Sustainable Design and Construction

The London Plan Supplementary Planning Guidance

May 2006

MAYOR OF LONDON

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Mayor's foreword

Breaking the links between development, resource depletion and environmental damage is key to achieving my vision for London to develop as an exemplary, sustainable world city. The London Plan sets policies and targets to reduce carbon dioxide emissions, increase waste recycled or composted, ensure a sustainable approach to flood management and increase the proportion of development taking place on previously developed land. I have made sure that the Greater London Authority group is leading a range of projects to make this happen, for example by establishing a new Climate Change Agency.

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There is a perception that the more sustainable options cost more, but there is little recognition of the consequences of not addressing these issues in the long term. As the insurance industry has pointed out the future consequences of ignoring these issues could be significant.

This Supplementary Planning Guidance sets out what can be done in the current policy framework to design and construct new developments in ways that contribute to sustainable development. I have already initiated work to review the London Plan policies on sustainable design and construction and on renewable energy to make them more radical. I have made climate change the central issue of this review.

The approach taken in this SPG is reinforced by the Government's Sustainable Communities Plan that states that the essential components of a sustainable community are developments that are environmentally sensitive, providing places for people to live that are considerate of the environment and well designed and built. I want all major developments in London to embrace the standards set out in this SPG so that in the future these standards become the norm.

Ken Livingstone
Mayor of London

Foreword from London Sustainable Development Commission

The London Sustainable Development Commission has supported the Mayor in the development of the Sustainable Design and Construction SPG since early in its development. It has been a challenging road to travel: recognising on one hand, the need to fundamentally move development standards in London to align with the numerous objectives of the London Plan so that sustainability is a serious consideration; and on the other, to meet the demands of industry for clarity, consistency and a practical approach.

I think we have now struck this balance with the SPG. The document clearly states performance-based minimum requirements and provides signposts to guidelines about how to achieve these. The standards are challenging but the approach gives industry appropriate scope for creativity to determine how these are to be met. Research proposed by the Commission has shown that the London Plan requirements summarised in the SPG can make a significant contribution to lowering London's footprint.

Is it the end of the story for making design and construction in London more sustainable? Clearly not. I support the commitment given to review the document at a point not too far into the future to further refine performance standards, guidance signposts, and general usability.

A lesson we have all learnt from the process of finalising the SPG has been that above all else, it is the level of consistency across development standards that is vital to the construction industry. The anticipated national standards for sustainable design and construction will need to be linked to the SPG, and there are plans for an online checklist that will give developers the opportunity to show how they have addressed the standards in their development.

We cannot afford to be complacent about the impact of the construction industry on climate, biodiversity, air quality, health, well-being and other natural and social building blocks upon which the quality of life of London and the world depends. This SPG is a key step in taking account of our impacts and asking us how we can develop for a more sustainable future.

I am pleased to have been asked to be involved in this project, and, on behalf of the London Sustainable Development Commission, I commend the Mayor for his vision in agreeing to initiate such a challenging but vital document for construction in London.

Peter Head, OBE
Chair, Planning and Development Sub-Group
London Sustainable Development Commission

1 Introduction

1.1 The purpose of this SPG

This Supplementary Planning Guidance (SPG) has been produced to provide additional information to support the implementation of the Mayor's London Plan (the Spatial Development Strategy). As SPG this document cannot set new policy. However the SPG can be taken into account as a further material consideration so has weight as a supplement to the London Plan. The SPG is applicable to all development types and associated spaces, with specific information on different building types provided where relevant.

London Plan Policy 4B.6 relates to sustainable design and construction and sets the context for this SPG. The SPG provides guidance on the way that the seven measures identified in the policy can be implemented to meet the London Plan objectives and therefore the SPG is structured around these seven factors.

Policy 4B.6 Sustainable design and construction

The Mayor will, and boroughs should, ensure future developments meet the highest standards of sustainable design and construction and reflect this principle in UDP policies.

These will include measures to:

- Re-use land and buildings
- Conserve energy, materials, water and other resources
- Ensure designs make the most of natural systems both within, in and around the building
- Reduce the impacts of noise, pollution, flooding and micro-climatic effects
- Ensure developments are comfortable and secure for users
- Conserve and enhance the natural environment, particularly in relation to biodiversity
- Promote sustainable waste behaviour in new and existing developments, including support for local integrated recycling schemes, CHP schemes and other treatment options (subject to Policy 4A.1 and 4A.2).

Applications for strategic developments should include a statement showing how sustainability principles will be met in terms of demolition, construction and long-term management.

Boroughs should ensure that, where appropriate, the same sustainability principles are used to address planning applications.

This SPG does not consider all aspects of sustainability in the built environment, notably wider sustainability issues related to strategic land use decisions are covered in detail in the London Plan itself or in other guidance or best practice documents. This policy can only be addressed to new development. Over the next decades most of existing buildings will remain. Many other measures beyond the scope of this SPG will need to be taken, such as educating facilities managers and occupiers on the most efficient operation of buildings so that the existing stock can also contribute to making London more sustainable.

1.2 Who this SPG is for

This SPG provides more detailed guidance for Local Planning Authorities on how to implement the London Plan policies. It explains the principles of sustainable design and construction and how they should be implemented in London. It gives architects, developers, designers and other professionals ideas where to find good technical advice and guidance on achieving development that can contribute to the Mayor's vision of London as an exemplary sustainable world city

1.3 How the SPG is structured

In order to provide clearer guidance for planners and developers using this SPG, the guidance is organised to relate to different parts of the development process. The guidance in Part 2 of this SPG is structured around the seven measures in Policy 4B.6. Part 3 covers sustainable construction.

Guidance in Part 2 sets out for each of the seven measures in Policy 4B.6:

- Standards – both essential standards and the Mayor's preferred standards. (See section 1.5 below)
- The principles that underlie the policy approach and guidance as to how the standards can be achieved. Where references are given to policies these refer to the London Plan.
- Signpost boxes refer to supporting information that will help in achieving the Mayor's expectations with more detailed information on the types of innovative and inventive ideas that need to be considered to meet the standards.

Appendix C to the SPG provides a range of further resources such as key technical and policy references, useful contact organisations and websites. Appendix D sets out an outline structure for energy statements. Case studies to illustrate the principles for each of the policy measures are set out in Appendix E.

1.4 Relationship to the London Plan and other Mayoral Strategies

The London Plan is the strategic development plan for London. It has statutory weight integrating the spatial implications of the Mayor's other strategies. Existing buildings are responsible for over 70% of London's emissions of carbon dioxide (CO_2), therefore implementing the sustainable design and construction policies for new development is particularly important in meeting the targets set out in the Mayor's Energy Strategy.

This SPG should be read with other SPGs relating to the London Plan. The detail of these is not repeated in this document. Of particular relevance is the SPG: Accessible London: Creating an Inclusive Environment that provides more guidance on policy 4.B.5 in the London Plan and should be read in conjunction with this document. Forthcoming SPGs of particular relevance to sustainable design and construction include that on renewable energy and the BPG on urban design principles and the public realm. The full list of SPGs and Best Practice Guides (BPGs) is set out in Appendix B.

1.5 Sustainable Design and Construction standards

To make London a sustainable city, far reaching changes are needed to the way the city develops. Incorporating sustainable design and construction principles can make a significant contribution. These issues should be considered at the start of the design process and continue as a key component of work on any development. For example the brief for any masterplan and for architects and other designers should set out a clear description of how sustainability is to be addressed referring to the sustainability principles set out in this SPG. The developer and construction contracts should also include specific clauses on performance measures and review points related to meeting the sustainability principles.

A holistic approach is required. Buildings built and operated in a sustainable way have a number of benefits in economic terms as well as social and environmental advantages. For example the ability to bring fresh air and natural daylight into an office building can lead to lower sickness absence among staff. In this regard it is helpful to include facilities managers as part of the design team to ensure that the systems and layouts are practical to run and support a sustainable development.

This guidance sets various essential standards that apply to all major developments in London and a second tier of 'Mayor's preferred' standards. The essential standards are minima based on current Building Regulations, the targets set out in the Mayor's strategies and current

good industry practice. The Mayor's preferred standards indicate more exemplary approaches that can be followed but are not yet policy requirements. The standards will be used by the Mayor to assess the planning applications that are referred to him and are intended to complement the performance indicators set out in Table 6B.1 of the London Plan. These performance indicators are used to monitor key elements of the plan's objectives and set the context for the standards in this SPG.

The Building Regulations are not repeated here. The Mayor will continue to work with the government and other stakeholders to ensure that the necessary changes are made to building regulations and other regulations to support the principles of sustainable development.

This SPG sets standards for new development. It does not prescribe how a particular standard should be achieved. The guidance that is set out under the principles gives examples as to how a standard could be achieved. It is not prescriptive.

To assist developers in assessing which are the relevant sections of this guidance for their specific proposal, a matrix follows this introduction, setting out the standards. The matrix also gives reference to where in the SPG both the principles underlying the standards and the guidance as to how the standards can be met, are set out.

1.6 How this guidance should be used

An integrated holistic approach is needed to the process of developing a scheme for a planning application that will become a sustainable development. Designing for sustainability has significant implications for site layout, form and the aesthetics of a building and of the spaces in between. Sustainability needs to be designed in from the outset and the production of a sustainability statement will both help a developer be clear about how sustainable a development will be and also be clear about when and why specific standards set out in this SPG have or have not been met. Policy 4B.6 requires that 'applications for strategic developments should include a statement showing how sustainability principles will be met in terms of demolition, construction and long-term management.' The statement will be used by planning officers in their assessment of the planning application.

The sustainability statement should include:

- Executive Summary
- Seven sections to mirror the seven principles outlined in Policy 4B.6 – each showing how the principles set out in this SPG are addressed in

the proposed development and which of the essential and preferred standards will be met, with justification given for the standards achieved by the development.

- Conclusion and commitments

Strategic developments that are referable to the Mayor (see glossary) are expected to meet all the essential standards and also to demonstrate how they have met where feasible, the Mayor's preferred standards. Where essential standards are not achievable on site, any adverse effects should be minimised through local mitigation measures.

For strategic developments this sustainability statement should be submitted to the Mayor as well as to the local planning authority. The statement should be contained within one document to accompany the planning application for ease of reference. The GLA is currently working with London Sustainable Development Commission, WWF and BRE to develop a sustainability checklist for London based on the standards and guidance in this SPG. It is hoped that this checklist will be published later in 2006. This should be completed by the applicant and accompany the sustainability statement. Completion of this checklist will be helpful to applicants in demonstrating to the Mayor and to the local planning authority how a proposal will meet the London specific standards set out in this SPG. It will be a tool to assist both developers and planners, enabling effective appraisal of proposals and assist in the formulation of appropriate conditions that can be attached to any resultant planning permission.

The London Plan policy also requires Boroughs to use the sustainability principles set out in Policy 4B.6 when assessing major applications. Applicants for smaller developments and individual householders are advised to liaise with their local authority that will apply the guidance as appropriate to the area.

1.7 Measuring and demonstrating sustainability

There are several methodologies currently available that can be employed to assess sustainability. However none of these currently address all aspects of the Mayor's policy on sustainable design and construction. Some of the current methodologies are set out in Appendix A as examples.

Traditionally sustainability evaluation in the UK, particularly in housing, has been based on temperate climatic calculations where only winter time temperatures and energy conservation measures are considered. However with increased levels of insulation and of summer temperatures, a more

holistic approach to sustainability evaluation needs to be taken to avoid over heating in summer and the additional consumption of electricity to power cooling fans and air conditioning. Building design (and the Building Regulations) in the UK, and in particular in London, may have to change to accommodate both winter and summer time living in buildings. Therefore measuring sustainability will have to change.

There are a number of national initiatives that are relevant in setting the context for this SPG and in its future development. A report for DEFRA's Advisory Committee on Consumer Products and the Environment (ACCPE) has examined the range of tools that are currently available for measuring aspects of sustainability in housing to consider the possibilities for developing a tool that can be used not only by planners in assessing new homes, but also by home buyers and mortgage companies when homes are sold on. Recommendations to the committee suggest that a new version of EcoHomes should be developed to fulfil this function. The effect of the Sustainable and Secure Building Act 2004 could also be considerable in pushing Building Regulations forward. This Act sets out provisions to strengthen and extend the content of Building Regulations including on security, the use of fuel and power, and provision of recycling facilities.

The Government has welcomed the Sustainable Buildings Task Group's recommendation for a code for Sustainable Buildings and is currently considering how to take this forward. An outline of the code was launched at the Sustainable Communities Summit in January 2005 and a consultation on the Code for Sustainable Homes was undertaken earlier in 2006. Like this SPG the Code does not prescribe how a particular standard should be achieved. The Government and its agencies have committed to using the Code on all housing developments where they are involved with the funding arrangements. In the proposed draft the Code set standards most of which are below the aspirations of this SPG for development in London. Following the consultation responses the Government has indicated that it is reviewing the scope and strength of the measures sought.

1.8 Monitoring and review

The essential and preferred standards in this SPG will be regularly reviewed as practice and technology advance, and today's 'preferred' standards are likely to become the essential standards of the future. The Mayor has initiated a review of the policies on sustainable design and construction in the published London Plan as part of the first review. The revised London Plan will be published early in 2008. Following this an early review of the standards in this SPG will be undertaken.

An assessment of sustainability will be undertaken when assessing proposals for major developments. However, it is how proposals are implemented on the ground that is the key to achieving a sustainable development. No clear method of monitoring implementation has emerged from consultation on the draft of this SPG. It was proposed by the Government that the standards set out in the consultation on the draft Code for Sustainable Homes should be monitored by amending the current BRE post occupation assessment methodology. Although the current standards proposed by the Government are very limited and fall far short of the aspirations for London, this proposed method would be a start towards monitoring residential developments. Further consideration needs to be given to achieving a better system.

Summary of essential and Mayor's preferred standards

SPG Guidance & Section	Essential standard	Mayor's preferred standard
PART 2		
Land 2.1.2	100% of development on previously developed land, unless very special circumstances can be demonstrated	
	Development density should be maximised based on local context (Policy 4B.7) design principles (Policy 4B.1) open space provision (Policy 3D.10) and public transport capacity (Policy 3D.10). Residential development will be assessed on the Matrix of Sustainable Residential Density in the London Plan (Table 4B.1).	
Buildings 2.1.3	Existing building are reused where practicable, where the density of development and residential amenity are optimised and where the building conforms or has the potential to meet the standards for energy, materials, biodiversity and water conservation set out in this SPG	
		Existing roof space is reused where practicable to create new outdoor spaces and enhance biodiversity alongside the integration of renewable energy (section 2.3.2)
Location and urban design 2.2.2	All development to follow the principles of good design set out in London Plan policy 4B.1	
	Minimise need for and use of mechanical ventilation, heating and cooling systems	

SPG Guidance & Section	Essential standard	Mayor's preferred standard
Adapting to Climate Change 2.2.3	Buildings provide for flexibility of uses during their projected operational lives	
	Buildings adapt to and mitigate for the effects of the urban heat island and the expected increases in hot dry summers and wet mild winters	
	Design in facilities for bicycles and electric vehicles	
Energy 2.3.2	Carry out an energy demand assessment	
	Maximise energy efficiency	
	Major commercial and residential developments to demonstrate that consideration has been given to the following ranking method for heating and where necessary cooling systems: - Passive design - Solar water heating; then - Combined heat and power for heating and cooling (i.e.trigeneration) , preferably fuelled by renewables; then - Community heating and cooling; then - Heat pumps; and then - Gas condensing boilers.	All developments to demonstrate that consideration has been given to the following ranking method for heating and where necessary for cooling systems and should incorporate the highest feasible of the following options:- solar water heating; then - combined heat and power/trigeneration, preferably fuelled by renewables; then - community heating. New developments should always be connected to existing community heating networks preferably fuelled by renewables where feasible

SPG Guidance & Section	Essential standard	Mayor's preferred standard
	Wherever on site outdoor lighting is proposed as part of a development it should be energy efficient, minimising light lost to sky	Wherever outdoor lighting or other electrically powered street furniture is proposed on site, it should be solar powered and minimise light lost to the sky
		Lighting, heating and cooling controls should enable services to operate efficiently under different loadings and allow for localised control
	Carbon emissions from the total energy needs (heat, cooling and power) of the development should be reduced by at least 10% by the on-site generation of renewable energy.	Major developments should be zero carbon emission developments (ZEDs)
		Major developments should make a contribution to London's hydrogen economy through the adoption of hydrogen and/or fuel cell technologies and infrastructure

SPG Guidance & Section	Essential standard	Mayor's preferred standard
Materials 2.3.3		No construction nor specification of material with high embodied impact to be used (as defined by the summary ratings in the Green Guide to specification) unless compelling whole life energy or technical case for its use exists.
	50% timber and timber products from Forest Stewardship Council (FSC) source and balance from a known temperate source	90% structural timber from FSC source and the balance of timber products from a known temperate source
		No peat or natural weathered limestone used in buildings or landscaping
	Insulation materials containing substances known to contribute to stratospheric ozone depletion or with the potential to contribute to global warming must not be used	
		Before demolition, appraisal of maximising recycling of materials by use of ICE's Demolition Protocol
		50% of construction materials by mass used in the development to be sourced from a factory/plant, quarry, wharf, railhead or recycling centre within 35 miles of site wherever feasible
	Minimize use of new aggregates	
		10% total value of materials used to be derived from recycled and reused content in products and materials selected

