http://www.ukcip.org.uk/essentials/uk-impacts/

Potential impact	Potential adaptation measure	SPG guidance
more extreme weather events	generally resilient buildings and spaces(general design and robust materials)	Section 2.6 Section 3.2

3.1.7 This section heavily cross references other sections in this SPG as issues relating to adaptation overlap with issues of resource management.

3.1.8 Developers need to consider how their developments will function in the future in the context of a changing climate. There is no set standard for how long a building will last, however history has shown us buildings can last well over 100 years. Much of London's housing stock was built between 1880s and 1970s and at current replacement rates, 80% of London's current stock will still be here in 2050.

3.2 TACKLING INCREASED TEMPERATURE AND DROUGHT

KEY GUIDANCE AREAS

3.2.1 This section of the SPG provides guidance on the following key areas:

- preventing developments from overheating in the future;
- promoting heat and drought resistant planting; and
- designing resilient foundations.

OVERHEATING

Mayor's Priority	London Plan policy
Developers should include measures, in the design of their schemes, in line with the cooling hierarchy set out in London Plan policy 5.9 to prevent overheating over the scheme's lifetime.	5.3, 5.9

3.2.2 Overheating can result from either too much heat entering a building and not being released or too much heat being generated within a building and not being released. Just like being too cold, overheating can result in discomfort for occupiers, poor productivity and health concerns. Therefore if the internal environment becomes too hot it is likely occupiers will try to find a way to cool their environment. In order to continue minimising carbon dioxide emissions it is important designers consider the internal comfort required by occupiers at the design stage and that this comfort level is met through implementing the cooling hierarchy set out in London Plan Policy 5.9.

3.2.3 Overheating is not fully assessed by carbon dioxide emission models, therefore developers are encouraged to undertake dynamic thermal modelling to ensure that their development does not overheat. This is particularly important for small south facing and top floor living accommodation. As outlined in the London Plan[42] the GLA is developing with the Chartered Institute of Building Services Engineers (CIBSE) guidance for developers to address the risk of overheating in buildings.

3.2.4 Section 2.4 sets out some broad measures on how a development's design can minimise carbon dioxide emissions. To prevent overheating developers should incorporate the following measures, as appropriate, into their schemes:

Passive measures:

- use materials with a **high thermal mass;**
- use **green roofs** and **green walls** to keep the heat out, and keep the building and its surroundings cool;
- use materials with **high albedo** surfaces;
- locate spaces and uses that need to be cool or that generate heat on the north side of development;
- use **smaller windows** on the south and western elevations with **low g-value glazing**;
- use carefully designed **shading measures**, including balconies, louvers, internal or external blinds, shutters, trees and vegetation;
- design the building and its internal layout to enable **passive ventilation**, including openable windows, a shallow floor plan, high floor to ceiling heights, the stack effect, a double façade; and
- design in **vegetation**, including green roofs and walls, and **water features** for passive cooling.

42 Paragraph 5.47

Active measures:

- energy efficient lighting and equipment to minimise internal heat generation; and
- follow the **Mayor's Low Carbon Cooling Guide** to select the most efficient ventilation and cooling systems.

thermal mass - the ability of a material to store heat
albedo – the reflectivity of a surface to the sun's radiation
g-value – the extent that glazing blocks heat from sunlight. The lower the G-value, the less solar heat is transmitted.

SIGNPOSTS

Socially just adaptation to climate change. Joseph Rowntree Foundation
http://www.jrf.org.uk/publications/socially-just-adaptation-climate-change

London climate change partnership
http://climatelondon.org.uk/resources/

BEST PRACTICE EXAMPLES

Colne and Mersea housing blocks (London Borough of Barking and Dagenham)
http://climatelondon.org.uk/wp-content/uploads/2013/02/Your-social-housing-in-a-changing-climate.pdf

HEAT AND DROUGHT RESISTANT PLANTING

Mayor's best practice	London Plan policy
The design of developments should prioritise landscape planting that is drought resistant and has a low water demand for supplementary watering.	5.3, 5.15

3.2.5 London Plan Policy 5.15 outlines that in dry years, London's mains water supply already outstrips demand. Therefore it is essential that landscaping does not use excessive amounts of water. Developers should select drought resistant planting so that it needs less watering and so that when water restrictions are in place, plants are more likely to survive and meet their intended purpose.

3.2.6 Section 2.5 of this guidance provides details on alternative sources of water for landscaping that does require watering.

SIGNPOST:

Right trees for a changing climate - This website helps anyone wanting to plant trees decide what trees are suitable to plant in London and other urban areas in face of a changing climate.
http://www.righttrees4cc.org.uk/

RHS Drought-resistant planting - provides advice on suitable plants
http://apps.rhs.org.uk/advicesearch/profile.aspx?pid=397

Landscape Architecture and the challenge of climate change
http://landscapeinstitute.org/PDF/Contribute/LIClimateChangePositionStatement.pdf

BEST PRACTICE EXAMPLES

Holmes Road drought resistant planting
http://diliplakhani.com/holmes-road-london/

RESILIENT FOUNDATIONS

Mayor's best practice	London Plan policy
Developers should consider any long term potential for extreme weather events to affect a building's foundations and to ensure they are robust.	5.3, 7.6

3.2.7 A large proportion of London has clay soils. Clay soils can shrink considerably and become hard and crack during hot and dry periods, leaving space in the soil and around foundations. When it rains for long periods clay soils can also swell and become like plasticine increasing the pressure on foundations. Extreme weather conditions could place increasing pressure on shallow and less robust foundations, which generally characterise traditionally constructed buildings.

3.2.8 Trees and vegetation can either remove more water from the soil or retain moisture to help keep ground conditions moist. Careful consideration should be given to the proposed landscaping based on the proposed foundations and local soil.

SIGNPOSTS

A review of current research relating to domestic building subsidence in the UK: what price tree retention? The Forestry Commission
http://www.forestry.gov.uk/pdf/Trees-people-and-the-buit-environment_Plante.pdf/$file/Trees-people-and-the-buit-environment_Plante.pdf

3.3 INCREASING GREEN COVER AND FOOD GROWING

KEY GUIDANCE AREAS

3.3.1 This section of the SPG provides guidance on the following key areas:

- promoting urban greening; and
- promoting the protection and planting of trees.

URBAN GREENING

Mayor's Priorities	London Plan policy
Developers should integrate green infrastructure into development schemes, including by creating links with wider green infrastructure network.	2.18, 5.3, 5.10, 5.11
Major developments in the Central London Activity Area (CAZ) should be designed to contribute to the Mayor's target to increase green cover by 5% in this zone by 2030.	5.10

3.3.2 Urban greening has been identified as a measure to help adapt the city to future climates. Green infrastructure is a network of mainly vegetated spaces and other environmental features, including water features with multifunctional and connectivity benefits. Green infrastructure can have numerous benefits including:

- urban cooling, through shading and evapotranspiration;
- reduced runoff, through the absorption of rainfall;
- reduced energy demand, through insulation of the property;
- improved air quality;
- improved biodiversity;
- enhanced amenity and visual interest, including in neighbourhoods and high streets and helping to create a sense of place;
- better quality of life for residents and workers; and
- for health and well-being, including tackling obesity and mental health by offering pleasant opportunities for exercise, including food growing.

3.3.3 To maximise the opportunities for urban greening, when preparing plans such as local plans, area action plans or surface water management plans boroughs should investigate the opportunities for new and enhanced green infrastructure. Boroughs should also identify the opportunities for delivering urban greening measures, such as through the CIL, borough or other agency climate change adaption or surface water management programmes or as an off-site provision required in lieu

of any shortfall not provided on their development site.

3.3.4 The highly urbanised nature of central London increases its vulnerability to extreme weather events. Therefore the CAZ has been identified as a focal point for increasing green cover as part of a package of measures to increase resilience. The Mayor has a target to increase the green cover in the CAZ by 5% on 2008 levels by 2030 (an increase of approximately 30ha). To facilitate the delivery of this target, developments should maximise the provision of green infrastructure within their developments. The green infrastructure most applicable in the most densely developed part of the city are urban greening measures such as green roofs, green walls, rain gardens and street trees.

3.3.5 To fully contribute to the Mayor's target, developers should provide the urban greening measures on-site, either on the buildings or within the curtilage of the site. Developers should design green infrastructure into their scheme at the initial design stage to ensure that the full consideration can be given to the type of vegetation that would be appropriate in the proposed location and whether there are any watering and daylight requirements.

3.3.6 The contribution on each site should be maximised by vegetating as much roof area or curtilage as is practical, that is by vegetating the area that is not covered by operating equipment[43] or required for circulation and access. To maximise the environmental benefits of green infrastructure the preference is that it is provided in the form of vegetated landscaping (including trees and rain gardens) at ground level or as a vegetated green roof. Green roofs should meet the standards set out in GLA guidance in the 'Living Roofs and Walls' report[44]. See section 2.7 on nature conservation and biodiversity.

3.3.7 Where no on-site provision is feasible due to the site's constraints, the developer should investigate options for providing urban greening measures off-site within the CAZ. This will involve working with the relevant planning authority and/or nearby property owners to identify suitable measures. Measures could include retrofitting green roofs or other vegetated landscaping. Measures could be provided in whole or part directly by the developer or by making a contribution that adds to an existing scheme. The implementation of the measures and their maintenance should be secured by conditions or s106 agreements, as relevant. However, any agreement for off-site measures, including financial contribution need to consider any restrictions imposed by the CIL Regulations.

3.3.8 As outlined in section 2.5, green infrastructure should be designed in ways that minimise the need for excessive watering and maintenance. Vegetation and landscaping should be maintained and its management may be secured for a period of time through the planning process.

3.3.9 The Mayor expects urban greening to be included in all major developments and in smaller schemes, where feasible.

43 Except for solar panels as panels can be provided on top of green roofs and have been found to work more efficiently.

44 http://www.london.gov.uk/priorities/environment/greening-london/urban-greening/greening-roofs-and-walls

TREES

Mayor's Priorities	London Plan policy
Developments should contribute to the Mayor's target to increase tree cover across London by 5% by 2025.	5.3, 5.10, 7.21
Any loss of a tree/s resulting from development should be replaced with an appropriate tree or group of trees for the location, with the aim of providing the same canopy cover as that provided by the original tree/s.	5.3, 5.10, 7.21

3.3.10 Trees and woodland form an essential part of London's design and landscape character. They also cool the urban environment (along with other green infrastructure), providing important health and social benefits. The ability of trees to intercept heavy rainfall, retain moisture and return water to the atmosphere through evapotranspiration will be increasingly important to help reduce surface water runoff and therefore flood risk. Boroughs should use their Tree Preservation Order powers to protect trees where appropriate.

3.3.11 In line with the Mayor's Preparing Trees and Woodland Strategy SPG, trees and woodland across London should be considered as a whole, as an urban forest. This means that boroughs should not manage trees in a fragmented and ad hoc manner but be planned, cared for and protected in a truly co-ordinated way, for the benefit of all.

3.3.12 It is essential that the design of development considers existing trees as well as the space trees require for growth. Where possible, boroughs and developers should retain existing trees as part of new development proposals. Where it is necessary to remove an existing tree it should ideally be replaced with a tree (or trees) that will grow to a similar size. Where required, the replacement of trees should be secure by condition. Tree planting and maintenance should follow the guidance produced by the *Trees and Design Action Group*, including *The Canopy, Trees in the Townscape and the forthcoming Trees in Hard Landscapes*[45].

3.3.13 The Capital Asset Value for Amenity Trees (CAVAT) or a similar methodology can be used by boroughs to assess and calculate the urban greening benefits of the existing tree compared to those proposed within the development.

