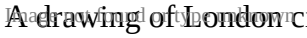
Chapter 9 Sustainable Infrastructure

The London Plan March 2021


A drawing of London city with buildings and trees.

Key information

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A Development Plans, through relevant strategic, site-specific and area based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1) Development proposals should not:

a) lead to further deterioration of existing poor air quality

b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits

c) create unacceptable risk of high levels of exposure to poor air quality.

2) In order to meet the requirements in Part 1, as a minimum:

a) development proposals must be at least Air Quality Neutral

b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures

c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1

d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

C Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:

1) how proposals have considered ways to maximise benefits to local air quality, and

2) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

D In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance. [147]

E Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.

9.1.1 **Poor air quality** is a major issue for London which is failing to meet requirements under legislation. Poor air quality has direct impacts on the health, quality of life and life expectancy of Londoners. The impacts tend to be most heavily felt in some of London's most deprived neighbourhoods, and by people who are most vulnerable to the impacts, such as children and older people. London's air quality should be significantly improved and exposure to poor air quality, especially for vulnerable people, should be reduced.

9.1.2 The Mayor is committed to **making air quality in London the best of any major world city**, which means not only achieving compliance with legal limits for Nitrogen Dioxide as soon as possible and maintaining compliance where it is already achieved, but also achieving World Health Organisation targets for other pollutants such as Particulate Matter.

9.1.3 The aim of this policy is to ensure that new developments are designed and built, as far as is possible, **to improve local air quality and reduce the extent to which the public are exposed to poor air quality**. This means that new developments, as a minimum, must not cause new exceedances of legal air quality standards, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits.[148] Where limit values are already met, or are predicted to be met at the time of completion, new developments must endeavour to maintain the best ambient air quality compatible with sustainable development principles.

9.1.4 Where this policy refers to 'existing poor air quality' this should be taken to include areas where legal limits for any pollutant, or World Health Organisation targets for Particulate Matter, are already exceeded and areas where current pollution levels are within 5 per cent of these limits.[149]

9.1.5 For major developments, **a preliminary Air Quality Assessment** should be carried out before designing the development to inform the design process. The aim of a preliminary assessment is to assess:

- The most significant sources of pollution in the area
- Constraints imposed on the site by poor air quality
- Appropriate land uses for the site
- Appropriate design measures that could be implemented to ensure that development reduces exposure and improves air quality.

9.1.6 **Further assessments** should then be carried out as the design evolves to ensure that impacts from emissions are prevented or minimised as far as possible, and to fully quantify the expected effect of any proposed mitigation measures, including the cumulative effect where other nearby developments are also underway or likely to come forward.

9.1.7 **Assessment of the impacts** of a scheme on local air pollution should include fixed plant, such as boiler and emergency generators, as well as expected transport-related sources. The impact assessment part of an Air Quality Assessment should always include all relevant pollutants. Industrial, waste and other working sites may need to include on-site vehicles and mobile machinery as well as fixed machinery and transport sources.

9.1.8 The impact assessment should provide decision makers with sufficient information to understand the **scale and geographic scope of any detrimental, or beneficial, impacts** on air quality and enable them to exercise their professional judgement in deciding whether the impacts are acceptable, in line with best practice.

9.1.9 Meeting the **Air Quality Neutral benchmarks**,[150] although necessary to control the growth in London's regional emissions, will not always be sufficient to prevent unacceptable local impacts, as these may be affected by other factors, such as the location of the emissions source, the rate of emissions (as opposed to the annual quantum) and the layout of the development in relation to the surrounding area. As developments can still have significant local impacts that are not captured by Air Quality Neutral, for example by concentrating emissions, increasing exposure or preventing dispersion in particular locations, it is still important for these impacts to be assessed and mitigated.

9.1.10 For most **minor developments**, achieving Air Quality Neutral will be enough to demonstrate that they are in accordance with Part B1 of this policy. However, where characteristics of the development or local features raise concerns about air quality, or where there are additional requirements for assessment in local policy, a full Air Quality Assessment may be required. Additional measures may also be needed to address local impacts. Guidance on Air Quality Neutral will set out streamlined assessment procedures for minor developments.

9.1.11 An **air quality positive approach** is linked to other policies in the London Plan, such as Healthy Streets, energy masterplanning and green infrastructure. One of the keys to delivering this will be to draw existing good

practice together in a holistic fashion, at an early stage in the process, to ensure that the development team can identify which options deliver the greatest improvement to air quality. Large schemes, subject to Environmental Impact Assessments, commonly have project and design teams representing a range of expertise, that can feed in to the development of a statement to set out how air quality can be improved across the proposed area of the development.

9.1.12 **Single-site schemes**, including referable schemes, are often constrained by pre-existing urban form and structure, transport and heat networks. These constraints may limit their ability to consider how to actively improve local air quality. By contrast, large schemes, particularly **masterplans**, usually have more flexibility to consider how new buildings, amenity and public spaces, transport and heat networks are deployed across the area and will therefore have greater opportunities to improve air quality and reduce exposure through the careful choice of design and infrastructure solutions. Delivery of an air quality positive approach will be project specific and will rely on the opportunities on site or in the surrounding area to improve air quality.

9.1.13 **Statements for large-scale development proposals**, prepared in response to Part C of this policy, should set out:

- How air quality is intended to be analysed and opportunities for its improvement identified as part of the design process.
- How air quality improvements have informed the design choices made about layout and distribution of buildings, amenity spaces and infrastructure.
- What steps will be taken to promote the uptake and use of sustainable and zero-emission modes of transport beyond minimum requirements. This may include specific measures in transport plans or delivery against Healthy Streets indicators.
- How air pollutant emissions from the buildings or associated energy centres can be reduced beyond the minimum requirements set out in Part B of this policy. This may include specific measures in heating masterplans or working with existing heat network providers to reduce or eliminate energy centre emissions.
- How specific measures that are identified to deliver air quality improvements will be evaluated and secured, including whether more detailed design specifications will be required so that the final development meets the desired performance.

9.1.14 The GLA will produce **guidance** in order to assist developers and boroughs in identifying measures and best practice to inform the preparation of statements for developments taking an air quality positive approach.

9.1.15 Where the Air Quality Assessment or the air quality positive approach assumes that specific measures are put in place to improve air quality, prevent or mitigate air quality impacts, these should be secured through the **use of planning conditions or s106 agreements**. For instance, if ultra-low NOx boilers are assumed in the assessment, conditions should require the provision of details of the installed plant prior to the occupation of the building, or where larger plant is used for heating, post installation emissions tests should be required to ensure that the modelled emission parameters are achieved.

9.1.16 The GLA maintains and publishes an **inventory of emission sources** (the London Atmospheric Emissions Inventory or LAEI). This inventory is based on a detailed assessment of all current sources of pollution in London and can be used to help understand the existing environment at development sites.

9.1.17 **Air Quality Focus Areas** (AQFA) are locations that not only exceed the EU annual mean limit value for nitrogen dioxide (NO2) but are also locations with high human exposure. AQFAs are not the only areas with poor air quality but they have been defined to identify areas where currently planned national, regional and local measures to reduce air pollution may not fully resolve poor air quality issues. There are currently 187 AQFAs

across London (Figure 9.1). The list of Air Quality Focus Areas is updated from time to time as the London Atmospheric Inventory is reviewed and the latest list in the London Datastore should always be checked.

9.1.18 AQFAs are distinct from **Air Quality Management Areas**. Air Quality Management Areas (AQMAs) are declared by the London boroughs in response to modelled or measured existing exceedances of legal air quality limits. The analysis underpinning AQMAs is often more spatially detailed than London-wide modelling and may include the identification of additional air quality hot spots or other local issues.

9.1.19 All London boroughs have declared AQMAs covering some or all of their area. Boroughs are required to produce **Air Quality Action Plans** setting out the actions they are taking to improve local air quality; planning decisions should be in accordance with these action plans and developers should take any local requirements in Air Quality Action Plans into account.

9.1.20 AQFAs are defined based on GLA modelling forecasts that incorporate actions taken by the GLA and others as well as broader changes in emissions sources and are not intended to supplant the role of AQMAs in planning decisions. In practice **developers will need to consider both designations** where they overlap.

9.1.21 It may not always be possible in practice for developments to achieve Air Quality Neutral standards or to acceptably minimise impacts using on-site measures alone. If a development can demonstrate that it has exploited all relevant on-site measures it may be possible to make the development acceptable through **additional mitigation or offsetting payments**.

9.1.22 Where there have been significant **improvements to air quality** resulting in an area no longer exceeding air quality limits, Development Plans should not take advantage of this investment and worsen the local air quality back to a poor level. The sustainability appraisal for local plans should consider the effect of national, London-wide and local programmes to improve air quality to ensure that any potential conflicts are avoided.

9.1.23 **Further guidance** will be published on Air Quality Neutral and air quality positive approaches as well as guidance on how to reduce construction and demolition impacts.

Figure 9.1 - Air Quality Focus Areas

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Policy SI 2 Minimising greenhouse gas emissions

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A Major development should be net zero-carbon.[151] This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy

hierarchy:
1) be lean: use less energy and manage demand during operation
2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
4) be seen: monitor, verify and report on energy performance.
B Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.
C A minimum on-site reduction of at least 35 per cent beyond Building Regulations[152] is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
1) through a cash in lieu contribution to the borough's carbon offset fund, or
2) off-site provided that an alternative proposal is identified and delivery is certain.
D Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.
E Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.
F Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

9.2.1 The Mayor is committed to London **becoming a zero-carbon city**. This will require reduction of all greenhouse gases, of which carbon dioxide is the most prominent.[153] London's homes and workplaces are responsible for producing approximately 78 per cent of its greenhouse gas emissions. If London is to achieve its objective of becoming a zero-carbon city by 2050, new development needs to meet the requirements of this policy. Development involving major refurbishment should also aim to meet this policy.

9.2.2 **The energy hierarchy** (Figure 9.2) should inform the design, construction and operation of new buildings. The priority is to minimise energy demand, and then address how energy will be supplied and renewable technologies incorporated. An important aspect of managing demand will be to reduce peak energy loadings.

9.2.3 Boroughs should ensure that all developments maximise opportunities for **on-site electricity and heat production** from solar technologies (photovoltaic and thermal) and use innovative building materials and smart technologies. This approach will reduce carbon emissions, reduce energy costs to occupants, improve London's energy resilience and support the growth of green jobs.

9.2.4 A zero-carbon target for major residential developments has been in place for London since October 2016 and applies to **major non-residential developments** on final publication of this Plan.

Figure 9.2 - The energy hierarchy and associated targets

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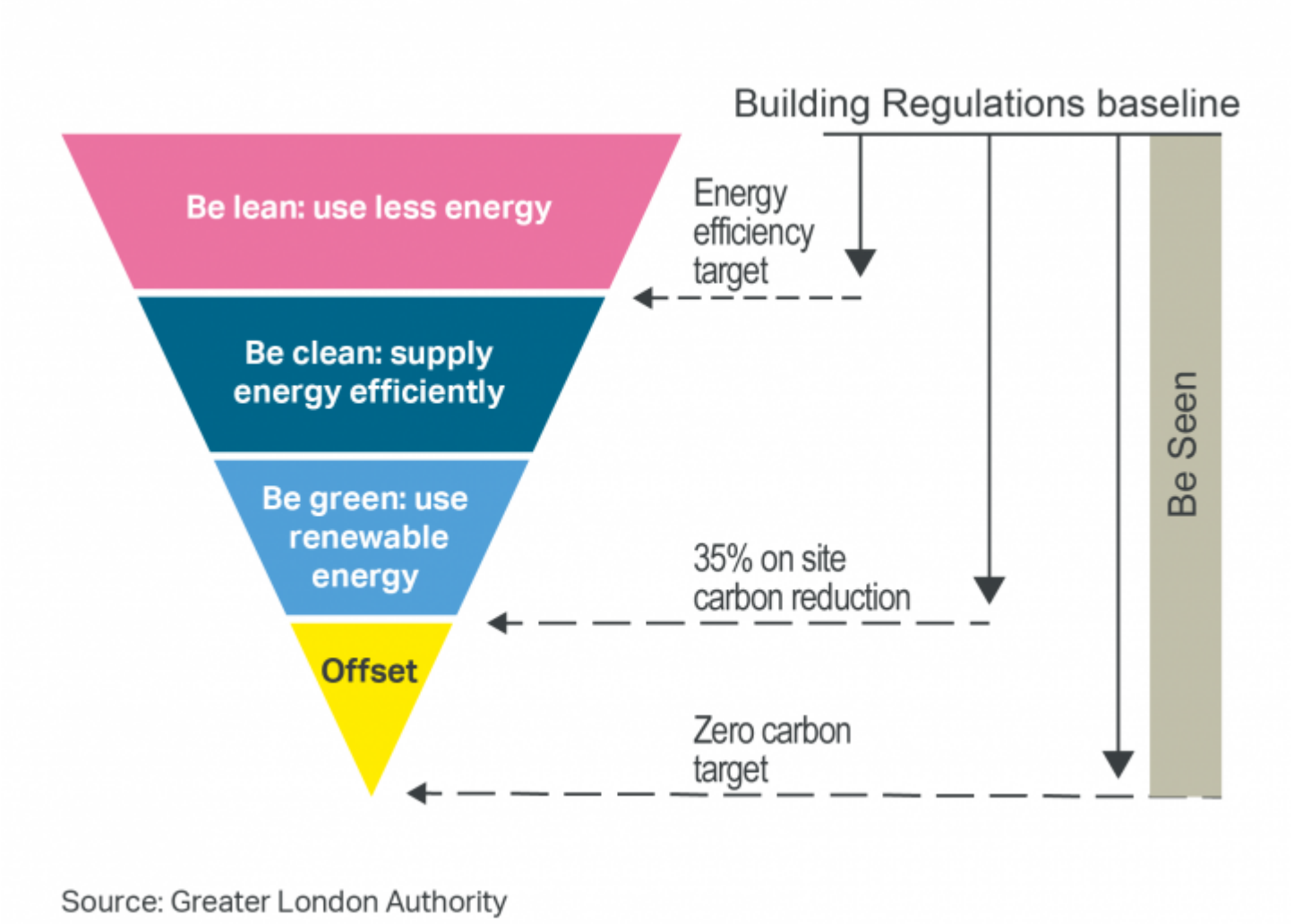

Source: Greater London Authority

9.2.5 To meet the zero-carbon target, an on-site reduction of at least 35 per cent beyond the baseline of Part L of the current Building Regulations is required.[154] The minimum **improvement over the Target Emission Rate** (TER) will increase over a period of time in order to achieve the zero-carbon London ambition and reflect the costs of more efficient construction methods. This will be reflected in future updates to the London Plan.