SPG Guidance & Section	Essential standard	Mayor's preferred standard
Water 2.3.4	Residential developments to achieve average water use in new dwellings of less than 40m^3 per bedspace per year (approximately 110 litres/head/day)	Residential developments to achieve average water use in new dwellings of less than 25m^3 per bedspace per year (approximately 70 litres/head/day)
	100% metering of all newly built property	
		Use of greywater for all non potable uses
Noise 2.4.2	Demonstrate that adverse impacts of noise have been minimised, using measures at source or between source and receptor (including choice and location of plant or method, layout, screening and sound absorption) in preference to sound insulation at the receptor, wherever practicable	
		For residential development achieve BS 8233:1999 (Table 5) 'good' standards for external to internal noise and improve on Building Regulations (2003) Part E for internal sound transmission standards by 5dB (See Ecohomes)
Air Pollution 2.4.3	All new gas boilers should produce low levels of NO_X	
		Low emission developments that are designed to minimize the air quality impact of plant, vehicles and other sources over the lifetime of the development
	Take measures to reduce and mitigate exposure to air pollution	

SPG Guidance & Section	Essential standard	Mayor's preferred standard
Water Pollution and Flooding 2.4.4	Use Sustainable Drainage Systems (SDS) measures, wherever practical	
	Achieve 50% attenuation of the undeveloped site's surface water run off at peak times	Achieve 100% attenuation of the undeveloped site's surface water run off at peak times
Microclimate 2.4.5	Mitigate any negative impact on the microclimate of existing surrounding public realm and buildings to meet the Lawson criteria for wind comfort and safety	
Indoor comfort 2.5.2	Inert and low emission finishes, construction materials, carpets and furnishings should be used wherever practical.	
		Design buildings for indoor comfort of users
	All plant and machinery should be accessible for easy maintenance	
Designing inclusive environments 2.5.3	All developments should meet the principles of inclusive design, adopting the principles of SPG "Accessible London: Achieving an Inclusive Environment".	
	All residential development should meet Lifetime Home standards and 10% should meet wheelchair accessibility standards (London Plan Policy 3A.4)	All residential development should be designed to meet wheelchair accessibility standards or be easily adaptable to meet wheelchair standards

SPG Guidance & Section	Essential standard	Mayor's preferred standard
Designing inclusive environments 2.5.3 cont		Developments should be fully e-enabled
Secure design 2.5.4	Developments should incorporate principles of "Secured by design"	
Open space 2.6.2 cont	No net loss of publicly accessible open space	Net gain of publicly accessible open space
	Create appropriate new open, green, publicly accessible spaces where these can redress identified areas of deficiency of public open space	
Natural environment and biodiversity 2.6.3	No net loss of biodiversity and access to nature on the development site	Net gain of biodiversity and access to nature on the development site
	Reduction in areas of deficiency in access to nature	
Waste 2.7.2	Minimise, reuse and recycle demolition waste on site where practical	
		Use prefabricated and standardised modulation components to minimise waste. If this is not feasible use low waste fabrication techniques
	Specify use of reused or recycled construction materials	

SPG Guidance & Section	Essential standard	Mayor's preferred standard
	Provide facilities to recycle or compost at least 25% of household waste by means of separated dedicated storage space. By 2010 this should rise to 35%.	Provide facilities to recycle or compost at least 35% of household waste. By 2015 this should rise to 60%.
		Provide facilities to recycle 70% of commercial and industrial waste by 2020.
		Incorporation of or access to new waste recovery facilities (anaerobic digestion, pyrolysis/gasification) especially to provide a renewable source of energy eg methane or hydrogen
	Recycling facilities should be as easy to access as waste facilities	
PART 3		
	Reduce waste during construction and demolition phases and sort waste stream on site where practical	
	Reduce the risk of statutory nuisance to neighbouring properties as much as possible through site management	
	All developers should consider and comply with the Mayor and ALG's London BPG on the control of dust and emissions during construction and demolition	All contractors should be required by tender requirements to sign up to the Mayor and ALG's London BPG on the control of dust and emissions during construction demolition
	Comply with protected species legislation	
	All developers should sign up to the relevant Considerate Constructors Scheme or in the City of London to the Considerate Contractor scheme	All contractors should be required by tender requirements to sign up to the relevant Considerate Constructors Scheme or in the City of London to the Considerate Contractor scheme

2 Sustainable Design

2.1 Re-use land and buildings

2.1.1 Introduction

London has a large population and a comparatively small land area. Land is a therefore a precious, finite resource. The efficient use of land requires that development optimise the carrying capacity of land, that previously developed land is re-used, and that green spaces within London are protected and opportunities for the provision of new open space are maximised.

2.1.2 Land

Essential Standards

- 100% of development on previously developed land, unless very special circumstances can be demonstrated.
- Development density should be maximised based on local context (Policy 4B.7) design principles (Policy 4B.1), open space provision (Policy 3D.10) and public transport capacity (Policy 3C.10). Residential development will be assessed on the Matrix of Sustainable Residential Density in the London Plan (Table 4B.1)

These standards are based in the principles of:

- Priority for development of previously developed land
- Making best use of all developable land by increasing density
- Ensuring all land within a site has a designated function
- Ensuring developments have direct access to open space
- Treating land contamination appropriately prior to development

Guidance on how these principles can be addressed

Priority for development of previously developed land – the priority should be for all development to be located on previously developed land unless very exceptional circumstances exist. These exceptional circumstances include where the previously developed land has been identified as a Site of Importance for Nature Conservation by the procedures set out in Appendix 1 of the Mayor's Biodiversity Strategy.

Making the best use of all developable land by increasing density – achieving higher density of development is important if London is to accommodate a 800,000 increase in population and an additional 640,000 jobs by 2016 (Policy 3A.1 and 3A.2). Opportunities to significantly increase densities should be taken where accessibility to public transport is or will be high and the scale and character of the area will not be damaged.

Development proposals should achieve the highest possible intensity of use compatible with the local context, the design principles in policy 4B.1 and with public transport capacity (Policy 4B.3). Residential density should follow the strategic framework indicated in Table 4B.1 of the London Plan. The mix of uses and density within a mixed use development should relate to the location of the development particularly:

- Within central London
- Within areas of opportunity, intensification or regeneration
- Within or adjacent to a town centre or transport interchange

Further clarification on urban design standards including development densities and achieving a high quality of design, is set out in the Mayor's SPG on Housing and the proposed BPG on urban design and the public realm to be published for consultation in late 2006.

Best use of land can be achieved by:

- Identifying and developing under-used land within the existing urban area, where this is supported by other planning policies and seeking to promote land assembly that supports the implementation of the London Plan (policy 6A.3).
- Increasing densities on existing developments, for example considering opportunities to convert and reuse upper floors or to add additional storeys to buildings where other policies allow.
- Developing new approaches to standard building forms, including the provision of mixed use or a mixture of uses, e.g. supermarkets with residential floorspace above,
- Maximising opportunities to provide for better access to open space including adding roof gardens and/or terraces to residential developments.
- Creating reduced car or car-free developments, releasing additional space for other uses.

Signpost: *Living Roofs;* Mayor of London and AUU. 2004 www.london.gov.uk/mayor/auu/livingroofs.jsp

Ensuring all land within a site has a designated function – all developments should make the most efficient use of a site, reflecting its particular characteristics and surroundings. The design process should include a commitment to designate all land within a site with a function, including the multifunctional use of space. This should include the designation of land for uses such as open and green (section 2.6.2) and

play space and new infrastructure e.g. energy infrastructure such as local on site CHP/ renewable energy generating stations (section 2.3.2); water, including rainwater harvesting and sustainable urban drainage (section 2.4.4) and waste collection and recycling facilities (section 2.7.2).

Ensuring developments have access to open space – this makes a substantial difference to everyday health and the quality of life and appropriate and imaginative measures should be taken to make better use of available land. Successful green spaces can often contain a mosaic of places, each suitable for different uses or mixes of uses. The possible multifunctional use of open spaces is also vital to consider where amenity spaces will be at a premium, for example green spaces around schools (section 2.6.2)

Treating land contamination appropriately prior to development – much previously developed land is contaminated and remediation should address both soil and groundwater. Methods of decontamination should be determined by the end-uses proposed for the site, and the form and density of the development. Bioremediation techniques can also be used in particular circumstances. If there are no formal plans for the end-use, the decontamination methods proposed should allow for a high density residential and mixed-use development. If the adopted decontamination methodology proposes to leave some contamination in-situ, then the impacts on the likely final development should be considered, and the benefits of leaving the material in place should be demonstrated.

2.1.3 Buildings

Essential Standard

- Existing building reused where practicable, where the density of development and residential amenity are optimised and where the building conforms to or has the potential to meet the standards for energy, materials, biodiversity and water conservation set out in this SPG.

Mayor's Preferred Standard

- Existing roof space reused where practicable to create new outdoor spaces and enhance biodiversity alongside the integration of renewable energy (section 2.3.2)

These standards are based on the principle of:

- Maximising the re-use of existing buildings

Guidance on how this principle can be addressed

Maximising the re-use of existing buildings - existing buildings can be refurbished or extended without the need for substantial use of new materials from primary resources. This can provide viable futures for listed buildings yet meet new needs. Proposals for development should demonstrate there are no existing vacant or underused buildings that could be adapted for the intended purpose where the density of the existing buildings is optimal for the location and where its reuse conforms to or has the potential to meet the standards for energy, materials and water conservation and opportunities for biodiversity set out elsewhere in this SPG. Carrying out a pre-demolition audit can also be useful prior to refurbishment to identify value and recovery options for existing materials and products. The re-use of existing buildings should, where other policies permit:

- Maximise the re-use of the buildings including the basements and roof spaces;
- Investigate the opportunities to incorporate mixed-uses within buildings, particularly public access uses (retail, leisure etc) at ground floor level;
- Where other policies allow, consider increasing the floorspace of the existing building through additional floors and/or extensions;
- Review the function of any open land within the site, considering opportunities for example to remove surface vehicle parking to provide for enhanced public realm, wildlife habitat or landscaping and developing the potential for incorporating additional open space uses such as children's play where appropriate;
- Ensure that the works do not restrict the occupation of the building by other uses in the future, i.e. create a building with greater flexibility for future re-use.

Signpost: *Energy Efficiency in Buildings* – Chapter 16: Refurbishment. CIBSE 2004

2.2 Maximise the use of natural systems

2.2.1 Introduction

The overriding principle is that location, urban design, passive solar design and maximizing the use of natural ventilation should be used to minimize resource use and maximize the comfort of users over the lifetime of the development. The main climatic influences on internal comfort include solar heat and air flow. Building facades are the interface between the external and internal climate. The relationship of the façade to the internal depth, particularly in large buildings is crucial.

The use of natural systems relies on consideration of the external climatic effects on the internal building environment at the conceptual stage of the design process. Given current knowledge of the likely effects of climate change on London's climate over the next decades, buildings will need to adopt designs to make full use of these natural systems. Natural systems should be considered holistically when planning building scale, orientation, location of entrances, window or opening designs and vegetation and open spaces.

2.2.2 Location and Urban Design

Essential Standards

- All development to follow the principles of good design set out in London Plan policy 4B.1
- Minimize need for and use of mechanical ventilation, heating and cooling systems

These standards are based on the principles of:

- High quality urban design
- Utilising Passive Solar Design
- Making maximum use of natural ventilation and shading

Guidance on how these principles can be addressed

High quality urban design – the London Plan identifies the broad location for development while sub-regional development frameworks and borough Local Development Documents (LDD) will clarify locations in more detail (London Plan Chapter 5). The principles of urban design for London are set out in Policy 4B.1 of the London Plan. (Also Section 2.5). Good design at both the masterplan and at the site level are crucial to making a place or building liveable. At the site level, location and position of a building and its relationship with adjoining buildings affects its ability to optimise the benefits of the external climatic conditions on the internal comfort levels.

Signpost: *By Design – Urban Design in the Planning System: Towards Better Design*, CABE, 2000

Utilising Passive Solar Design (PSD) – orientation of buildings, choice of materials, nearby vegetation and the appropriate design of elevations are major factors in successful PSD. These can minimize dependence on artificial heating, cooling and lighting. Overshadowing on adjoining buildings should be minimised-otherwise overshadowing can reduce the use of PSD.

PSD should consider capture systems for solar gain from the following:

- Direct systems: Allow solar energy to penetrate directly into the building. For example, useful daylight should penetrate 3-6 m inside a building from windows.
- Semi-direct systems: Use an intermediate space between external glass and the internal space to regulate energy penetration.
- Indirect systems: Capture solar energy using a storage mass element and circulate using conduction, convection and radiation.
- Natural systems: Employ woody deciduous planting to provide shade in the summer whilst letting the sun through in the winter.

With increased summer heat as a result of climate change, the need for adequate and appropriate shading to be incorporated into any design is absolutely critical. This means that shading must be designed to perform two functions: keeping out summer sun and allowing winter sun to penetrate. For south facing shading, lateral external shade structures are appropriate (such as awnings or pergolas) that allow the lower angled winter sun to penetrate while blocking higher angled summer sun. For east-west facing windows, vertical external shade structures are appropriate (such as sliding panels of louvres or deciduous vegetation) that block sun as it tracks diagonally across these planes throughout the day. In medium to high density developments, the use of courtyard space, balconies and other potential sun-spaces should be effectively planned to deliver solar gain in winter regardless of orientation, and be effectively shaded from solar gain in summer.

PSD should be considered in conjunction with other energy efficiency measures throughout the whole of the building and its surrounds (Section 2.3.2). The Building Regulations Part L require a Standard Assessment Procedure (SAP) 2005 calculation for dwellings and this calculation is an essential part of achieving the effective use of PSD. Increasingly the use of building modelling software can inform the use of PSD to ensure that overheating and hence unnecessary cooling are avoided.

Signpost: *Guidance on design information for solar shading control.* TM37. CIBSE 2005

Making maximum use of natural ventilation and shading – this enables reliance on mechanical ventilation and cooling systems to be reduced and can complement PSD. Air conditioning units can be or become noisy and dump waste heat externally which affects occupants of adjoining properties – especially residential buildings. This is an important consideration in higher density mixed use environments (Section 2.4.2).

Cities with warmer climates than London can deal with high solar gain without over-reliance on mechanical cooling systems. Modern buildings increasingly apply the principles of natural ventilation by allowing cool air, including cooler ambient air at night, to be drawn in at low levels, and for normal convection currents to encourage the air to move upwards through the building and be ejected at a high level. It is important that the stack effect is not neutralised by incoming winds. Solar siphons can be designed to drive natural ventilation. Opening windows or wall vents can be used to allow air in and to leave the building through purpose designed vents at roof level, which can sometimes be used as positive architectural features. Shaded balconies can complement natural ventilation and provide access to the outside, although consideration does need to be given to security (Section 2.5.5). Commercial buildings with a floor plan depth of less than 15 metres allow for the penetration of maximum daylight and for the opportunity to ventilate and cool naturally.

The need for shading may become increasingly significant as the effects of climate change are felt. In buildings where summer overheating may be problematic (e.g. commercial buildings where heat is also generated by occupants, equipment and lighting), devices such as louvres, external blinds and eaves, and well-placed deciduous planting of appropriate species can be specified to shade glazed areas and external movement areas. These shade high summer sun but allow the weaker winter and evening sun to increase the heat and light input to the building.

'Green roofs' and 'green walls' are vegetated building surfaces that can minimise solar gain, provide additional cooling that also improves the performance of photo voltaics (PVs), slow storm water run-off and provide for visual amenity and biodiversity (Section 2.6.3). Using materials that create light coloured facades to buildings can also help to minimize the need for artificial cooling.

Where mechanical cooling is required, techniques to be considered include district cooling or those powered by renewable energy technologies (Section 2.3.2). Where buildings such as hospitals and care homes to accommodate vulnerable groups are being designed, mixed mode operation can be considered. The design should eliminate the need for cooling and use natural ventilation most of the time with active cooling provided only during the hottest periods. Areas should be subject to individual temperature control as this improves efficiency as well comfort to users.

Signpost: *Good Practice Guide 290. Ventilation and cooling options appraisal. A client guide.* CIBSE

Signpost: *Good Practice Guide 291. A designers guide to the options for ventilation and cooling.* CIBSE

Signpost: *Natural ventilation in non-domestic buildings.* Application Manual AM10: CIBSE 2005

2.2.3 Adapting to Climate change

Essential Standards

- Buildings provide for flexibility of uses during their projected operational lives
- Buildings adapted to and mitigate for the effects of the urban heat island and the expected increases in hot dry summers and wet mild winters.
- Design in facilities for bicycles and electric vehicles

These standards are based on the principles of:

- Adapting to climate change
- Designing new buildings for flexible use
- Managing overheating
- Using high thermal mass materials
- Mitigating for possibilities of subsidence
- Encouraging non carbon based transport modes

Guidance on how these principles can be addressed

Adapting to climate change – climate change has significant implications for the built environment, specifically on heating and cooling requirements (see the London's Warming Report, London Climate Change Partnership 2002). Buildings and infrastructure should be designed for the climate change that they will experience over their design lifetime, or be capable of being adapted as climate change progresses. For example, wind speeds may increase in the future so air proofing of buildings could need to increase. In terms of adaptation to the effects of climate change a balance has to be struck between ventilation to improve air quality indoors versus air tightness to improve energy efficiency performance.

The main locally specific design issues relating to climate change are:

- Risk of flooding from tidal, river and heavy rainfall (section 2.4.4)
- Water resources (section 2.3.4)
- Higher temperatures
- Subsidence.

More detailed information on adaptation to climate change will be set out in the Mayor's Climate Change Adaptation Strategy currently being prepared. It is intended to publish this for public consultation in Autumn 2006.

Signpost: Detailed advice on designing development for climate change is given in the London Climate Change Partnership's *Adapting to Climate Change: a checklist for developers.* GLA. November 2005. Published by the GLA on behalf of the South East, East of England and London Climate Change Partnership

Signpost: *The Planning Response to Climatic Change; Advice on Better practice.* ODPM/Welsh Assembly/Scottish Executive. September 2004

Signpost: *Climate Change and the Indoor Environment: Impacts and Adaptation.* TM 36 CIBSE/RIBA/UKCIP 2005

Designing new buildings for flexible use - Changing economic, social or environmental demands, climate change, and the introduction of new technology can result in the original use of a building being no longer viable and its heating, lighting and ventilation systems requiring modernisation.