45 http://www.tdag.org.uk/guides.html

SIGNPOSTS

The Mayor's Tree and Woodland Strategy Supplementary Planning Guidance - provides guidance on how to value and manage trees as an asset and how to develop a borough wide tree and woodland strategy.
http://www.london.gov.uk/priorities/planning/publications/preparing-borough-tree-and-woodland-strategies-spg

The London Tree and Woodland Framework - provide a strategic approach to the conservation and management of trees and woodlands in London
http://www.forestry.gov.uk/ltwf

Trees in the Townscape. A guide for decision makers 2012 - This Trees and Design Action Group document provides guidance and case studies on how to incorporate the planning for trees into policy as well as detailed design guidance on how to make space for and incorporate trees into development. http://www.tdag.org.uk/trees-in-the-townscape.html

The benefits of large species trees in urban landscapes: a costing, design and management guide (C712) 2012 - This CIRIA document aims to highlight the vital importance of large species trees, including the retention and enhancement of existing trees and carrying out of new plantings in streets, squares and parks for new and existing developments.

CAVAT - provides a method for managing trees as public assets. It is a tool for decision-making which can be applied to the tree sock as a whole, or to individual trees, when value needs to be expressed in monetary terms http://www.ltoa.org.uk/index.php?option=com_content&view=article&id=120&Itemid=69

Living Roofs and Walls. Technical Report: Supporting London Plan Policy – provides information regarding the benefits of different types of green roof systems and suggested standards for substrate depth and biodiversity. http://www.london.gov.uk/sites/default/files/uploads/living-roofs.pdf

The GRO Green Roof Code (2011) - an industry led code of best practice to guide green roof design, specification, installation and maintenance. http://www.thegreenroofcentre.co.uk/Library/Default/Documents/GRO%20ONLINE.pdf

3.4 FLOODING

KEY GUIDANCE AREAS

3.4.1 This section of the SPG provides guidance on the following key areas:

- surface water flooding;
- sustainable drainage;
- flooding and the resilience and resistance of buildings;
- safety;
- flooding and basement developments;
- flood defences;
- flood risk management from tidal and fluvial flooding; and
- other sources of flooding.

SURFACE WATER FLOODING AND SUSTAINABLE DRAINAGE

Mayor's Priorities	London Plan policy
Through their Local Flood Risk Management Strategies boroughs should identify areas where there are particular surface water management issues and develop policies and actions to address these risks.	5.3, 5.12
Developers should maximise all opportunities to achieve greenfield runoff rates in their developments.	5.12, 5.13
When designing their schemes developers should follow the drainage hierarchy set out in London Plan policy 5.13.	5.13
Developers should design Sustainable Drainage Systems (SuDS) into their schemes that incorporate attenuation for surface water runoff as well as habitat, water quality and amenity benefits.	5.3, 5.13, 5.14

3.4.2 It is important to incorporate sustainable drainage in all developments, except for perhaps those at the bottom of a catchment, to prevent the increasing volume of surface water runoff during heavy rainfall. Surface water flooding is the most likely form of flooding that development may be exposed to. Surface water flooding is likely to increase due to the anticipated increased intensity in rainfall events as well as the continuing urbanisation of London. For small developments, including those that do not require planning permissions, simple measures can include draining impervious surfaces to a landscaped area of the garden or to a soak away or installing a water butt to collect water from an existing or new impervious roof. More options are provided in Table 2 below. Guidance on how to design to limit the impact of other forms of flooding can be found later in this section (paragraph 3.4.42).

SURFACE WATER MANAGEMENT PLANS

3.4.3 Under the Floods and Water Management Act 2010[46] the responsibility for surface water flooding in London lies with boroughs[47] which must develop, maintain, apply and monitor a strategy for local flood risk management in its area. It is essential that local planning policies and decisions complement any actions a Surface Water Management Plan (SWMP) or Local Flood Risk Management Strategy identify to address local surface water flooding issues. This will generally require a coordinated approach between the local planning authority, the local highways authority and the open space department. The local water company can also be included.

3.4.4 A catchment wide approach should be taken in urban areas, particularly where surface water in one borough may result in flooding in another borough and there is insufficient space to fully deal with surface

46 http://www.legislation.gov.uk/ukpga/2010/29/contents
47 The term 'lead local flood authority' is used in the Act

water in a single borough. Surface water maps will be published by Drain London in autumn 2013 and separately by the Environment Agency in early 2014. SuDS measures should be retrofitted where ever possible to address local surface water management issues. The SuDS measure may be located upstream, even some distance, from the actually area at risk of surface water flooding.

GREENFIELD RUNOFF RATES

3.4.5 London Plan policy 5.13 states that developers should aim for a greenfield runoff rate from their developments. Greenfield runoff rates are defined as the runoff rates from a site, in its natural state, prior to any development. Typically this is between 2 and 8 litres per second per hectare. The CIRIA SuDS Manual[48] generally recommends the institute of Hydrology Report 124 methodology for calculating greenfield runoff rates.

3.4.6 Achieving a greenfield runoff rate is of particular importance where the development is located in a catchment that contributes to combined sewers with known and/or modelled capacity or flooding issues. Information to determine whether capacity/flooding issues exist is available from borough SWMPs and Strategic Flood Risk Assessments (SFRAs) as well as other historic data.

3.4.7 If greenfield runoff rates are not proposed, developers will be expected to clearly demonstrate how all opportunities to minimise final site runoff, as close to greenfield rate as practical, have been taken. This should be done using calculations and drawings appropriate to the scale of the application. In order to achieve this, applicants should:

- consider the permeability of all existing and proposed surfaces on the application site;
- assess the existing surface water and foul drainage networks and their discharges; and
- assess a range of return periods (the probability of a rainfall event of a particular size occurring and resulting in flooding) up to and including the 1 in 100 year plus climate change critical storms (an additional 20-30%).

3.4.8 Most developments referred to the Mayor have been able to achieve at least 50% attenuation of the undeveloped site's surface water runoff at peak times. This is the minimum expectation from development proposals.

3.4.9 There may be situations where it is not appropriate to discharge at greenfield runoff rates. These include, for example, sites where the calculated greenfield runoff rate is extremely low and the final outfall of a piped system required to achieve this would be prone to blockage. An appropriate minimum discharge rate would be 5 litres per second per hectare.

3.4.10 All developments on greenfield sites must maintain greenfield runoff rates. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. The only exceptions to this, where greater discharge rates may be acceptable, are where a pumped discharge would be required to

48 Table 4.2

meet the standards or where surface water drainage is to tidal waters and therefore would be able to discharge at unrestricted rates. For example, development alongside the Thames or docks discharge directly into the waterway.

The drainage hierarchy

3.4.11 The drainage hierarchy set out in London Plan policy 5.13 comprises two elements:

- managing and storing surface water on-site before it is finally discharged, if required (Numbers 1 to 4); and
- disposal of surface water from a piped drainage system (Numbers 5, 6 and 7).

3.4.12 The capture and storage of rainwater for later use is always the priority in order to also meet the objective of making efficient use of water resources. See section 2.5 for more details on water reuse. Where there are no opportunities to collect and reuse rainwater, the site, where practical should drain to the ground to recharge groundwater resources. Where infiltration is not possible, surface water should be stored on-site in open water features such as ponds and wetlands and then released at a controlled rate. The final option is to store surface water in tanks or cellular storage before it is released at a controlled rate. This is the least preferable storage option as it does not provide wider sustainability benefits such as habitat provision or water quality improvements.

MULTI-FUNCTIONAL BENEFITS OF SUDS

3.4.13 Development should utilise SuDS unless there are practical reasons for not doing so. The aspiration is to deliver SuDS schemes that provide multiple benefits, in addition to reducing flood risk. The most beneficial schemes will successfully contribute to the delivery of the Water Framework Directive[49] by reducing water pollution and providing additional valuable habitat to improve the status of our water bodies. SuDS schemes should also aim to improve amenity, and therefore the quality of life of Londoners, as well as contribute to the wider goals relating to green infrastructure, biodiversity, water efficiency and recreation.

3.4.14 SuDS measures should be specified to maximise multi-functional benefits by following Table 2 shown below.

3.4.15 SuDS should be fully justified by adopting techniques in a hierarchical manner, maximising the use of those techniques higher up the hierarchy and those that deliver multi-functional benefits before considering others further down the hierarchy. (see Table 2 below). A London SuDS Guidance Pack from the London Drainage Engineers Group will be available in early 2014.

3.4.16 Site conditions to consider when assessing the suitability of different SuDS include:

- the contaminants present in runoff;
- the catchment area;
- local hydrology; and
- the type of development.

49 http://www.environment-agency.gov.uk/research/planning/33362.aspx

Most sustainable	SUDS technique	Floor Reduction	Pollution Reduction	Landscape & Wildlife Benefit
	Living roofs	✔	✔	✔
	Basins and ponds • Constructed wetlands • Balancing ponds • Detention basins • Retention ponds	✔	✔	✔
	Filter strips and swales	✔	✔	✔
	Infiltration devices • Soakaways • Infiltration trenches and basins	✔	✔	✔
	Permeable surfaces and filter drains • Gravelled areas • Solid paving blocks • Porous paviors	✔	✔	
Least sustainable	**Tanked systems** • Over-sized pipes/tanks • Storms cells	✔		

Table 2: The multi-functional benefits of SuDS (Source: Environment Agency 2006)

3.4.17 Infiltration methods need to consider:

- soil permeability;
- ground stability;
- depth to water table;
- soil attenuation, both flow and quality;
- contaminants present in ground; and
- local hydrogeology and risk of groundwater contamination.

Management of SuDS and contributions

3.4.18 Drainage designs incorporating SuDS measures should include details of how each SuDS feature, and the scheme as a whole, will be managed and maintained throughout its lifetime. When published the National Standards for sustainable drainage systems should be followed with additional consideration given to the issues associated with the constrained nature and abundance of below ground services on London sites.

3.4.19 Some borough SWMPs may include actions to deliver SuDS schemes to help alleviate existing surface water flooding issues. Developers should consider these proposals and investigate ways to implement or contribute towards such schemes.

SIGNPOST

The SUDS manual (C697) 2007 - This CIRIA guidance provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS.
http://www.ciria.org/service/AM/ContentManagerNet/Default.aspx?Section=bookshop_entrance&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=69&ContentID=12345

Site handbook for the construction of SUDS (C698) 2007 - This CIRIA handbook provides guidance on the construction of SuDS to facilitate their effective delivery.
http://www.ciria.org/service/AM/ContentManagerNet/Default.aspx?Section=bookshop_entrance&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=69&ContentID=12345

Planning for SuDS – making it happen (C687) 2010 - This CIRIA guidance provides an introduction to SuDS and the planning and development process.
http://www.ciria.org/service/AM/ContentManagerNet/Default.aspx?Section=bookshop_entrance&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=69&ContentID=12345

Retrofitting to manage surface water (C713) 2012 - This CIRIA guidance sets out a process to achieve the retrofitting of surface water management measures. It integrates the principles of urban design with surface water management.
http://www.ciria.org/service/AM/ContentManagerNet/Default.aspx?Section=bookshop_entrance&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=69&ContentID=12345

UK Rain Gardens guide - provides to help the homeowner or property manager to create a simple rain garden within their own property.
http://raingardens.info/

Sustainable Drainage Systems: maximising the potential for people and wildlife
http://www.rspb.org.uk/Images/SuDS_report_final_tcm9-338064.pdf

BEST PRACTICE EXAMPLES

Susdrain - is a web-site that provides information and case studies to facilitate the delivery of SuDs
http://www.susdrain.org/

Building a better environment. The Environment Agency. 2006.
http://www.environment-agency.gov.uk/static/documents/1_GETH1106BLNE-e-e(1).pdf

Thames Water general
http://www.thameswater.co.uk/cr/Sustainabledrainage/Sustainableurbandrainagesystems/index.html

Thames Water Counters Creek scheme
http://www.thameswater.co.uk/about-us/9344.htm

FLOOD RESILIENCE AND RESISTANCE OF BUILDINGS IN FLOOD RISK AREAS

Mayor's Priority	London Plan policy
Development in areas at risk from any form of flooding should include flood resistance and resilience measures in line with industry best practice.	5.3, 5.12, 5,13

3.4.20 The simplest way to prevent development from experiencing fluvial and tidal flooding is to locate development outside areas of flood risk, that is locating development in areas identified as Flood Zone 1[50], where possible. Where development cannot be located in Flood Zone 1, boroughs should ensure that development is directed to locations of lowest flood risk.