9.2.6 The Mayor recognises that **Building Regulations** use outdated carbon emission factors and that this will continue to cause uncertainty until they are updated by Government. Interim guidance has been published in the Mayor's Energy Planning Guidance on the use of appropriate emissions factors. This guidance will be updated again once Building Regulations are updated to help provide certainty to developers on how these policies are implemented.

9.2.7 Developments are expected to achieve carbon reductions beyond Part L from **energy efficiency measures** alone to reduce energy demand as far as possible. Residential development should achieve 10 per cent and non-residential development should achieve 15 per cent over Part L. Achieving energy credits as part of a Building Research Establishment Environmental Assessment Method (BREEAM) rating can help demonstrate that energy efficiency targets have been met. Boroughs are encouraged to include BREEAM targets in their Local Plans where appropriate.

9.2.8 The price for offsetting carbon[155] is regularly reviewed. Changes to the GLA's suggested **carbon offset price** will be updated in future guidance. New development is expected to get as close as possible to zero-carbon

on-site, rather than relying on offset fund payments to make up any shortfall in emissions. However, **offset funds** have the potential to unlock carbon savings from the existing building stock through energy efficiency programmes and by installing renewable technologies – typically more expensive to deliver in London due to the building age, type and tenure.

9.2.9 The Mayor provides **support to boroughs** by advising those which are at the early stages of setting up their carbon offsetting funds, and by setting out guidance on how to select projects. To ensure that offset funds are used effectively to reduce carbon whilst encouraging a holistic approach to retrofitting, Mayoral programmes offer additional support.[156]

9.2.10 The move towards zero-carbon development requires comprehensive **monitoring of energy demand and carbon emissions** to ensure that planning commitments are being delivered. Major developments are required to monitor and report on energy performance, such as by displaying a Display Energy Certificate (DEC), and reporting to the Mayor for at least five years via an online portal to enable the GLA to identify good practice and report on the operational performance of new development in London.

9.2.11 Operational carbon emissions will make up a declining proportion of a development's whole life-cycle carbon emissions as operational carbon targets become more stringent. To fully capture a development's carbon impact, a **whole life-cycle approach** is needed to capture its unregulated emissions (i.e. those associated with cooking and small appliances), its embodied emissions (i.e. those associated with raw material extraction, manufacture and transport of building materials and construction) and emissions associated with maintenance, repair and replacement as well as dismantling, demolition and eventual material disposal). Whole life-cycle carbon emission assessments are therefore required for development proposals referable to the Mayor. Major non-referable development should calculate unregulated emissions and are encouraged to undertake whole life-cycle carbon assessments. The approach to whole life-cycle carbon emissions assessments, including when they should take place, what they should contain and how information should be reported, will be set out in guidance.

9.2.12 The Mayor may publish further planning guidance on sustainable design and construction[157] and will continue to regularly update the guidance on preparing **energy strategies** for major development. Boroughs are encouraged to request energy strategies for other development proposals where appropriate. As a minimum, energy strategies should contain the following information:

a. a calculation of the energy demand and carbon emissions covered by Building Regulations and, separately, the energy demand and carbon emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (i.e. the unregulated emissions), at each stage of the energy hierarchy

b. proposals to reduce carbon emissions beyond Building Regulations through the energy efficient design of the site, buildings and services, whether it is categorised as a new build, a major refurbishment or a consequential improvement

c. proposals to further reduce carbon emissions through the use of zero or low-emission decentralised energy where feasible, prioritising connection to district heating and cooling networks and utilising local secondary heat sources. (Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI 3 Energy infrastructure)

d. proposals to further reduce carbon emissions by maximising opportunities to produce and use renewable energy on-site, utilising storage technologies where appropriate

e. proposals to address air quality risks (see Policy SI 1 Improving air quality). Where an air quality assessment has been undertaken, this could be referenced instead

f. the results of dynamic overheating modelling which should be undertaken in line with relevant Chartered Institution of Building Services Engineers (CIBSE) guidance, along with any mitigating actions (see Policy SI 4 Managing heat risk)

g. proposals for demand-side response, specifically through installation of smart meters, minimising peak energy demand and promoting short-term energy storage, as well as consideration of smart grids and local micro grids where feasible

h. a plan for monitoring and annual reporting of energy demand and carbon emissions post-construction for at least five years

i. proposals explaining how the site has been future-proofed to achieve zero-carbon on-site emissions by 2050

j. confirmation of offsetting arrangements, if required

k. a whole life-cycle carbon emissions assessment, and actions to reduce life-cycle carbon emissions (for development proposals referable to the Mayor)

l. analysis of the expected cost to occupants associated with the proposed energy strategy

m. proposals that connect to or create new heat networks should include details of the design and specification criteria and standards for their systems as set out in Policy SI 3 Energy infrastructure.

Policy SI 3 Energy infrastructure

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A Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.
B Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities) which establish the most effective energy supply options. Energy masterplans should identify:
1) major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
2) heat loads from existing buildings that can be connected to future phases of a heat network
3) major heat supply plant including opportunities to utilise heat from energy from waste plants
4) secondary heat sources, including both environmental and waste heat
5) opportunities for low and ambient temperature heat networks
6) possible land for energy centres and/or energy storage
7) possible heating and cooling network routes
8) opportunities for futureproofing utility infrastructure networks to minimise the impact from road works
9) infrastructure and land requirements for electricity and gas supplies
10) implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector
11) opportunities to maximise renewable electricity generation and incorporate demand-side response measures.
C Development Plans should:

1) identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure
2) identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.
D Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:
1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
a) connect to local existing or planned heat networks
b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
d) use ultra-low NOx gas boilers
2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality
3) where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.
E Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent.

9.3.1 The Mayor will work with boroughs, energy companies and major developers to promote the **timely and effective development of London's energy system** (energy production, distribution, storage, supply and consumption).

9.3.2 London is part of a national energy system and currently sources approximately 95 per cent of its energy from outside the GLA boundary. Meeting the **Mayor's zero-carbon target by 2050** requires changes to the way we use and supply energy so that power and heat for our buildings and transport is generated from local clean, low-carbon and renewable sources. London will need to shift from its reliance on using natural gas as its main energy source to a more diverse range of low and zero-carbon sources, including renewable energy and secondary heat sources. Decentralised energy and local secondary heat sources will become an increasingly important element of London's energy supply and will help London become more self-sufficient and resilient in relation to its energy needs.

9.3.3 Many of London's existing **heat networks** have grown around combined heat and power (CHP) systems. However, the carbon savings from gas engine CHP are now declining as a result of national grid electricity decarbonising, and there is increasing evidence of adverse air quality impacts. Heat networks are still considered to be an effective and low-carbon means of supplying heat in London, and offer opportunities to transition to zero-carbon heat sources faster than individual building approaches. Where there remains a strategic case for low-emission CHP systems to support area-wide heat networks, these will continue to be considered on a case-by-case basis. Existing networks will need to establish decarbonisation plans. These should include the identification of low- and zero-carbon heat sources that may be utilised in the future, in order to be zero-carbon by 2050. The Mayor will consider how boroughs and network operators can be supported to achieve this.

9.3.4 Developments should connect to existing heat networks wherever feasible. New and existing networks should incorporate good practice design and specification standards comparable to those set out in the CIBSE/ADE Code of Practice CP1 for the UK or equivalent. They should also register with the Heat Trust or an equivalent scheme. This will support the development of good quality networks whilst helping network operators prepare for regulation and ensuring that customers are offered a reliable, cost-competitive service.

Stimulating the delivery of new district heating infrastructure enables the opportunities that district heating can provide for London's energy system to be maximised. The Mayor has identified **Heat Network Priority Areas**, which can be found on the London Heat Map website.[158] These identify where in London the heat density is sufficient for heat networks to provide a competitive solution for supplying heat to buildings and consumers. Data relating to new and expanded networks will be regularly captured and made publicly available. Major development proposals outside Heat Network Priority Areas should select a low-carbon heating system that is appropriate to the heat demand of the development, provides a solution for managing peak demand, as with heat networks, and avoids high energy bills for occupants.

9.3.5 Where developments are proposed within Heat Network Priority Areas but are beyond existing heat networks, the heating system should be designed to **facilitate cost-effective future connection**. This may include, for example, allocating space in plant rooms for heat exchangers and thermal stores, safeguarding suitable routes for pipework from the site boundary and making provision for connections to the future network at the site boundary. The Mayor is taking a more direct role in the delivery of district-level heat networks so that more new and existing communally-heated developments will be able to connect into them, and has developed a comprehensive decentralised energy support package. Further details are available in the London Environment Strategy.

9.3.6 The Mayor also supports the development of **low-temperature networks** for both new and existing systems as this allows cost-effective use of low-grade waste heat. It is expected that network supply temperatures will drop from the traditional 90°C-95°C to 70°C and less depending on system design and the temperature of available heat sources. Further guidance on designing and operating heat networks will be set out in the updated London Heat Network Manual.

9.3.7 **Low-emission CHP** in this policy refers to those technologies which inherently emit very low levels of NOx. It is not expected that gas engine CHP will fit this category with the technology that is currently available. Further details on circumstances in which it will be appropriate to use low-emission CHP and what additional emissions monitoring will be required will be provided in further guidance. This guidance will be regularly updated to ensure that it reflects changes in technology.

Figure 9.3 - Heat Network Priority Areas

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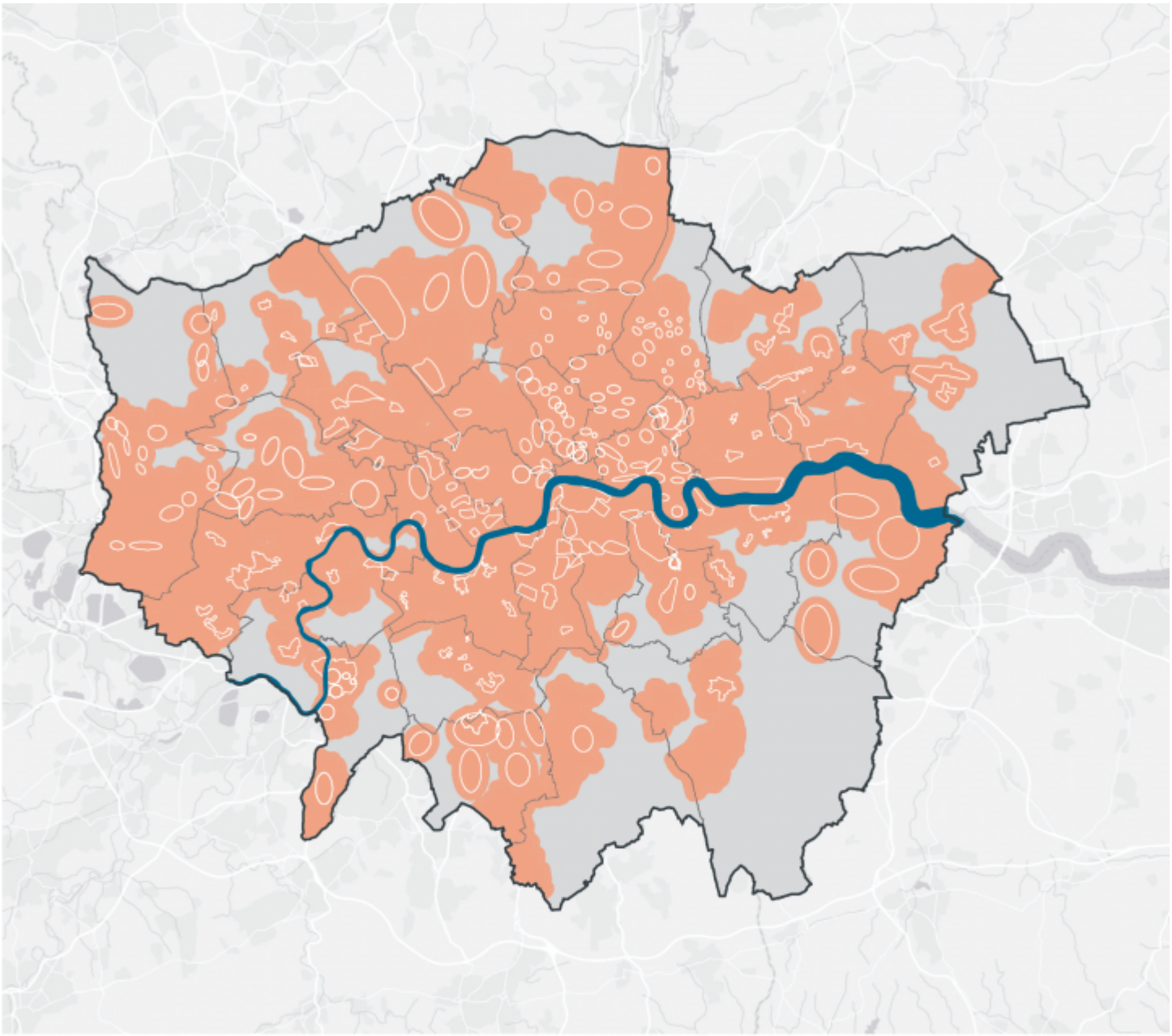


9.3.8 Increasing the amount of **renewable and secondary energy** is supported and development proposals should identify opportunities to maximise both secondary heat sources and renewable energy production on-site. This includes the use of solar photovoltaics, heat pumps and solar thermal, both on buildings and at a larger scale on appropriate sites. There is also potential for wind and hydropower-based renewable energy in some locations

within London. Innovative low- and zero-carbon technologies will also be supported.

9.3.9 **Electricity** is essential for the functioning of any modern city. Demand is expected to rise in London in response to a growing population and economy, the increased take up of electric vehicles, and the switch to electric heating systems (such as through heat pumps). It is of concern that the electricity network and substations are at or near to capacity in a number of areas, especially in central London. The Mayor will work with the electricity and heat industry, boroughs and developers to ensure that appropriate infrastructure is in place and integrated within a wider smart energy system designed to meet London's needs.

9.3.10 Demand for **natural gas** in London has been decreasing over the last few years, with a 25 per cent reduction since 2000.[159] This trend is expected to continue due to improved efficiency and a move away from individual gas boilers. Alongside the continuing programme of replacing old metal gas mains (predominantly with plastic piping), local infrastructure improvements may be required to supply energy centres, associated with heat networks, that will support growth in Opportunity Areas and there may also be a requirement for the provision of new pressure reduction stations. These requirements should be identified in energy masterplans.