Wherever practical, new buildings should provide flexible space capable of multiple uses. Ground floors are particularly suited to changes of use. Provision should be made at the design stage for incorporating renewable energy sources and for combined heat and power wherever feasible.

Design attributes that contribute to achieving flexibility include:

- Use of a grid structure to provide a consistent and generic internal environment
- Use of non-load bearing partitions;
- Integration of additional service capacity and ceiling heights to facilitate changes of room use and servicing requirements.

Signpost: *Flexible building services for office based environments. Principles for designers.* TM 27 CIBSE 2005

Managing overheating – London as with all urban areas, experiences an 'urban het island effect', where higher ambient air temperatures are experienced after sunset in comparison with rural areas. The urban heat island is traditionally described as the volume of air within cities below roof level that possesses higher temperatures than the surrounding rural

air at a similar height. In London, the urban heat island can be 5-6 degrees C higher than the surrounding green belt areas. The principal causes of the heat island are the materials and layout of urban landscapes absorbing more solar radiation, combined with anthropogenic heat emissions and a loss of green space to cool off the city. This phenomenon has been found to have adverse impacts with increased morbidity in vulnerable groups such as the very young and the elderly, people with long term limiting illness, the disabled and people with mental health problems.

London has already experienced significantly high temperatures that have affected the capital's health, economy and environment. London will continue to experience progressively warmer summers and an increased frequency and intensity of very hot weather periods because of:

- Global warming induced climate change
- The intensification of London's urban heat island effect due to:
  - climate change
  - increased densification of London through new development
  - increased release of heat from energy consumption.

Mitigation measures that can be used include:

- PSD and other design measures to reduce reliance on air conditioning (section 2.2.2).
- Reducing the ratio between height and spacing of buildings (the H/W ratio) to improve air flow and cooling
- Planting trees and vegetation, including vegetated roofs and walls.
- Installing fountains and open water (section 2.3.4)
- Incorporating courtyards and shading
- In addition for commercial building stock, consideration should be given to:
  - Ground water cooling by the use of boreholes to access naturally cold water for use to cool air and as a wet underfloor cooling system.
  - Where active cooling cannot be prevented through good design mixed-mode operation using maximum natural ventilation with active cooling provided only during the very hottest periods.
  - Where vegetated surfaces are not practicable use of materials with highly reflective properties to minimise the need for cooling. This includes light coloured building and street surfaces whilst avoiding overheating and dazzling effects in nearby public realm.
  - Buffer zones can be achieved by the use of double skin façades that also allow the space to be used for air flow using thermal flue technology.

Designing for future proofing for overheating inside buildings is covered in section 2.5.2

Using high thermal mass materials – using component materials with a high capacity to store heat can help reduce variation in temperature within a building. Therefore they can help with ameliorating both high and low outdoor temperatures. Mass with a high capacity to store heat can assist in moderating temperature change by storing excessive day time heat that can be released at night. The use of appropriate materials can lead to reduced energy use. Water can also be used for this purpose. Internal structural cooling should be combined with smaller windows and higher ceilings to promote cooling by natural circulation of air. Keeping surfaces exposed is needed for this cooling effect. High thermal mass components at the core of a building can be combined with lightweight construction in areas where adaptability is needed. This will also allow for future response to further climate change.

Principles and guidance for the use of materials is covered in Section 2.3.3

Mitigating for possibilities of subsidence – this is a key issue for clay soils which lie under most of London and which it is expected to be exacerbated by the effects of climate change. Careful consideration needs to be given to the design of foundations and to the positioning and choice of trees.

Signpost: *The Mayor's Tree and Woodland Framework*. GLA/Forestry Commission. 2005

Encouraging non carbon based transport modes – carbon dioxide emissions from fossil fuel based transport contribute to climate change. Facilities can be provided in developments to support different transport modes such as the provision of bicycle racks or charging points for electric vehicles. Showers and changing facilities can usefully be provided in non residential buildings to encourage cycling.

2.3 Conserve energy, materials and water resources

2.3.1 Introduction

This section sets out policies, principles and targets so that London's buildings and development schemes make the most efficient use of natural resources throughout their life. As with other aspects, it is important that resource management is considered early in the design stage.

2.3.2 Energy

Essential Standards

- Carry out energy demand assessment
- Maximise energy efficiency
- Major commercial and residential developments to demonstrate that consideration has been given to the following ranking method for heating and where necessary, cooling systems:
  - passive design;
  - solar water heating; then
  - combined heat and power for heating and cooling (i.e.trigeneration), preferably fuelled by renewables; then
  - community heating and cooling then
  - heat pumps; and then
  - gas condensing boilers.
- Wherever on site outdoor lighting is proposed as part of a development, it should be energy efficient, minimising light lost to sky.
- Carbon emissions from the total energy needs (heat, cooling and power) of the development should be reduced by at least 10% by the on-site generation of renewable energy.

Mayor's Preferred Standards

- All developments to demonstrate that consideration has been given to the following ranking method for heating and where necessary for cooling, systems and should incorporate the highest feasible of the following options:
  - solar water heating; then
  - combined heat and power/ trigeneration, preferably fuelled by renewables; then
  - community heating.

  New developments should always be connected to existing community heating networks preferably fuelled by renewables where feasible.
- Wherever outdoor lighting or other electrically powered street furniture is proposed on site, it should be solar powered and minimise light lost to the sky.
- Lighting, heating and cooling controls should enable services to operate efficiently under different loadings and allow for localised control.
- Major developments should be zero carbon emission developments (ZEDs).

- Major developments should make a contribution to London's hydrogen economy through the adoption of hydrogen and/or fuel cell technologies and infrastructure

These standards are based on the principles of:

- The energy hierarchy
  - Using less energy
  - Using renewable energy
  - Supplying energy efficiently
- An energy demand assessment

Guidance on how these principles can be addressed

The Energy hierarchy – the sustainable supply and use of energy in London's buildings is covered by policies in the London Plan (Policies 4A.7, 4A.8 and 4A.9). It aims to ensure that emissions of carbon dioxide are minimised thorough minimising energy use, promoting energy efficiency and supplying residual energy requirements in the least environmentally damaging way possible. In particular major developments are expected to demonstrate that they have incorporated heating and cooling systems in line with the Mayor's hierarchy (Policy 4A.8).

Appendix D provides more detail on addressing this hierarchy through the completion of an energy statement as part of specific planning applications, particularly in relation to Combined Heat and Power/Trigeneration and renewable energy technologies.

Using less energy – all new developments are required to incorporate energy efficient design and technology and renewable energy technology, where feasible (Policy 4A.7).

The majority of energy consumption occurs during building use. The energy efficiency of a building is determined largely by its design, the choice of materials, including their thermal mass and the choice of plant and equipment. Designs should allow for the maximum use of low carbon techniques such as optimising u-values and natural ventilation (section 2.2.2). Increasing the energy efficiency of a building reduces its overall energy requirement and so makes it easier for a greater proportion of its energy demand to be met by on site renewable energy production. The preferred standard extends the approach in the essential standard to all development. Experience gained in implementing London Plan Policy 4A.8 has shown that there are opportunities for extending the approach to all types of development.

London Renewables has produced a toolkit for planners, developers and consultants giving guidance and information on incorporating energy efficient and renewable energy technology and design. It includes technology guides that contain brief descriptions of energy efficiency measures that should be considered at the earliest stages of design. It includes references to further sources of information on these matters. Energy savings from CHP/CCHP should be included with other energy efficiency savings before renewables are considered.

The Standard Assessment Procedure (SAP) is the Government's standard procedure for assessing home energy efficiency and carbon emissions. The SAP is intended to give householders, architects and builders a measure of the overall efficiency of a home in an easy to understand form. Non-domestic buildings over 1000 m^2 are covered by the Energy Performance of Buildings Directive (EPBD) (EU Directive 2002/91/EC). A software tool, the simplified building energy method (SBEM) has been developed to simplify the calculation methodology required to comply with the revised Part L of the Building Regulations and to produce the energy rating required under the EPBD.

Signpost: *The Standard Assessment Procedure.* (SAP) ODPM. 2005

Signpost: *Energy efficiency in Buildings.* Guide F. CIBSE 2004

Using renewable energy – major developments are required to show how they will generate a proportion of a scheme's energy demand from renewable energy sources, where technologies are feasible. The Mayor's Energy Strategy states that this proportion should be a minimum of 10 percent.

Renewable energy can be produced in a variety of ways and the Mayor encourages use of a range of technologies. The selection should be based on the mix of feasible technologies that can achieve the greatest reduction in CO_2 equivalent emissions in the specific development. Developments not initially incorporating photovoltaics(PV) should be of suitable design and orientation to support them later. Integrating PVs and green roofs can improve the performance of PVs. There are barriers to the installation of low and zero carbon technologies, such as the lack of public awareness of its benefits and of the actual costs. To overcome these barriers further work outside the scope of this SPG is needed and is being promoted by the London Energy Partnership.

SPG to the London Plan on renewable energy will give guidance on the feasibility of different renewable energy technologies in different types of

development. It will include a tool for use by planners, developers and building service engineers to calculate the contribution of renewables to fulfilling the energy demands of development. The SPG will be informed by the toolkit published by London Renewables in September 2004.

Signpost: *London Renewables, 'Integrating renewable energy into new developments: A toolkit for planners, developers and consultants'* September 2004

Signpost: *Planning Policy Statement 22: Renewable Energy.* ODPM 2004

Signpost: *Best Practice Guidance to PPS 22: Renewable Energy.* ODPM 2004

Supply energy efficiently – in many circumstances use of energy from the national supply system (gas and electricity) is not the most efficient or sustainable method. The scale of development proposed in the London Plan will enable trigeneration of cooling, heating and power (CCHP) or co-generation with combined heat and power (CHP) to be designed into schemes from the outset. All buildings in particular benefit in efficiency terms from a centralized heating system with individual time and temperature controls to each area. This can also make buildings more comfortable for the occupiers (Section 2.2.2). There are stringent safety and ventilation requirements with cost implications if tall buildings are to be supplied with gas and as a result they often have inefficient electric heating. In terms of reducing carbon emissions, the use of electric heating should be avoided.

All developments should incorporate CCHP or CHP wherever feasible. Micro CCHP/CHP can be used within small scale developments, while larger schemes work particularly well as part of mixed-use developments that include residential, which balance heat and power needs through the daily cycle. Opportunities to extend new CCHP or CHP schemes to serve adjoining areas and to link with other schemes should be sought. Energy savings from CHP/CCHP should be included with other energy efficiency savings before renewables are considered.

The European Directive of Energy Performance in Buildings (EU Directive 2002/91/EC) states that for new buildings with a total useful floor area over 1,000m^2 the technical, environmental and economic feasibility of alternative systems have to be considered before construction starts.

These technologies are:

- Decentralised energy supply systems based on renewable energy
- CHP
- District or block heating or cooling, if available
- Heat pumps under certain conditions.

A similar requirement applies to existing buildings with a total useful floor area over 1000m2 that are undergoing major renovation. Implementation of this directive should increase government, industry and public awareness and interest in the role of the built environment in reducing energy use.

An important development in CCHP and CHP systems is progress in commercial fuel cell systems. Fuel cells use hydrogen as a fuel source but do not necessarily require a pure hydrogen feedstock, with systems making use of natural or other hydrogen rich fuel e.g. methane or ethanol. Fuel cell technologies provide a highly efficient means of heat and electrical energy generation, with very low levels of harmful atmospheric emissions. Where hydrogen is produced from renewable sources, a renewable power supply or derived from biological waste then fuel cells are a renewable, virtually emission free, energy supply.

Fuel cell systems are becoming commercially available, and consideration should be given to their use during the energy demand assessment stage. Where fuel cells are not to be incorporated into a development their future inclusion should be facilitated by ensuring that the infrastructure is compatible with fuel cell requirements. These considerations are similar to general consideration around future proofing for combined heat and power, but may also include ensuring that any gas services or pipes supplying the site are of a standard capable of carrying hydrogen.

A mix of technologies can offer the greatest reduction in CO_2 equivalent emissions and local security of supply. This will depend on the type of application. The provision of a management plan for the use of the energy technology in a built development can help improve the efficiency of operation by the occupiers.

The Mayor's Energy Strategy sets out a requirement for one zero carbon development in each Borough (proposal 2). The London Energy Partnership is expecting to produce a toolkit to assist in designing low carbon developments in 2006.

Signpost: *Energy Performance in Buildings.* EU Directive 2002/91/EC

Signpost: *Part L Building Regulations.* ODPM

An energy demand assessment – major developments should provide an energy demand assessment (Policy 4A.8). This should be part of the energy statement that should accompany all planning applications, and in addition plans should show how selected energy efficient and renewable energy measures have been incorporated. The failure to submit this may result in the scheme not satisfying the London Plan energy policies.

Energy statements should contain the following sections:

1. Executive summary
2. Energy demand assessment
3. Energy efficient design measures
4. Heating and cooling systems, including Combined Heat and Power/Trigeneration feasibility
5. Renewable energy technologies
6. Conclusion and commitments

More detailed guidance on the requirements of an Energy Statement is set out in appendix D.

2.3.3 Materials

Material specification should consider the impact of infrastructure, external cladding, insulation materials, windows, flooring, paints and landscaping materials. For operational construction issues see Part 3. This document does not provide specific guidance on individual material types. The Green Guides to Specification produced by BRE provide more detailed information on the incorporation of materials into specifications.

Essential Standards

- 50% timber and timber products from Forest Stewardship Council (FSC) source and balance from a known temperate source
- Insulation materials containing substances known to contribute to stratospheric ozone depletion or with the potential to contribute to global warming must not be used
- Minimize use of new aggregates

Mayor's Preferred Standards

- No construction material nor specification with high embodied impact to be used (as defined by the summary ratings within the Green Guide to Specification) unless a compelling whole life energy or technical case for its use exists.

- 90% structural timber from FSC source and balance of timber products from a known temperate source
- No peat or natural weathered limestone used in buildings or landscaping
- 50% of construction materials by mass used in the development to be sourced from a factory/plant, quarry, wharf, railhead or recycling centre within 35 miles of site wherever feasible
- 10% total value of materials used to be derived from recycled and reused content in products and materials selected
- Before demolition, appraisal of maximising recycling of materials by use of Institute of Civil Engineers (ICE) Demolition Protocol

These standards are based on the principles of:

- Procure and use materials sustainably
- Select materials with low lifecycle impacts
- Optimise use of local materials
- Use an appropriate palette of materials

Guidance on how these principles can be addressed

Procure and use materials sustainably by:

- Reducing waste by specifying and purchasing only what is needed for the project and ensuring demolition waste is managed in line with the waste hierarchy (Part 3);
- Use Demolition protocol –Appraise for maximising recycling of on site materials (Section 2.7.2 and Part 3). When demolition is given greater priority in the project planning phase cost savings have resulted. Earliest consideration of demolition can lead to improved planning for the recovery of materials;
- Optimising use of recycled and reused materials. The Waste & Resources Action Programme (WRAP) has devised a recycled content toolkit that should be used at the design stage to assess how use of recycled and reused materials can be maximised;
- Specifying materials and components according to their required performance over their design life - select materials appropriate to the building use and locality and the delivery of design elements such as passive solar, thermal insulation or acoustic performance. Bear in mind the time period for refurbishment when considering the appropriate material specification, particularly for commercial buildings, Listed Buildings or those in Conservation Areas;
- Maximising the proportion of materials and components that can be re-used at the end of the building's life - by designing for deconstruction

and disassembly. Avoid where possible the use of composite materials that are particularly hard to recycle.

Signpost: *Opportunities to use recycled materials* WRAP 2005

www.wrap.org.uk/construction

Select materials with low lifecycle impacts – procure materials that have low lifecycle environmental and toxicity impacts. Have consideration for the impacts of material extraction, processing, manufacture, transport, use and disposal. This should include considerations of biodiversity impacts such as the use of peat, weatherworn limestone and other materials from vulnerable habitats. This applies to landscaping materials as well as buildings.

Factors to consider in making choice of materials:

- use materials with low carbon input.
- minimise new aggregate use.
- minimise use of products that have emissions damaging to the wider environment or internal air quality e.g. insulation foams using HFCs.
- maximise use of materials with recycled and reused contents.
- maximise use of timber from FSC sources. Where other temperate timber is used it should be from a known source with a sustainable purchasing policy. Defra has created a Central Point of Expertise in Timber (CPET). A timber procurement policy has been drawn up for government and CPET has evaluated 5 major certification schemes. It offers online advice on procurement.
- avoid materials such as aluminium with high embodied energy, unless a whole life energy or technical case exists for its use.

Optimise use of local materials – procure materials locally (wherever practical) to reduce their transportation impacts. This should include plant and equipment to be used in the development wherever possible. For primary aggregates, steel and glass in particular it is not always practical nor the most sustainable solution to obtain these materials locally. However it is desirable for construction materials to be procured locally ie within 35 miles of a site wherever practical.

Use an appropriate palette of materials – specified to support sustainability objectives such as passive solar design and noise attenuation, whilst considering their aesthetic qualities particularly in relation to context and setting.

Architects and developers can incorporate many of these material selection principles into their contractor briefs.

Signpost: *Green Guide to Specification.* Jane Anderson and David Shiers with Mike Sinclair. Blackwell Science 2002

Signpost: *Green Guide to Housing Specification.* Jane Anderson and Nigel Howard. BRE 2002

Signpost: *Green Building Handbook.* Tom Wooley and Sam Kimmins. Sponpress 2001

2.3.4 Water

Essential Standards

- Residential developments to achieve average water use in new dwellings of less than 40m³ per bedspace per year (approx. 110 litres/head/day)
- 100% metering of all newly built property

Mayor's Preferred Standards

- Residential developments to achieve average water use in new dwellings of less than 25m³ per bedspace per year (approx.70 litres/head/day)
- Use of greywater for all non-potable uses.