3.4.21 **Flood resistance** refers to designing and constructing a building to prevent floodwater entering the building and damaging its fabric. Measures include installing a flood gate across the front door or raised finished floor and/or threshold levels above expected flood levels (see the section on Safety below at paragraph 3.4.27).

3.4.22 **Flood resilience** refers to designing and constructing a building so that, although flood water may enter the building, its impact is reduced. Measures should aim to ensure no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated. This may also include ensuring that, if damaged, elements can be easily repaired or replaced.

3.4.23 Some forms of river-related development need to be located in areas at risk of flooding, for example boat clubs. These should be designed so that they can be flooded with minimal damage.

50 As set out in Table 1 of the National Planning Policy Framework Technical Guidance

3.4.24 Internal flood resilient design measures include:

- solid floors rather than suspended floors or suspended floors set above expected flood levels;
- treated timber to resist water logging or marine plywood for shelves and fittings;
- electric, gas and phone circuits are located above expected flood level;
- one-way auto seal valves on toilets;
- water resistant alternatives to traditional plaster or plaster boarding for internal wall finishes;
- avoiding the use of materials particularly vulnerable to water such as chipboard or MDF e.g. in kitchen units; and
- fitted carpets on ground floor should be avoided.

SIGNPOSTS

Improving the flood performance of new buildings – flood resilient construction. DCLG. 2007

Your home in a changing climate – retrofitting existing homes for climate change impacts. London Climate Change Partnership. 2008

FLOOD RISK MANAGEMENT

3.4.25 This section seeks to address the potential impacts from tidal and fluvial flood risk. The potential impacts from other forms of flooding are outlined at the end of this section.

Mayor's Priorities	London Plan policy
Developments are designed to be flexible and capable of being adapted to and mitigating the potential increase in flood risk as a result of climate change.	5.3, 5.12
Developments incorporate the recommendation of the TE2100 plan for the future tidal flood risk management in the Thames estuary.	5.3, 5.12
Where development is permitted in a flood risk zone, appropriate residual risk management measures are to be incorporated into the design to ensure resilience and the safety of occupiers.	5.3, 5.12

THE DESIGN LIFE OF DEVELOPMENT

3.4.26 An appropriate design life should be set for each development in order to inform the climate change allowances to be applied in flood risk assessments (FRAs). For residential developments the design life should be at least 100 years and at least 60 years for commercial developments.

3.4.27 The Technical Guidance to the National Planning Policy Framework sets out the required allowances to be included in FRAs to account for climate change. The standards for design life set out above indicate which allowance should be applied for a development. There may be exceptions to these standards, for example time-limited planning permissions. In these cases, design life should be agreed with the local planning authority and justification included within the FRA.

SAFETY

3.4.28 Developers should ensure design measures are included in their development so it remains safe for occupiers throughout its lifetime, in line with the following standards:

- For highly and more vulnerable development[51] on sites where defences are below the design standard[52]:

  ◊ Finished floor and/or threshold levels should be set at least 300mm above the design event[53],

51 Defined in Table 2 of the National Planning Policy Framework Technical Guidance. http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance.
52 The design standard for fluvial defences should be the 1 in 100 flood level and for tidal defences the 1 in 200 flood level, both should include the appropriate allowance for climate change.
53 The design event is the 1 in 100 year fluvial flood level and 1 in 200 year tidal flood level including the appropriate allowance for climate change.

- ◊ A safe access/egress route should where possible be located above the design event. This route should be continuous from the development to a place of safety outside the floodplain;

- For less vulnerable development[54] on sites where defences are below the design standard and more vulnerable development on sites defended to the design standard:

  - ◊ The risk of internal flooding should be managed in line with the requirements of the local planning authority, including incorporating raised floor levels, resistance and resilience measures as appropriate,
  - ◊ The safety of occupants should be managed in line with the requirements of the local planning authority, including incorporating access/egress routes, safe refuge and/or emergency planning measures as appropriate.

3.4.29 It is the responsibility of the developer to prepare a comprehensive assessment of all sources of flood risk and provide suitable mitigation measures to ensure the site is safe. All developments in flood zones should be signed up to the Environment Agency Flood Warning Direct service. Reliance should not normally be placed on future flood alleviation schemes yet to be constructed in the consideration of standards for safety.

3.4.30 If a safe access/egress route cannot be achieved, the local planning authority may wish to consider submission of an emergency plan to achieve a means of safety and to inform their planning decision. Boroughs should secure the above measures through a s106 agreement to ensure the on going safe occupation of the site.

3.4.31 An acceptable emergency plan should incorporate information on the following aspects:

- the type and source of flooding;
- frequency;
- depth;
- velocity and speed of onset and duration of flooding;
- resident awareness of flood risk;
- flood warning arrangements;
- potential response of occupiers and users of the development, including the elderly and those with mobility issues, during a flood event;
- evacuation procedures and ways of ensuring these are provided for the lifetime of the development;
- arrangements for refuge within buildings, including the use of lifts;
- operation and maintenance of flood management measures;
- structural safety of the building; and
- impact of a flood on the service provided to the development, e.g. water, electricity and fuel supplies.

54 Defined in Table 2 of the National Planning Policy Framework Technical Guidance

3.4.32 Undeveloped land in the floodplain provides storage capacity for flood waters. Development should not result in any loss of floodplain storage capacity nor adversely impact the routes flood waters are most likely to take. Where floodplain compensation is required, this is to be provided on a level-for-level and volume-for-volume basis up to the flooding event the measures are designed to protect against. Floodplain compensation is required to ensure that safety on sites is not compromised due to the increased extents or depths of floods and that flood risk is not increased off-site as a result of new development displacing flood waters. Compensation should normally be provided as the first stage of site development in order to protect the construction site should flooding occur and not after the development has been constructed.

3.4.33 Liaison with the Environment Agency should be undertaken prior to designing a development behind tidal flood defences as breach analysis may be required to ensure development can satisfactorily address safety issues associated with breach of the flood defences. This may influence the design and feasibility of a scheme.

BASEMENTS

3.4.34 This section should be read in conjunction with section 2.2 which provides detailed guidance on the planning for and construction of basements and lightwells. This section only focuses on the safety aspects, if a basement should be occupied in areas vulnerable to flooding.

3.4.35 Developers and occupiers should adhere to the following guidance when designing and occupying basements.

Self-contained basement dwellings[55] ('highly vulnerable'[56] development)

- Where defences are below the design standard[57] or within the area of tidal residual risk[58] in Flood Zone 3, developments pose a significant risk to life and in accordance with the National Planning Policy Framework (NPPF) Technical Guidance (or any subsequent guidance on flood risk issued in support of the NPPF) self-contained dwellings in basements should not be permitted.

- Outside the area of tidal residual risk self-contained basement dwellings should be managed in line with the requirements of the local planning authority, including incorporating access/egress routes, safe refuge and/or emergency planning measures as appropriate and consider all forms of flooding.

Basements to 'more vulnerable' development

- In areas where defences are below the design standard finished floor, threshold and aperture levels should be set at least 300mm above the design event.

55 Basements are considered self-contained if they do not have free internal access to an upper floor to which people can escape at all times.
56 Defined in Table 2 of the National Planning Policy Framework Technical Guidance http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance.
57 The design standard is 1 in 100 year fluvial flood level and 1 in 200 year tidal flood level including the appropriate allowance for climate change
58 The area of tidal residual risk is taken to be the extent of flooding which would occur should there be failure of the tidal defences and should be defined by the Local Planning Authority in their SFRA or an area defined by the Environment Agency with agreement from the LPA

- In areas of tidal residual risk finished floor and/or threshold levels and safe refuge should where possible be set above the design event.

Basements to less vulnerable, water compatible and essential infrastructure

- In areas where defences are below the design standard finished floor, threshold and aperture levels should where possible be set at least 300mm above the design event.

- In areas of tidal residual risk basements should be managed in line with the requirements of the local planning authority, including incorporating access/egress routes, safe refuge and/or emergency planning measures as appropriate and consider all forms of flooding.

3.4.36 All basement development proposals in London should incorporate appropriate mitigation measures and be sufficiently resistant and resilient to flooding from all sources (see section 2.2 and paragraphs 3.4.19 -3.4. 23 on resistance and resilience and paragraphs 3.4.36 - 3.4.40 on flood defences and watercourses). Basements exits should be clearly signposted to enable escape and should contain sump areas to enable effective post-flood clean-up.

SIGNPOSTS

Planning Policy Statement 25: Development and Flood Risk Practice Guide 2009 - this CLG guidance sets out how to address flooding in all stages of the planning process.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7772/pps25guideupdate.pdf

Technical Guidance to the National Planning Policy Framework 2012 - This DCLG guidance provide additional technical guidance on planning for flooding to support the NPPF.
http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance.

The Thames Estuary 2100 Plan - sets out actions the Environment Agency and others will need to take – in the short, medium and long term to manage flood risk in the Thames estuary to the end of the century and beyond.
http://www.environment-agency.gov.uk/homeandleisure/floods/125045.aspx

The Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purposes – Clarification of Table 13.1 of FD2320/TR2 and Figure FD2321/TR1, published in May 2008, provides useful guidance on the danger to people for different combinations of depth and velocity.

FLOOD DEFENCES

Mayor's Priority	London Plan policy
Development should maximise all opportunities to achieve an 8m setback on fluvial watercourses between built development and watercourses, flood defences and culverts.	5.3, 5.12
Development should maximise all opportunities to achieve a 16m setback on tidal watercourses between built development and watercourses and flood defences.	5.3, 5.12

3.4.37 The setback distances outlined above are set out in the Thames Region Flood Defence Byelaws. Any development located within this zone requires consent from the Environment Agency. These distances were developed to protect and avoid compromising flood defences (which are often larger and more complex on tidal watercourses, hence 16m compared to 8m on fluvial watercourses) and ensure access for emergency and routine maintenance.

3.4.38 There may be situations where it is not appropriate to set back development by the above amounts. Where developers wish to depart from these standards full justification must be provided. Developers will still need to enable the inspection, maintenance and replacement of flood defences to be done in a safe manner without incurring undue costs and environmental impacts.

3.4.39 Where work to flood defences is required to make the development safe throughout its design life, plans and sections should be submitted containing proposals showing how the flood defences will be raised as part of the proposed development, or how they will be raised in future in light of climate change. Structural implications of the raising as well as its impact on the amenity value of the riverside should be taken into account in any design.

3.4.40 Where work to flood defences is required to facilitate development and ensure its safety the following standards shall apply:

- flood defence design should aim to allow for a loading of 25 kilo newtons per square metre (kN/m2) on adjacent land from plant, materials and construction work;

- flood defences shall have a design life commensurate with that of the development situated adjacent to them. Flood defences shall have a minimum residual life of 50 years before intervention is required to upgrade them to achieve the appropriate design life; and

- development shall make provision for the future raising of tidal flood defences in line with the requirements of the Thames Estuary 2100 Plan.

3.4.41 Where loadings depart from these standards developers should justify in detail why they have adopted a given loading capacity. In all cases this should not be less than 10kN/m2.