9.3.11 Cadent Gas and SGN operate London's gas distribution network. Both companies are implementing significant **gasholder de-commissioning programmes**, replacing them with smaller gas pressure reduction stations. The Mayor will work with key stakeholders including the Health and Safety Executive to achieve the release of the resulting brownfield sites for redevelopment including energy infrastructure where appropriate.

9.3.12 Land will be required for energy supply infrastructure including **energy centres**. These centres can capture and store energy as well as generate it. The ability to efficiently store energy as well as to generate it can reduce overall energy consumption, reduce peak demand and integrate greater levels of renewable energy into the energy system.

Policy SI 4 Managing heat risk

Policy SI 4 Managing heat risk
A Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.
B Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
2) minimise internal heat generation through energy efficient design
3) manage the heat within the building through exposed internal thermal mass and high ceilings
4) provide passive ventilation
5) provide mechanical ventilation
6) provide active cooling systems.

9.4.1 Climate change means London is already experiencing higher than historic average temperatures and more severe hot weather events. This, combined with a growing population, urbanisation and the urban heat island effect, means that **London must manage heat risk** in new developments, using the cooling hierarchy set out above. Whilst the cooling hierarchy applies to major developments, the principles can also be applied to minor development.

9.4.2 In managing heat risk, new developments in London face two challenges – the need to ensure London does not overheat (the urban heat island effect) and the need to ensure that individual buildings do not overheat. **The urban heat island effect** is caused by the extensive built up area absorbing and retaining heat during the day and night leading to parts of London being several degrees warmer than the surrounding area. This can become problematic on the hottest days of the year as daytime temperatures can reach well over 30?C and not drop below 18?C at night. These circumstances can lead many people to feel too hot or not be able to sleep, but for those with certain health conditions, and 'at risk' groups such as some young or elderly Londoners, the effects can be serious and worsen health conditions. Green infrastructure can provide some mitigation of this effect by shading roof surfaces and through evapotranspiration. Development proposals should incorporate green infrastructure in line with Policy G1 Green infrastructure and Policy G5 Urban greening.

9.4.3 Many aspects of building design can lead to increases in overheating risk, including high proportions of glazing and an increase in the air tightness of buildings. Single-aspect dwellings are more difficult to ventilate naturally and are more likely to overheat, and should normally be avoided in line with Policy D6 Housing quality and standards. There are a number of low-energy measures that can **mitigate overheating risk**. These include solar shading, building orientation and solar-controlled glazing. Occupant behaviour will also have an impact on overheating risk. The Mayor's London Environment Strategy sets out further detail on actions being taken to address this.

9.4.4 Passive ventilation should be prioritised, taking into account external noise and air quality in determining the most appropriate solution. The increased use of **air conditioning systems** is not desirable as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. If active cooling systems, such as air conditioning systems, are unavoidable, these should be designed to reuse the waste heat they produce. Future district heating networks are expected to be supplied with heat from waste heat sources such as building cooling systems.

9.4.5 The Chartered Institution of Building Services Engineers (CIBSE) has produced **guidance on assessing and mitigating overheating risk in new developments**, which can also be applied to refurbishment projects. TM 59 should be used for domestic developments and TM 52 should be used for non-domestic developments. In addition, TM 49 guidance and datasets should also be used to ensure that all new development is designed for the climate it will experience over its design life. Further information will be provided in guidance on how these documents and datasets should be used.

Policy SI 5 Water infrastructure

Policy SI 5 Water infrastructure

A In order to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner.

B Development Plans should promote improvements to water supply infrastructure to contribute to security of supply. This should be done in a timely, efficient and sustainable manner taking energy consumption into account.

C Development proposals should:

1) through the use of Planning Conditions minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)

2) achieve at least the BREEAM excellent standard for the 'Wat 01' water category[160] or equivalent (commercial development)
3) incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future-proofing.
D In terms of water quality, Development Plans should:
1) promote the protection and improvement of the water environment in line with the Thames River Basin Management Plan, and should take account of Catchment Plans
2) support wastewater treatment infrastructure investment to accommodate London's growth and climate change impacts. Such infrastructure should be constructed in a timely and sustainable manner taking account of new, smart technologies, intensification opportunities on existing sites, and energy implications. Boroughs should work with Thames Water in relation to local wastewater infrastructure requirements.
E Development proposals should:
1) seek to improve the water environment and ensure that adequate wastewater infrastructure capacity is provided
2) take action to minimise the potential for misconnections between foul and surface water networks.
F Development Plans and proposals for strategically or locally defined growth locations with particular flood risk constraints or where there is insufficient water infrastructure capacity should be informed by Integrated Water Management Strategies at an early stage.

9.5.1 Londoners consume on average 149 litres of water per person per day – around 8 litres above the national average. All water companies that serve London are located in areas classified as seriously water-stressed. London is at risk of drought after two dry winters. During 2006 and 2012 **water use restrictions** affecting London were imposed. These restrictions were limited to sprinkler, hosepipe and non-essential user bans. A severe drought – with rota cuts, standpipes, reduced mains pressure or adding non-potable water to the mains supply – would have major implications for Londoners' health and wellbeing, the environment and London's economy. The Mayor will work with the water industry to prevent this level of water restriction being required for London in future.

9.5.2 An important aspect of avoiding the most severe water restrictions is to ensure that leakage is reduced and **water used as efficiently as possible**. The Optional Requirement set out in Part G of the Building Regulations should be applied across London.[161] A fittings-based approach should be used to determine the water consumption of a development. This approach is transparent and compatible with developers' procurement and the emerging Water Label,[162] which Government and the water companies serving London are supporting.

9.5.3 Even with increased water efficiency and reduced leakage, water companies are forecasting an increasing demand for water. Without additional sources of supply, the increased demand will increase the risk of requiring water restrictions during drought periods. **Security of supply** should be ensured. Demand forecasts need to continue to be monitored and based on the consistent use of demographic data across spatial and infrastructure planning regimes.

9.5.4 Thames Water has set out through the water resource management planning process its preferred approach to **strategic water supply options** to serve London and parts of the Wider South East. It is considering a suite of options, including a potential new reservoir, effluent reuse, water transfers and new groundwater sources.

9.5.5 A strategic approach to water supply networks to ensure future water resilience and, in particular, the timely planning for a new strategic water resource to serve London and the Wider South East is important. In its draft Water Resource Management Plan, Thames Water has explored coordinated supply options with the other water companies serving London and the South East of England working with the Water Resource South East Group. Water Resource East has undertaken similar work in the East of England area. All this involves

partnership working with key stakeholders within London and beyond its boundaries.

9.5.6 **Infrastructure investment** is constrained by the short-term nature of water companies' investment plans. Similar to the approach to electricity supply, in order to facilitate the delivery of development it is important that investment in water supply infrastructure is provided ahead of need. To minimise wastage, water supply infrastructure improvements should give consideration to the replacement of ageing trunk mains.

9.5.7 In the context of the significant investment needed, measures to **protect and support vulnerable customers** in particular from rising water bills are important.

9.5.8 In relation to **wastewater** and improvements to the water environment, Water Framework Directive requirements should be maintained through the Thames River Basin Management Plan and the Catchment Plans prepared by the Catchment Partnerships, of which there are 12 in London. These Partnerships share lessons, experiences and best practice, and help achieve a coordinated approach to delivering the Thames River Basin Management Plan. Development Plans should be supported by evidence, which demonstrates that the development planned for:

a. will not compromise the Thames River Basin Management Plan objective of achieving 'Good' status, or cause deterioration in water quality; and

b. will be supported by adequate and timely provision of wastewater treatment infrastructure.

9.5.9 The Urban Wastewater Treatment Directive drives improvements in **wastewater treatment infrastructure**. Figure 9.4 provides a spatial illustration of the wastewater drainage capacity across London. Additional land may be required for upgrades or improvements at some wastewater treatment plants during the Plan period. Different wastewater treatment options may vary significantly in terms of their energy requirements, and there are significant opportunities for energy generation from wastewater treatment (sewage sludge).

9.5.10 The Thames Tideway Tunnel is under construction and will help to improve the water quality of the River Thames by significantly reducing the frequency of untreated sewage being discharged into the Thames (known as combined sewer overflows). **Sustainable drainage** measures are of particular importance in areas with sewer capacity limitations and their widespread implementation over the coming decades will help the resilience of London and avoid the need for further major sewer tunnel projects. Thames Water is taking a long-term approach to drainage and wastewater management planning. Its London 2100 plan will identify the most appropriate strategy for ensuring that London's drainage and wastewater systems can meet the needs of London over the next 80 years in the most sustainable way.

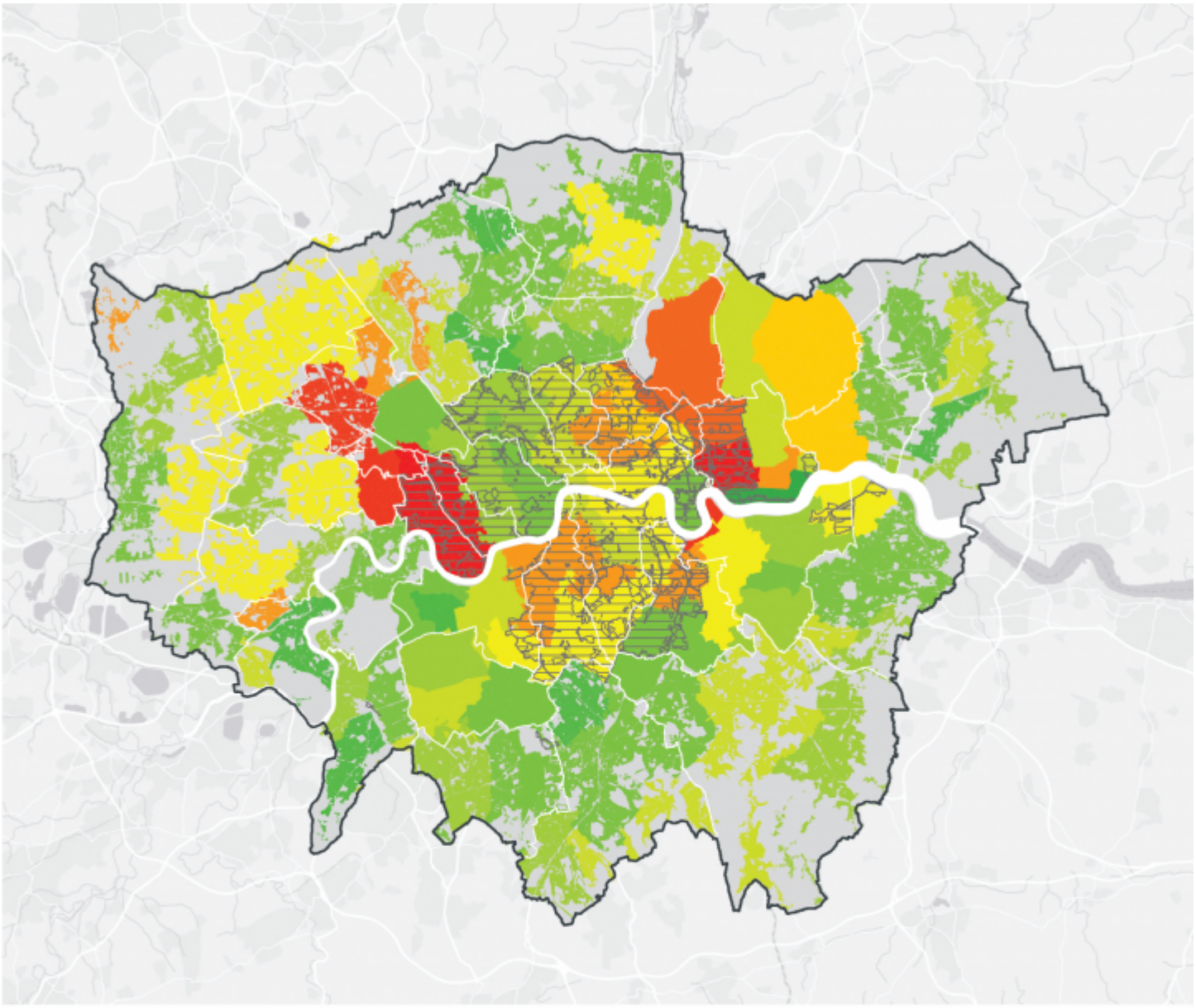
9.5.11 London's tributary rivers suffer significant pollution from **misconnected sewers**. This allows untreated sewage into what are often small streams, many of which flow through London's parks and open spaces. Conversely, if surface water is misconnected to the foul system, sewer capacity issues are created within sewers and at sewage treatment works. Development proposals should therefore take action to minimise the potential for misconnections.

9.5.12 Development Plans and proposals should demonstrate that they have considered the opportunities for **integrated solutions** to water-related constraints and the provision of water infrastructure within strategically or locally defined growth locations. These could be Opportunity Areas or growth locations defined in Local Plans. Where such opportunities are identified, Development Plans should require an integrated and collaborative approach from developers. This could for example lead to the establishment of local water reuse systems or integrated drainage networks. Integration with the planning of green infrastructure could deliver further benefits.

9.5.13 A **water advisory group** with representatives from across the water sectors in London has been established to advise the Mayor and share information on strategic water and flood risk management issues across the capital.

Figure 9.4 - Spatial illustration of wastewater drainage capacity across London

Figure 9.4 - Spatial illustration of wastewater drainage capacity across London



Note for Figure 9.4: Thames Water has developed a model of its drains and sewers in London to assess waste water flows. The model compares the theoretical capacity of the drain or sewer pipe against how much waste

water flow the pipe is currently receiving during a one in two-year rainfall event. The model's outputs can be visualised as a 'heat map', which highlights at a strategic scale where there is a higher (green) or lower (red) ability to receive additional flows.'Green' areas do not mean that no additional drainage infrastructure is required. The modelling does not consider how waste water is routed through the network, so it should be noted that some 'green' areas will flow into 'red' areas, hence increasing flows upstream will exacerbate performance in the downstream catchments. The hatched area on the map shows the portions of the sewer system that are generally combined sewers, which means they capture both waste water and surface water flows.