These standards are based on the principles of:

- Incorporating water saving devices
- Making use of alternative water sources
- Designing low water use landscaping and gardens

Guidance on how these principles can be addressed

London is amongst the driest capital cities in the world. The effects of climate change are likely to further reduce supply and could increase demand. Designs for buildings and landscaping should incorporate measures to avoid water wastage. Appropriate specification of bathroom and kitchen appliances can help to achieve major savings in water consumption throughout the life of the building. An array of measures will be needed to achieve the Mayor's preferred standard of 25m3 per bedspace per year including rainwater harvesting, use of greywater for flushing, small baths and showers with a low flow rate.

The principles and guidance for the use of Sustainable Drainage systems (SDS) are covered in section 2.4.4.

Incorporating water saving devices – there should be 100% use of water saving devices:-

- **Low flush toilets** – water regulations require that new toilets have a maximum flush of only 6 litres, although best practice dual-flush toilets can have flush volumes as low as 4 and 2 litres.
- **Waterless urinals** – standard urinals use around 6 to 10 litres of water to flush, waterless urinals use none. Waterless urinals can be retrofitted to replace existing flushing systems. Buildings with high occupancy rates such as schools, hotels or offices benefit particularly quickly from the installation of waterless urinals. As well as saving significant volumes of water, they are also very low maintenance as they have no mechanical components. Urinals with high levels of usage can offer savings of more than £1000 a year. However careful installation is needed to prevent hygiene and odour issues developing.
- **Taps** – spray and low flow taps, self closing or infrared controlled taps and flow restrictors are cost-effective and easy to fit. They need to be set to ensure minimal consumption of water per use.
- **Water-saving white goods** – low water use alternatives and economy options should be selected where available for washing machines and dishwashers.
- **Bathing** – showers (excluding power showers) generally use less than half the water need to take a bath. Specification of aerated spray and low flow showerheads will reduce water consumption further. An alternative is the installation of low volume baths.
- **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. A swimming pool can re-utilise its waste water by re-circulating the backwash water to the balance tank, diluting with fresh water and making use of the treatment systems that exist in the pool.

Make use of alternative water sources – utilising rainwater harvesting, water recycling and groundwater extraction where possible to reduce the use of potable water.

- **Rainwater Harvesting Techniques** – where possible, harvested rainwater should be substituted for mains water. It can be used for flushing toilets (unless harvested from a green roof), watering plants/gardens, topping up garden ponds and wetland habitats, and for general cleaning tasks such as car washing. Systems should be connected to the mains supply to ensure that water is always available, even at times of low rainfall. SDS can also be integrated with rainwater harvesting schemes and can be designed to provide water attenuation during storms.

- **Water recycling**, including greywater and blackwater systems - Greywater (water that has already been used in washbasins, showers and baths) can be filtered and disinfected before being used again in toilet flushing and other non-potable activities (e.g. watering the garden or washing the car). It cannot be used for drinking, washing, cooking and food production. Dual potable and non-potable systems should be considered. It is also possible to recycle blackwater (water used for toilet flushing and washing up) by passing it through a blackwater recycling system that breaks down solids and purifies the water ready for reuse for non potable uses. Blackwater recycling can have high maintenance costs, be impractical to use on confined sites or sites of less than 150 properties. Both grey and blackwater systems should be checked for functionality and certified safe.
- **Sourcing groundwater** from boreholes has reduced the problems of rising groundwater to Central London. The Environment Agency will permit its use for non-consumption eg closed loop cooling and heating systems. There is now limited scope for other uses. Water from boreholes is generally at a stable and relatively low temperature (around 13oC) and can be used for cooling (replacing traditional refrigeration) although not at low enough temperature to provide dehumidification. Also with increasing drier summers and higher temperatures, ground water cooling may not be a reliable or sufficient source of cooling in the future and will need to be assessed.
- **Local packaged sewage treatment systems** can be utilised for large new developments. They need to demonstrate through a comparative life cycle analysis that local treatment is the most long term sustainable option.

Designing low water use landscaping / gardens for both residential and commercial developments –

- Consider the cleaning needs of large surfaces, as this could result in significant water use.
- Dry gardens or low water use gardens/landscaping are an effective way of reducing the water consumption. Low water use gardens and landscapes can be achieved by imitating the conditions and attributes of London's vegetated brownfield sites or by working with the existing natural vegetation, or selecting drought-resistant plants, or using water-retaining mulches.
- Automatic drip irrigation systems are water efficient and cost-effective solutions that provide regular watering as required depending upon weather conditions.
- Where water features such as fountains are used they should be closed systems recycling water.

- Utilise rainwater harvesting techniques such as installing water butts to collect water from rainwater downpipe outlets to use on gardens.

Signpost: *Reclaimed Water* KS1 CIBSE 2004

Signpost: *A Toolkit for Delivering Water Management and Climate Change Adaptation through the Planning System* SEERA/Environment Agency 2005

Signpost: *Guidance on the Integration of biodiversity and water attenuation* CIRIA 2005

2.4 Reduce the impacts of noise, pollution, flooding and microclimatic effects

2.4.1 Introduction

Increased densities and mixed uses are needed to meet certain sustainability criteria, such as reducing the need to travel. However design needs to address the associated risks of this type of development increasing other adverse effects such as noise and pollution. A significant proportion of London lies within the floodplain of the River Thames and its tributaries. Increasing use of a high proportion of impermeable surfaces can also contribute to flash flooding. As such, all new development should minimise contributions to flooding and include appropriate mitigation for potential worst case situations. This section also deals with microclimatic effects such as the impact on the wind environment.

2.4.2 Noise

Essential Standard

- Demonstrate that adverse impacts of noise have been minimised, using measures at source or between source and receptor (including choice and location of plant or method, layout, screening and sound absorption) in preference to sound insulation at the receptor, wherever practicable

Mayor's Preferred Standard

- For residential development, achieve BS 8233:1999 (Table 5) 'good' standards for external to internal noise and improve on Building Regulations (2003) Part E for internal sound transmission standards by 5dB (See BRE Ecohomes)

These standards are based on the principles of:

- Using layout to mitigate noise effects
- Using building design and internal layout to mitigate noise pollution

Guidance on how these principles can be addressed

Noise can impact upon health, productivity and quality of life, particularly at home. In the future, climate change bringing increased temperatures may result in the need for windows to be open more often. However there are a number of design and layout principles that can reduce the adverse impacts of noise. The balance between noise reduction and other needs should be struck on a place-specific basis, taking account of potential changes in noise sources, and in competing needs, over the lifetime of the development.

Using layout to mitigate noise effects - during the design of layout the following factors can be used:

- **Soundscape** – the overall soundscape should be considered at the early design stage, identifying any sound features or 'soundmarks' of special interest e.g. flowing water.
- **Noise mitigation through good design** – Local Environmental Health Officers (EHOs) should be consulted on construction noise. Operational noise limits on many types of noise can be imposed at any time if a statutory nuisance occurs. Noise limits are much easier to comply with if taken into account in the design and planning stage and many can be addressed through optimising the site layout. Road traffic, railways and aircraft are the main sources of environmental noise in London, but human voices can cause disturbance – for example, school playgrounds, sporting venues and late night entertainment. Uses likely to generate significant noise should be separated from those requiring quiet, by the greatest practical distances. Where this is impractical, uses likely to generate significant noise should be separated from areas requiring quiet by screening, isolation or other acoustic design methods.
- **Noise generating activities** - Noise generating activities should be identified and low noise alternatives used where practicable. (Noise generating activities include air handling equipment, pumps, fans, vehicle manoeuvre, loading/unloading, etc)

Using building design and internal layout to mitigate noise pollution - Building design and internal layout needs to address the following issues:

- **Building over noise sources** – Such as railways, roads, car parks, etc. can be an effective way of designing out noise, although this can be expensive. Surfaces within openings, for example at each end of an

enclosed road, may need to be sound absorbing to avoid reverberation increasing noise nearby. Specialist design is needed to prevent both airborne and structure-borne noise.

- **Planning of buildings and rooms** – Buildings and rooms whose uses are not susceptible to noise should be located to act as screens or baffles between noise sources and quiet areas. Also 'stacking' of conflicting uses, for example placing bedrooms of one flat below the living area of another flat, is likely to generate noise problems or require more acoustic treatment. Windows or ventilation system design should incorporate acoustic features to address noise, especially at night.
- **Façade continuity** - Development following traditional street blocks, can significantly reduce noise from surface sources on the 'quiet side' for example within courtyards. However, reflection of sound between opposing, acoustically hard building surfaces can increase noise levels, particularly in 'urban street canyons'. Façades at a wrong angle can reflect sound into quiet areas. In compact urban environments, the use of absorptive noise barrier surfaces is preferable to inclining surfaces to reflect sound upwards.
- **Tightly-enclosed spaces between buildings** – These can be quiet, but can also 'trap' sound, including that emanating from poorly designed, installed or maintained ventilation plant, waste facilities, vehicle manoeuvring, neighbours, or aircraft. Acoustic absorbency within 'courtyard' areas should normally be maximised, by, for example, use of dense vegetation and acoustically soft ground. The balance of advantage between contained and more open layouts depends on the relative contributions of different noise sources.
- **Tall buildings** – May receive noise from a wider area than lower ones. For example, acoustic balconies with absorptive surfaces to avoid reflection off the underside into windows below, and stepping back of upper floors can provide significant benefits.
- **Positioning of building services** – Building services such as air extract ducting should be positioned away from sensitive windows and properties and be isolated from the structure to prevent structural noise. Particular care should be taken to avoid or attenuate fan and vent noise on the 'quiet side' of buildings with passive alternatives sought wherever possible.
- **Noise insulation** – Except where local soundscape quality is high or can be improved, good practice includes achieving noise insulation standards beyond those required by Building Regulations, particularly for roofs, glazing and party walls and floors. For example, lobbies with two sets of doors creating an air lock can reduce the escape of sound, from late night entertainment premises.
- **Selection of materials** – Materials with a higher density normally

provide greater resistance to the passage of airborne sounds, but may be vulnerable to impact noise particularly if hard surfaces are used. Composite or sandwich constructions may be specified to perform a variety of acoustic functions (see also waste 2.7).'Negative texture' surfaces can reduce noise not just on roads, but as sound propagates across surfaces other than those that are trafficked.

- **Innovative sustainable acoustic design** – Stack ventilation, dual facades, building integrated renewables and other sustainable design features are the subject of new fact sheets being prepared as part of the implementation of the Mayor's Ambient Noise Strategy.

Signpost: *Noise and Vibration Control for HCVA*, Guide B5 CIBSE 2002 now part of *'Heating, Ventilating, Air Conditioning and Refrigeration Guide'* B CIBSE 2005

Signpost: *Planning Policy Guidance 24: Noise*. ODPM. 1994

Signpost: *Sound conscious design; Urban design examples; Innovative sustainable acoustic design (forthcoming); Principles of acoustic design* (forthcoming).

www.london.gov.uk/mayor/strategies/noise

2.4.3 Air Pollution

Essential Standards

- All new gas boilers should produce low levels of NO_X
- Take measures to reduce and mitigate exposure to air pollution

Mayor's Preferred Standards

- Low emission developments that are designed to minimize the air quality impact of plant, vehicles and other sources over the lifetime of the development.

These standards are based on the principles of:

- Ensuring that building services plant has the lowest emissions practicable
- Protecting internal air quality

Guidance on how these principles can be addressed

The Mayor's strategy on air quality seeks to reduce emissions of air pollutants. There are a number of principles that can be incorporated into the design and construction of buildings (Section 2.5.2). It is important to consider the projected lifetime of the building and to design it to be as low

emitting as possible. Reducing emissions from the use of the building (to provide heating for internal air space and water for example) are largely brought about via the methods used to improve energy efficiency (section 2.3.2). Additional measures, as well as those to protect internal air quality are discussed below. Methods to reduce emissions from the construction phase are discussed in Part 3.

Ensuring that building services plant has the lowest emissions practicable - improving the efficiency of plant will generally lead to lower emissions; approximately 20 per cent of the oxides of nitrogen emitted in London are directly from buildings, mainly from the burning of natural gas. Low NO_X burners should be used whenever practicable. Where gas boilers are used in new buildings as an essential standard they should have a NO_X3 rating, the preferred standard would be met with a boiler of NO_X5 rating.

Protecting internal air quality – regular maintenance and inspection of plant and machinery can avoid adverse health impacts, so it needs to be designed to be readily accessible and easily maintained. All plant should be subject to a regular service agreement to maintain operational efficiency and to minimise harmful emissions. Any new specialist plant should have the lowest emissions practicable. (See also section 2.5.2). The main source of external air pollutants in London is traffic. Developments should consider the impact of external air quality on internal air quality and develop suitable mitigation to ensure that air entering buildings is not polluted.

Signpost: *Environmental Criteria for Design* – Guide A. CIBSE. 2000

Signpost: *Minimizing pollution at air intakes* TM 21. CIBSE. 2001

2.4.4 Water Pollution and Flooding

Essential Standards

- Use of Sustainable Drainage Systems (SDS) measures, wherever practical
- Achieve 50% attenuation of the undeveloped site's surface water run off at peak times

Mayor's Preferred Standard

- Achieve 100% attenuation of the undeveloped site's surface water run off at peak times

These standards are based on the principles of:

- Incorporating Sustainable Drainage Systems (sometimes also called Sustainable Urban Drainage Systems) to make surface water run off patterns more sustainable
- Protecting water quality
- Identifying potential sources of flooding and assessing their possible impacts both now and in the future
- Adopting principles of flood resistant design

Guidance on how these principles can be addressed

Much of London is situated on a floodplain and tidal water levels in south east England are rising each year. Ground water levels have also been rising in inner London (Section 2.3.4). Flash flooding can occur almost anywhere, especially in built up areas with a high proportion of impermeable surface. Predicted climate change with increases in storm episodes and sea level rises mean that it is vital that developers address future flood risk. Waste water issues are also likely to become more important with the reduced carrying capacity of rivers from lower flows in the predicted warmer, drier summers. It is important that developers engage with water utility companies as early as possible in the design stages.

Incorporating Sustainable Drainage Systems (SDS) – as an alternative to traditional approaches to managing runoff from buildings and hardstanding. SDS reduce the total amount, flow and rate of surface water that runs directly to rivers through stormwater systems which is a contributory factor in flooding incidents and affects the biological quality of waterways. It may not be possible to achieve the preferred standard in situations where a proposed development is of high density, particularly in central London or town centres or where there are high levels of contamination in ground conditions.

Site conditions to consider when assessing the suitability of different SDS approaches:

- the contaminants present in run-off
- the catchment area
- local hydrology
- the type of development.

Infiltration methods additionally need to consider:

- soil permeability
- ground stability

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

Implementation of SDS can lead to cost savings such as avoiding or reducing the need to construct or access surface water sewers or pipe connections to distant outfalls. By using landscaping features that would already be provided as part of the site scheme (e.g. grassed amenity areas, car parking) SDS offers further cost savings. SDS may also control pollution for example by incorporating petrol and grease interceptors, as well as reducing flood risk. Wherever possible multiple benefits from SDS should be sought, such as the provision of open space, wildlife improvements and water conservation. SDS should also be linked to large scale catchment based flood management. If SDS cannot be provided on site, consideration should be given to making a contribution to off site SDS. Rainwater harvesting can also offer benefits of attenuation (section 2.3.4).

Approaches to SDS include:

- **Pervious pavements** – permeable concrete blocks, crushed stone, asphalt or other surfacing allows water to infiltrate directly into the subsoil, or be stored in an underground reservoir (e.g. crushed stone layer) before soaking into the ground. This may be particularly appropriate on London Clay where infiltration is slow. If necessary, an overflow can keep the pavement free of water in all conditions.
- **Swales and basins** – provide temporary storage for storm water, reduce peak flows to receiving waters and can be created as landscape features within a site. They facilitate the filtration of pollutants, microbial decomposition and water infiltration directly in the ground. At ground level, SDS schemes often provide opportunities for the creation of wildlife habitats within swales, temporary storage areas and water bodies. The design of the green space is crucial to achieving this.
- **Ponds and wetlands** – enhance flood storage capacity, enable high levels of filtering through plants and algae and also offer the potential to recycle grey water. Ponds and wetlands can be fed by swales, filter drains or piped systems. Where practical, storm water runoff from a development can feed a pond, which overflows into a vegetated wetland area to act as a natural soakaway. Even in impermeable site conditions a sealed pond or even a storage tank can be used to discharge water at a steady rate.

- **Infiltration trenches, basins and filter drains** – infiltration trenches are stone filled reservoirs where stormwater run-off is diverted. Water gradually infiltrates the ground from the trench. Pollutant removal is by absorption, filtering and microbial decomposition in the surrounding soil.
- **Green roofs** – the plants and their growing medium (substrate) provides temporary storage of storm water. Significantly less water will flow from the roof and more slowly due to absorption by the substrate, and through evaporation and evapotranspiration from the substrate and plant surfaces. Deeper substrates offer greater SDS performance and support greater plant diversity, thus improving the energy efficiency and biodiversity potential benefits. Green wall systems can also be designed to retain water and can contribute to SDS.