3.4.42 Development, particularly in areas of flood risk should be designed from the outset to be safe at the end of its design life. It may be appropriate to consider one or more milestones within the design life in order to demonstrate that later work to restore/enhance the flood defence can be carried out in a safe, economic and environmentally sensitive way.

BEST PRACTICE EXAMPLE

Building a better environment. The Environment Agency. 2006. http://www.environment-agency.gov.uk/static/documents/1_GETH1106BLNE-e-e(1).pdf

OTHER SOURCES OF FLOODING

Mayor's Priority	London Plan policy
All sources of flooding need to be considered when designing and constructing developments.	5.3, 5.12, 5.13

3.4.43 The sections above provide standards for tidal and fluvial flood risk. Other forms of flooding, including from groundwater, reservoir and surface water are less well understood. Borough SWMPs produced through the Drain London project are seeking to address this and improve our understanding of surface water flood risk. In the interim, the following guidance should provide a useful starting point.

GROUNDWATER FLOODING

3.4.44 The risk of groundwater flooding can be identified using individual borough SFRAs and consulting groundwater emergence and susceptibility maps. Assessments of groundwater flooding risk need to consider both risk to the proposed development as well as increased risk elsewhere due to interruption of groundwater flow routes or groundwater displacement. Appropriate mitigation may include tanking and installing appropriate drainage.

RESERVOIR FLOODING

3.4.45 Areas at potential risk from reservoir flooding can be identified in individual borough SFRAs as well as by using the Environment Agency's reservoir flood maps[59]. These maps are for emergency planning purposes and show the extent of flooding based on the worse-case scenario in the unlikely event the reservoir failed. The maps can be used to highlight locations where more detailed flood risk assessment may be required in order to inform emergency planning decisions on new development proposals, for example when considering safe escape and evacuation.

SURFACE WATER FLOODING

3.4.46 Critical Drainage Areas (CDAs) are identified in borough SWMPs. These are areas where there is significant risk of flooding affecting houses, businesses and/

59 http://www.environment-agency.gov.uk/homeandleisure/floods/124783.aspx

or infrastructure. They also incorporate the contributing catchment area and features that influence the predicted extent of flooding. Borough SWMPs have produced action plans to deliver projects to improve surface water flooding in identified critical drainage areas. Developers can use these plans to determine whether it would be possible to deliver any of these projects in tandem with new development in London. Paragraphs 3.4.2 – 3.4.18 above outlines some measures to reduce the potential impacts of surface water flooding.

SIGNPOSTS

Groundwater susceptibility maps British Geological Survey
http://www.bgs.ac.uk/products/hydrogeology/groundwaterFlooding.html

Reservoir flooding Environment Agency
http://www.environment-agency.gov.uk/homeandleisure/floods/124783.aspx

Drain London Greater London Authority (GLA)
http://www.london.gov.uk/drain-london

CHAPTER 4

POLLUTION MANAGEMENT – LAND, AIR, NOISE, LIGHT AND WATER

4.1 INTRODUCTION

4.1.1 The density of activity across London can lead to various forms of disturbance to nearby occupiers and can result in legally recognised levels of pollution. These forms of pollution include air, noise and light. Activities can also create incidents of pollution further away, where it may not be noticed by the polluter. For example, polluting activities could affect water bodies through runoff and pollutants entering the sewer. Historic polluting land uses have resulted in land contamination. Potentially polluting uses need to incorporate mitigation measures to prevent further pollution.

4.1.2 Separate to the planning process, the Environment Agency regulates certain industrial, waste and agricultural activities and substances under the Environmental Permitting Regulations (EPR). These activities and substances must obtain a permit or be registered as exempt to operate. A full list of activities and at what size a permit is required can be found on the Environment Agencies web-site[60]. Where a permit is required, developers are strongly encouraged to seek pre-application advice with the Environment Agency prior to the submission of a planning application. This is to ensure the development will be acceptable in principle on environmental protection grounds.

4.1.3 Advice from the Environment Agency will help developers identify any risks they will need to address and how best to proceed with the application. Where the Environment Agency grants a permit, they monitor compliance and enforce conditions as necessary. The Environment Agency reviews environmental permits from time to time to ensure they continue to protect people and the environment. The Environment Agency has produced a useful guide for developers requiring planning permission and an environmental permit which can be found on their web-site[61].

4.1.4 The NPPF[62] states that 'local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves, where these are subject to approval under pollution control regimes'. In London there are limited alternative sites to provide for the growing demand for housing, employment space and supporting infrastructure and therefore uses are often intensified on existing sites that may already experience exposure to pollution. In some instances the potentially polluting equipment is too small to be covered by environmental protection legislation, but the incremental increases in the pollutant could lead to or exacerbate exposure to unacceptable levels of pollution. In these instances it is reasonable for the local planning authority to adopt planning policies and to negotiate with a developer for a development to include the lowest polluting equipment viable.

4.2 LAND CONTAMINATION

KEY GUIDANCE AREAS

4.2.1 This section of the SPG provides guidance on the following key areas:

60 http://www.environment-agency.gov.uk/business/topics/permitting/32330.aspx

61 http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/LIT_7260_bba627.pdf

62 Paragraph 122

- who is responsible for dealing with land contamination; and

- bioremediation.

Mayor's Priorities	London Plan policy
Developers should set out how existing land contamination will be addressed prior to the commencement of their development.	3.2, 5.3, 5.21
Potentially polluting uses are to incorporate suitable mitigation measures.	3.2, 5.3, 5.21

4.2.2 Boroughs hold details on potentially contaminated land based on historic land uses. Where a site is affected by contamination it is the developer's or landowner's responsibility that the site is developed safely[63]. Sufficient details, prepared by a suitably qualified person, should be provided by the developer to support a planning application. The extent of works required to remediate the site are based on the proposed use of the site. As a minimum the works should result in the site no longer being classed as contaminated under Part IIA of the Environmental Protection Act 1990. Boroughs should condition or secure by s106 agreement that the site is treated and remediated to the required standard prior to construction works commencing.

4.2.3 **Bioremediation** works are encouraged, where they are suitable. Bioremediation is the treatment of contaminated soil using micro-organisms and accelerating the culture by use of chemicals as nutrients and the addition of oxygen producing aerobic conditions for the remediation. This process is not suitable for all contaminants.

63 Paragraph 120 - National Planning Policy Statement. Department of Communities and Local Government. 2011

4.2.4 Where an activity has the potential to result in land contamination, appropriate mitigation measures should be identified at planning application stage. The implementation and maintenance of these mitigation measures should be secured by the local authority through a condition or a s106 agreement.

SIGNPOSTS:

The **Environment Agency** provides information on land contamination. http://www.environment-agency.gov.uk/research/planning/33706.aspx

4.3 AIR POLLUTION

KEY GUIDANCE AREAS

4.3.1 This section of the SPG provides guidance on the following key areas:

- assessment requirements;

- design and occupation;

- construction and demolition;

- air quality neutral policy for buildings and transport; and

- pemissions standards for combustion plant.

Mayor's Priorities	London Plan policy
Developers are to design their schemes so that they are at least 'air quality neutral'.	7.14
Developments should be designed to minimise the generation of air pollution.	5.3, 7.14
Developments should be designed to minimise and mitigate against increased exposure to poor air quality.	3.2, 5.3, 7.14
Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7.	7.14
Developers and contractors should follow the guidance set out in the emerging Minimising dust and emissions from construction and demolition SPG when constructing their development.	5.3, 7.14

4.3.2 The Mayor is committed to improving air quality in London and has put in place an ambitious strategy of measures to reduce air pollution and minimise human exposure in order to improve Londoner's health and quality of life. The two pollutants of specific concern in London are particulate matter (PM10 and PM25) and nitrogen dioxide (NO2). Nitric oxide easily converts into NO2, therefore these are both generally referred to as NOx. Transport is responsible for the majority of NO2 and PM10 emissions in Greater London. PM10 are concentrated at hotspots along the road network. NO2 emissions are dispersed more widely. Areas that do not meet national air quality targets for nitrogen dioxide (NO2) and particulate matter (PM10) are designated Air Quality Management Areas (AQMA). The Mayor's Air Quality Strategy[64] sets out how the Mayor proposes to reduce air emissions across London. Each borough with an AQMA has its own Air Quality Strategy.

64 www.london.gov.uk/airquality

AIR QUALITY ASSESSMENTS

4.3.3 For the developments set out in paragraph 4.3.4 below developers will be required to produce an air quality assessment which should be submitted with the planning application. The air quality assessment should include the following:

- a review of air quality around the development site using existing air quality monitoring and/or modelling data;

- air quality dispersion modelling data carried out in accordance with the London Councils Air Quality and Planning Guidance;

- an indication of the number of people (receptors) which will be exposed to poor air quality as a result of the development, and show their location on a map;

- an assessment of the impact on air quality during the construction phase and detailed mitigation methods for controlling dust and pollution emissions in line with the emerging revised SPG on *The control of dust and emissions from construction and demolition*; and

- an outline and justification of mitigation measures associated with the design, location and operation of the development in order to reduce air pollution and exposure to poor air quality.

4.3.4 Air quality assessments are required for major developments where the development:

- is located in an Air Quality Management Area (AQMA);

- is likely to result in a new air pollution exceedence[65];

- is likely to exacerbate an existing air pollution exceedence;

- is located within 150 meters of a sensitive receptor (schools, hospitals, care homes, nurseries);

- will bring sensitive receptors into an area of poor air quality; and

- includes biomass boilers and/or combined heat and power.

MINIMISING AIR QUALITY EMISSIONS

Location and transport measures

4.3.5 Section 2.2 sets out that developments and land uses which generate a high number of trips are encouraged in areas of good transport. Chapter 6 of the London Plan sets out the transport measures that are encouraged to support development. Policy 6.3 specifically requires transport assessments for major planning applications and seeks the submission of travel plans, construction logistic plans and delivery and servicing management plans from developers. These plans and assessments seek to ensure the capacity and safety of the transport network, and help minimise emissions into the air. Further guidance on optimising the use of land is provided in section 2.2.

Construction and demolition

4.3.6 The Mayor's emerging SPG on *The control of dust and emissions from construction and demolition* sets out how impacts on air quality can be minimised during the construction phase of development and advises on necessary mitigation measures. It focuses on the following five areas:

- demolition;

- earthworks;

- construction;

- trackout; and

- non-road mobile machinery (NRMM).

65 Exceedence is the period of time during which the concentration of a pollutant is greater than, or equal to, the limit for the pollutant/s. For Air Quality Standards, exceedence is a concentration of air pollutants greater than the limit for the pollutant/s.

Design and Occupation

Exposure to poor air quality

4.3.7 The location and design of a development has a direct influence on exposure to elevated air pollution levels. This is particularly relevant where developments include sensitive uses such as hospitals, schools, open spaces and playgrounds. Developers should maximise the contribution the building's design, layout and orientation make to avoiding the increased exposure to poor air quality and therefore need to be considered at the initial design stage. An air tight building (as required by energy policy) with any air intakes located away from the main source of air pollution will help minimise increased exposure to poor air quality. For developments located in areas of poor air quality it is recommended that developers adhere to European standard EN 13779 to ensure that air filters are fitted and regularly maintained.

4.3.8 Developers should also consider the location of outside space including gardens, balconies and roof terraces proposed in areas of particular poor air quality. These should be screened where practical with exposure minimised through appropriate positioning and design. The latest evidence suggests that green infrastructure can have a small but beneficial effect, absorbing air pollution to reduce local concentrations and/or acting as a protective screen. The location of equipment should not result in flues and exhaust vents being in close proximity to recreational areas.

4.3.9 In order to assist developers and architects in designing air quality improvements into the urban realm the GLA is producing Air Quality Street guidance which will provide best practice examples and signposting.