Policy SI 6 Digital connectivity infrastructure

Policy SI 6 Digital connectivity infrastructure
A To ensure London's global competitiveness now and in the future, development proposals should:
1) ensure that sufficient ducting space for full fibre connectivity infrastructure is provided to all end users within new developments, unless an affordable alternative 1GB/s-capable connection is made available to all end users
2) meet expected demand for mobile connectivity generated by the development
3) take appropriate measures to avoid reducing mobile connectivity in surrounding areas; where that is not possible, any potential reduction would require mitigation
4) support the effective use of rooftops and the public realm (such as street furniture and bins) to accommodate well-designed and suitably located mobile digital infrastructure.
B Development Plans should support the delivery of full-fibre or equivalent digital infrastructure, with particular focus on areas with gaps in connectivity and barriers to digital access.

9.6.1 The **provision of digital infrastructure** is as important for the proper functioning of development as energy, water and waste management services and should be treated with the same importance. London should be a world-leading tech hub with world-class digital connectivity that can anticipate growing capacity needs and serve hard to reach areas. Fast, reliable digital connectivity is essential in today's economy and especially for digital technology and creative companies. It supports every aspect of how people work and take part in modern society, helps smart innovation and facilitates regeneration.

9.6.2 **London's capability** in this area is currently limited by a range of issues, including the availability of fibre and the speeds delivered. The industry regulator Ofcom publishes the data on digital connectivity coverage on which Figure 9.5 is based, but there are some limitations to the practicality of the data that is collected. Further work will be done to accurately identify locations in the capital where current connectivity provisions are not suitable for the needs of the area.

9.6.3 **Better digital connectivity** with a focus on capability, affordability, security, resilience and the provision of appropriate electrical power supply should be promoted across the capital. The specific requirements of business clusters, such as a symmetrical-capable service with the same upload and download speeds, should also be met.

9.6.4 Given the fast pace at which digital technology is changing, a flexible approach to development is needed that supports **innovation and choice**. Part R1 of the Building Regulations 2010 requires buildings to be equipped with at least 30 MB/s ready in-building physical infrastructure, however new developments using full fibre to the property or other higher-grade infrastructure can achieve connectivity speeds of 1GB/s. Developers should engage early with a range of network operators, to ensure that?development proposals?are designed to be capable of providing this level of connectivity to all end users. Mechanisms should also be put in place to enable

further future infrastructure upgrades. Innovation is driving reductions in the size of infrastructure, with marginal additional unit costs, but greater digital connectivity is needed in more locations.

9.6.5 Development proposals should also demonstrate that **mobile connectivity** will be available throughout the development and should not have detrimental impacts on the digital connectivity of neighbouring buildings. Early consultation with network operators will help to identify any adverse impact on mobile or wireless connectivity and appropriate measures to avoid/mitigate them.

9.6.6 Access for network operators to rooftops of new developments should be supported where an improvement to the mobile connectivity of the area can be identified. Where possible, other opportunities to secure **mobile connectivity improvements** should also be sought through new developments, including for example the creative use of the public realm.

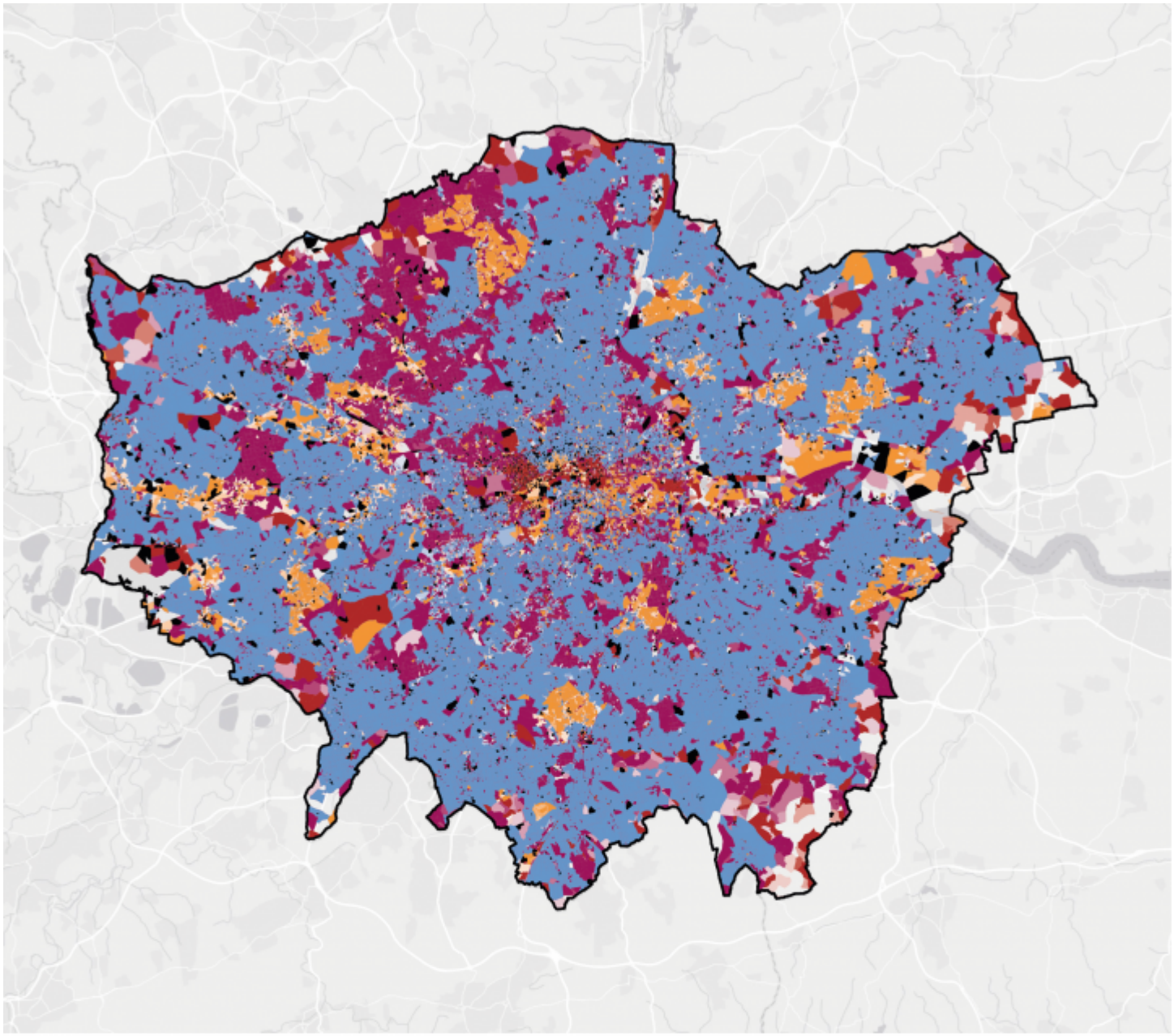
9.6.7 For some types of development (such as commercial) specific requirements regarding **communications access and security** may apply. Data centres, in particular, depend on reliable connectivity and electricity infrastructure. Warehouse-based data centres have emerged as a driver of industrial demand in London over recent years and this will need to be taken into account when assessing demand for industrial land (see Policy E4 Land for industry, logistics and services to support London's economic function, Policy E5 Strategic Industrial Locations (SIL), Policy E6 Locally Significant Industrial Sites and Policy E7 Industrial intensification, co-location and substitution).

9.6.8 The Mayor will work with network operators, developers, councils and Government to develop guidance and share good practice to **increase awareness and capability** amongst boroughs and developers of the effective provision of digital connectivity and to support the delivery of policy requirements. The Mayor will also help to identify spatial gaps in connectivity and overcome barriers to delivery to address this form of digital exclusion, in particular through his Connected London work. Boroughs should encourage the delivery of high-quality / world-class digital infrastructure as part of their Development Plans.

9.6.9 Digital connectivity supports **smart technologies** in terms of the collection, analysis and sharing of data on the performance of the built and natural environment, including for example, water and energy consumption, waste, air quality, noise and congestion. Development should be fitted with smart infrastructure, such as sensors, to enable better collection and monitoring of such data. As digital connectivity and the capability of these sensors improves, and their cost falls, more and better data will become available to improve monitoring of planning agreements and impact assessments, for example related to urban design. Further guidance will be developed to make London a smarter city.

Figure 9.5 - Broadband coverage May 2019

Figure 9.5 - Broadband coverage May 2019



Broadband coverage as of May 2019

Availability (% Premises)

Full Fibre	Ultra-fast Broadband	Super-fast Broadband	30Mbit/s Unavailability
1 - 20	1 - 20	1 - 20	1 - 20
21 - 40	21 - 40	21 - 40	21 - 40
41 - 60	41 - 60	41 - 60	41 - 60
61 - 80	61 - 80	61 - 80	61 - 80
81 - 100	81 - 100	81 - 100	81 - 100
			No Data Available (Postcode areas)

Source: Ofcom

Note for Figure 9.5: For the most up to date broadband coverage and information on broadband connection types please see the Connected London web page

Policy SI 7 Reducing waste and supporting the circular economy

Policy SI 7 Reducing waste and supporting the circular economy
A Resource conservation, waste reduction, increases in material re-use and recycling, and reductions in waste going for disposal will be achieved by the Mayor, waste planning authorities and industry working in collaboration to:
1) promote a more circular economy that improves resource efficiency and innovation to keep products and materials at their highest use for as long as possible
2) encourage waste minimisation and waste prevention through the reuse of materials and using fewer resources in the production and distribution of products
3) ensure that there is zero biodegradable or recyclable waste to landfill by 2026
4) meet or exceed the municipal waste recycling target of 65 per cent by 2030[163]
5) meet or exceed the targets for each of the following waste and material streams:
a) construction and demolition – 95 per cent reuse/recycling/recovery
b) excavation – 95 per cent beneficial use[164]
6) design developments with adequate, flexible, and easily accessible storage space and collection systems that support, as a minimum, the separate collection of dry recyclables (at least card, paper, mixed plastics, metals, glass) and food.
B Referable applications should promote circular economy outcomes and aim to be net zero-waste. A Circular Economy Statement should be submitted, to demonstrate:
1) how all materials arising from demolition and remediation works will be re-used and/or recycled
2) how the proposal's design and construction will reduce material demands and enable building materials, components and products to be disassembled and re-used at the end of their useful life
3) opportunities for managing as much waste as possible on site
4) adequate and easily accessible storage space and collection systems to support recycling and re-use
5) how much waste the proposal is expected to generate, and how and where the waste will be managed in accordance with the waste hierarchy
6) how performance will be monitored and reported.
C Development Plans that apply circular economy principles and set local lower thresholds for the application of Circular Economy Statements for development proposals are supported.

9.7.1 Waste is defined as anything that is discarded. A **circular economy** is one where materials are retained in use at their highest value for as long as possible and are then re-used or recycled, leaving a minimum of residual waste. London should move to a more circular economy as this will save resources, increase the resource efficiency of London's businesses, and help to reduce carbon emissions. The successful implementation of circular economy principles will help to reduce the volume of waste that London produces and has to manage. A key way of achieving this will be through incorporating circular economy principles into the design of developments (see also Policy D3 Optimising site capacity through the design-led approach) as well as through Circular Economy Statements for referable applications.

9.7.2 The adoption of circular economy principles for referable applications means creating a built environment where buildings are designed for **adaptation, reconstruction and deconstruction**. This is to extend the useful life of buildings and allow for the salvage of components and materials for reuse or recycling. Un-used or discarded materials should be brought back to an equal or comparable level of quality and value and reprocessed

for their original purpose (e.g. recycling glass back into glass, instead of into aggregate).

9.7.3 To assist with the introduction of Circular Economy principles, the Mayor will be providing further guidance on **Circular Economy Statements**. Circular Economy Statements are intended to cover the whole life cycle of development. This will apply to referable schemes and be encouraged for other major infrastructure projects within London. Boroughs are encouraged to set lower local thresholds through Development Plans.

9.7.4 In 2015[165] London produced just under 18 million tonnes (mt) of **waste**, comprising:

- 3.1mt household waste – 17 per cent
- 5.0mt commercial/industrial waste – 28 per cent
- 9.7mt construction, demolition and excavation waste – 54 per cent

9.7.5 Modelling[166] suggests that if London achieves the Mayor's reduction and recycling targets, it will have sufficient **Energy from Waste** capacity to manage London's non-recyclable municipal waste, once the new Edmonton and Beddington Lane facilities are operational.

9.7.6 The London Environment Strategy sets out a pathway to achieving a municipal recycling target of 65 per cent by 2030 and outlines the Mayor's approach to **municipal waste** management in detail. This includes London achieving a 50 per cent reduction in food waste and associated packaging waste per person by 2030, and London local authorities needing to provide a minimum level of recycling service, including separate food waste, to residents by 2020. To achieve these recycling targets, it will be important that recycling, storage and collection systems in new developments are appropriately designed. Further detail on how developments should do this is set out in guidance.

9.7.7 Re-use and recycling rates for **construction, demolition and excavation waste** and material (CD&E) in London is estimated between 50 – 60 per cent[167] for 2015 with some large construction projects including the Olympic Park achieving 85 – 95 per cent recovery rates. The targets for CD&E waste and material are already being set on some projects, but better data (particularly relating to reuse on site) is needed to inform performance. The adoption of circular economy principles in referable applications (and promoted in Local Plans) is expected to help London achieve the CD&E waste and material recovery targets early in the Plan period.

9.7.8 The movement and management of household, commercial and industrial, and construction, demolition and excavation waste will be monitored in collaboration with other stakeholders through available data sets (including the Environment Agency's Waste Data Interrogator tool and WasteDataFlow) and reporting against commitments in Circular Economy Statements. This will inform reporting on and **monitoring** of the achievement of the targets set out in this policy, Part A.

9.7.9 Part A4 reflects recent **changes to the regulatory regime** that mean that the particular characteristics of excavation waste make it difficult to recover. The Mayor will continue to work with stakeholders to understand the implications of this regulatory change and to promote its beneficial use and limit the amount sent to landfill. The best environmental option practicable for the management of excavation material should be used. This

could, for example, include using the material as a resource within the construction of the proposed development, or in other local construction projects, or using the material in habitat creation, flood defences or landfill restoration. In line with circular economy principles, the management of excavation waste should be focused on-site or within local projects.

9.7.10 When it is intended to send **waste to landfill** it will be important to show evidence that the receiving facility has the capacity to deal with waste over the lifetime of the development. This information should be made available to the relevant waste planning authority to help plan for future needs.