Signpost: *Green roofs – research advice note.* British Council of Offices and Corporation of London 2003

Signpost: *Living roofs* Mayor of London and AUU. 2004 www.london.gov.uk/mayor/auu/livingroofs

Signpost: *Sustainable Urban Drainage Systems: an Introduction.* Scottish Environment Protection Agency, Environment Agency, Environment and Heritage Service 2003

Signpost: *Interim code of practice for SD Systems.* National SUDS working group 2005

Signpost: *Source control using constructed pervious surfaces – hydraulic, structural and water quality performance issues* (C582) CIRIA. 2001

Signpost: *Sustainable Urban Drainage Systems:* design manual for England and Wales. (C522) CIRIA 2000

Signpost: *Pollution Protection Guidelines PPG 1 General Guidelines to the Prevention of Pollution.* Environment Agency. 2003

Protecting water quality – although the provision of SDS can help to protect water sources from pollution there are a number of other design measures that could be incorporated on a site including:

- Oil separators
- Clear marking of drainage systems and correcting wrong connections

- Bunding of oil storage tanks
- Bunded chemical storage areas
- Designated fuel delivery areas
- Designated area for cleaning activities

Further details can be found by contacting the Environment Agency. www.environment-agency.gov.uk

Identifying potential sources of flooding and assessing their possible impacts both now and in the future – any development proposed needs to consider flood risk from a variety of possible sources, such as watercourses, groundwater, foul and surface water sewer and overland flow. The Environment Agency publishes flood maps showing tial and non tidal river flood plains. Other sources will need to be considered on a more localized basis. All development must conform to the sequential test set out in PPG25 (now further developed in consultation on PPS 25) and supported by the London Plan (Policy 4C.6) This makes it clear that development in functional floodplains or inappropriately defended floodplains should be wholly exceptional. Development should incorporate safe access routes above the flood levels likely during the design life of the development.

Adopt principles of flood resistant design – (Policy 4C.8). The Environment Agency is opposed to unsustainable land uses within areas of flood risk. It is working to influence development patterns to minimize risk, primarily by developing land outside flood plains first, followed by land at lowest risk in defended areas. Some forms of development need to be beside rivers, for example, boat clubs. These should be designed so that they can be flooded without causing any undue damage.

In other areas development can be designed to be flood resistant. For example putting living accommodation on the first floor or building on stilts. Roof drainage can also be designed to cope with the higher levels of rainfall and increased occurrence of storms expected from climate change.

Internal design measures include:

- Solid floors rather than suspended floors or suspended floors set above expected flood levels
- Use treated timber to resist waterlogging or marine plywood for shelves and fittings
- Fit electric, gas and phone circuits above expected flood level
- Fit one way auto seal valves on WCs
- Use water resistant alternatives to traditional plaster or plasterboarding

for internal wall finishes
- Do not use chip board or MDF eg in kitchen units
- Avoid fitted carpets on ground floor

Signpost: *Preparing for Floods* DTLR February 2002
http://www.odpm/stellent/groups/odpm_buildreg/documents/page/odpm_breg_600451.pdf

Signpost: *Strategic Planning for Flood Risk*. Association of British Insurers July 2004 www.abi.org.uk

2.4.5 Microclimate

Essential Standard
- Mitigate any negative impact on the microclimate of existing surrounding public realm and buildings to meet the Lawson criteria for wind comfort and safety.

This standard is based on the principle of:
- Avoiding creation of adverse local climatic conditions for both nature and people

Guidance on how this principle can be addressed
Some new developments, especially tall buildings can have a marked effect on local climatic conditions. These effects are particularly significant on small urban wildlife sites.

Avoiding creation of adverse local climatic conditions for both nature and people – this can be achieved by:
- **Avoiding creation of wind tunnel effect** – this is particularly marked alongside water courses or where a design creates a canyon effect that funnels winds to cause strong very localised wind effects. A wind environment assessment for tall buildings over for example 10 storeys can identify these effects at the design stages. All proposals for tall buildings should undertake a wind environment assessment to compare the wind environment to be created with that existing. The wind tunnel test should be designed to predict the wind velocities occurring in the public realm and accessible landscaped areas for comparison against the Lawson criteria. The Lawson criteria define acceptable windiness for different activities such as sitting, walking and standing.
- **Avoiding creation of deep shadows particularly over water bodies** – these can have a significant adverse effect on the biodiversity

in the water and consequent hydrological effects. Criteria set out in BRE BR209 should be addressed on this issue.

- **Improving local climatic conditions** by the retention of natural vegetation and well designed landscaping (Section 2.2.2). This can result in reduced wind speeds, appropriate shading and shelter, increased moisture retention and even local cooling of the air. The design should take into account details of surrounding landscape that affect wind patterns and solar gain.

Signpost: *Daylight and sunlight* BR209 BRE

Signpost: *Lighting Guide 10: Daylight and window design* CIBSE

2.5 Ensure developments are comfortable and secure

2.5.1 Introduction

Developments must be comfortable and safe to use for all sections of society including older people, women, children and young people, black and minority ethnic groups, disabled people and all cultures and religions.

Further clarification of comfort, accessibility and security standards can be found in the Mayor's SPG on Accessible London: achieving an Inclusive Environment and will be included in SPG on Meeting the Spatial Needs of Diverse Communities and the BPG on Urban Design Principles and the Public Realm that will be published for consultation in 2006.

2.5.2 Indoor comfort

Essential Standards

- Inert or low emission finishes, construction materials, carpets and furnishings should be used wherever practical.
- All plant and machinery should be accessible for easy maintenance

Mayor's Preferred Standard

- Design buildings for indoor comfort of users

These standards are based on the principles of:

- Designing for and managing internal air quality to benefit the health of building occupiers
- Bringing natural light into buildings and offering local control of light and temperature
- Future proofing for internal temperature comfort

Guidance on how these principles can be addressed

Designing for and managing internal air quality to benefit the health of building occupiers – the factors to be considered are:

- **Manage internal air quality** to benefit the health of building occupiers. Exposure to airborne pollutants released from within buildings can result in health impacts and allergic reactions including Sick Building Syndrome. This is a complex problem caused by a range of factors that may include airborne pollutants released from buildings. The most common impacts are odours, eye irritation and respiratory problems. Regular maintenance and inspection of plant and machinery can avoid these impacts and mitigation for prevention of these problems is needed by design.

A number of causes can be identified for adverse health impacts within buildings:

- Volatile Organic Compounds (VOCs) - Released from many synthetic materials, furnishing and chemical products. Many VOCs are respiratory irritants.
- Carbon Monoxide - Problems arise with poorly maintained equipment and when chimneys or flues are blocked, or if there is not sufficient ventilation to supply air to the appliance or where air intakes are located too close to roads or areas used for car parking.
- Fine Particles - less than 10μm in diameter can cause irritation and respiratory problems.

Building energy management systems can be used to control the mix of supply and extract air and indoor air quality particularly in office buildings can be improved. Air handling unit filtration and pollution sensors can control both internal and external air to prevent the build up of CO_2 inside buildings by diluting with external air, and the ingress of high pollution levels.

Signpost: *Sick Building Syndrome: a review SIR No 10.* HSE Guidance. 1988.

Signpost: *Environmental Criteria for Design* – Guide A. CIBSE.2000.

Signpost: *Building related sickness: causes, effects and ways to avoid it.* A.Palmer & R.Rawlings BSRIA 2002

- **Specify materials that do not contain or emit toxic substances** – Internal air quality can be significantly improved by the use of natural rather than synthetic products. Solvents and other chemicals often have

a negative impact on indoor air quality and low solvent finishing products should be used whenever possible (paints, varnishes etc.). Some construction material, furnishings and carpets can also emit substances that affect people's health (eg formaldehyde). Care should be taken to have adequate ventilation to remove these chemicals. This can be addressed when considering operational maintenance requirements if the need for them cannot be designed out by using inert or low emission products. The preference is to use inert materials where feasible.

- **Using natural ventilation** – Section 2.2.3

Bringing natural light into buildings and offering local control of light and temperature

- **Bring natural light into buildings** – a lack of natural lighting in winter can have health effects. Office environments may need artificial lighting supplemented in winter with light stimulation in the ultraviolet 280-400nm range. Development of deeper building plots, where natural light is difficult, should include internal atriums and tubular skylights directing sunlight into the building.
- **Control artificial lighting with high frequency control gear** by daylight sensors. These can dim or switch off artificial lighting when daylight levels achieve the specified illumination levels. This system will significantly reduce artificial lighting energy consumption and heat gains. It is also important to control lighting levels for the comfort of the buildings users. In large buildings this is best achieved with local controls for each area.
- **Local temperature controls** – section 2.3.2

Signpost: *The Installers Guide to Lighting design. Good Practice Guide 300.* Carbon Trust. January 2002

Signpost: *Code for lighting: Society of Light and Lighting* CIBSE 2004

Future proofing for internal temperature comfort – with the expected increases in summer temperatures and the urban heat island effect (section 2.2.3) internal temperature comfort will become increasingly important. With the exception of schools, the UK does not have a universally agreed definition or standard for thermal comfort in buildings. In the absence of an agreed criterion of 'overheating', benchmark temperatures and overheating criterion have been put forward by CIBSE as a useful guideline for designers.

Temperature thresholds in buildings (table reference CIBSE TM36, 2005)			
Building type	**'Warm' threshold temperature/ºC**	**'Hot' temperature threshold /ºC**	**Overheating Criterion**
Residential			
-living areas	25ºC	28ºC	1% occupied hours over 28ºC
-bedrooms	21ºC	25ºC	1% occupied hours over 25ºC
Offices	25ºC	28ºC	1% occupied hours over 28ºC
Schools	25ºC	28ºC	1% occupied hours over 28ºC

Signpost: *Temperature thresholds in buildings* CIBSE TM36, 2005

Signpost: *Beating the Heat: keeping UK buildings cool in a warming climate.* J N Hacker, SE Belcher, and RK Connell. UKCIP Briefing Report, UKCIP, Oxford 2005

2.5.3 Designing Inclusive environments

Essential Standards

- All developments should meet the principles of inclusive design, adopting the principles of SPG *Accessible London: Achieving an Inclusive Environment*.
- All residential development should meet Lifetime Home standards and 10% should meet wheelchair accessibility standards (London Plan Policy 3A.4)

Mayor's Preferred Standards

- All residential development should be designed to meet wheelchair accessibility standards or be easily adaptable to meet wheelchair standards
- Developments should be fully e-enabled.

These standards are based on the principle of:

- Making buildings accessible to all

Guidance on how this principle can be addressed

Making buildings accessible to all – many buildings and environments are still not designed to accommodate the wide ranging needs of disabled people, people with young children and older people. Access needs are often an afterthought, added on at a late stage of the detailed design, rarely included as a requirement in the initial brief at the beginning of the

process, resulting in undignified, segregated and inferior provision. However, for a community to be sustainable the needs of the whole community must be considered at the outset of the development process.

All new developments should meet the highest standards of access and inclusion. The vision is to create an environment in London in which all people have equal, easy and dignified access to London's buildings, places and spaces. Planning applicants are expected to address these needs early and as required by the Planning and Compulsory Purchase Act, to outline the process and standards used in Access Statements. The use of access consultancy expertise at an early stage and the involvement of disabled people in the design of the scheme through the local access groups and access fora can ensure that inclusive design is effectively implemented. The key features of Lifetime Homes and wheelchair accessibility standards are set out in the SPG to the London Plan: Accessible London: Achieving an Inclusive Environment

An inclusive environment is one which:

- places people at the heart of the design process
- acknowledges human diversity and difference
- offers choice where a single design solution cannot accommodate all users
- provides for flexibility in use
- aims to provide buildings and environments that are convenient, equitable and enjoyable to use by every one, regardless of ability, age and gender.

Accessiblity needs to be addressed in its widest sense:

- New development should be accessible for people walking and cycling and travelling by public transport.
- Safe and convenient pedestrian, cycle and wheelchair access should be provided into the site and pedestrian and wheelchair access into the building and around the site itself.
- E-enabling by the provision of accessible duct routes through buildings to facilitate installation of IT systems.

CABE has developed a set of residential standards to ensure that homes are environmentally sustainable, help to create successful places and are comfortable to use.

Signpost: *Building for Life Standards.* CABE 2003 www.buildingforlife.org/standard

Signpost: *Accessible London: Achieving an Inclusive Environment.* SPG to the London Plan. GLA 2004

Signpost: *Access Audit Handbook.* Alison Grant Centre for Accessible Environments. 2005

Signpost: *Design of buildings and their approaches to meet the needs of disabled people.* BS 8300. British Standards Institute 2001.

Signpost: *Wheelchair Housing Design Guide.* Stephen Thorpe. National Wheelchair Housing Association group. Home Housing Trust. Construction Research Communications Ltd 1997 – Revised e dition expected 2006

2.5.4 Secure Design

Essential Standard

- Developments should incorporate principles of "secured by design".

This standard is based on the principles of:

- Helping people feel safe and secure by design
- Enabling safe routes to transport.

Guidance on how these principles can be addressed

Helping people feel safe and secure by design – adopt best practice in the secure design of developments. Development schemes should incorporate measures in their design, layout, siting and landscaping to minimise the risk of crime and maximise security. The adoption of urban design principles can contribute significantly to a safer environment. Blank walls and parts of buildings such as loading bays that cannot contribute to passive surveillance, should not face onto public space but should be placed at the backs of blocks. The adoption of the 'perimeter block' layout can support these measures, comprising frontages where the public realm is readily overlooked from adjacent properties and the rear gardens are private secure areas which are difficult for third parties to access.

The following issues should be addressed in designing a development:

- The need to incorporate passive surveillance of streets, spaces, parking and servicing areas;

- The adoption of a 'perimeter block' approach wherever practicable and appropriate;
- Strong demarcation between public and private space;
- The need for public areas that are well lit and landscaping and vegetation that does not obscure views into and out of the space yet avoids obtrusive light affecting other buildings;
- The use of construction materials with an appropriate level of vandal resistance, and ensuring that maintenance arrangements are in place, and,
- The installation of sprinkler systems and hard wire smoke alarms where feasible.

Signpost: *Secured by Design*. Association of Chief Police Officers Project and Design Group. 1994

Signpost: *Designing out crime*. RVG Clarke and P Mayhew. HMSO. 1980

Signpost: *Safer Places* – the Planning System and Crime Prevention. OPDM and Home Office. 2003

Enabling safe routes to transport

- **For public transport** – Developments that will impact upon public transport provision, either through the creation of new routes or by increasing its usage should seek to ensure that:
  - Access is clearly marked and easily accessible by all sections of society;
  - Access is in a location that is overlooked by active frontages, on well-used and well-lit routes; and
  - Any landscaping and other vegetation is selected to avoid creating inappropriate screening.
- **Providing safe and secure parking for personal transport** - Development proposals can contribute to accessibility and safety by ensuring that access to parking, servicing and storage areas are safe and secure. This can be achieved through:
  - Locating surface parking areas within the private defensible space of a residential development on the street or in a well surveyed parking court overlooked by active building frontages;
  - Ensuring that parking, servicing and storage areas for cars, bicycles and other means of personal transport are well illuminated;
  - Wherever possible providing bicycle facilities inside a building or close to the main entrance, lit and unobstructed.

Designating bays for disabled and older people and people with small children close to the main entrance of buildings

Signpost: *Streetscape Guidance*. TfL August 2005

2.6 Conserve and enhance the natural environment and biodiversity

2.6.1 Introduction

Open and green spaces can contribute to the image and vitality of areas. As London becomes more compact and intensive in its built form, the value of these open spaces will increase (Section 2.1.2). Open spaces will need to fulfil a multitude of functions, from educational to social and cultural to sport and recreation as well as visual respite from the hard urban areas. The Mayor's vision for fundamental improvements in London's open environment is set out in policy 3D.7 to 3D.15 of the London Plan and also in the Biodiversity Strategy. The focus of the Biodiversity Strategy is upon biodiversity, wild species and their habitats, the natural quality of open spaces and enhancing access to natural places.

Green spaces and water spaces occupy two-thirds of London's land area and encompass a diverse range of natural environment. Of this, about a third of the total area is in private gardens, a third in parks or in sports use and a further third is in a wide range of other categories, including much wildlife habitat. These open spaces support over 1500 species of flowering plants and 300 types of birds. The diversity of wildlife they support adds to people's enjoyment of these areas. The London Biodiversity Action Plan lists 20 priority habitats and 103 priority species. The priority habitats are largely covered by Wildlife Sites identified according to the procedures in appendix 1 of the Biodiversity Strategy.

2.6.2 Open space

Essential Standards

- No net loss of publicly accessible open space
- Create appropriate new open, green publicly accessible spaces where these can address identified areas of deficiency of public open space

Mayor's Preferred Standard

- Net gain of publicly accessible open space

These standards are based on the principles of:

- Enabling easy access to open spaces
- Providing new and enhanced green spaces to serve the community-

Guidance on how these principles can be addressed

Enabling easy access to open spaces – the design of new development should:

- improve access to and the accessibility of open spaces, through support for public transport, cycling, walking and improving access and facilities for disabled people;
- improve linkages between open spaces and the wider public realm;
- ensure that the open space can be used and owned by the community;
- make use of interpretation to help improve accessibility and foster understanding and use of open space; and,
- increase confidence in using open spaces by design that is sensitive to issues of safety, anti-social behaviour and fear of crime in green spaces.

Providing new and enhanced green spaces to serve the community – where development is taking place within or near an identified area of open space deficiency new publicly accessible open space should be created. London's Open Space hierarchy (London Plan Table 3D.1) should be used as a basis for this assessment until a borough Open Space Strategy has been produced and has identified the priority needs and areas for provision. Residential development in particular should address the needs of children for playspace.

Signpost: *A Guide to Open Space Strategies: Best Practice Guide*. Mayor of London. GLA. 2004

Signpost: *Guide to Preparing Play Strategies*. Mayor of London. GLA 2005

2.6.3 Natural environment and biodiversity

Essential Standards

- No net loss of biodiversity and access to nature on thedevelopment site
- Reduction in areas of deficiency of access to nature.

Mayor's Preferred Standard

- Net gain of biodiversity and access to nature on the development site

These standards are based on the principles of:

- Conserving and enhancing the values of natural open spaces
- Protecting waterside environments whilst supporting the sustainable use of a waterside location.