Protecting internal air quality

4.3.10 To protect internal air quality, developers should specify environmentally sensitive (non-toxic) building materials and the use of materials or products that produce VOC (volatile organic compounds) and formaldehyde which can affect human health should be avoided. The use of 'healthy' material options can contribute towards attaining the BREEAM/Code for Sustainable Homes credits but a clear audit trail will need to be provided to gain these credits.

4.3.11 It is also important to maintain combustion plant and equipment such as boilers and ensure they are operating at their optimum efficiency to minimise harmful emissions.

AIR QUALITY NEUTRAL

4.3.12 The NPPF[66] states that planning policies should sustain compliance with and contribute towards EU limits values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.

4.3.13 The London Plan and the Mayor's Air quality Strategy set out that developments are to be at least 'air quality neutral'. To enable the implementation of this policy emission benchmarks have been produced for buildings' operation and transport

66 Paragraph 124

across London based on the latest technology (including its effectiveness and viability). Developments that do not exceed these benchmarks will be considered to avoid any increase in NOx and PM emissions across London as a whole and therefore 'air quality neutral'. The benchmarks will be kept under review and will be updated in line with technological and commercial advances.

4.3.14 This policy applies to all major developments in Greater London. Developers will have to calculate the NOx and/or PM10 emissions from the buildings and transport elements of their developments and compare them to the benchmarks set out in Appendix 5 and 6. For smaller developments paragraphs 4.3.21 – 4.3.22 set out emissions standards for combustion plant.

4.3.15 Where schemes do not meet the 'air quality neutral' benchmarks, after mitigation measures have been implemented on-site, the developer will be required to off-set emissions off-site. Further information on off-setting requirements is included below.

4.3.16 To complement this policy emission standards have been recommended for combustion plant that provide heat and power to developments. These are outlined below in paragraphs 4.3.23 – 4.3.25.

Emissions from buildings

4.3.17 Two Building Emission Benchmarks (BEBs) have been defined; one for NOx and one for PM10, for a series of land-use classes. The benchmarks are provided in Appendix 5. Section 4 of The Air quality neutral report[67] provides further details on how to apply these benchmarks.

Transport emissions

4.3.18 Developments should be designed to encourage and facilitate walking and cycling and the use of public transport. This will enable air pollutants deriving from a particular development to be minimised. To further support this policy, boroughs should also ensure developments do not exceed local car parking standards.

4.3.19 To meet 'air quality neutral', the benchmarks set out in Appendix 6 should be met. Section 4 of The Air quality neutral report[68] provides further details on how to apply these benchmarks.

EMISSION STANDARDS FOR COMBUSTION PLANT

4.3.20 The London Plan states that new development proposals should meet the minimum standards outlined in this SPG. Emission standards are provided for:

- individual gas boilers;
- communal gas boilers;
- solid biomass boilers; and
- combined Heat and Power (CHP) plant.

Ultra Low NOx boilers

4.3.21 Where individual and/or communal gas boilers are installed in commercial and domestic buildings they should achieve a NOx rating of <40 mgNOx/kWh. Guidance

67 Available on the GLA web-site www.london.gov.uk
68 Available on the GLA web-site www.london.gov.uk

issued by DCLG[69] notes that individual gas boilers with NOx emissions lower than 40 mg/kWh are now standard for many developers and hence no extra cost is incurred.

4.3.22 Planning authorities have limited control over the plant installed in smaller developments, but most boroughs require new development to comply with Level 3 or 4 of the Code for Sustainable Homes or BREEAM 'very good' or 'excellent'. To encourage developments to make their contribution to air quality 'neutral' across London, boroughs may consider encouraging developers to obtain the maximum number of credits in the NOx emissions Issue (CfSH - Pol2 and BREEAM - Pol4). This equates to NOx emissions of no greater than 40 (mg/kWh) from heating plant.

Solid biomass and CHP plant

4.3.23 Emissions standards have been developed based on the latest technology, viability and the implication for carbon dioxide emissions of any abatement measures to reduce the NOx and PM10 emissions from the plant. The emission standards are provided in Appendix 7 and are target minimum standards. If an assessment indicates that significant air quality effects may occur even when meeting the emission standards, additional measures (such as stack height increase, enforcement of more stringent standards etc.) should be considered in order to produce an acceptable level of impact.

4.3.24 These emission standards apply to all developments in London where solid biomass or CHP plant are proposed. These standards will be kept under review and will be updated in line with technological and commercial advances.

4.3.25 It is acknowledged that developers may not procure plant until planning permission has been obtained. Developers will therefore be required to provide a written statement of their commitment and ability to meet the emission standards within their Air Quality Assessments. When securing these emissions standards, it is best to agree maximum emissions as opposed to the technology. Technology may improve between the time planning permission is granted and the equipment is procured.

OFF-SETTING PROVISIONS

4.3.26 Developers of schemes which do not meet the 'air quality neutral' benchmark for buildings or transport (considered separately) after appropriate on-site mitigation measures have been incorporated will be required to off-set any excess in emissions. The developer should investigate options for providing NOx and PM abatement measures off-site in the vicinity of the development. This will involve working with the relevant planning authority or nearby property owners to identify suitable mitigation measures. Measures could include:

- green planting/walls and screens, with special consideration given to planting that absorbs or supresses pollutants;
- upgrade or abatement work to combustion plant;
- retro-fitting abatement technology for vehicles and flues; and

69 Code for Sustainable Homes Cost Review, DCLG, 2010.

- exposure reduction.

4.3.27 For the purpose of this policy air quality monitoring is not eligible for funding as it is not considered to contribute to actual air quality improvements.

4.3.28 Measures could be provided in whole or part directly by the developer or by making a contribution to an existing project. Measures should be secured by condition or s106, as appropriate. However, any agreement for off-site measures, including financial contribution, need to consider any restrictions imposed by the CIL Regulations.

SIGNPOSTS

The **Department of Food, Environment and Rural Affairs (DEFRA)** provides more information on air quality.
http://uk-air.defra.gov.uk/air-pollution/

Air quality neutral report
www.london.gov.uk/airquality

Emissions standards report
www.london.gov.uk/airquality

4.4 NOISE

KEY GUIDANCE AREAS

4.4.1 This section of the SPG provides additional information the following key areas:

- the sources of noise;
- ways to mitigate noise emitted by developments;
- ways to mitigate the impact of noise on developments; and
- some detailed design considerations.

Mayor's Priorities	London Plan policy
Areas identified as having positive sound features or as being tranquil should be protected from noise.	3.2, 7.15
Noise should be reduced at source, then designed out of a scheme to reduce the need for mitigation measures.	3.2, 5.3, 7.6.7, .15

SOURCES OF NOISE

4.4.2 The main sources of noise and vibration in London are generated from:

- road traffic;
- air traffic;
- railways;
- industrial uses;
- entertainment uses (such as bars and nightclubs);
- outdoor events (such as music and sports);
- playgrounds;
- servicing areas for loading and unloading;
- plant and mechanical equipment; and
- construction sites.

MITIGATION MEASURES

Ways to mitigate noise emitted by developments

4.4.3 Where a proposed development will emit noise, developers should implement the most appropriate of the following measures. Boroughs should ensure the appropriate measures are incorporated into the design of new schemes to minimise future noise complaints.

Engineering measures

- reduce the noise emitted at its point of generation (e.g. by using quiet machines and/or quiet methods of working);

- contain the noise generating equipment (e.g. by insulating buildings which house machinery and/or providing purpose-built barriers around the site); and

- protect any surrounding noise-sensitive buildings (e.g. by improving sound insulation in these buildings and/ or screening them by purpose-built barriers).

Careful Layout Design
- ensure an adequate distance between source and noise-sensitive buildings or areas; and

- screen with natural barriers, buildings, or non-critical rooms in the development.

Administrative measures
- limit the operating time of the source of noise;

- restrict activities allowed on the site; and

- specify an acceptable noise limit.

Ways to minimise the impact of noise on development

4.4.4 The density and mix of uses in some areas contribute to London's vibrancy. However, this noise can be a nuisance to sensitive occupiers. New development containing sensitive uses that are to be located near a noise generating use, such as pubs and servicing areas, should be designed to limit the exposure of the new use to the existing noise source.

4.4.5 Where a proposed development is likely to be exposed to noise, developers should implement the most appropriate of the following measures, proportionate to the level of noise exposure and sensitivity of the proposed uses:

Design measures
- locate noise sensitive areas/rooms away from the parts of the site most exposed to noises;

- create setbacks;

- design the building so its shape and orientation reflect noise and protect the most sensitive uses;

- stack similar rooms (such as kitchens and living rooms) above each other;

- position non-residential uses closer to the noise source in mixed use developments;

- design in lobbies, balconies, winter gardens and dual facades; and

- carefully locate noise generating equipment for the building such as plant and services away from sensitive uses.

Built fabric measures
- insulate and soundproofing doors, walls, windows, floors and ceilings;

- seal air gaps around windows;

- double glazing and other treated glazing measures;

- use air locks; and

- include architectural fins (where appropriate);

Measures for landscaping and amenity areas

- incorporate planting, soft landscaping, fencing/barriers and solid balconies to absorb or reflect sound; and

- use surfaces that can reduce noise in highly trafficked areas - both pedestrian and vehicular.

Detailed design considerations

4.4.6 The upper floors of tall buildings may experience noise from a wider area. Balconies or stepping back can help reduce the impact of noise on these floors. However, if a development incorporates measures that will reflect noise, the reflection should not be towards existing sensitive uses.

4.4.7 Building around or over a noise source can protect nearby uses from this noise source. However, specialist design is needed to prevent both airborne and structure borne noise.

4.4.8 Proposals will be expected to include appropriate attenuation measures to alleviate or mitigate the impact of noise and vibrations to an acceptable level. Where appropriate, the cumulative impact of noise sources (for example, plant) should be considered. Mitigation measures will be secured by condition or s106 agreement, as appropriate.

4.4.9 Everyday domestic activities can also generate noise, e.g. communal entrances and roof terraces. Developers should ensure sufficient sound insulation must be provided between dwellings to prevent the transmission of noise between them, particularly in conversions where new partition walls are often deficient in terms of insulation. This is generally a matter for building control (Part E of the Building Regulations) and not planning.

SIGNPOSTS

Noise Policy Statement for England. Defra, 2010. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

The Department of Food, Environment and Rural Affairs (DEFRA) provides more information on noise. http://services.defra.gov.uk/wps/portal/noise

4.5 LIGHT POLLUTION

KEY GUIDANCE AREAS

4.5.1 This section of the SPG provides additional information on the following key areas:

- the types of light pollution;

- the potential harmful effects of light pollution; and

- how to design lighting appropriately to minimise nuisance.

Mayor's Priorities	London Plan policy
Developments and lighting schemes should be designed to minimise light pollution.	5.2, 5.3, 6.7

4.5.2 Light pollution comprises any adverse effect of artificial lighting and includes:

- **Glare** - the uncomfortable brightness of a light source when viewed against a dark sky;
- '**Light trespass**' – the spread of light spillage the boundary of the property on which a light is located; and
- '**Sky glow**' - the orange glow we see around urban areas caused by a scattering of artificial light by dust particles and water droplets in the sky.

4.5.3 Artificial lighting has many benefits, however excessive or poorly designed lighting can be damaging to the environment and result in visual nuisance including by:

- having a detrimental impact on the quality of life of neighbouring residents;
- significantly changing the character of the locality;
- altering wildlife and ecological patterns; and
- wasting energy.

4.5.4 Nuisance often occurs due to glare and 'light spillage' because the lighting has been poorly designed. Even where planning permission is not required, lighting should be energy efficient and 'Dark Sky' compliant, thereby not causing obtrusive light pollution, glare or spillage (by reference to the British Astronomical Association Campaign for Dark Skies). It is best to consider the lighting requirement at the initial design stage to ensure that sufficient, but not excessive sources of light at the appropriate brightness. Where planning permission is required for lighting, or it forms part of a wider planning application, boroughs may seek to restrict the time lights are in use, the number of lights and their brightness by way of condition or s106 agreement, as appropriate.