Policy SI 8 Waste capacity and net waste self-sufficiency

Policy SI 8 Waste capacity and net waste self-sufficiency
A In order to manage London's waste sustainably:
1) the equivalent of 100 per cent of London's waste should be managed within London (i.e. net self-sufficiency) by 2026
2) existing waste management sites should be safeguarded (see Policy SI 9 Safeguarded waste sites)
3) the waste management capacity of existing sites should be optimised
4) new waste management sites should be provided where required
5) environmental, social and economic benefits from waste and secondary materials management should be created.
B Development Plans should:
1) plan for identified waste needs
2) identify how waste will be reduced, in line with the principles of the Circular Economy and how remaining quantums of waste will be managed
3) allocate sufficient sites, identify suitable areas, and identify waste management facilities to provide the capacity to manage the apportioned tonnages of waste, as set out in Table 9.2 – boroughs are encouraged to collaborate by pooling their apportionment requirements
4) identify the following as suitable locations to manage borough waste apportionments:
a) existing waste and secondary material sites/land, particularly waste transfer facilities, with a view to maximising their capacity
b) Strategic Industrial Locations and Locally Significant Industrial Sites
c) safeguarded wharves with an existing or future potential for waste and secondary material management.
C Mayoral Development Corporations must cooperate with host boroughs to meet identified waste needs.
D Development proposals for materials and waste management sites are encouraged where they:
1) deliver a range of complementary waste management and secondary material processing facilities on a single site
2) support prolonged product life and secondary repair, refurbishment and remanufacture of materials and assets
3) contribute towards renewable energy generation, especially renewable gas technologies from organic/biomass waste, and/or
4) are linked to low emission combined heat and power and/or combined cooling heat and power (CHP is only acceptable where it will enable the delivery or extension of an area-wide heat network consistent with Policy SI 3 Energy Infrastructure Part D1c).
E Developments proposals for new waste sites or to increase the capacity of existing sites should be evaluated against the following criteria:
1) the nature of the activity, its scale and location
2) effective implementation of the waste hierarchy and its contribution to London's circular economy
3) achieving a positive carbon outcome (i.e. re-using and recycling high carbon content materials) resulting in significant greenhouse gas savings – all facilities generating energy from waste will need to meet, or

demonstrate that steps are in place to meet, a minimum performance of 400g of CO2 equivalent per kilowatt hour of electricity produced
4) the impact on amenity in surrounding areas (including but not limited to noise, odours, air quality and visual impact) – where a site is likely to produce significant air quality, dust or noise impacts, it should be fully enclosed
5) the transport and environmental impacts of all vehicle movements related to the proposal – the use of renewable fuels from waste sources and the use of rail and waterway networks to transport waste should be supported.
F When planning for new waste sites or to increase the capacity at existing sites the following should be considered:
1) job creation and social value benefits, including skills, training and apprenticeship opportunities
2) local need
3) accessibility of services for local communities and businesses.

Table 9.1 - Forecast arisings of household, commercial and industrial waste by borough 2021-2041 (000’s tonnes)

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Table 9.1 shows forecast arisings of household, commercial and industrial waste by borough 2021-2041 (thousands of tonnes)

Borough	2021	2041
Barking & Dagenham	214	230
Barnet	315	340
Bexley	225	241
Brent	259	274
Bromley	249	267
Camden	360	374
City of London	230	238
Croydon	305	327

Borough	2021	2041
Ealing	291	306
Enfield	305	327
Greenwich	209	226
Hackney	183	195
Hammersmith & Fulham	183	190
Haringey	190	201
Harrow	188	205
Havering	229	249
Hillingdon	347	365
Hounslow	260	275
Islington	241	251
Kensington & Chelsea	201	210
Kingston	152	160
Lambeth	208	219
Lewisham	191	206
Merton	174	184

Borough	2021	2041
Newham	244	260
Redbridge	196	216
Richmond	179	190
Southwark	292	308
Sutton	161	172
Tower Hamlets	260	273
Waltham Forest	202	218
Wandsworth	251	264
City of Westminster	722	749
London total	**8,217**	**8,726**

Table 9.2 - Borough-level apportionments of household, commercial and industrial waste 2021-2041 (000’s tonnes)

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Table 9.2 shows Borough-level apportionments of household, commercial and industrial waste 2021-2041 (thousands of tonnes)

Borough	Apportionment *	2021	2041

Barking & Dagenham	6.1	505	537
Barnet	2.6	215	229
Bexley	5.6	457	485
Brent	5.0	412	437
Bromley	2.3	192	204
Camden	1.6	133	141
City of London	1.0	84	90
Croydon	3.1	252	268
Ealing	6.6	542	576
Enfield	4.3	356	379
Greenwich	4.1	338	359
Hackney	1.3	111	118
Hammersmith & Fulham	2.6	210	223
Haringey	2.3	192	203
Harrow	1.9	160	170
Havering	4.5	370	393

Hillingdon	5.1	423	449
Hounslow	5.0	407	432
Islington	1.2	101	108
Kensington & Chelsea	1.4	116	123
Kingston	2.3	187	199
Lambeth	1.7	143	152
Lewisham	2.2	184	195
Merton	2.9	238	253
Newham	4.7	383	407
Redbridge	1.8	151	160
Richmond	1.8	148	157
Southwark	1.8	150	159
Sutton	2.6	211	224
Tower Hamlets	2.4	195	207
Waltham Forest	2.4	199	211
Wandsworth	3.2	264	280

City of Westminster	2.3	188	200
London total	**100.0**	**8,217**	**8,726**

* Apportionment is per cent share of London's total waste to be managed by borough

Table 9.3 - Projected net exports of household, commercial and industrial waste from London (000's tonnes)

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Table 9.3 shows the projected net exports of household, commercial and industrial waste from London (thousands of tonnes)

Type	2015	2021	2026	2041
London's arisings	8,100	8,216	8,299	8,726
London's exports	3,449	1,725	0	0

Note: 2015 is an actual figure (SLR May 2017), data for 2021, 2026 and 2041 are projections

9.8.1 In 2015, London managed 7.5mt of its own waste and exported 11.4mt of waste. London also imported 3.6mt of waste. This gives London a current waste **net self-sufficiency figure** of approximately 60 per cent. Around 5mt (49 per cent) of waste exported from London went to the East of England and 4.2mt (42 per cent) to the South East. The bulk of this waste is CD&E waste. Approximately 1.3mt of waste was exported overseas. The term net self-sufficiency is meant to apply to all waste streams, with the exception of excavation waste. The particular characteristics of this waste stream mean that it will be challenging for London to provide either the sites or the level of compensatory provision needed to apply net self-sufficiency to this waste stream.

9.8.2 In 2015, 2.9mt of the waste sent to the East of England went to landfill and 2.2mt went to landfill in the South East. Some 32 per cent of London's waste that was biodegradable or recyclable was sent to landfill. The Mayor is committed to **sending zero biodegradable or recyclable waste to landfill by 2026**.

9.8.3 Waste contracts do not recognise administrative boundaries and waste flows across borders. Therefore, sufficient sites should be identified within London to deal with the equivalent of 100 per cent of the waste apportioned to the boroughs as set out in Table 9.2. The Mayor will work with boroughs, the London Waste and Recycling Board, and the London and neighbouring Regional Technical Advisory Bodies to address **cross-**

boundary waste flow issues. Examples of joint working include ongoing updates to the London Waste Map, sharing data derived from Circular Economy Statements, the monitoring of primary waste streams and progress to net self-sufficiency, supporting the Environment Agency's annual monitoring work, and collaboration on management solutions of waste arisings from London.

9.8.4 Waste is deemed to be managed in London if any of the following activities take place within London:

- waste is used for energy recovery
- the production of solid recovered fuel (SRF), or it is high-quality refuse-derived fuel (RDF) meeting the Defra RDF definition as a minimum[168] which is destined for energy recovery
- it is sorted or bulked for re-use (including repair and re-manufacture) or for recycling (including anaerobic digestion)
- it is reused or recycled (including anaerobic digestion).

9.8.5 Supporting the production of **SRF and high-quality RDF feedstock** will promote local energy generation and benefit Londoners, improving London's energy security, helping to achieve regional self-sufficiency and possibly reducing leakage of SRF and RDF overseas. London facilities should produce high-quality waste feedstock with very little recyclable content (i.e. plastics), supporting renewable energy generation.

9.8.6 Table 9.1 shows projected arisings for household, commercial and industrial waste for each borough. National policy guidance requires boroughs to have regard to the **waste apportionments** set out in the London Plan. The Plan's waste apportionment model defines the proportion of London's total household, commercial and industrial waste that each borough should plan for, and these apportionments are set out in Table 9.2. Part B3 requires boroughs to allocate sufficient land (sites and/or areas) and identify waste management facilities to provide the capacity to manage their apportioned tonnages of waste. Boroughs are encouraged to collaborate by pooling their apportionment requirements. Boroughs with a surplus of waste sites should offer to share these sites with those boroughs facing a shortfall in capacity before considering site release.

9.8.7 Boroughs should examine in detail **how capacity can be delivered at the local level** and demonstrate how this can be provided for through the allocation of sufficient sites and the identification of suitable areas in Development Plans to meet their apportionment, and should aim to meet their waste apportionment as a minimum. It may not always be possible for boroughs to meet their apportionment within their boundaries and in such circumstances boroughs will need to agree the transfer of apportioned waste. Where?apportionments are pooled, boroughs must demonstrate how their joint apportionment targets will be met, for example through joint waste Development Plan Documents, joint evidence papers or bilateral agreements.

9.8.8 **Mayoral Development Corporations** (MDCs) must cooperate with host boroughs to meet identified waste needs; this includes boroughs' apportionment requirements. This could be widened to cover boroughs in the relevant waste planning group where appropriate. In future iterations of the Plan full consideration will be given to apportioning waste needs to MDCs.

9.8.9 Waste planning authorities and groups should plan to meet the identified waste management needs of their local area and are encouraged to identify suitable **additional capacity for waste**, including those waste streams not apportioned by the London Plan, where practicable. This could include, waste transfer sites, new sites managing construction, demolition and excavation waste, or the reconfiguration and intensification of existing

uses that increase management capacity.

9.8.10 Plans or agreements **safeguarding waste sites** should take a flexible approach. They should be regularly reviewed and updated to take account of development that may lead to the integration of waste sites or appropriate relocation of lost waste sites. Waste plans should be responsive to strategic opportunities across borough and joint waste planning boundaries for optimising capacity on existing waste sites, or that help to unlock investment in developing new waste sites. Where a waste site may be lost, compensatory capacity should first be explored within the borough. In cases where this can't be provided, and suitable capacity is found in another borough, the receiving borough or joint waste planning group is encouraged to take on the apportionment and include it as part of their Development Plan.

9.8.11 Land in Strategic Industrial Locations will provide the main opportunities for locating waste treatment facilities. Existing waste management sites should be clearly identified and safeguarded for waste use. Boroughs should also look to Locally Significant Industrial Sites and intensification of existing waste management sites. Large-scale redevelopment opportunities and redevelopment proposals should incorporate waste management facilities within them. The London Waste Map[169] shows the locations of London's permitted waste facilities and sites that may be suitable for waste facility location.

9.8.12 As noted above, waste flows across boundaries and London exported 3.4mt of household, commercial and industrial waste in 2015. To meet the Mayor's policy commitment of net self-sufficiency by 2026 there needs to be a reduction in exports or an increase in imports in the lead up to 2026. Table 9.3 is included to help neighbouring authorities plan for London's expected household, commercial and industrial waste exports.

9.8.13 Tables 9.1, 9.2 and 9.3 only refer to household, commercial and industrial waste, not construction, demolition and excavation waste. As the **reliability of CD&E waste data is low**, apportionments for this waste stream are not set out. For a fuller discussion of the issues around CD&E waste data see paragraph 9.7.7 and the SLR consulting report (task 2) (May 2017).

9.8.14 To support the shift towards a low-carbon circular economy, all facilities generating energy from waste should meet, or demonstrate that they can meet in future, a measure of minimum greenhouse gas performance known as the **carbon intensity floor** (CIF). The CIF is set at 400g of CO_2 equivalent generated per kilowatt hour (kwh) of electricity generated. The GLA's free on-line ready reckoner tool can assist boroughs and applicants in measuring and determining performance against the CIF.[170] Achieving the CIF effectively rules out traditional mass burn incineration techniques generating electricity only. Instead, it supports techniques where both heat and power generated are used, and technologies are able to achieve high efficiencies, such as when linked with gas engines and hydrogen fuel cells. More information on how the CIF has been developed and how to meet it can be found in the London Environment Strategy.

9.8.15 Waste to energy facilities should be equipped with a **heat off-take** from the outset such that a future heat demand can be supplied without the need to modify the heat producing plant in any way or entail its unplanned shut-down. It should be demonstrated that capacity of the heat off-take meets the CIF at 100 per cent heat supply. In order to ensure it remains relevant, the CIF level will be kept under review.

9.8.16 Examples of the '**demonstrable steps**' required under Part E3 are:

- a commitment to source truly residual waste – waste with as little recyclable material as possible

- a commitment (via a Section 106 obligation) to deliver the necessary means for infrastructure to meet the minimum CO2 standard, for example investment in the development of a heat distribution network to the site boundary, or technology modifications that improve plant efficiency

- an agreed timeframe (via a Section 106 agreement) as to when proposed measures will be delivered

- the establishment of a working group to progress the agreed steps and monitor and report performance to the consenting authority.

9.8.17 To assist in the delivery of 'demonstrable steps' the GLA can help to advise on **heat take-off opportunities** for waste to energy projects, particularly where these are linked to GLA supported energy masterplans.

9.8.18 In 2015 around 324,000 tonnes of **hazardous waste** was produced in London. Hazardous waste makes up a component of all waste streams and is included in the apportionments for household, commercial and industrial waste set out in Table 9.2. London sends small amounts of hazardous waste to landfill outside of London, approximately three per cent of the national total. The amount of such waste produced has continued to grow in the short and medium-term. Without sustained action, there remains the risk of a major shortfall in our capacity to treat and dispose of hazardous waste safely. This could lead to storage problems, illegal disposal (including fly tipping) and rising public concern about health and environmental impacts.?There is therefore a need to continue to identify hazardous waste capacity for London.?The main requirement is for sites for regional facilities to be identified.?Boroughs will need to work with neighbouring authorities to consider the necessary facilities when planning for their hazardous waste.