Guidance on how these principles can be addressed

The Mayor's London Plan Strategic Objective 6 and his objectives for biodiversity (paragraph 2.63 of the Biodiversity Strategy) outline the values of natural open spaces which this guidance seeks to promote. The Mayor's two targets for biodiversity in proposal 70 of the Biodiversity Strategy indicate how progress will be measured.

Conserving and enhancing the values of natural open spaces can be achieved by:

- **Following an order of priority** – tThe design of developments should first enhance, second avoid harm, third mitigate, and last, where there is no alternative, compensate for biodiversity losses. 'Design for biodiversity' guidance, produced by the LDA, enlarges upon this priority sequence.

Signpost: *Design for Biodiversity.* LDA 2004 and www.d4b.org.uk

- **Give protection to Sites of Importance for Nature Conservation** - many of the features that should be protected and enhanced on a site will be included within the Sites of Importance for Nature Conservation. These are identified according to the procedures in appendix 1 of the Mayor's Biodiversity Strategy and protected in the relevant Development Plan Document.
- **Increase access to nature** – improve the natural value of accessible land on the development site or nearby, especially where this assists to reduce an Area of Deficiency in access to nature, as defined by the Mayor. Reductions in deficiency can be achieved also by improvements to access routes to natural open spaces and entrances.
- **Reduce indirect adverse effects** – design should reduce indirect impacts of the development on species, habitats and landscapes, which include visual intrusion, increased use and disturbance, hydrological changes, level of noise, pollution, shading and lighting disturbance. Design layout, building lines, levels and foundations should accommodate the root system and crown spread of established trees or other woody vegetation on and adjacent to the site. Design should provide sufficient space for the growth of vegetation. As nature comes under increasing stress from the impacts of climate change, it will become more important that the negative impacts of development on nearby areas are reduced.

- **Maintain and increase quality landscape and wildlife habitats** – developments can achieve this by:
  - linking into the existing network of natural open spaces through maintaining or contributing to 'buffer' habitat, 'stepping stones' and 'corridors';
  - incorporating gardens that provide habitat similar to hedgerows or the edges of woodlands, with trees, shrubs, climbers, borders, and both long and short grass;
  - giving priority to retaining any existing valuable vegetation on the site. Where more vegetation is required, use the existing vegetation as a starting point to inform the selection of new species that are suitable to the microclimate, soil and water regime of the site;
  - considering the particular structure of landscape or vegetation required by any important present animal and plant species present;
  - taking opportunities to green built development, including climbing plants, green walls, green roofs, roof gardens, terraces, balconies, courtyards, permeable surfaces, living fences, pergolas, arbours, window boxes, wildlife friendly landscaping and appropriate nesting and roosting structures. Such features can make a bold design statement
  - minimising the requirement for importing topsoil and using artificial irrigation.
  - using subsoil of low fertility or other local materials such as crushed concrete and by ensuring that both well and poorly drained conditions are created can promote floral diversity.
  - resourcing the ongoing ecological management of the wildlife habitat.

Signpost: *Thames Gateway: Natural Regeneration.* London Wildlife Trust and English Nature. 2005

Signpost: *Building Green. A guide to using plants on roofs, walls and pavements.* Greater London Authority. 2004.

www.london.gov.uk/mayor/strategies/biodversity/docs/Building_Green_main_text_pdf

Signpost: LivingRoofs.org www.livingroofs.org

Protecting waterside environments whilst supporting the sustainable use of a waterside location – the London Plan sets out policies for the Blue Ribbon Network which includes the River Thames, the canal network, other tributaries, rivers, streams and open water spaces

such as docks, reservoirs and lakes. The biodiversity of the waterside environment can be protected and enhanced by many of the measures listed above and specifically:

- carrying out assessments of biodiversity impact for proposed development adjacent to the Blue Ribbon Network, detailing the extent of their impact on biodiversity and mitigation measures to address any adverse impacts.
- opening up culverts, naturalising river channels and removing impounding structures where possible.
- protecting and improving water quality by ensuring that surface water run-off is managed on site, preferably with sustainable urban drainage systems, (section 2.4.4) that may provide additional wildlife habitat.

Signpost: *South London River Restoration Strategy.* Environment Agency 2002

Signpost: *North London River Restoration Strategy.* Environment Agency. Forthcoming summer 2006

2.7 Promoting sustainable waste behaviour

2.7.1 Introduction

London produces about 17 million tonnes of solid waste every year. Of this, councils collect 4.4 million tonnes from households and some commercial and industrial sources as "municipal waste". Household waste accounts for three-quarters of the total municipal waste.

The balance is made up of 6.4 million tonnes of commercial and industrial waste and 6.1 million tonnes of construction and demolition waste. Although these sectors produce more waste, they are also more efficient at reusing or recycling it than the municipal sector. In 2002/03, landfill accounted for 71 per cent of municipal waste, with around 90 per cent of this going to sites outside Greater London. A further 20 per cent of London's municipal waste is incinerated at the two waste incineration plants within London, at Edmonton and Lewisham, where the process generates electricity.

2.7.2 Waste

Essential Standards

- Minimise, reuse and recycle demolition waste
- Specify use of reused or recycled construction materials
- Provide facilities to recycle or compost at least 25% of household waste

by means of separated dedicated storage space. By 2010 this should rise to 35%.

- Recycling facilities should be as easy to access as waste facilities

Mayor's Preferred Standards

- Use prefabricated and standardised modulation components to minimise waste. If this is not feasible use low waste fabrication techniques
- Provide facilities to recycle or compost at least 35% of household waste. By 2015 this should rise to 60%.
- Provide facilities to recycle 70% of commercial and industrial waste by 2020.
- Incorporation of or access to new waste recovery facilities (anaerobic digestion, pyrolysis/gasification) especially to provide a renewable source of energy eg methane or hydrogen

These standards are based on the principles of:

- Sustainable waste management
- Designing for waste

Guidance on how these principles can be addressed

Sustainable waste management involves producing less waste, and dealing better with the waste that is produced. The waste hierarchy provides a framework for sustainable waste management.

1. Reduce the amount of waste generated
2 Reuse
3. Recycle
4. Recovery (of energy & materials)
5. Disposal - this is the least desirable option within the waste hierarchy.

This applies at all stages of development, design, construction and operation.

At the design stage development proposals should consider the following issues for the construction phase:

- Dealing with hazardous waste on site
- Reuse and recycle construction and demolition waste on site
- Maximise use of recycled materials.

Re-use and cycling of materials is covered in section 2.3.3. Construction is dealt with in more detail in Part 3.

Signpost: *Demolition Protocol*. ICE and London Remade 2003

Signpost: *Aggregates Resource Efficiency in Demolition and Construction Volumes 1-4*. WRAP 2003

Signpost: *Code of Practice on Waste Management Infrastructure in New Developments: Resource Sustainable Communities Volume 1: Waste Infrastructure and Management*. ICE/Enviro Centre/Forward Scotland. 2005

Signpost: *Site Waste Management Plans, Voluntary Code of Practice*. 139/04, DTI

Designing for waste – the design of a development is critical to ensure that sustainable waste management can be achieved. Integration of sustainable waste management principles into design includes:

- **Storage and recycling facilities** – design of suitable individual or shared waste sorting and recycling facilities (such as storage bins in kitchens and integrating recycling bins or composting areas into the building or site fabric). This needs to take account of storage needs that will be capable of meeting the future higher recycling standards. Provision of local shared recycling facilities for new residential or mixed use developments needs to be made- e.g. paper, glass, plastics, cans, and clothing. Provision should be made for local shared recycling facilities at the rate of one site per 500 persons or per 1000 habitable rooms as well as facilities for kerb side collection. Suitable recycling storage facilities should be incorporated into non-domestic developments.

- **Provision of local facilities encourages uptake** of recycling and reduces the need to drive to a central facility. Siting of recycling facilities should follow consideration of vehicular access to the site, and potential nuisance (noise) impacts on amenity

- **Composting** – provision of a composting facility in properties with gardens or landscaped space.

- **Renewable Energy** – incorporation of or access to biological waste treatment facilities to provide a renewable energy source for CCHP, CHP or district heating schemes (e.g. anaerobic digestion producing methane) (See Section 2.3.2).

Part 3 Sustainable construction

3.1 Introduction

Although many aspects of sustainable design and construction that effect how a development will operate need to be incorporated at the design stages, many aspects of the construction process can also have a significant adverse impact on the quality of the site and its surroundings. Sustainable construction makes economic sense as it involves the prudent use of existing and new resources and the efficient management of the construction process. This Part is intended to give guidance towards achieving a construction phase of development that contributes to achieving the objectives of the sustainability principles set out in Policy 4B.6 of the London Plan. Reference to achieving these standards should be included in the sustainability statement submitted with major planning applications.

3.2 Standards

Essential Standards

- Reduce waste during construction and demolition phases and sort waste stream on site where practical
- Reduce the risk of statutory nuisance to neighbouring properties as much as possible through site management
- All developers should consider and comply with the Mayor and ALG's London Best Practice Guide on the control of dust and emissions from demolition and construction
- Comply with protected species legislation
- All developers should sign up to the relevant Considerate Constructors Scheme or in the City of London to the Considerate Contractor scheme

Mayor's Preferred Standards

- All contractors should be required by tender requirements to sign up to the Mayor and ALG's London Best Practice Guide on the control of dust and emissions from demolition and construction
- All contractors should be required by tender requirements to sign up to the relevant Considerate Constructors Scheme or in the City of London to the Considerate Contractor scheme

These standards are based on the principles of:

- The construction phase of a development contributing to achieving the sustainability principles set out in Part 2 Design

Guidance on how these principles can be addressed

Waste – as part of the construction phase the treatment of waste is a crucial issue. About 80% of demolition and construction waste is currently recycled or reused in London. The target is to increase this to 95% by 2020. The waste hierarchy provides a framework for sustainable waste management that is applicable during the construction phase. (Section 2.7.2). Use of prefabricated materials and of consolidation centres can contribute to this. (see below) Preparation of a site waste management plan is considered to be good practice and is included in the ODPM draft Code for Sustainable Homes. It should identify quantities and types of construction and demolition waste, demonstrate how off site disposal of waste will be minimised and managed, better segregation for recovery of construction waste that is hazardous and reduce the amount of waste sent to landfill. Site Waste Management Plans will be required on certain construction sites in future under the Clean Neighbourhoods and Environment Act 2005.

Signpost: *Site Waste Management Plans, Voluntary Code of Practice*. 139/04, DTI

Pre-fabrication and Modular Construction – use of pre-fabricated elements and modern methods of construction where appropriate in order to reduce total energy used in the construction phase, speed up assembly, improve quality and minimise defects and wastage. The source location of pre-fabricated elements should be considered in order to minimise transportation.

Standardised or modular designs of components can reduce waste, while "just in time" construction techniques ensure that only materials that are needed immediately are kept on site. Stockpiling materials increases likelihood of damage or deterioration.

Logistics – onsider use of City Logistics / Consolidation Centres: Partnerships between local authorities, retailers and logistics suppliers can provide urban consolidation centres, improve recycling and reduce transportation by bringing aspects of the supply chain together. This can also have benefits in assisting recycling and in reducing the need for transport over long distances. It can also reduce waste by minimising packaging.

Materials and resources – the UK construction industry uses 6 tonnes of building materials per head of population each year, the vast majority of which is minerals. In addition, 6% of UK energy is used to produce and transport construction materials. Shorter journeys for materials reduce the

consumption of energy, and saves both environmental and financial costs. It is, therefore, important to source construction materials, especially the high mass materials, from as close to the development as possible. The use of water/rail transport for moving materials is also more efficient for energy use. Within London, opportunities to source new materials are few. However opportunities to recycle existing materials present on site or from nearby are significant. Their use as an alternative to freshly won aggregates avoids the aggregate levy and the landfill tax.

Proposals for development should therefore consider:

- Recycling of existing building materials on site that could then be re-used in the redevelopment e.g. crushing and reuse of concrete
- Secure recycled building materials from nearby sites
- Re-use of building materials, such as slate or clay roof tiles, bricks and wooden structural beams that can be safely removed from a building prior to demolition. .

In terms of the construction operations, proposals should consider the following issues:

- Reduce waste by specifying and purchasing only what is needed for the project and ensuring demolition waste is managed in line with the waste hierarchy.
- Sort waste streams to maximise recycling and reuse of waste and decrease landfill costs.

Carrying out a pre-demolition audit can also be useful prior to refurbishment to identify value and recovery options for existing materials and products (Section 2.3.3).

This document does not provide specific guidance on individual material types. More detailed information on common materials can be found in the Green Guides to Specification produced by BRE (See also section 2.3.3)

Signpost: *Ecohomes: The environmental rating for homes,* BRE 2000

Signpost: *Transport and buildings: the environmental impact,* BRE 1999

Signpost: *Demolition Protocol.* ICE and London Remade 2003

Air quality – the Mayor and ALG's London Best Practice Guide on the control of dust and emissions from construction and demolition is currently in draft form, following consultation in early 2006. A final version will be released later in 2006. It sets out the steps that need to be taken. It covers the need to identify potential sources of dust and other air pollution as early as possible and implement the following dust control measures:

- Activities that may affect air quality or generate dust should be located away from sensitive human receptors (e.g. hospitals, schools, housing) and ecological resources whenever possible. Note that the Environmental Protection Act 1990 requires the implementation of Best Practicable Means to control dust.
- Completed earthworks should be sealed or replanted as early as practicable.
- Where practicable, stockpiled materials should be located to take account of the prevailing wind and any sensitive receptors. Stockpiles should be dampened.
- Dust sources such as skips should be covered.
- Roadways (including haul roads), construction sites and dust generating activities such as stone cutting should be dampened and swept when required.
- Sites should be designed to accommodate wheel washer facilities as appropriate.
- Low emission vehicles and plant equipment should be used particularly for on-site generators.
- Controls also need to be in place during demolition. Dampening down during demolition activities can assist with preventing dust pollution.

Equipment – equipment should be as efficient as possible and well maintained to minimise energy use and emissions. This includes the vehicles that transport materials and personnel to and from site.

Construction noise – construction noise and disruption should be minimised through the specification of techniques such as the use of framed construction and pre-fabricated components. These can reduce some of the noise impacts associated with both the transportation and use of materials. Construction activities should be planned to limit both the level and duration of noise, to minimise disturbance to premises and amenities in the area. Consultation with Borough Environmental Health Officers (EHO) is needed at an early stage. Noise issues are part of Considerate Constructors Schemes.

Biodiversity and pollution prevention – CIRIA has prepared biodiversity indicators for construction, which involve an assessment of the construction process. Areas of existing value that are to be kept and enhanced must be secured from harm during construction, including existing trees and waterside zones, preferably through being fenced securely. Other impacts to be avoided can include such things as soil compaction, and pollution of soils and water. Where construction activities require temporary access over, or removal and replacement of, habitat these operations should be supervised by trained staff, or a qualified ecologist.

Where protected species are involved there may be a statutory requirement for obtaining a license and the work may need to be undertaken in a particular season. Such restrictions can be quite wide (for example all nesting birds are protected from disturbance under the Wildlife and Countryside Act 1981, as amended).

On all construction sites it is good practice to compost organic wastes on site to supplement topsoil for landscaping and also conserve topsoil on site with as little disturbance as possible.

Physical protection should be given to existing trees and waterside zones during construction. Around 3% of serious water pollution incidents are caused by construction and demolition industries. The Environment Agency should be contacted about all discharges to be made off site.

Signpost: *Pollution Prevention Guidelines 6: Working on construction and demolition sites.* Environment Agency

Signpost: *Biodiversity and construction: working with wildlife.* (E3217) CIRIA. 2003

Considerate Contracting – nuisance dust emissions and noise generation from construction-related activities are common problems for property occupants close to demolition and construction sites and construction activities are responsible for more recorded pollution incidents than any other industrial activity.

Many London boroughs have declared air quality management areas and are required to reduce pollutant levels within their areas. Emissions caused by construction and demolition can be significant locally and should be minimised. Six London boroughs already have Construction Codes of Practice.

Signpost: Considerate Constructors Scheme - www.considerateconstructorsscheme.co.uk

Appendices

Appendix A Sustainability appraisal methodologies and checklists

The following methodologies are currently in use:

BRE BREEAM, EcoHomes & Sustainability Checklist

BREEAM is widely accepted as a benchmark for measuring environmental performance. It offers an independent assessment of a proposal using a range of criteria for which credits are given to reward positive steps taken. The number of credits attained are interpreted in the form of an overall rating of Excellent, Very Good, Good and Fair. BRE / ICE have developed a civil engineering companion assessment tool named CEEQUAL.

Sustainability Appraisal

This assessment technique is a qualitative exercise that uses the expertise of appraisers to assess how a given proposal is aligned with sustainable development objectives. Aspects requiring further consideration or revision are identified and recommendations are made. The outputs from an appraisal are used in future revisions of the proposals with the intention of continued improvement in sustainability performance.

Arup SPeAR

The Sustainable Project Appraisal Routine is based on a four quadrant model that structures the issues of sustainability into a robust framework focusing on environmental protection, social equity, economic viability and efficient use of resources. The techniques allows a visual profile of sustainability to be produced.

Entec Guide to Sustainability Appraisal

This guide presents a review of sustainability appraisal as a tool for integrating the concept of sustainable development into planning decision making. It introduces the methodologies for undertaking sustainability appraisals highlighting the evolution of the technique and the overlaps with other forms of strategic and project level appraisals.

Housing Corporation Sustainability Works

This is an on-line facility offering guidance on how to embrace the social and environmental agenda of sustainability. The site includes best practice information as well as advice on the use of assessment tools such as EcoHomes and Housing Quality Indicators.

CABE Design Quality Indicators

This method for assessing the design quality of a proposal involves a non-technical questionnaire looking at functionality, build quality and

impact. The process is envisaged to be used throughout the life cycle of a development including briefing, mid-design, ready for occupation and in-use.