HOW TO DESIGN LIGHTING APPROPRIATELY TO MINIMISE NUISANCE

4.5.5 To minimise obtrusive light the following general principles taken from the Institution of Lighting Engineers, Guidance Notes for the Reduction of Obtrusive Light (2005) should be followed:

- lighting should be directed downwards wherever possible to illuminate its target. If there is no alternative to up lighting, then the use of shields will help reduce the spill of light to a minimum. Up lighting is a particularly bad form of obtrusive light and contributes to sky glow;
- lighting should be designed to minimise the spread of light near to, or above, the horizontal. Again, any light that shines above the horizontal line of the light adds to the sky glow effect;

- lighting should be designed to the correct standard for the task. Over-lighting is a cause of obtrusive light and also represents a waste of money and energy;

- the main beam angle of all lights proposed directed towards any potential observer should be kept below 70°. It should be noted that the higher the mounting height, the lower the main beam angle could be. This will help reduce the effect of glare and light spill on neighbouring dwellings, passing motorists, pedestrians, etc;

- lighting should be directed to minimise and preferably avoid light spillage onto neighbouring properties. Wherever possible use floodlights with asymmetric beams that permit the front glazing to be kept at, or near parallel to, the surface being lit; and

- the lights used should be the most efficient taking into account cost, energy use, and the purpose of the lighting scheme required. All lighting schemes should meet British Standards.

4.5.6 Artificial lighting should be sited in the most appropriate locations to cause minimal disturbance to occupiers and wildlife, while still illuminating the intended area. This includes considering any occupiers located above the lighting source.

4.5.7 The design of lighting should be specific to the use it supports (e.g. for recreation facilities). Hours of lighting should be limited to the times needed to support the use (both in summer and winter) and be restricted through the use of timers and sensors where relevant (e.g. for security lighting).

4.5.8 Artificial lighting can often impact on wildlife habitats, particularly where lighting is proposed in open spaces, for example to provide lighting for sports courts and pitches or to improve security. Artificial lighting can have particularly severe implications for the natural daily rhythms of a range of animals and plants, and therefore sites and habitats identified for their nature conservation value should not be adversely affected by lighting.

SIGNPOSTS

Institute of Lighting Engineers Guidance note
http://www.darkskies4ni.co.uk/images/ile.pdf

Environmental Considerations for Exterior Lighting. The Chartered Intuition of Building Services Engineers, 2003

4.6 WATER POLLUTION

KEY GUIDANCE AREAS

4.6.1 This section of the SPG provides additional information the following key areas:

- how sustainable drainage can contribute to water quality;

- the connection of new developments to the sewer network; and

- private sewage plants.

SURFACE WATER RUNOFF

Mayor's Priority	London Plan policy
In their aim to achieve a greenfield runoff rate developers should incorporate sustainable urban drainage systems (SuDS) into their schemes which also provide benefits for water quality.	5.3, 5.13, 5.14

Mayor's best practice	London Plan Policy
Encourage good environmental practice to help reduce the risk from business activities on the London water environment.	5.3, 5.13, 5.14
Encourage those working on demolition and construction sites to prevent pollution by incorporating prevention measures and following best practice.	5.3, 5.14

SUSTAINABLE DRAINAGE

4.6.2 Some activities can lead to pollutants such as oil, sediments, fertilisers, pesticides, animal waste and litter accumulating on roads and areas of urban hard standing. During rainfall events these pollutants are washed off and can end up in London's waterways. This type of pollution is called 'urban diffuse pollution'. Traditional drainage solutions are generally not designed to help remove this pollution.

4.6.3 Some SuDS designs can help to minimise pollution in urban runoff and improve water quality. In addition to addressing flooding issues, developers should incorporate the appropriate following measures into the proposed SuDS to provide benefits for water quality:

- vegetation slows runoff and helps filter out pollutants;
- temporary storage in ponds and other still water will allow contaminated sediment to settle out;
- infiltration trenches will remove pollutants; and
- use of porous surfaces traps pollution and will allow for natural biological break down.

4.6.4 Sediment removed from detention / retention ponds or infiltration device during maintenance or cleaning may be contaminated and require specialist disposal.

CONSTRUCTION AND DEVELOPMENT SITE PREVENTION MEASURES

4.6.5 To prevent surface water from the site being contaminated the developer should ensure the following measures, as appropriate are incorporate into the development from the outset to control pollution at source:

- oil separators;
- clear marking/signage of drainage stems;
- correcting wrong connections to the drainage systems;
- bunding of chemical, fuel and oil delivery storage areas;
- designating and bunding of areas for cleaning activities; and
- bunding of construction sites - See the Mayor's emerging SPG on *The control of dust and emissions from construction and demolition* sites for further potential measures on limiting emissions.

4.6.6 Boroughs should secure the appropriate design and mitigation measures by condition to ensure they are implemented and maintained.

SIGNPOSTS

More advice on legal requirements and good environmental practice to help reduce environmental risk from polluting activities can be found on the Environment Agency's website.
http://www.environment-agency.gov.uk/research/policy/40125.aspx
http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx
http://www.environment-agency.gov.uk/business/topics/water/116476.aspx

WASTEWATER TREATMENT

Mayor's Best practice	London Plan policy
Residential developments discharging domestic sewage should connect to the public foul sewer or combined sewer network where it is reasonable to do so.	5.3, 5.14
Commercial developments discharging trade effluent should connect to the public foul sewer or combined sewer network where it is reasonable to do so subject to a trade effluent consent from the relevant sewerage undertaker.	5.3, 5.14
Developments should be properly connected and post-construction checks should be made by developers to ensure that mis-connections do not occur.	5.3, 5.14

4.6.7 For much of London, how the building connects to the public sewer will not be a primary concern. However, where the public sewer is some distance from the proposed buildings, developers should consider, from the design stage how satisfactory pipe work can be installed between the buildings and the public sewer. Where levels do not allow for gravity flow, developers may need to install pumps and additional space will be required within the building or in the wider site.

NON-PROLIFERATION OF PRIVATE SEWAGE TREATMENT PLANTS

4.6.8 Developments discharging domestic sewage will be expected to connect to the public foul sewer or combined sewer network where it is reasonable to do so. The Environment Agency will not normally grant an Environmental Permit for a private sewage treatment plant where this is possible. Discharges of trade effluent will also be expected to connect to the public foul sewer or combined sewer network, where it is reasonable to do so, and subject to the sewerage undertaker granting a trade effluent consent or entering into a trade effluent agreement.

4.6.9 The proliferation of private sewage treatment plants in sewered areas is not supported by the Environment Agency. A sewered area is one that is within 30 metres of a public sewer. This is due to the fact that these systems rely on proper operation and regular maintenance[70].

4.6.10 Whether a connection to the public sewerage network would be considered reasonable is based on practicality, cost and environmental grounds. If connection to a public sewer is not viable, proposed installation and use of a private sewage treatment plant would need to be justified as the most long term sustainable option for a site and measures put in place to ensure that it was properly operated and regularly maintained.

70 Compliance figures based on Environment Agency regulated private sewage treatment plans show that they perform significantly worse than public works. They are prone to failure causing pollution of land and/or watercourses as well as potential nuisance and risk to human health.

MIS-CONNECTIONS

4.6.11 Incorrect plumbing in residential and commercial developments can result in wastewater discharging untreated to watercourses. If household appliances are accidentally connected to the surface water drain, instead of the foul water drain, wastewater from sinks, baths/showers, toilets and washing machines goes straight into watercourses. These 'mis-connected' pipes are a common cause of pollution to rivers and streams, especially in towns and cities, including London. This type of pollution is one of the factors contributing to water bodies failing to achieve 'good status' under the Water Framework Directive.

4.6.12 In combined sewer areas this problem does not occur as all surface and foul water goes via the combined sewer to a sewage treatment works.

SIGNPOST

Information on how to ensure household appliances are correctly connected: http://www.connectright.org.uk/documents/PDF%20Guidelines%20-%20Is%20your%20home%20connected%20right.pdf

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APPENDICES

APPENDIX 1: LONDON PLAN POLICIES THAT RELATE TO SUSTAINABLE DESIGN AND CONSTRUCTION

The London Plan includes a range of policies that relate to Sustainable Design and Construction. They are summarised below.

Policy 2.18: Green Infrastructure
Policy 2.18 aims to protect, promote, expand and manage the extent and quality of, and access to, London's network of open and green spaces.

Policy 3.2: Addressing health and reducing health inequalities
Policy 3.2 supports the provision and improvement of health facilities and encourages the design of buildings to promote healthy lifestyles.

Policy 3.5: Quality and Design of housing development
Policy 3.5 introduces a presumption against development on back gardens or other private residential gardens.

Policy 5.1: Climate change mitigation
Policy 5.1 sets out the Mayor's strategic target for the reduction of carbon dioxide emissions across London of 60 per cent (below 1990 levels) by 2025. It expects the GLA group, the boroughs and other organisations to make a contribution towards this target and that all new development fully contributes towards the London wide reduction target.

Policy 5.2: Minimising carbon dioxide emissions
Policy 5.2 sets out the Mayor's energy hierarchy which developers are to follow when designing their schemes. It also sets out carbon dioxide reduction targets that developers are to aim for from their developments over the lifetime of the Plan and that where these can't be achieved an off-site or financial contribution in lieu can be sought by the local borough.

Policy 5.4: Retrofitting
Policy 5.4 encourages the retro-fitting of measures to reduce carbon dioxide emissions, improve the efficiency of resource use (such as water) and minimise generation of pollution and waste from existing building stock and states that any opportunities created by new development for retro-fitting should be identified.

Policy 5.5: Decentralised energy networks
Policy 5.5 sets out the Mayor's strategic target for decentralised energy, which is that 25% of the heat and power used in London is to be from local sources by 2025. The policy sets out how plans can identify and support opportunities for decentralised energy networks.

Policy 5.6: Decentralised energy in proposals
Policy 5.6 sets out a hierarchy for selecting a development's heating system and states that the feasibility of combined heat and power (CHP) should be evaluated for the proposed development as well as the potential for extending the heating network beyond the site boundary.

Policy 5.7: Renewable energy
Policy 5.7 seeks to increase the proportion of energy generated from renewable sources, including through their incorporation into new developments and by identifying specific opportunities within London.

Policy 5.8: Innovative energy technologies
Policy 5.8 encourages the use of innovative energy technologies that will provide an alternative energy source and reduce carbon dioxide emissions.

Policy 5.9: Overheating and cooling
Policy 5.9 states that developments should be designed to limit their contribution to the heat island effect and encourages spaces to be designed to avoid overheating, including by following the cooling hierarchy set out in the policy.

Policy 5.10: Urban greening
Policy 5.10 encourages the greening of London's buildings and spaces and specifically those in central London by including a target for increasing the area of green space (including green roofs etc) within the Central Activities Zone.

Policy 5.11: Green roofs and development site environs
Policy 5.11 specifically supports the inclusion of planting within developments and encourages boroughs to support the inclusion of green roofs.

Policy 5.12: Flood risk management
Policy 5.12 outlines the requirement for boroughs and developers to carry out flood risk assessments and that developments must comply with national planning policy on flood risk assessments and management to ensure they are designed and built to be resilient to flooding.

Policy 5.13: Sustainable drainage
Policy 5.13 promotes the inclusion of sustainable urban drainage systems in developments and sets out a drainage hierarchy that developers should follow when designing their schemes.

Policy 5.14: Water quality and waste water infrastructure
Policy 5.14 seeks to ensure that adequate provision is made for waste water infrastructure, and that water quality is protected and improved.

Policy 5.15: Water use and supplies
Policy 5.15 encourages developments to incorporate measures to minimise the use of mains water with a water consumption target for residential schemes of 105 litres or less per head per day.