9.8.19 **Waste processing facilities** should be well designed. They should respect context, not be visually overbearing and should contribute to the local economy as a source of new products and new jobs. They should be developed and designed in consultation with local communities, taking account of health and safety within the facility, the site and adjoining neighbourhoods. Developments supporting circular economy outcomes such as re-use, repair and re-manufacture, will be encouraged. Where movement of waste is required, priority should be given to facilities for movement by river or rail. Opportunities for combined heat, power and cooling should be taken wherever possible. Although no further landfill proposals in London are identified or anticipated within the Plan period, if proposals do come forward for new or extended landfill capacity or for land-raising, boroughs should ensure that the resultant void-space has regard to the London Environment Strategy.

9.8.20 Following the Agent of Change principle, developments adjacent to waste management sites should be designed to **minimise the potential for disturbance and conflicts of use**. Developers should refer to the London Waste and Recycling Board's design guide for ensuring adequate and easily accessible storage space for high-rise developments, see Part E of Policy D6 Housing quality and standards.

Policy SI 9 Safeguarded waste sites

Policy SI 9 Safeguarded waste sites
A Existing waste sites should be safeguarded and retained in waste management use.
B Waste facilities located in areas identified for non-waste related development should be integrated with other uses as a first principle where they deliver clear local benefits.
C Waste plans should be adopted before considering the loss of waste sites. The proposed loss of an existing waste site will only be supported where appropriate compensatory capacity is made within London that must be at or above the same level of the waste hierarchy and at least meet, and should exceed, the maximum achievable throughput of the site proposed to be lost.
D Development proposals that would result in the loss of existing sites for the treatment and/or disposal of hazardous waste should not be permitted unless compensatory hazardous waste site provision has been secured in accordance with this policy.
E Development proposals for the relocation of waste sites within London are supported where strategic waste management outcomes are achieved.

9.9.1 London has approximately 500 **waste sites**, defined as land with planning permission for a waste use or a permit from the Environment Agency for a waste use. This applies to land used for any waste stream. These sites cover a wide range of waste activities and perform a valuable service to London, its people and economy.

9.9.2 Any **proposed release of current waste sites** or those identified for future waste management capacity should be part of a plan-led process, rather than done on an ad-hoc basis. Waste sites should only be released to other land uses where waste processing capacity is re-provided elsewhere within London, based on the maximum achievable throughput of the site proposed to be lost. When assessing the throughput of a site, the maximum throughput achieved over the last five years should be used; where this is not available potential capacity of the site should be appropriately assessed.

9.9.3 Policy SI 8 Waste capacity and net waste self-sufficiency promotes **capacity increases at waste sites** where appropriate to maximise their use. If such increases are implemented over the Plan period, it may be possible to justify the release of waste sites if it can be demonstrated that there is sufficient capacity available elsewhere in London at appropriate sites over the Plan period to meet apportionment and that the target of achieving net self-sufficiency is not compromised. In such cases, sites could be released for other land uses.

Policy SI 10 Aggregates

Policy SI 10 Aggregates
A An adequate supply of aggregates to support construction in London will be achieved by:
1) encouraging re-use and recycling of construction, demolition and excavation waste within London, including on-site
2) extracting land-won aggregates within London
3) importing aggregates to London by sustainable transport modes.
B Development Plans should:
1) make provision for the maintenance of a landbank (i.e. seven years' supply) of at least five million tonnes of land-won aggregates up to 2041, in particular through a landbank apportionment of:
a) at least 1.75 mt to London Borough of Havering
b) at least 0.7 mt to London Borough of Redbridge
c) at least 1.75 mt to London Borough of Hillingdon
d) at least 0.7 mt to London Borough of Hounslow.

2) ensure sufficient capacity of aggregates wharves and aggregate rail depots is available to ensure a steady and adequate supply of imported and marine aggregates to London and maximise the movement of aggregates by sustainable modes
3) support the production of recycled/secondary aggregates and, where practicable, expand capacity at/or adjacent to aggregates wharves and rail depots and quarries during their operational life, within or adjacent to major construction projects.
C All Mineral Planning Authorities should, in Development Plans:
1) identify mineral safeguarding areas to protect sand and gravel resources from development that would otherwise sterilise future potential extraction
2) identify and safeguard sites and facilities, including wharves and railheads, with existing, planned or potential capacity for transportation, distribution, processing and/or production of primary and/or secondary/recycled aggregates.
D To reduce the environmental impact of aggregate sites and facilities development proposals should:
1) demonstrate that appropriate measures to deal with aftercare, restoration and re-use of minerals sites following extraction are in place; with particular emphasis on promoting green infrastructure and biodiversity
2) ensure that potential impacts, in particular to the natural and historic environment and to human health, are assessed and effectively controlled.
E Development proposals should be designed to avoid and mitigate potential conflicts with sites safeguarded for the transportation, distribution, processing and/or production of aggregates, in line with the Agent of Change principle.

9.10.1 London needs a **reliable supply of construction materials** to support continued growth. National planning policy requires Mineral Planning Authorities to maintain a steady and adequate supply of aggregates.?These include land-won sand and gravel, crushed rock, marine sand and gravel, recycled materials and secondary aggregates created from construction, demolition and excavation (CD&E) and industrial waste. Most aggregates used in the capital come from outside London, including marine sand and gravel and land-won aggregates, principally crushed rock from other regions. There are relatively small resources of workable land-won sand and gravel in London.

9.10.2 A realistic **landbank** (i.e. seven years' supply) of at least 5 million tonnes of land-won aggregates for London throughout the Plan period has been apportioned to boroughs as set out in this policy. There remains some potential for extraction beyond the four boroughs identified, including within the Lee Valley. Boroughs with aggregates resources should consider extraction opportunities when preparing Development Plans.

9.10.3 Those boroughs with an apportionment should plan to meet their landbank target and plan for the steady and adequate supply of **minerals** through the identification of specific sites where viable resources are known to exist, preferred areas where known resources are likely to get planning permission, and areas of search where mineral resources might reasonably be anticipated.

9.10.4 Aggregates are bulky materials so Development Plans should maximise their use and re-use and minimise their movement, especially by road.?The objective of proximity dictates that the best option is the use of local materials where feasible. The **re-use/recycling** of building materials and aggregates is a significant and well established component of the circular economy advocated in Policy SI 7 Reducing waste and supporting the circular economy and reduces the demand for natural materials.

9.10.5 Boroughs should identify and safeguard existing, planned and potential **sites for aggregate extraction, transportation, processing and manufacture** – and recognise where there may be benefits in their co-location. Existing and future wharf capacity is essential, especially for transporting marine-dredged aggregates, and should be protected in accordance with Policy SI 15 Water transport. Equally important are railway depots for

importing crushed rock from other parts of the UK. Railheads are vital to the sustainable movement of aggregates and boroughs should safeguard these sites in line with Policy T7 Deliveries, Servicing and Construction. Boroughs should also safeguard sites for the production and distribution of aggregate products.

9.10.6 Development proposals and planning decisions should ensure that **impacts to environment, heritage and amenity values** are considered, including the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality. Principal issues include noise, dust, air quality, lighting, archaeological and heritage features, traffic, land contamination, impacts to surface and ground water and land stability.

9.10.7 **Sites for depots** may be particularly appropriate in preferred industrial locations and other employment areas. Boroughs should examine the feasibility of using quarries as CD&E recycling sites once mineral extraction has finished.

9.10.8 Mineral Planning Authorities are required to prepare an annual **Local Aggregates Assessment (LAA)**. The Mayor will work with boroughs and the London Aggregates Working Party to explore options for the preparation of joint LAAs in the future.

Policy SI 11 Hydraulic fracturing (Fracking)

Policy SI 11 Hydraulic fracturing (Fracking)
A Development proposals for exploration, appraisal or production of shale gas via hydraulic fracturing should be refused.

9.11.1 In line with the Plan's policy approach to energy efficiency, renewable energy, climate change, air quality, and water resources, the Mayor does not support fracking in London.

9.11.2 The British Geological Survey concluded in a 2014 report for the Department of Energy and Climate Change that "there is no significant Jurassic shale gas potential in the Weald Basin".[171] It is highly unlikely that there is any site that is geologically suitable for a fracking development in London.

9.11.3 Should any London fracking proposal come forward there is a high probability that it would be located on **Green Belt or Metropolitan Open Land**. Furthermore, London and the south east of England are **seriously water-stressed areas**. Fracking operations not only use large amounts of water but also presents risks of potential contamination, presenting significant risks to London.

9.11.4 In addition to avoiding or mitigating adverse construction and operational impacts (noise, dust, visual intrusion, vehicle movements and lighting, on both the natural and built environment, including air quality and the water environment), any fracking proposal would need to take full account, where relevant, of the following **environmental constraints**:

- Areas of Outstanding Natural Beauty
- Sites of Special Scientific Interest
- Groundwater Source Protection Zone 1
- Special Protection Areas (adopted or candidate)
- Special Areas of Conservation (adopted or candidate)
- Sites of Metropolitan Importance for Nature Conservation
- groundwater or surface water

9.11.5 The United Kingdom Onshore Oil and Gas Group (UKOOG), which represents the industry, has established a **Community Engagement Charter** for new onshore oil and gas proposals.[172] The Charter sets out a number of commitments for operators which includes engagement with local communities at each of the three main stages of operations (exploration, appraisal and production). Where any proposals for fracking to come forward, applicants who are members of UKOOG would be expected to comply with these commitments.

Policy SI 12 Flood risk management

Policy SI 12 Flood risk management

A Current and expected flood risk from all sources (as defined in paragraph 9.12.2) across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

B Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London.

C Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

D Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.

E Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

F Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.

G Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat.

9.12.1 In London, the boroughs are **Lead Local Flood Authorities** (LLFAs) and are responsible, in particular, for local surface water flood risk management and for maintaining a flood risk management assets register. They produce Local Flood Risk Management Strategies. LLFAs should cooperate on strategic and cross-boundary issues.

9.12.2 The **Regional Flood Risk Appraisal** (RFRA) considers all sources of flood risk including tidal, fluvial, surface water, sewer, groundwater and reservoir flooding and has been updated in collaboration with the Environment Agency. The RFRA provides a spatial analysis of flood risk including consideration of risks at major growth locations such as Opportunity Areas and Town Centres and key infrastructure assets. The Government's updated allowances for climate change are reflected in the expected sea level rise and increased flood risks considered in the RFRA. The updated allowances consider the lifetime, vulnerability and location of a development.

9.12.3 The **Thames Estuary 2100 Plan** (TE2100), published by the Environment Agency, and endorsed by Government, focuses on a partnership approach to tidal flood risk management. It requires the ability to maintain

and raise some tidal walls and embankments. The Environment Agency estimates that a new Thames Barrier is likely to be required towards the end of the century. Potential sites will be needed in Kent and/or Essex requiring close partnership working with the relevant local authorities.

9.12.4 The concept of Local Authorities producing **Riverside Strategies** was introduced through the TE2100 Plan to improve flood risk management in the vicinity of the river, create better access to and along the riverside, and improve the riverside environment. The Mayor will support these strategies.

9.12.5 The Environment Agency's Thames River Basin District **Flood Risk Management Plan** is part of a collaborative and integrated approach to catchment planning for water. Measures to address flood risk should be integral to development proposals and considered early in the design process. This will ensure they provide adequate protection, do not compromise good design, do not shift vulnerabilities elsewhere, and are cost-effective. Natural flood risk management in the upper river catchment areas can also help to reduce risk lower in the catchments. Making space for water when considering development proposals is particularly important where there is significant exposure to flood risk along tributaries and at the tidal-fluvial interface. The Flood Risk Management Plan should inform the boroughs' Strategic Flood Risk Assessments.

9.12.6 In terms of mitigating **residual risk**, it is important that a strategy for resistance and then resilience including safe evacuation and quick recovery to address such risks is in place; this is also the case for utility services. In the case of a severe flood, especially a tidal flood, many thousands of properties could be affected. This will make rescue and the provision of temporary accommodation challenging. Designing buildings such that people can remain within them and be safe and comfortable in the unlikely event of such a flood, will improve London's resilience to such an event.

Policy SI 13 Sustainable drainage

Policy SI 13 Sustainable drainage

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

B Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2) rainwater infiltration to ground at or close to source
3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) controlled rainwater discharge to a surface water sewer or drain
6) controlled rainwater discharge to a combined sewer.

C Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

9.13.1 London is at particular risk from surface water flooding, mainly due to the large extent of impermeable surfaces. Lead Local Flood Authorities have responsibility for managing surface water drainage through the planning system, as well as ensuring that appropriate maintenance arrangements are put in place. **Local Flood Risk Management Strategies and Surface Water Management Plans** should ensure they address flooding from multiple sources including surface water, groundwater and small watercourses that occurs as a result of heavy rainfall.

9.13.2 Development proposals should aim to get as close to greenfield run-off rates[173] as possible depending on site conditions. The **well-established drainage hierarchy** set out in this policy helps to reduce the rate and volume of surface water run-off. Rainwater should be managed as close to the top of the hierarchy as possible. There should be a preference for green over grey features, and drainage by gravity over pumped systems. A blue roof is an attenuation tank at roof or podium level; the combination of a blue and green roof is particularly beneficial, as the attenuated water is used to irrigate the green roof.

9.13.3 For many sites, it may be appropriate to use **more than one form of drainage**, for example a proportion of rainwater can be managed by more sustainable methods, with residual rainwater managed lower down the hierarchy. In some cases, direct discharge into the watercourse is an appropriate approach, for example rainwater discharge into the tidal Thames or a dock. This should include suitable pollution prevention filtering measures, ideally by using soft engineering or green infrastructure. In addition, if direct discharge is to a watercourse where the outfall is likely to be affected by tide-locking, suitable storage should be designed into the system. However, in other cases direct discharge will not be appropriate, for example discharge into a small stream at the headwaters of a catchment, which may cause flooding. This will need to be assessed on a case-by-case basis, taking into account the location, scale and quality of the discharge and the receiving watercourse. The maintenance of identified drainage measures should also be considered in development proposals.

9.13.4 The **London Sustainable Drainage Action Plan** complements this policy. It contains a series of actions to make the drainage system work in a more natural way with a particular emphasis on retrofitting.