SEEDA Sustainability Checklist

The checklist presents positive measures to be taken to reduce environmental impact or enhance environmental, social and economic benefits. The checklist addresses issues in ten sections that underlie the principles of sustainability. Issues related to buildings and infrastructure are treated in individual chapters in order to allow specific requirements for individual buildings to be assessed without the whole checklist needing to be completed.

Environmental Impact Assessment

Environmental Impact Assessment is applied to particular development projects as set out in EIA Regulations that are likely to have significant environmental effects. For developments that are subject to EIA, the issues covered by the other types of sustainability assessment listed above would normally be expected to be included within the Environmental Statement.

Appendix B Supplementary Planning Guidance and Best Practice Guidance

The London Plan provides the framework for the Mayor to produce more detailed strategic guidance on issues that cannot be addressed in sufficient detail in the plan. To provide detailed advice on its policies, Supplementary Planning Guidance (SPG) and Best Practice Guidance (BPG) documents are being produced. They are initially published in draft for consultation.

SPG documents

Accessible London: achieving an inclusive environment

This SPG provides detail on the policies in the London Plan which promote inclusive design. It sets out a framework and policies for achieving the highest standards of safe, easy and inclusive access for all people, regardless of disability, age or gender. It will be of interest to all planning authorities in London, developers including house builders and housing associations, designers, planners, access officers, and voluntary organisations, particularly disability organisations.

Draft published July 2003

Final publication 27 April 2004

Industrial Capacity

Supplementary Planning Guidance on implementation of the Plan's policies to ensure adequate industrial capacity to meet London's needs and, in line with the national requirement, manage and coordinate the release of surplus stock. The SPG will also detail how the wider policies in the London Plan bear on employment land, in line with national policy. Surplus employment land should help meet strategic and local requirements for other uses such as education and community activities and, in particular, housing.

Draft published September 2003

Final publication Summer 2006

Housing including Affordable Housing

Supplementary Planning Guidance on planning for housing provision, including guidance on how UDP policies should promote future housing provision in line with the London Plan policies will be set out in Supplementary Planning Guidance. Further guidance on the basis for setting borough affordable housing targets consistent with the Londonwide target, and which recognise sub-regional and regional demand/capacity mismatches, will be set out in Supplementary Planning Guidance on Affordable Housing.

Affordable Housing:

Draft published July 2004 and December 2004

Final publication November 2005

View management framework

The Mayor proposes that the current views set down in Government. Directions should be replaced by this plan and forthcoming Supplementary Planning Guidance, which he will produce in collaboration with boroughs, English Heritage, the Royal Parks and other organisations represented at the EIP. The proposed view management plans will be an integral part of the proposed Supplementary Planning Guidance.

Draft publication spring 2005

Final publication Summer 2006

Land for transport functions

London has experienced problems in retaining land for transport purposes and in new land being made available for expanding transport provisions, for example, to support the large growth in bus services by provision of terminals and garages. Transport needs to be provided where activity is most intense, where land is scarce and competition from other uses is strongest.

Draft publication May 2006

Final publication 2007

Renewable energy

The Mayor in partnership with London Renewables will produce Supplementary Planning Guidance on renewable energy. The Mayor will encourage use of the range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible. Work on feasibility will be attached to Supplementary Planning Guidance and so be subject to public consultation.

Draft publication Late 2006

Final publication 2007

Meeting the spatial needs of London's diverse communities

Not only are some communities and individuals disadvantaged by where they live, some also experience other forms of disadvantage and discrimination. The key spatial and land use issues faced by different communities in outlined in the London Plan. Building on these issues the Mayor will prepare Supplementary Planning Guidance to help boroughs implement policy 3A.14.

Draft publication summer 2006

Final publication 2007

Retail need assessments

Guidance on implementing policy to meet strategic needs, including reconciliation with local capacity, in terms of broader town objectives and the sequential test. A sequential approach to identifying suitable sites. Sub-Regional Development Frameworks will be central to this process.

Draft publication summer 2006

Final publication 2007

Best Practice Guidance

Development Plan Policies for Biodiversity

The Mayor expects the biodiversity and natural heritage of London to be conserved and enhanced for the benefit of this and future generations. He will assist boroughs in doing this with advice on UDP policies for biodiversity. Planning applications should give full consideration to the effects, both direct and indirect, of development upon biodiversity and wildlife habitat. Indirect effects include increased use and disturbance, hydrological changes, level of noise, pollution, shading and lighting disturbance.

Draft published October 2004

Final publication November 2005

Guide to Preparing Open Space Strategies

The London Plan recognises the valuable contribution that open spaces play in providing a good quality environment that makes London an attractive place to live, work and visit. In order to understand fully the provision of open space and the demands and needs placed on them, the London Plan states that the Boroughs should produce an Open Space Strategy. The Guide will assist this process and establish a common framework for benchmarking and strategic planning in London. The Guide sets out practical guidelines on the methodology and content of an Open Space Strategy within the London context. It provides advice on assessing the quantity and quality of open spaces and in identifying the needs of local communities and other users of open spaces

Draft published June 2003

Final publication 29 March 2004

Managing the Night Time Economy

The Mayor will work with strategic partners to develop a coherent and strategic approach to managing the night time economy. In doing so they should involve stakeholders, including their local communities.

Draft publication Spring 2006

Final Autumn 2006

Urban design and the public realm

Good design is rooted firmly in an understanding and appreciation of the local social, historical and physical context, including urban form and movement patterns and historic character. London is highly diverse and constantly changing, but developments should show an understanding of, and respect for, existing character. The Mayor has already produced some guidance on best practice for well-designed higher density housing.

Draft publication summer 2006

Final publication 2007

Tomorrow's suburbs

In collaboration with boroughs, the Mayor will prepare good practice guidance and a 'sustainable suburbs' toolkit to guide development policies in suburban centres, employment areas, neighbourhoods and heartlands.

Draft publication February 2005

Final publication May 2006

Health issues in UDPs

Health is far more than the absence of illness; rather it is a state of physical, mental and social wellbeing. A person's health is therefore not only linked to age and gender, but to wider factors such as education, employment, housing, social networks, air and water quality, access to affordable nutritious food, and access to social and public services in addition to health care. The Mayor will, in collaboration with strategic partners, produce additional guidance to boroughs on promoting public health.

Draft publication summer 2006

Final publication 2007

Appendix C

Websites

Association for Environmental Conscious Building	**www.aecb.net**
Beddington Zero Energy Development	**www.bedzed.org.uk**
BEDZED	**www.bedzed.org.uk**
Building Research Establishment	**www.bre.co.uk**
CABE and CABESpace	**www.cabe.org.uk**
Carbon Trust	**www.thecarbontrust.co.uk**
Centre of Alternative Technology	**www.cat.org.uk**
Centre of Excellence for Sustainable Buildings	**www.sustainable.doe.gov.uk**
Chartered Institution of Building Services Engineers (CIBSE)	**www.cibse.org**
CIRIA	**www.ciria.org.uk**
Clear Skies	**www.clear-skies.org.uk**
Combined Heat and Power Association	**www.chpa.gov.uk**
Constructing Excellence	**www.constructingexcellence.org.uk**
Construction Resources	**www.ecoconstruct.com**
Central Point of Expertise in Timber (CEPT)	**www.proforest.net/cpet**
Energy Efficiency Advisory Service	**www.saveenergy.co.uk**
Energy Saving Trust	**www.est.co.uk**
English Heritage	**www.english-heritage.gov.uk**
Environment Agency	**www.environment-agency.gov.uk**
Forest Stewardship Council	**www.fsc.org**
Green Building Store	**www.greenbuildingstore.co.uk**
Green roofs	**www.greenroofs.com**
High performance maps for facades	**www.fabermaunsell.com**
Housing Corporation	**www.sustainabilityworks.org.uk**

Integer	**www.interproject.co.uk**
LEARN: Low Energy Architecture Research Unit	**www.unl.ac.uk/LEARN/**
Lifetime Homes	**www.lifetimehomes.org.uk**
Living roofs	**www.livingroofs.org**
London Biodiversity Partnership	**www.lbp.org.uk**
London Hydrogen Partnership	**www.lhp.org.uk**
London Remade	**www.londonremade.com**
Recycled Products	**www.recycledproducts.org.uk**
Rethinking Construction	**www.rethinkingconstruction.org**
Secured by design	**www.securedbydesign.com**
Sustainability Works	**www.sustainabilityworks.org.uk**
Sustainable City Initiatives	**www.lsx.org.uk**
Sustainable Construction	**www.sustainable-construction.org.uk**
Sustainable Homes	**www.sustainablehomes.co.uk**
Tall Buildings	**www.cityoflondon.gov.uk**
UK Government Sustainable Development	**www.sustainable-development.gov.uk**
Water Technologies	**www.eca.gov.uk**

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Glossary

BREEAM

Building Research Establishment Environmental Assessment Method – independent appraisal method to certify environmental performance of a building.

Embodied Energy

The total life cycle energy used in the collection, manufacture, transportation, assembly, recycling and disposal of a given material or product.

Inclusive design

- places people at the heart of the design process
- acknowledges human diversity and difference
- offers choice where a single design solution cannot accommodate all users
- provides for flexibility in use
- aims to provide buildings and environments that are convenient, equitable and enjoyable to use by every one, regardless of ability, age and gender.

Lifecycle or Whole Life Impacts

Assesses the impacts of a product or operation on the environment throughout its life e.g. from production and manufacture, operational and maintenance, through to final disposal/demolition.

Low Emissivity Glazing

Low emissivity glazing is double glazing where the outer pane is coated with a transparent layer that reflects back radiated heat. This greatly increases the insulation levels of the window.

Microclimate

A microclimate is where a certain area is able to maintain distinct environmental conditions by virtue of its design in relation to its surroundings. Microclimates can be created using shading or ventilation.

Open space

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

Passive Solar Design

Passive solar design refers to the use of solar energy for the heating and cooling of buildings. Using this approach, the building itself or some part of it will take advantage of the natural energy in materials and air created by exposure to the sun.

Photovoltaic Cell (PV)

Converts solar energy into electricity. Interconnected cells are encapsulated into a sealed module that produces a voltage.

Previously developed or brownfield land

Includes both land and premises and refers to a site that has previously been used or developed and is not currently fully in use, although it may be partially occupied or utilised. It may also be vacant, derelict or contaminated. This excludes open spaces and land where the remains of previous use have blended into the landscape, or have been overtaken by nature conservation value or amenity use and cannot be regarded as requiring development.

Renewable Energy

Renewable energy is that generated from sources that do not require the use of exhaustible materials (such as fossil fuels).

Strategic and Major developments

There are two levels of major development addressed by the SPG and the London Plan policy (4B.6):

- Strategic Developments Referable To The Mayor.

The Mayor's London Plan policy refers only to planning applications which must be referred to the Mayor according to Parts I - IV of the Town and Country Planning (Mayor of London) Order 2000. Examples include 500 dwellings, 30,000 sq m commercial space in the city, 20,000 sq m and 15,000 sq m of commercial space in and outside Central London respectively.

- Major Developments As Defined By The Boroughs.

Each borough is able to define what it considers to be a major development. It is suggested that the definition adopted by boroughs is that currently used both by the ODPM PS2 form that each district planning authority must use to report general developments, and by other London boroughs that have already adopted or are in the process of adopting a similar policy.

- Major Developments can be defined as:

For dwellings: where 10 or more are to be constructed (or if number not given, area is more than 0.5 hectares).

For all other uses: where the floor space will be 1000 sq metres or more (or site is 1 hectare or more). Area of site is that directly involved in some aspect of the development. Floor space is defined as the sum of floor area within the building measured externally to the external wall faces at each level. Basement car parks, rooftop plant rooms, caretakers' flats etc. should be included in the floor space figure.

U Value

The U-value (or heat loss factor) is the measurement used to express the thermal performance of a material. The lower the U-value, the less heat is transmitted through the material. The U-value is a measure of the rate of heat loss (measured in Watts) per unit of surface area (measured in square metres) for a temperature differential of 1 degree Kelvin (K) on either side of the material, hence W/m2K.

Appendix D

Energy Statements

Appendix D provides more detail on addressing the energy hierarchy through the completion of an energy statement to accompany specific planning applications.

Suggested Outline Structure

1 Executive Summary

The following information should be set out:

Energy demand – completion of the following table is recommended:

KWh		Carbon dioxide (%)
Baseline emissions		
Savings from energy efficiency		
Savings from renewable energy		

Key energy efficient design measures

Heating and cooling system incorporated (including outcome of CHP/Trigeneration feasibility study)

Choice of renewable energy technology.

2 Energy demand assessment

Applicants should complete the following table to demonstrate the likely heating, cooling and electricity demand. The purpose of this information is to help identify the technical feasibility of energy efficient and renewable energy technologies, and to identify where an applicant can make the most effective energy and carbon emissions savings in a scheme. It will also validate whether a scheme achieves the Mayor's 10% target for reduction in carbon emissions from renewable energy technologies.

Total energy efficiency savings vs baseline scheme (annual figures)

	1.8.1.1 Baseline scheme (see assumptions and benchmarks below)		**1.8.1.2 Proposed scheme** (Incl. energy efficient design and technology)		**1.8.1.3 Change**	
kWh		Kg/CO_2	kWh	Kg/CO_2	KWh	Kg/CO_2
Electricity						
Heating						
Cooling						
Total						

Energy efficiency savings summary

	Amount	%
Reduction in energy demand (kWh)		
Reduction in CO_2 emissions		

Renewable energy savings
Carbon dioxide emissionsreductions

	Amount (kg CO_2/year)	%
Required CO_2 reductions from renewable		10%
Proposed CO_2 reductions from renewables:		
	Amount (kWh)	%
Required energy generation from Renewables		10%
Proposed energy generation from Renewables:		

3 Energy efficient design

Part L building regulations 2006 will be the baseline standard that all new buildings must meet. The policies in the London Plan are not in place to duplicate regulations. Energy statements should therefore set out the architectural and building fabric measures specific to the scheme and demonstrate the extent to which they exceed building regulations. Applicants are encouraged to demonstrate site-specific or innovative measures that show energy efficiency is fundamental to a scheme's design.

4 Heating and cooling systems

All planning applications should demonstrate how they have applied the Mayor's heating and cooling hierarchy. In particular, all applications should investigate the feasibility of Combined Heat and Power and Tri-generation. These technologies are technically dependent on available power, heating and cooling loads. Where a mixed-use scheme is proposed, applicants should demonstrate a site-wide consideration of energy.

5 Renewable energy technologies

Energy statements should set out consideration of each renewable energy technology in Policy 4A.7 of the London Plan. Where the Mayor's 10% target has not been achieved, scheme-specific justification is required. All technologies listed in the London Plan 4A.7 are considered potentially technically feasible in London. In particular, wind and biomass should not be rejected on generic planning grounds, and applicants are expected to demonstrate limitations, or discuss them at the pre-application stage.

6 Conclusions and Commitments

To assist in the completion of the energy statement the following fundamental principles from the London Plan policies should be borne in mind:

- Policy 4A.7 requires the incorporation of energy efficiency measures and renewable energy measures. Planning applications should demonstrate that the feasibility of energy efficiency measures and renewable energy technologies have been investigated, and the incorporation of one is not sufficient justification to reject the other where it is feasible to incorporate both energy efficiency and renewable energy.
- The energy hierarchy, in paragraph 4.19 of the London plan, states that applicants should apply the sequence of (1) using less energy, (2) using renewable energy and (3) supplying energy efficiently. Policies 4A.7 and 8 establish that applicants are required to incorporate

measures in accordance with this hierarchy where feasible. For the purposes of calculating the proportion of energy demand met by renewable energy technologies, the required energy from renewable sources is determined once the reduction in demand from (1) and (3) have been calculated.

- The Mayor's energy strategy policy 13 states that the Mayor will expect applications referable to him to generate at least 10% of the site's energy needs from renewable energy on the site where feasible. This target will be applied through policies 4A.7 and 4A.9 to consider the extent to which renewable energy technologies meet objectives of these policies.
- Green tariff electricity is not counted towards the consideration of on-site generation or of a scheme's ability to meet the Mayor's 10% target.

Outline planning applications

Outline planning applications need to fully address and commit to energy measures. Depending on the matters to be considered, applicants should still undertake initial feasibility work on all the aspects set out above. The energy statement should address a site-wide energy strategy to form the framework of consideration for reserved matters applications. The structure should be the same as set out for full planning applications. Local Planning Authorities should secure conditions to ensure that reserved matters applications contain an energy strategy that demonstrates consistency with the outline energy strategy.

The use of planning conditions

For full planning applications, planning conditions should be used to secure the outcome of proposed energy efficiency and renewable energy measures in detailed designs and to ensure that commitments are implemented. Conditions should not be used to secure feasibility work to determine energy efficiency and renewable energy measures for a scheme. The technical and economic feasibility of such measures can be influenced by the stage at which they are considered in the design process. With the planning guidance now available, and the established London Plan policies, energy should be fundamental to any new planning application.

Appendix E Case studies

The numbers refer to the sections in the main document.

2.1 Re use Land and Buildings

Demolition of poor quality buildings to enable efficient re-use of land

Marsham Street, Westminster

One of London's most notorious eyesores, the former Department of the Environment building in Marsham Street, Westminster, has been demolished and the site re-used for a new headquarters for the Home Office and prison service.

The development is being delivered by a special purpose vehicle (Annes Gate Property PLC) which conceived the opportunity to remove the notorious government blocks to replace them with a modern and efficient mixed use development.

The new complex which includes housing and shops, was completed in 2005, but some retail units are yet to be let.

Conversion of major disused landmark for new cultural uses

Tate Modern

The transformation of Bankside Power Station into Tate Modern began in 1995 with the removal of all the power station machinery ('de-planting') by the previous owners, Magnox Electric plc. Tate Modern is a substantial building conversion in the heart of London by the Swiss architects Herzog & de Meuron. The building consists of a brick-clad steel structure, constructed from more than 4.2 million bricks.