Policy 5.16: Waste self-sufficiency
Policy 5.16 sets out how the Mayor will support London authorities to manage as much of their waste as possible within London including through minimising waste generation and encouraging the reuse, recycling/composting and reduction in the use of materials.

Policy 5.17: Waste capacity
Policy 5.17 sets out criteria for assessing waste management facilities and states that developments should include suitable waste and recycling storage facilities.

Policy 5.20: Aggregates
Policy 5.20 sets targets for, and encourages the recycling or re-use of construction, demolition and excavation waste within London.

Policy 5.21: Contaminated land
Policy 5.21 supports the remediation of contaminated sites and seeks to ensure that developments don't activate or spread contamination.

Policy 7.6: Architecture
Policy 7.6 encourages the highest architectural quality, including so that development does harm privacy, overshadowing, wind and micro-climate and so they incorporate best practice in resource management and climate change mitigation and adaptation.

Policy 7.14: Improving air quality

Policy 7.14 aims to reduce exposure to poor air quality in London as well as reduce emissions from development, including during the demolition and construction phases and seeks new development to be 'air quality neutral'.

Policy 7.15: Reducing noise and enhancing soundscapes

Policy 7.15 seeks to reduce overall exposure to noise within London as well as protect new occupiers from noise within their developments.

Policy 7.19: Biodiversity and access to nature

Policy 7.19 seeks a proactive approach to the protection, enhancement, creation, promotion and management of biodiversity.

Policy 7.20: Geological conservation

Policy 7.20 seeks to protect, enhance and enable access to areas of national, regional and locally important geological sites.

Policy 7.21: Trees and woodlands

Policy 7.21 seeks to protect, maintain and enhance trees and woodlands on a strategic scale as well as protect and promote the provision of additional trees in the public realm as well as on development sites.

Policy 7.22: Land for food

Policy 7.22 seeks to protect allotments and encourages the use of land for food growing close to urban areas.

APPENDIX 2: RELEVANT LEGISLATION AND NATIONAL POLICY

National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out the government's approach to promoting sustainable development in England through the planning system. It recognises the proactive role planning can make towards meeting the objectives and provisions of the Climate Change Act 2008 by shaping places to secure radical reductions in greenhouse gas emissions and minimising vulnerability and providing resilience to the impacts of climate change, including through the delivery of supporting infrastructure. The NPPF also encourages local planning authorities to ensure viability and deliverability in plan-making and decision-taking.

The Planning and Energy Act 2008

This Act enables a local planning authority in England, through their development plan documents, to include policies imposing reasonable requirements for:

- a proportion of energy used in development in their area to be energy from renewable sources in the locality of the development;
- a proportion of energy used in development in their area to be low carbon energy from sources in the locality of the development;
- development in their area to comply with energy efficiency standards that exceed the energy requirements of building regulations.

Climate Change Act 2008

The Climate Change Act sets legally binding greenhouse gas emission reductions targets of at least 80% by 2050 (with an interim target of 26% by 2020) against a 1990 baseline, which are to be achieved through action taken in the UK and abroad. The Government is to produce carbon budgets and report on these. The Act also requires the reporting of the risks from the effects of climate change. It contains provisions to enable the Government to require public bodies and statutory undertakers to carry out their own risk assessment and make plans to address the risk of climate change.

Energy Act 2011

The Act includes provisions for the establishment of the Green Deal, which is a new financing framework to fund improvements to the energy efficiency of domestic and non-domestic properties, which is to be paid back through a charge on the energy bill so that there is no upfront cost for consumers.

The Act includes provisions to ensure that from April 2016, private residential landlords will be unable to refuse a tenant's reasonable request for energy efficiency improvements where a finance package such as the Green Deal is available. In addition the Act provides powers to ensure that from April 2018, it will be unlawful to rent out a residential or business property that does not reach a minimum energy efficiency standard (the intention is for this to be set at EPC rating 'E').

Building Regulations

The Building Regulations set out statutory standards developments are to meet. These standards cover measures including energy efficiency, water efficiency, sanitation, fire safety, sound resistance and ventilation. Part L of the Building regulations covers energy efficiency and sets out the maximum carbon dioxide occupied buildings are to emit. The Government has stated that Part L of the Building Regulations will be tightened in 2013 and again in 2016 when it will set out

the requirement for 'zero carbon' residential properties.

Part G of the Building Regulations seeks to limit the domestic use of water to 125litres per person per day. This is assessed using a water calculator, which is the same as that used for the Code for Sustainable Homes[1].

Greater London Authority Act (as amended)
The principles purposes of the GLA and the Mayor are to:

- promote economic development and wealth creation in Greater London;
- promote social development in Greater London, and
- promote the improvement of the environment in Greater London

Floods and Water Management Act 2010
The Floods and Water Management Act gives the Environment Agency an overview of all flood and coastal erosion risk management and unitary councils the lead in managing the risk of all local floods. It encourages the uptake of sustainable drainage systems by removing the automatic right to connect to sewers and providing for councils to adopt SUDS for new developments and redevelopments.

The Natural Environment and Rural Communities Act 2006
Section 40 of this Act imposes a duty on public bodies 'to have regard' to conservation of biodiversity in England when carrying out their normal functions. Under Section 41 of this Act, the Secretary of State has published a list of species of flora and fauna and habitats considered to be principal importance in the conservation of biodiversity.

There is also European legislation and a wider range of national legislation that protects nature conservation sites and protects individual species.

Environmental Protection Act 1990
This Act sets out the framework for waste management and the control of emissions into the environment. This Act is supported by numerous pieces of legislation that control waste and polluting substances.

Air quality standards regulation 2007
The Air Quality Regulations transpose into UK law the limit values set out in the European Union Ambient Air Quality Directive. The GLA Act places a duty on the Mayor to set out proposals and policies for the achievement in Greater London of the air quality standards and objectives.

National strategies and reports

The Carbon Plan 2011
The national Carbon Plan is a pre-cursor to the carbon budgets required by the Climate Change Act 2008. This plan sets out broadly how the UK can meet the carbon dioxide reduction targets set out in the Climate Change Act 2008, including what measures are already in place and when additional measures will commence.

Climate change risk assessment (CCRA) 2012
This national risk assessment provides an evaluation of the potential impacts due to climate change with consideration give to - their likelihood; the scale of their potential consequences and the urgency with which action may be needed to address them.

1 http://www.planningportal.gov.uk/uploads/br/water_efficiency_calculator.pdf

Climate change risk report 2012
This national report sets out the main priorities for adaptation in the UK under 5 key themes identified in the CCRA 2012 Evidence Report – Agriculture and Forestry; Business, Industries and Services; Health and Wellbeing; Natural Environment and Buildings and Infrastructure – and describes the policy context, and action already in place to tackle some of the risks in each area. The report is to be reviewed every five years.

The UK Climate Projections (UKCP09) provide climate information to help plan to adapt to a changing climate. The projections are presented for three different future scenarios representing high, medium and low greenhouse gas emissions. Projections are made for regions across the UK, including London and include both summer and winter projections with varying probability scenarios (10%, 50%, 90%) for climatic elements including temperature, rainfall, storm surge and sea level rise.

APPENDIX 3: THE MAYOR'S RELEVANT STRATEGIES AND SUPPLEMENTARY PLANNING GUIDANCE

Strategies

Elements of Sustainable Design and Construction are also addressed in a number of the Mayor's strategies and initiatives. The Mayor has published the following strategies:

- The Mayor's Energy and Climate Change Mitigation Strategy
- The Mayor's Climate Change Adaption Strategy
- The Mayor's Water Strategy
- The Mayor's Waste Management Strategy
- The Mayor's Air Quality Strategy
- The Mayor's Noise Strategy
- The Mayor's Transport Strategy

The Mayor has also published the following useful background reports:

- Powering ahead: Delivering low carbon energy for London
- The London Heat Map
- London Decentralised Energy Capacity Study Phase 1: Technical Assessment
- London Decentralised Energy Capacity Study Phase 2: Deployment potential
- London Decentralised Energy Capacity Study Phase 3: Roadmap to deployment
- The Impacts of the London Plan Energy Policies
- London Regional Flood Risk Appraisal 2009 (currently being updated)
- Living roofs and walls. Technical report: Supporting the London Plan Policy

Supplementary Planning Guidance

Housing SPG
The London Housing Design Guide[2] (chapters 5 and 6), published by the Mayor in 2010, and the Housing SPG[3] both include internal space standards and environmental requirements for housing in London. A list of the most relevant standards to this SPG is included in Appendix 4 of this guidance.

Town Centre SPG
The Town Centre SPG provides specific guidance on sustainable design and construction for Town Centres.

The control of dust and emissions from construction and demolition SPG
The SPG on The control of dust and emissions from construction and demolition provides detailed guidance on how to minimise the generation of dust and other emissions to the air during the demolition and construction phase of development, including mitigation measures to reduce the impact of demolition and construction on air quality. This SPG is being updated.

Preparing Borough Tree and Woodland Strategies SPG
The SPG on Preparing Borough Tree and Woodland Strategies sets out how boroughs should prepare strategies to protect, maintain and enhance trees and woodlands in their boroughs.

2 Mayor of London. London Housing Design Guidance (LHDG). LDA, 2010
3 Mayor of London. Housing SPG. GLA, 2012

All London Green Grid SPG
The All London Green Grid aims to promote the concept of green infrastructure, and increase its delivery by boroughs, developers, and communities, by describing and advocating an approach to the design and management of green and open spaces to deliver unrealised benefits.

London's foundations SPG
The London's foundations SPG sets out London's geological heritage, identifying strategically important geological sites for protection and advising boroughs on how to promote as well as protect geodiversity.

APPENDIX 4: HOUSING SPG DESIGN STANDARDS RELATING TO SUSTAINABLE DESIGN AND CONSTRUCTION

Design Standards			Source
1.0	**Shaping Good Places**		
1.1	**Defining places**		
1.1.1	Development Proposals should demonstrate: a. how the design responds to its physical context, including the character and legibility of the area and the local pattern of building, public space, landscape and topography.	Baseline	LP Policy 7.4 and Building For Life
1.2	**Outdoor spaces**		
1.2.1	Development proposals should demonstrate that they comply with the borough's open space strategies, ensuring that an audit of surrounding open space is undertaken and that, where appropriate, opportunities to help address a deficiency in provision by providing new public open spaces are taken forward in the design process.	Baseline	LP Policy 2.18 and Building for Life
2.0	**Housing for a Diverse City**		
2.1	**Appropriate density**		
2.1.1	Development proposals should demonstrate how the density of residential accommodation satisfies LP policy relating to public transport accessibility levels (PTALs) and the accessibility of local amenities and services, and is appropriate to the location in London.	Baseline	LP Policy 3.4 and Building for Life
3.0	**From Street to Front Door**		
3.4	**Cycle storage**		
3.4.1	All developments should provide dedicated storage space for cycles at the following levels: i. 1 per 1 or 2 bedroom dwelling; or ii. 2 per 3 or more bedroom dwelling	Baseline	LP Policy 6.9
3.4.2	Individual or communal cycle storage outside the home should be secure, sheltered and adequately lit, with convenient access to the street. Where cycle storage is provided within the home, it should be in addition to the minimum GIA and minimum storage and circulation space requirements. Cycle storage identified in habitable rooms or on balconies will not be considered acceptable.	Baseline	Design for London