Policy SI 14 Waterways – strategic role

Policy SI 14 Waterways – strategic role
A Development Plans and development proposals should address the strategic importance of London’s network of linked waterways, including the River Thames, and should seek to maximise their multifunctional social, economic and environmental benefits.
B To ensure coordination and alignment at the interface between terrestrial and marine planning, Development Plans and development proposals should take account of the emerging Marine Spatial Plans prepared by the Marine Management Organisation.
C Boroughs are encouraged to work together on policies or other appropriate area-based strategies that address cross-boundary waterways issues.
D To reflect the distinctiveness of areas that specifically relate to the River Thames, relevant Development Plans should designate, and ensure the maintenance of, Thames Policy Areas (TPAs). Setting the boundary of TPAs should be done in consultation with neighbouring boroughs, including those across the river. Boroughs are encouraged to plan for TPAs through joint Thames Strategies.
E Joint Thames Strategies and other area-based joint waterways strategies should consider:
• the local character of the river/waterway
• water-based passenger and freight transport nodes
• development sites and regeneration opportunities
• opportunities for environmental/ecological and urban design improvements

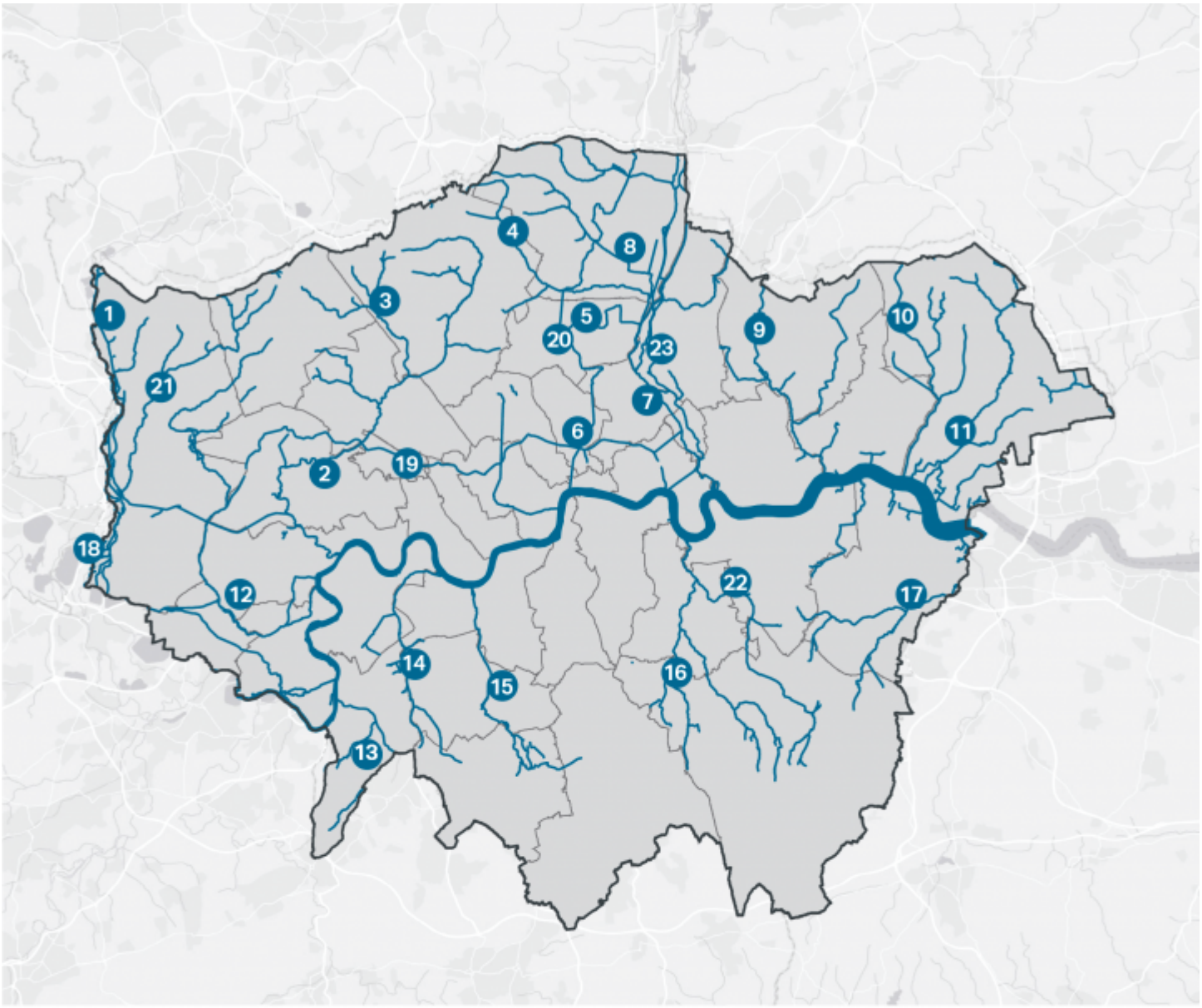
• sites of ecological, historic, or archaeological importance
• sites, buildings, structures, landscapes and views of particular sensitivity or importance
• focal points of public activity
• inclusive public access
• strategic cultural value
• recreation and marine infrastructure
• river crossings and other structures
• indicative flood risk and water quality.

9.14.1 The term ‘waterways’ does not only refer to the River Thames, its tributary rivers and canals, but also to other water spaces including docks, lakes and reservoirs. **This network of linked waterways** – also known as the Blue Ribbon Network – is of strategic importance for London. Every London borough contains some waterways – 17 border the Thames and 15 contain canals (see Figure 9.6).

9.14.2 London’s **waterways are multifunctional assets**. They provide transport and recreation corridors; green infrastructure; a series of diverse and important habitats; a unique backdrop for important heritage assets, including World Heritage Sites, landscapes, views, cultural and community activities; as well as drainage, flood and water management and urban cooling functions. As such, they provide environmental, economic and health and wellbeing benefits for Londoners and play a key role in place making. They also provide a home for Londoners living on boats. The waterways are protected and their water-related use – in particular safe and sustainable passenger and freight transport, tourism, cultural, community and recreational activities, as well as biodiversity – is promoted. Many of these functions are also supported by boroughs’ local Riverside Strategies, the Environment Agency’s Thames River Basin Management Plan and the Port of London Authority’s Vision for the Thames. In addition to the Thames, other water spaces, and in particular canals, have a distinct value and significance for London and Londoners.

Figure 9.6 - London’s Network of Waterways (the Blue Ribbon Network)

Figure 9.6 - London’s Network of Waterways (the Blue Ribbon Network)



London's Waterways

Source: OS Open Rivers

Waterways

Note: Not all tributaries shown

1. Grand Union Canal
2. River Brent
3. Silk Stream
4. Pymmes Brook
5. Moselle Brook
6. Regents Canal
7. Lee Navigation
8. Salmons Brook
9. River Roding
10. River Rom
11. Ingrenbourne R.
12. R. Crane
13. Hogsmill River
14. Beverley Brook
15. R. Wandle
16. Ravensbourne R.
17. River Cray
18. River Colne
19. Paddington Arm
20. New River
21. River Pinn
22. River Quaggy
23. River Lea

9.14.3 The **Thames and London Waterways Forum**[174] has been established jointly by the GLA, TfL and the Port of London Authority to address waterways priorities set out in this Plan, the Mayor's Transport Strategy, the London Environment Strategy and the Port of London Authority's Vision for the Thames.

9.14.4 As London's waterways cross borough boundaries, it is important to plan for their management strategically. Boroughs are encouraged to work together to develop appropriate policies or **joint area-based waterways strategies** to maximise the multifunctional benefits waterways provide.

9.14.5 The River Thames is a strategically-important and iconic feature of London. It is a focal point for London's identity reflecting its heritage, natural and landscape values as well as cultural opportunities. Its character changes on its way through London. Where **Thames Policy Areas** (TPAs) are not defined in Development Plans, the boundaries defined in Figure 9.7 apply. Within TPAs, lower-height thresholds for referable planning applications apply (25m compared to 30m elsewhere).

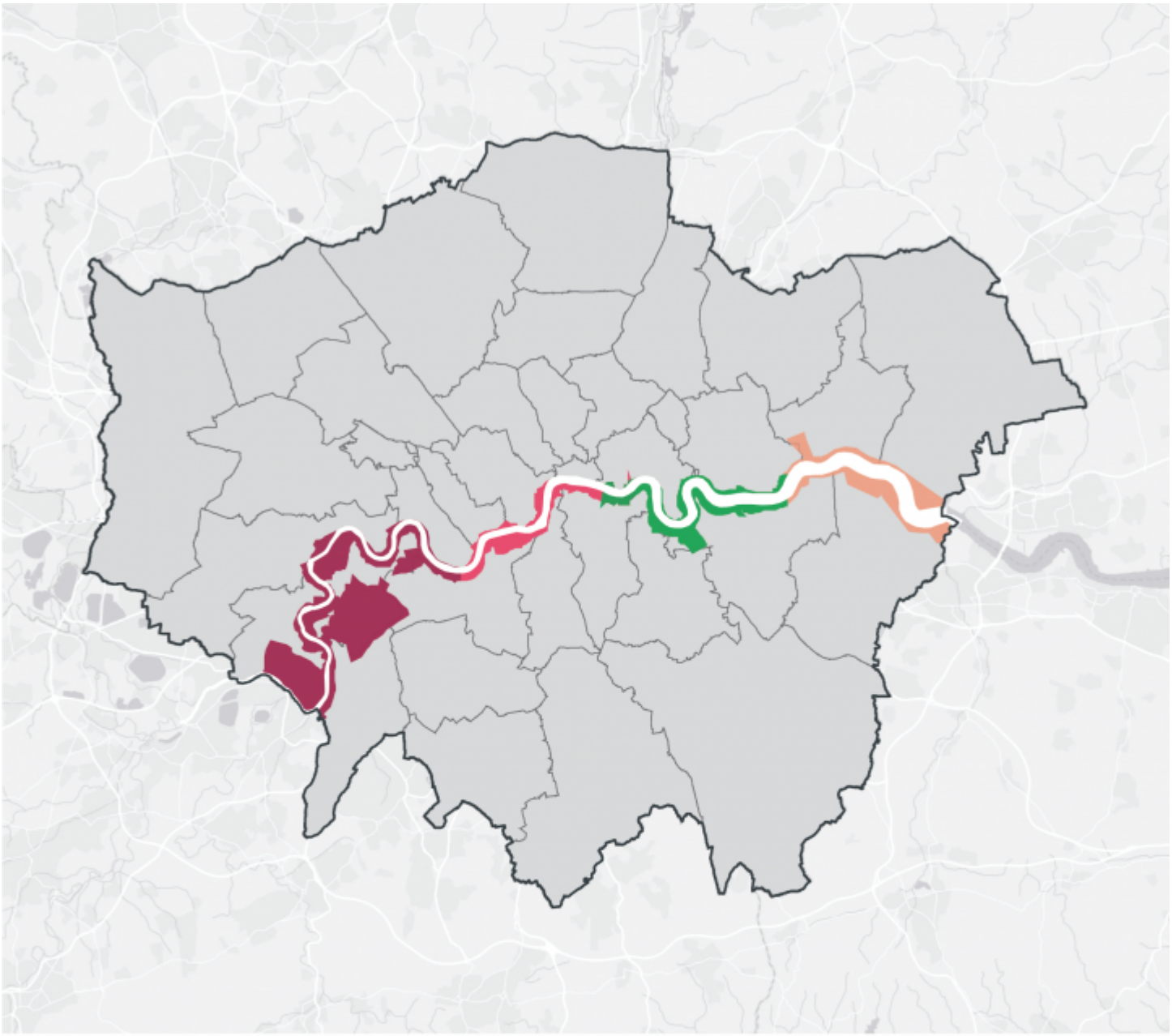
9.14.6 In **defining TPA boundaries**, boroughs should work collaboratively and have regard to the following:

- proximity to the Thames
- clear visual links between areas, buildings and the river
- specific geographical features such as main roads, railway lines and hedges
- the whole curtilage of properties or sites adjacent to the Thames
- areas and buildings whose functions relate or link to the Thames
- areas and buildings that have an historic, archaeological or cultural association with the Thames
- consistent boundaries with neighbouring authorities.

9.14.7 **Joint Thames Strategies** should specifically identify and address deficiencies in: water-based passenger, tourism and freight transport; sport, leisure and mooring facilities; marine support infrastructure; and inclusive access and safety provision. Thames Strategies are in place for Hampton–Kew, Kew-Chelsea and East (of Tower Bridge). No joint strategy currently exists for the central section of the Thames (Chelsea-Tower Bridge).

Figure 9.7 - Thames Policy Areas

Figure 9.7 - Thames Policy Areas



9.14.8 The interface between terrestrial land-side and marine planning is at the centre of on-going coordination and engagement with the Marine Management Organisation (MMO). The **South East Inshore Marine Plan** is currently under development as part of a suite of Marine Spatial Plans[175] under the Marine Policy Statement. It

covers the coastline from Felixstowe to Dover, including the tidal Thames. Development Plans and development proposals should take account of these plans.

Policy SI 15 Water transport

Policy SI 15 Water transport
A Development proposals should protect and enhance existing passenger transport piers and their capacity. New piers will be supported in line with the Port of London Authority and Transport for London's Pier Strategy. The necessary provision of moorings, waste and sewage facilities for passenger vessels should be provided.
B Existing boatyard sites should be protected and development proposals to increase their capacity or range of services should be supported. Alternative use of a boatyard site should only be accepted if the facilities of the site are re-provided at a site with equivalent or enhanced facilities in Greater London. Proposals for a new strategic-scale boatyard site, at an appropriate site within London, will be supported.
C Development proposals to facilitate an increase in the amount of freight transported on London's waterways should be supported.
D The Mayor will keep the network of safeguarded wharves under regular review. Boroughs should protect existing locations and identify new locations for additional waterborne freight. There may be opportunities to consolidate wharves as part of strategic land use change, in particular, within Opportunity Areas; these will need to ensure that the existing and potential?capacity and operability of the safeguarded wharves is retained and where possible expanded.
E Safeguarded wharves should only be used for waterborne freight-handling use, including consolidation centres. The redevelopment of safeguarded wharves for other land uses should only be accepted if the wharf is no longer viable or capable of being made viable for waterborne freight-handling (see viability testing criteria). Temporary uses should only be allowed where they do not preclude the wharf being reused for waterborne freight-handling uses.
F Development proposals which increase the use of safeguarded wharves for waterborne freight transport, especially the reactivation of wharves which are currently not handling freight by water, will be supported.
G Development proposals on a safeguarded wharf that include the provision of a water freight use below or alongside another land use, must ensure that the water freight use is secured long-term, that the development is designed so that there are no conflicts of use and that the freight-handling capacity of the wharf is not reduced.
H Development proposals adjacent to or opposite safeguarded wharves (including vacant wharves) should be designed to minimise the potential for conflicts of use and disturbance, in line with the Agent of Change principle.
I Development proposals close to navigable waterways should maximise water transport for bulk materials during demolition and construction phases.