The original Bankside Power Station was designed by Sir Giles Gilbert Scott. The conversion has highlighted the building's new function while respecting the integrity of the original design.

Work on the first piece of construction, a vast concrete raft, forming a foundation on which the museum sits, commenced during October 1997. The most noticeable change to the exterior of the building is a new two-storey glass structure or lightbeam spanning the length of the roof which not only provides natural light into the galleries on the top floors, but also houses a café offering views across London.

Utilising roof space to provide amenity

Springbok works, Dalston

Springbok Works was built in 1932 as a spring mattress factory. It is three storeys high and 90m_2 in area. In 1998 it was converted into an

apartment, a studio and a workshop. The flat roof was converted to a large roof terrace with a play area and garden. The roof terrace provides the sole external amenity space to the new dwelling. The project was completed in 2000.

2.2 Maximise use of natural systems

Utilising innovative form to maximise benefits and minimise impacts of air flows

Swiss Re Headquarters, 30 St Mary Axe

This distinctive world class landmark building in the heart of London's financial centre is the capitals first bioclimatically designed tall building. The building materials, form and structure are a direct expression of the fundamental environmental considerations that informed the design process.

The building design develops concepts first explored in the 'Climatroffice' by Buckminster Fuller in the early 1970's. Modern digital technologies have allowed this concept to be refined. The resultant form has produced a highly innovative and efficient 'diagrid' structure achieved in part by using the aerodynamic properties of the building to encourage wind flows around its face thus minimising wind loads.

Natural air movements are facilitated by the buildings curved form which generates substantial air pressure differences across its face. Air is drawn through lightwells that spiral up the length of the building. Air is oxygenated during the day by trees and plants in 'sky gardens'. Openable windows allow this air flow to be controlled by the office users directly. This enables significant reductions in energy consumption to be made by offering an alternative to mechanical cooling and ventilation systems for up to 40% of the year.

The glazing of the office areas comprises of two layers of glass with a cavity ventilated by used air drawn from the offices. This enables solar radiation to be intercepted before it reaches the office spaces and so reduces the air conditioning requirement.

The relatively small circular building footprint allows outdoor space at ground level to be provided even on a tight city centre site occupied by a tower. Unlike a conventional rectilinear tower, wind is not deflected to ground level which helps to maintain pedestrian comfort and safety at the base of the building thus encouraging use of the space.

Passive design and energy efficiency

Coningham Sure Start Building, Shepherd's Bush

The Sure Start building was constructed to be highly energy efficient and features well insulated walls, floors and roof. Part timber frame construction has been used in conjunction with high performance insulation and ground floor masonry providing good thermal mass. The roof is covered by a living green sedum blanket. To counter summer overheating in south facing rooms, shading is incorporated into the design. Natural daylight is provided in every room from at least two directions and sunpipes are also used to provide additional natural sunlight to some of the ground floor areas. A natural passive stack ventilation system has also been installed.

Designing for flexibility

Alexandra Park School, LB Haringey

A new sixth form extension to the school was designed for maximum flexibility. The buildings are constructed with a simple concrete frame with exposed concrete ceilings to provide good thermal mass. The buildings are also designed to avoid the use of mechanical cooling systems. The buildings are carefully orientated with use of external shading to avoid excessive heat gain. The supply and circulation of fresh air is assisted by the use of chimneys in the centre of the building. Rooms for noise sensitive uses had to be carefully located and materials selected with sound reducing and absorbing qualities. An underground tank is used to collect rain water that can be used for flushing toilets.

2.3 Conserve energy materials and water resources

Sustainable energy system for a town centre

Thameswey Energy Ltd, Woking

Woking Borough Council established a wholly owned Energy and Environmental services Company (ESSCo) called Thameswey Ltd. in 1999 as a first step towards establishing a sustainable energy system financed primarily from the private sector. This ESSCo has in turn formed a public/private joint venture Energy Services Company (ESCO) called Thameswey Energy Ltd., which is in part owned by Thameswey Ltd., and part owned by a Danish ESCO. Thameswey Energy Ltd developed the first town centre private wire CHP / absorption cooling trigeneration district energy system in the UK. The project comprises 1.46 MWe of CHP, 1.4 MW of heat fired absorption cooling and 163,000 litres of thermal storage distributed over a number of mixed use buildings in Woking town centre. Buildings are interconnected with heat and chilled mains and high voltage / low voltage private wire networks. The system is a distributed

generation system able to grow organically with the connection of further buildings simply by adding more CHP or renewable energy into the private wire district energy network. Woking Borough Council reduced CO2 emissions in its own buildings and transport by 75 per cent between 1990/91 and 2002/03, along with energy savings of 46 percent.

Woking Borough Council and Thameswey also established the first fuel cell in the UK, a 200 kW CHP system alongside 1 MW CHP system, again with thermal storage and heat fired absorption cooling in Woking Park serving three swimming pools, a leisure centre and local residents in sheltered housing. The fuel cell quadgeneration system provides low grade heat to the swimming pool water, high grade heat to the district heating system (where the return water is also recycled back into the low grade heat circuit), chilled water for air conditioning cooling water and dehumidification and 100% pure water (which are the emissions of the fuel cell) via a water recovery system.

The Woking 'dilution economics' approach to projects, where mixed green energy technology systems can finance new technologies such as fuel cells and solar energy by diluting the costs into larger commercial energy generation applications, such as CHP, has enabled Woking to install the largest concentration of solar energy photovoltaics in the UK at more than 10% of total UK installed capacity. This demonstrates how a holistic approach to projects and new development can achieve high levels of renewable energy and even hydrogen fuel cells.

Energy efficiency at the heart of Parliament

Portcullis House, Westminster

Portcullis House is the relatively new parliamentary building adjacent to the Palace of Westminster which provides offices, committee rooms and other facilities for MPs.

The building was conceived with the principles of energy efficiency at the heart of the project. The energy consumption target is 90kWh/m^2 (based on a 50 hour week). This compares with 124-140 kWh/m^2 for an air conditioned building with comparable use.

Portcullis House uses a courtyard form to provide the maximum amount of internal space capable of utilising natural light. Offices are no more than 5.4m deep to ensure adequate lighting. Daylit offices therefore reduce daytime energy needs considerably. Internal corridors are lit using reflected light from lightshelves above the windows via glass partitions at the top of the walls. Daylight is controlled using a blind over the bottom

half of the window to reduce glare without reducing the amount of light in the room.

Although the building uses a mechanical ventilation system, refrigeration energy is saved by using 100% fresh air drawn from the base of the buildings in 14 turrets. This also reduces the need for refrigerants. Air is circulated via bronze airshafts to each room having very low pressure loss air handling and duct system components.

Cold water in a borehole in the basement is used for cooling as part of the air conditioning process. The need for cooling is minimised by the provision of significant shading devices.

The building is in effect one large solar collector. The buildings fabric has a high thermal mass which enables heat to be stored until it is needed to be used. Dark coloured blinds and materials on the façade absorb heat which is recovered by heat exchangers in the turrets and is released in the building. Gas-fired condensing boilers provide the main heating source. The building also has a highly efficient triple-glazed facade with adjustable dark-coloured blinds in the inner cavity. Exhaust air from the rooms is drawn through the inner cavity, reducing the heat gain in summer, and heat loss in winter, the dark blinds act as solar collectors in winter.

Renewable energy in a school

St James Catholic High School, LB Barnet

The school received support from the council and from Creative Environmental Networks (CEN) as part of the REAL project (Renewable Energy Action for London). The installed system covers a roof area of 11.5 square metres and will generate over 1200kWh of electricity. The panel will be grid connected and excess electricity sold to the grid. This will be used as an example of good practice to encourage similar projects in Barnet as well as for ongoing educational work about the sustainable technologies involved. The school is now embarking on a project to install a wind turbine.

Zero Energy Development in the suburbs

BedZED

BedZED is an environmentally friendly, energy efficient mix of affordable and desirable housing and workspace on a former sewage works in Sutton, South London. The 'zero energy development' only uses energy from renewable sources generated on site – it is therefore the first large-scale, zero net carbon emission community in the UK.

Everything about the scheme, from the layout and the building materials, to the heating supply, has been designed to cut energy consumption. The energy-efficient design features include: south facing houses to make the most of the heat from the sun, excellent insulation, triple glazed windows and stonecrop covered green roofs. The thick walls of the building prevent overheating in summer and store warmth in the winter to be released slowly during periods such as at night and on overcast days. Well-sealed windows and doors, and the concrete construction, stop the heat leaking out. A heat exchanger in the wind driven ventilation system recovers between 50 per cent and 70 per cent of the warmth from the outgoing stale air.

A CHP unit provides all the development's heat and electricity from timber produced from Sites of Importance for Nature Conservation in Croydon. The CHP unit generates electricity and distributes hot water around the site via insulated pipes. These deliver heat to domestic hot water cylinders positioned centrally in every home and office so that they can double up as heat emitters in cold spells. BedZED has a green transport plan which aims to reduce reliance on the car by cutting the need for travel (e.g. through internet shopping links and on-site facilities) and through providing a car pool. All of the homes are also fitted with photovoltaic panels, which provide power for the electric pool cars.

The Mayor would like to see at least one zero energy development in every borough by 2010.

The BedZed development also addresses issues of noise and safety and security. Internal daylight is maximised by the use of full height glazed facades. Noise is reduced by the terraced layout with the gable end facing the busiest main street. Security is enhanced by allowing natural surveillance of the street and of properties from buildings without compromising privacy. Access to public transport is available to the whole development from the nearby main road.

Tackling energy

The Score Centre, LB Waltham Forest

The Score Centre is a new sports and community centre in Leyton. It includes a number of sustainability features including solar power with panels installed on south facing roofs, a gas run CHP unit, natural ventilation from tilt and turn windows, and energy efficient light fittings with movement sensors in and outside the building. Reclaimed materials have been used as part of a landscaping scheme.

Implementing planning policy on renewable energy

The Chancerygate Business Park, LB Merton

This business park is the first development to respond to LB Merton's UDP policy to provide 10% of energy needs from renewable energy. The development includes 10 windsave micro-turbines, 5kWp of photovoltaics, and passive stack ventilation. It also incorporates water saving infrastructure.

Implementing policy on sustainable timber procurement

Fairfax Housing, Lambeth

This is the first construction project in Britain to be independently certified by the Forest Stewardship Council for its use of sustainable timber. It is a social housing construction project led by Lambeth Housing to fully refurbish twenty 1970s homes. The refurbishment incorporates passive stack ventilation, low-e double glazed timber windows, condensing boilers ans a high degree of insulation, all of which reduce heating costs. The contractor also recycled aluminium windows and hard core during the project.

Using Sustainable materials

The Millennium Centre, Barking & Dagenham

This is a visitor and education centre open to visitors throughout the year. It incorporates several sustainable design and construction measures, such as a wind turbine and rainwater recycling. The walls and insulation are constructed using masonite wood fibre composite studs, external walls and roof insulated with recycled newspaper or cellulose blown fibre. Underneath that paving slabs, the floor is made of layers of sand and gravel and there is a layer of foam glass made in part from recycled windscreen, which acts as further insulation.

Recycled content in construction

Waste & Resources Action programme (WRAP)

Wrap have carried out a number of studies to identify ways of achieving increased use of recycled content in a construction project. Calculated as a % of total cost of materials various projects have been assessed including residential and commercial.

www.aggregan.org,uk

www.wrap.org.uk/procurement

Water management and conservation

Starks Field primary School, LB Enfield

The external surface water drainage incorporates collection tanks to store water, discharging it to the main system; this enables a controlled flow of water to the drainage system. Water conservation is the principle for the taps installed. The drainage run off from the main play space feeds into a pond area and is managed so that in times of heavy rain allows water to drain naturally back into the ground.

The timber materials are from sustainable managed timber sources and the external cladding is cedar. There is a green roof of over 2,000 sq meters. The building incorporates energy efficiency measures including a Building Management System control for heating and ventilation systems.

2.4 Reduce impacts of noise

Using building fabric and layout to control the noise environment

Hammersmith Doctors Surgery

This building has been built on a former disused car park on a noisy junction on one of London's busiest roundabouts close to a concrete flyover. The building responds to the noise and harshness of the neighbouring environment with a series of distinctive white walls, curved in two dimensions and extending beyond the building in both length and height. Steps in this wall create tall, thin windows that light the corridor down to the consulting rooms, with directional views along a local footpath, avoiding the dominance of the flyover. On the other side of the building, a glazed, concave curtain wall focuses the building on a quiet, secluded courtyard - an attractive contrast to the traffic outside.

2.5 Ensure developments are comfortable and secure

Working with disabled people for inclusive access

Case Studies. Mayor of London November 2004

A series of case studies showing the experience of a range of organisations that have worked with disabled people to make their buildings and services accessible to all. Nine case studies, three local authority buildings, two from the health service, three from the voluntary sector and one from a faith community

An illustrated journey through an accessible environment. Case study examples. Mayor of London October 2004

The introduction of the final provisions of the Disability Discrimination Act 1995 in October 2004 has ensured that many service providers have reviewed how they provide their service to disabled people. As a result

there are now some good examples of buildings in London where access for disabled people has been successfully improved. Although no building is flawless, providing information on buildings that have been made accessible can inspire others. A number of photographic examples of building elements have therefore been illustrated in this document, with the aim of inspiring developers, designers, and planners, helping to supplement the advice given in the SPG and assisting in implementing the London Plan policies on inclusive design.

2.6 Conserve and enhance the natural environment and biodiversity

Enhancing the natural environment incorporated with landmark development

Greenwich Millennium Village

The UK's first Millennium Village is the response to a challenge to create a model for 21st century urban living. It is part of the largest development site in London implementing the wider regeneration of the Greenwich Peninsular to form a new innovative and sustainable urban quarter for the city. The emphasis of the village is on energy efficiency and mixed tenure homes. A total of 1,377 homes are to be built with around 20% social housing. The wider development includes an ecological park, a commercial area and modern transport links to central London.

Utilising roof space to enhance biodiversity

Laban Dance Centre

As part of the regeneration programme in the Deptford Creek area, the new Laban Dance Centre was constructed during 2002. The centre was designed by architects Herzog & de Meuron and includes a green roof covering approximately 460 m2. The roof has a 15 cm deep substrate of crushed brick and concrete taken from the development site in order to recreate the brownfield conditions favoured by the black redstart, a rare bird and certain rare and scarce invertebrates.

Incorporating wildlife in the Palace gardens

Police Support Building, Buckingham Palace

This building replaced a soil mound erected to screen the Palace garden from the windows of a nearby hotel. The designer's remit was to replicate (as far as possible) the original mound. To achieve this a roof garden was incorporated into the building design. After several years of growth this appears to have been achieved. Planting consisted of species including alder, birch, dogwood, holly, rose and various ivies.

Since the planting some areas have become populated with brambles and some elder which provide extra cover and food sources for wildlife. The

planted areas are only 600 mm deep and so need to be irrigated regularly, however very little maintenance is carried out so there is little disturbance of the site, and prunings are left on site to provide habitat for fungi and beetles. The site is fertilised once a year using an organic fertiliser.

Other examples of living roofs; www.livingroofs.org and www.london.gov.uk/mayor/auulivingroofs

Domestic scale biodiversity, in your back garden

Lillington Gardens Housing Estate, Pimlico

Lillington Gardens (formerly Pimlico Village) is a housing estate comprising some 940 properties and is home to over 1,800 people. Designed and built 30 years ago, the scheme displays a number of elements that support biodiversity:

A wildlife area which has a pond, surrounded by sympathetic planting, the pond is home to a variety of fauna including frogs and dragonflies.

A mixed native species hedge. Over 50 metres in length this hedge forms a considerable habitat. Comprising of hawthorn, spindle, field maple, hazel and holly, the hedge is home to a variety of birds.

The Estate also houses a quiet garden, which is fully accessible to people with disabilities, again the planting regime consists of a mosaic of native species which help to attract wildlife.

Buildings incorporating biodiversity with their fabric

The Creekside Educational Trust Building, Deptford

Set alongside Deptford Creek in southeast London, the Creekside Educational Trust building utilises the principles of passive solar design and other features of sustainable design and construction. The architects incorporated high and low level windows for natural ventilation, south facing roof lights to passively heat the entrance and exhibition space, natural fibre wall insulation and underfloor heating provided by a CHP generator. The entire roof is covered in recycled aggregate/soil mix to encourage the natural colonisation of plants and whole scheme is a showcase for wasteland biodiversity conservation. Rainwater is collected and used for flushing the toilet.

Gold Lane, Edgware www.audleyenglish.com/ecoHousesp1.c.html

Nottingham University Jubilee Campus

www.archleague.org/tenshadesofgreen/university.html

7 Promoting sustainable waste behaviour

Mainstream composting of household waste

Organics in West London (OWL)

Sainsbury's is taking part in a pilot scheme in West London aimed at making composting economically viable and to collect kitchen waste as part of a mainstream kerbside recycling service. Called Organics in West London (OWL) Recycling, the pilot has been set up by a partnership of local authorities, business and environmental organisations. The 12 month scheme will see organic waste, along with dry recyclables, being collected weekly from 3,800 homes in the London boroughs of Brent, Ealing, Hounslow and Richmond, as well as eight Sainsbury's supermarkets.

Extensive research will also be carried out, as part of the pilot, to establish the potential of marketing organic compost in urban areas. Under the scheme, residents are being offered one of three different disposal systems that they can use to recycle all their vegetable and fruit scraps, used tea and coffee grounds. Every home has been given two small containers, one of which is kept in the kitchen until full and then emptied into a larger outside container for weekly collection. The three systems test the use of biodegradable bags, along with different container sizes, to find the most viable combination. The pilot partnership, brought together by London Remade with funding from the London Recycling Fund, aims in the long term to show that composting urban waste can be self-sustaining if marketed locally.