3.5	**Refuse, post and deliveries**		
3.5.1	Communal refuse and recycling containers, communal bin enclosures and refuse stores should be accessible to all residents including children and wheelchair users, and located on a hard, level surface. The location should satisfy local requirements for waste collection and should achieve full credits under the Code for Sustainable Homes Technical Guide. Refuse stores within buildings should be located to limit the nuisance caused by noise and smells and provided with means for cleaning.	Baseline	LP Policy 5.17 and Code for Sustainable Homes
3.5.2	Storage facilities for waste and recycling containers should be provided in accordance with the Code for Sustainable Homes Technical Guide and local authority requirements.	Baseline	LP Policy 5.17 and Code for Sustainable Homes
4.0	**Dwelling Space Standards**		
4.8	**Study and work**		
4.8.1	Dwelling plans should demonstrate that all homes are provided with adequate space and services to be able to work from home. The Code for Sustainable Homes guidance on working from home is recommended as a reference.	Baseline	Code for Sustainable Homes
4.8.2	Service controls should be within a height band of 450mm to 1200mm from the floor and at least 300mm away from any internal room corner [Lifetime Homes Criterion 16].	Baseline	Lifetime Homes Criterion 16
4.10	**Private open space**		
4.10.1	A minimum of 5 sq m of private outdoor space should be provided for 1-2 person dwellings and an extra 1 sq m should be provided for each additional occupant.	Baseline	HCA Housing Quality Indicator standards
5.0	**Home as a Place of Retreat**		
5.2	**Dual aspect**		
5.2.1	Developments should avoid single aspect dwellings that are north facing, exposed to noise levels above which significant adverse impacts on health and quality of life occur, or contain three or more bedrooms.	Baseline	LP Policy 3.5, PPG 24

5.3	**Noise**		
5.3.1	The layout of adjacent dwellings and the location of lifts and circulation spaces should seek to limit the transmission of noise to sound sensitive rooms within dwellings.	Baseline	LP Policy 7.15, PPG 24
5.4	**Floor to ceiling heights**		
5.4.1	The minimum floor to ceiling height in habitable rooms should be 2.5m between finished floor level and finished ceiling level.	Baseline	Design for London
5.5	**Daylight and sunlight**		
5.5.1	Glazing to all habitable rooms should be not less than 20% of the internal floor area of the room.	Good Practice	Code for Sustainable Homes
5.5.2	All homes should provide for direct sunlight to enter at least one habitable room for part of the day. Living areas and kitchen dining spaces should preferably receive direct sunlight.	Good Practice	Code for Sustainable Homes
5.6	**Air quality (new standard ex LP EIP)**		
5.6.1	Minimise increased exposure to existing poor air quality and make provision to address local problems of air quality : be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs).	Baseline	LP policy 7.14, Code for Sustainable Homes,
6.0	**Climate Change Mitigation and Adaptation**		
6.1	**Environmental performance**		
6.1.1	Designers should seek to achieve a minimum of Level 4 of the Code for Sustainable Homes in all new developments.	Good Practice	Code for Sustainable Homes
6.1.2	All homes should satisfy LP policy on sustainable design and construction and make the fullest contribution to the mitigation of and adaptation to climate change.	Baseline	LP Policy 5.3
6.2	**Energy and CO2**		

<table>
<tr><td>6.2.1</td><td>Development proposals should be designed in accordance with the LP energy hierarchy, and should meet the following minimum targets for carbon dioxide emissions reduction.<table><tr><th>Year</th><th>improvement on 2010 building regulations</th></tr><tr><td>2010-2013</td><td>25%</td></tr><tr><td>2013-2016</td><td>40%</td></tr><tr><td>2016-2031</td><td>Zero carbon</td></tr></table></td><td>Baseline</td><td>LP Policy 5.2</td></tr>
<tr><td>6.3</td><td>Overheating</td><td></td><td></td></tr>
<tr><td>6.3.1</td><td>Development proposals should demonstrate how the design of dwellings will avoid overheating during summer months without reliance on energy intensive mechanical cooling systems.</td><td>Baseline</td><td>LP Policy 5.9</td></tr>
<tr><td>6.4</td><td>Water</td><td></td><td></td></tr>
<tr><td>6.4.1</td><td>New dwellings should be designed to ensure that a maximum of 105 litres of water is consumed per person per day.</td><td>Baseline</td><td>LP Policy 5.15</td></tr>
<tr><td>6.4.2</td><td>Where development is permitted in an area at risk of flooding, it should incorporate flood resilient design in accordance with PPS25.</td><td>Baseline</td><td>LP Policy 5.12</td></tr>
<tr><td>6.4.3</td><td>New development should incorporate Sustainable Urban Drainage Systems and green roofs where practical with the aim of achieving a Greenfield run-off rate, increasing bio-diversity and improving water quality. Surface water run-off is to be managed as close to source as possible.</td><td>Baseline</td><td>LP Policies 5.11 and 5.13</td></tr>
<tr><td>6.5</td><td>Materials</td><td></td><td></td></tr>
<tr><td>6.5.1</td><td>All new residential development should accord with Code for Sustainable Homes Level 4 and the London Sustainable Design and Construction SPG with regard to the sourcing of materials.</td><td>Good Practice</td><td>Code for Sustainable Homes</td></tr>
<tr><td>6.5.2</td><td>All new residential development should meet the requirements of the Code Level 4 with regard to using materials with lower environmental impacts over their lifecycle.</td><td>Baseline</td><td>Code for Sustainable Homes and LP 5.3</td></tr>
<tr><td>6.6</td><td>Ecology</td><td></td><td></td></tr>
</table>

6.6.1	The design and layout of new residential development should avoid areas of ecological value and seek to enhance the ecological capital of the area in accordance with GLA best practice guidance on biodiversity and nature conservation.	Baseline	LP Policy 7.19

APPENDIX 5. 'AIR QUALITY NEUTRAL' EMISSIONS BENCHMARKS FOR BUILDINGS

Two Building Emission Benchmarks (BEBs) have been defined; one for NOx and one for PM_{10}, for a series of land-use classes. The benchmarks are expressed in terms of g/m^2/annum. The gross floor area (GFA) is used to define the area. For the less common types of development it will be for the developer to provide convincing evidence for which BEB should be used.

Land Use Class	NOx (g/m^2)	PM_{10} (g/m^2)
Class A1	14.4	1.57
Class A3 - A5	47.9	5.23
Class A2 and Class B1	19.6	2.15
Class B2 - B7	29.6	4.29
Class B8	19.1	2.76
Class C1	45.2	4.93
Class C2[1]	150	11.5
Class C3[1]	57.3	4.38
D1 (a)	27.4	2.99
D1 (b)	47.8	5.22
Class D1 (c -h)	19.7	2.15
Class D2 (a-d)	57.5	6.28
Class D2 (e)	181	19.8

APPENDIX 6: 'AIR QUALITY NEUTRAL' EMISSIONS BENCHMARKS FOR TRANSPORT

Land use			
	CAZ	Inner	Outer
NOx (g/m²/annum)			
Retail (A1)	152	194	206
Office (B1)	1.14	10.1	56.5
NOx (g/dwelling/annum)			
Residential (C3)	212	496	1278
PM_{10} (g/m²/annum)			
Retail (A1)	14.7	35.1	35.4
Office (B1)	0.11	1.83	9.72
PM_{10} (g/dwelling/annum)			
Residential (C3,C4)	20.4	89.6	220

APPENDIX 7: EMISSIONS STANDARDS FOR SOLID BIOMASS AND CHP PLANT

Emission Standards for Solid Biomass Boilers and CHP Plant in the Thermal Input range 50kWth – 20 MWth

To deliver both reductions in carbon dioxide emissions and improve air quality a tiered approach has been developed for applicable emission standards. This approach is based upon differentiation according to the baseline air quality in the area of development and will be dependent upon whether or not the development falls into the two tiers defined below.

Band	Applicable Range	
	Baseline Annual Mean NO2 and PM10	**Baseline 24-Hour Mean PM10**
Band A	> 5% below national objective	> 1-day less than national objective
Band B	Between 5% below or above national objective	1 day below or above national objective

The emission standards below are target minimum standards. If an assessment indicates that significant air quality effects may occur even when meeting the emission standards, additional measures (such as stack height increase, enforcement of more stringent standards etc.) should be considered in order to produce an acceptable level of impact.

Emission Standards for Solid Biomass Boilers and CHP Plant in the Thermal Input Range 50kWth – 20 MWth for development in Band A

Combustion Appliance	Pollutant	Emission Standard (mg Nm^{-3})	Indicative Emission Factor	Likely Technique Required to Meet Emission Standard
Spark ignition engine (natural gas/biogas)	NO_x	250[A]	0.7 g/kWh	Advanced lean burn operation (lean burn engines) NSCR (rich burn engines)
Compression ignition engine (diesel/bio-diesel)	NO_x	400[A]	1.1 g/kWh	SCR
Gas turbine	NO_x	50[B]	0.4 g/kWh	None above standard technology for modern turbines
Solid biomass boiler (including those involved in CHP applications)	NO_x	275[C]	100 g/GJ	Modern boiler with staged combustion and automatic control
	PM	50[C]	20 g/GJ	Cyclone/ multicyclone

Combustion Appliance	Pollutant	Emission Standard (mg Nm^{-3})	Indicative Emission Factor	Likely Technique Required to Meet Emission Standard
All (stack heat release less than 1MW)[D]	Stack discharge velocity	10 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity
All (stack heat release greater than or equal to 1MW) [D]	Stack discharge velocity	15 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity

Notes:

[A] At reference conditions 273K, 101.3kPa, 5% O_2, dry gas

[B] At reference conditions 273K, 101.3kPa, 15% O_2, dry gas

[C] At reference conditions 273K, 101.3kPa, 6% O_2, dry gas

[D] The stack heat release can be calculated as per equation (3) in the D1 guidance note:

$$Q = \frac{V\left(1 - \frac{283}{T}\right)}{2.9}$$

Where:
Q = Stack heat release (MW)
V = Volume flow of stack gases at discharge conditions (Am^3s^{-1})
T = Discharge temperature (K)

N.B. Stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g., rain cowls, 'China-man Hats')

Emission Standards for Solid Biomass Boilers and CHP Plant in Thermal Input Range 50kWth – 20 MWth for development in Band B

Combustion Appliance	Pollutant/ Parameter	Emission Standard (mg Nm^{-3})	Indicative Emission Factor	Likely Technique Required to Meet Emission Standard
Spark ignition engine (natural gas/biogas)	NO_x	150[A]	0.3 g/kWh	SCR (lean burn engines) NSCR (rich burn engines)
Compression ignition engine (diesel/bio-diesel)	NO_x	400[A]	1.1 g/kWh	SCR
Gas turbine	NO_x	50[B]	0.4 g/kWh	None above standard technology for modern turbines
Solid biomass boiler (including those involved in CHP applications)	NO_x	180[C]	70 g/GJ	Modern boiler with staged combustion, automatic control and/ or SNCR
	PM	15[C]	6 g/GJ	Fabric/ceramic filter
All (stack heat release less than 1MW)[D]	Stack discharge velocity	10 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity
All (stack heat release greater than or equal to 1MW)[D]	Stack discharge velocity	15 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity

Notes:

[A] At reference conditions 273K, 101.3kPa, 5% O_2, dry gas

[B] At reference conditions 273K, 101.3kPa, 15% O_2, dry gas

[C] At reference conditions 273K, 101.3kPa, 6% O_2, dry gas

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us at the address

Chinese **Hindi**

Nếu bạn muốn có văn bản tài liệu này bằng ngôn ngữ của mình, hãy liên hệ theo số điện thoại hoặc địa chỉ dưới đây.

আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি (কপি) চান, তা হলে নীচের ফোন্ নম্বরে বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

Vietnam- **ese**

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Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος εγγράφου στη δική σας γλώσσα, παρακαλείστε να επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυδρομικά στην παρακάτω διεύθυνση.

اگر آپ اِس دستاویز کی نقل اپنی زبان میں چاھتے ھیں، تو براہ کرم نیچے دئے گئے نمبر پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

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જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં જોઈતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.