9.15.1 The Mayor will work with relevant partners to **increase the number of people travelling by river** on passenger and tourist services in line with the 20 million by 2035 patronage target outlined in the Port of London Authority (PLA) Thames Vision. This builds on significant passenger trip increases in recent years.

9.15.2 The PLA and Transport for London's **Pier Strategy** will promote extending river services to East London and its growth areas to encourage modal shift to the river. This will relieve road congestion and better integrate other forms of transport such as walking and cycling.

9.15.3 **Boatyards** are essential for servicing passenger and other vessels. Beyond the existing strategic-scale boatyard at Bay Wharf, Greenwich, research indicates that a further facility with the capability to repair and service large commercial boats is required. This is to avoid operators having to get their vessels serviced and repaired far beyond the Thames Estuary at the East Coast or even in the near continent.

9.15.4 Water transport is recognised as one of the most sustainable modes for **freight**, particularly for low-value, non-time-critical bulk movements. Water transport already reduces the number of lorry movements on London's roads and their associated negative impacts on Londoners. Greater use of water transport has the ability to remove further lorries from London's roads. The Mayor will promote positive action to achieve this, including consolidation and the use of compulsory purchase powers where necessary, to bring inactive sites into use or to optimise the use of under-utilised sites. Appropriate access to the highway network and relevant freight-handling infrastructure such as jetties should also be protected.

9.15.5 Many of London's **river freight wharves** are located in areas of high demand and high value for other land uses. A network of wharves is protected from redevelopment by Safeguarding Directions. The Mayor will regularly review wharf safeguarding to ensure the changing need for waterborne freight is addressed. Where the transition of wharves from waterborne freight to other uses is acceptable, the re-use of those wharves for waterborne public transport use should be considered.

9.15.6 The **redevelopment of safeguarded wharves** should only be accepted if a wharf is no longer viable or capable of being made viable for waterborne freight-handling uses. The only exception to this would be for a strategic proposal of essential benefit for London, which cannot be planned for and delivered on any other site in Greater London.

9.15.7 Where a development proposal for a safeguarded wharf includes land uses unrelated to the handling of waterborne freight, the design of the development must not result in conflicts of?use between wharf operations and the other land uses, nor constrain the **long-term use and viability** of the safeguarded wharf. The freight-handling capacity of the wharf must not be reduced and the reactivation of the wharf for waterborne freight handling must be delivered and secured for the long-term in order for proposals to be deemed acceptable.

9.15.8 Factors to be considered in **assessing the viability of a safeguarded wharf** under Part E of this policy include:

- its size, shape, navigational access, road access, rail access (where possible), planning history, environmental impact and surrounding land use context
- its geographical location, in terms of proximity and connections to existing and potential market areas
- the existing and potential contribution it can make towards reducing road-based freight movements
- existing and potential relationships between the wharf and other freight-handling sites or land uses
- the location and availability of capacity at comparable alternative wharves, having regard to current and projected wharf capacity and market demands.

9.15.9 Appropriate **temporary uses on vacant safeguarded wharves** can ensure that investment in those wharves is maintained and negative perceptions are minimised. Temporary uses must maintain the existing freight-handling infrastructure to a specified standard and be limited by a temporary permission with a specific end date. Priority should be given to uses which require a waterside location. Temporary uses should not be

permitted where a permanent freight-handling use is available.

9.15.10 Many wharves are in Opportunity Areas and/or are increasingly surrounded by different land uses that do not have an industrial or freight purpose. In line with the **Agent of Change principle**, new development next to or opposite wharves should utilise the site layout, building orientation, uses and materials to design out potential conflicts. Proposals for neighbouring development sites must ensure that appropriate highway access to wharves for commercial vehicles is maintained.

Policy SI 16 Waterways – use and enjoyment

Policy SI 16 Waterways – use and enjoyment
A Development Plans and development proposals should protect and enhance waterway infrastructure.
B Development proposals should protect and enhance, where possible, water-related cultural, educational and community facilities and events, and new facilities should be supported and promoted, but should take into consideration the protection and other uses of the waterways.
C Development proposals that increase the provision of water sport centres and associated new infrastructure will be supported if a deficit in provision has been identified locally, and if the infrastructure does not negatively impact on navigation or on the protection of the waterway (see Policy SI 17 Protecting and enhancing the London's waterways).
D Development proposals adjacent to waterways should protect and enhance, where possible, existing moorings. The provision of new moorings and/or required facilities (such as power, water and waste disposal) should be supported if they are:
1) off-line from main navigation routes, in basins or docks, unless there are negative impacts on navigation or on the protection of the waterway (see Policy SI 17 Protecting and enhancing London's waterways)
2) appropriately designed including the provision of wash mitigation, where necessary
3) managed in a way that respects the character of the waterways.
E Existing access points to waterways (including slipways and historic steps) and alongside waterways (including paths) should be protected and enhanced.
F Development proposals along waterways should protect and enhance inclusive public access to and along the waterway front and explore opportunities for new, extended, improved and inclusive access infrastructure to/from the waterways.
G Development proposals should improve and expand the Thames Path and the towpaths, improve alignment with the waterway where relevant, enhance them as walking routes, and provide better linkages to the transport network. This will require collaboration with relevant partners including London boroughs, the PLA, the Canal and River Trust, the Environment Agency and Natural England, as well as landowner, developer and community representatives. These paths will be public and not private spaces.

9.16.1 New development should utilise the waterways (also known as the Blue Ribbon Network) for transport purposes where possible, but also for active water-based leisure, and for informal waterside recreation or access. In order to make the maximum use of London's waterways a range of supporting infrastructure is required including jetties, moorings, slipways, steps and waterside paths (piers, wharves and boatyards are addressed in Policy SI 15 Water transport). **Waterways infrastructure** can directly enable water-based recreation and sports including rowing, canoeing and sailing. New water sports centres may bring such activities together, and development proposals should consider the affordability of these activities for Londoners. Waterways infrastructure can also facilitate the enjoyment of wildlife, landscapes, heritage and culture. There could be particular scope for new infrastructure within specific Opportunity Areas.

9.16.2 Moorings, moored boats, and continuous cruiser boats, as well as live-aboard boat dwellers are an integral part of the character of the waterways. There has been a significant increase in the number of boats on London's canals (from 2,000 sighted in 2010 to 5,000 in 2016), with a notable increase in central and eastern parts of London's network. There is a **deficit of short-stay and long-term moorings** and required facilities (such as power, water and waste disposal) to meet this increase in demand, including for residential, leisure, visitor and commercial uses.

9.16.3 The Canal and River Trust has produced a London Mooring Strategy which provides an overview of the number of people living on boats on the canal network and identifies zones for potential **additional moorings**. Some community-based projects to create residential moorings may be considered as community-led housing (Part A4 of Policy H2 Small sites). In addition, a number of creative businesses such as artists' studios and post-production facilities are located on boats. Development proposals for residential moorings in particular should consider innovative solutions to address site-specific conditions, including wash, to enable the creation of new appropriate moorings without detrimentally impacting on navigation.

9.16.4 Historic steps and slipways to the Thames foreshore are vital for enabling access to/from activities and events. The **Thames Path and the towpaths** are particularly important in terms of providing safe access for a large number of Londoners along the waterways, facilitating their enjoyment of the river as well as providing health and wellbeing benefits as walking routes. Development proposals provide a significant opportunity to improve and expand the Thames Path and the towpaths, and to develop better linkages to the transport network. This requires prioritisation and collaboration between local, strategic and institutional partners. Borough River Strategies and Thames Strategies should support these opportunities.

9.16.5 Complementing development proposals for cultural facilities and events, the Mayor is producing, in partnership with the Port of London Authority, a case for a **Cultural Vision for the River Thames**. It aims to increase Londoners' engagement with the River for culture and leisure purposes, including night-time use and focusing on under-used areas. It also provides information on the heritage and importance of the River Thames and its banks to London's cultural life, especially in Opportunity Areas.

9.16.6 London's waterways are often an appropriate setting for public art and performance. People generally like to gather by the waterside and opportunities for this should be encouraged. The waterways are also a valuable **educational resource** with organisations promoting water-based educational programmes. This should also be encouraged.

Policy SI 17 Protecting and enhancing London's waterways

Policy SI 17 Protecting and enhancing London's waterways

A Development Plans should support river restoration and biodiversity improvements.

B Development proposals that facilitate river restoration, including opportunities to open culverts, naturalise river channels, protect and improve the foreshore, floodplain, riparian and adjacent terrestrial habitats, water quality as well as heritage value, should be supported. Development proposals to impound and narrow waterways should be refused.

C Development proposals should support and improve the protection of the distinct open character and heritage of waterways and their settings.

D Development proposals into the waterways, including permanently moored vessels, should generally only be supported for water-related uses or to support enhancements of water-related uses.

E Development proposals along London's canal network, docks, other rivers and water space (such as reservoirs, lakes and ponds) should respect their local character, environment and biodiversity and should contribute to their accessibility and active water-related uses. Development Plans should identify opportunities for increasing local

distinctiveness and recognise these water spaces as environmental, social and economic assets.
F On-shore power at water transport facilities should be considered at wharves and residential moorings to help reduce air pollution.

9.17.1 London's rivers have been significantly altered from their natural state. **River restoration** seeks to enhance their biodiversity, water quality and amenity value. The London Rivers Action Plan,[176] and the Catchment Partnerships[177] which support the Thames River Basin Management Plan, identify many opportunities for river restoration, as well as showing examples that have been implemented around London.

9.17.2 Generally, permanently-moored vessels and **development into waterways** should only be permitted for water-related uses. However, ancillary uses, such as bars and restaurants (for example ancillary to a passenger pier), can support enhancements of water-related uses, as well as improve access to or along waterways and related public realm. Ancillary uses can also add to the diversity, vibrancy and regeneration of waterways, in particular in basins or docks. The specific siting of such facilities requires careful consideration so that navigation, hydrology, biodiversity and the character, access to, and use of waterways is not compromised. The waterways should not be used as an extension of developable land in London, nor should parts be a continuous line of moored craft.

9.17.3 **Pollution** from vessels should be minimised in terms of emissions from vessels and related land-side infrastructure. A baseline is being established jointly with key stakeholders including TfL and the PLA, along with appropriate measures and investment to minimise impact. This includes the requirement in this policy to consider providing on-shore power at wharves and moorings.

9.17.4 Development proposal should protect and promote the vitality, attractiveness and historical interest of London's **remaining dock areas**.

Navigation

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[147] The Control of Dust and Emissions During Construction and Demolition Supplementary Planning Guidance, Mayor of London, 2014

[148] Air Quality Standards Regulations, 2010 (or subsequent revisions thereof), http://www.legislation.gov.uk/uksi/2010/1001/contents/made

[149] Land-Use Planning & Development Control: Planning for Air Quality, Institution of Air Quality Management, 2017, http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf. This guidance indicates that even very small impacts on ambient air quality cannot be considered 'negligible' where existing levels are within 5% of limits.

[150] See Glossary

[151] Where zero-carbon is used in the Plan it refers to net zero-carbon – see Glossary for definition.

[152] Building Regulations 2013. If these are updated, the policy threshold will be reviewed. https://www.gov.uk/government/publications/conservation-of-fuel-and-power-approved-document-l

[153] Carbon' is used in the London Plan as a shorthand term for all greenhouse gases. London's carbon accounting is measured in carbon dioxide equivalent, which includes the conversion of other greenhouse gases into their equivalent carbon dioxide emissions.

[154] Building Regulations 2013. If these are updated, the policy threshold will be reviewed. https://www.gov.uk/government/publications/conservation-of-fuel-and-power-approved-document-l

[155] Boroughs should develop a price for offsetting carbon using either a nationally recognised carbon pricing mechanism or a price based on the cost of offsetting carbon across the borough. A nationally recognised non-traded price of £95/tonne has been tested as part of the viability assessment for the London Plan which boroughs may use to collect offset payments.

[156] For examples see London Environment Strategy 2018.

[157] This will build on the 2014 Sustainable Design and Construction SPG.

[158] London Heat Map, https://www.london.gov.uk/what-we-do/environment/energy/london-heat-map

[159] Based on data from London Energy and Greenhouse Gas Inventory (LEGGI) https://data.london.gov.uk/dataset/leggi

[160] Achieve at least a 12.5% improvement over defined baseline performance standard

[161] Planning Practice Guidance: Paragraph 014 of 'Housing: optional technical standards', DCLG, 27 March 2015. Where there is a clear local need, local planning authorities can set out Local Plan policies requiring new dwellings to meet the tighter Building Regulations' Optional Requirement of 110 litres per person per day.

[162] http://www.europeanwaterlabel.eu/thelabel.asp

[163] Based on the EU definition of municipal waste being household waste and other waste similar in composition to household waste. This includes business waste collected by local authorities and by the private sector.

[164] All inert excavation waste should be used for beneficial uses.

[165] https://www.london.gov.uk/what-we-do/planning/london-plan/london-plan-technical-and-research-reports

[166] See objective 7.4 London Environment Strategy, May 2018

[167] Based on CD&E waste data interrogator data 2015. Estimate only as actual CD&E waste performance data is not available and not a requirement to report. Actual performance likely to be higher as waste reused or recycled on- site is not reported through the waste data interrogator.

[168] See http://www.sita.co.uk/services-and-products/our-products/rdf-srf for an explanation of the differences between SRF and RDF.

[169] London Waste Map, https://maps.london.gov.uk/webmaps/waste/

[170] https://www.london.gov.uk/what-we-do/environment/waste-and-recycling/waste-policy

[171] The Jurassic shales of the Weald Basin: geology and shale oil and shale gas resource estimation, British Geological Survey, 2014

[172] Community Engagement Charter – oil and gas from unconventional reservoirs, UKCOOG, 2013, http://www.ukoog.org.uk/community/charter

[173] The runoff that would occur from a site in undeveloped natural state.

[174] The Forum replaces the former London Waterways Commission and the River Concordat Group.

[175] South East Inshore Marine Plan, Marine Management Organisation, https://www.gov.uk/government/collections/south-east-marine-plan

[176] http://www.therrc.co.uk/lrap/lplan.pdf

[177] https://www.thames21.org.uk/catchment-partnerships-in-london/

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