Source: iStockphoto/Getty Images

LONDON'S ENVIRONMENT REVEALED

State of the Environment Report for London, June 2011

Environment Agency

NATURAL ENGLAND

Forestry Commission England

MAYOR OF LONDON

Enquiries: datastore@london.gov.uk

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Please consider the environment before printing this report

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Foreword

Foreword by Boris Johnson (Mayor of London), Howard Davidson (Director, South East, Environment Agency), Adam Wallace (Area Manager, London, Natural England) and Ron Melville (Regional Director, Forestry Commission).

London's unique liveliness, culture and diversity make it one of the most dynamic cities to live and work in. It is a world class city, a place where eight million people live and more than 300 languages are spoken.

As an economic engine for the UK, London attracts investment and growth, and is a hub for finance and tourism. Its strengths lie in the arts, commerce, education, entertainment, fashion, finance, healthcare, media, professional services, research and development, tourism and transport, all contributing to its prominence. Essential to these characteristics is its environment.

This London State of the Environment Report – 'London's Environment Revealed' - is the first report produced by a partnership of the Greater London Authority, the Environment Agency, Natural England and the Forestry Commission.

The report looks at the state of London's environment today and highlights the improvements that have been made and the challenges we face. The report also features many local projects and schemes that have improved London's environment in recent years. The report identifies improvements to Londoners' quality of life through cleaner streets, a greener city than 10 years ago, greater access to green spaces, and improved access to public transport.

In particular, we would like to draw your attention to three success stories:

- A sustainable approach to the London 2012 Olympic and Paralympic site.
- River Thames – winner of Theiss International Riverprize (2010).
- 'Love Clean London' campaign - engaging local people with the environment and improving street cleanliness.

The report has identified some big improvements to London's environment, particularly in waste and recycling, public transport, wildlife habitats and urban greening. Furthermore, London is the first summer Olympics host city to embed sustainability in its planning from the start - setting new standards and creating positive, lasting change for the environment and its communities.

Of course, London still faces some big challenges from a growing population, a changing climate and the current economic situation. We need to do more to reduce the impact of our activities on the environment, particularly through reducing energy use and carbon emissions, minimising the amount of waste we produce and send to landfill, and reducing our consumption of water to lessen the amount taken from the environment.

Brent reservoir
Source: Natural England

These challenges also present opportunities to create a sustainable green economy. We have the chance to ensure

sustainable economic growth, create jobs and reduce environmental pollution and resource depletion in our capital city. Through developments in renewable energy, green buildings and cleaner transport we can continue to enhance the quality of life for Londoners.

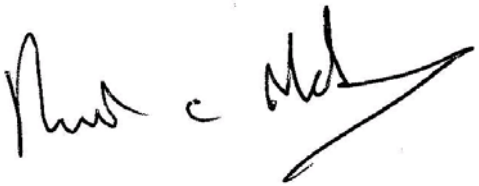
The partnership looks forward to providing annual data updates and monitoring progress against the environmental indicators presented in the report.

We hope you enjoy the read.

Boris Johnson, Mayor of London

Adam Wallace, Area Manager
(Natural England)

Howard Davidson, Director
(South East, Environment Agency)



Ron Melville, Director
Forestry Commission (London)

Executive summary

This is the first joint report on the State of the Environment in London, produced by the Greater London Authority, the Environment Agency, Natural England and the Forestry Commission. The report looks at how the environment has changed over the last decade, using 2000 as the report baseline where data is available.

Overall, the quality of London's environment is improving despite the challenges from a growing population and climate change. This report uses a series of indicators to illustrate the changes in the state of the environment within eight themes, aligned to each chapter. The chapter summaries below identify the main outputs from each indicator. This is also highlighted in the indicator summary table.

Chapter 1: Climate change

Emissions of carbon dioxide and other greenhouse gases from the production, supply and use of energy are contributing to climate change. The resulting rise in temperature and changing rainfall patterns will mean London is more likely to experience an increased risk of floods, droughts and heat waves.

Population growth in London is likely to further increase emissions, but this report has identified a decoupling between emissions and growth over the last decade. Emissions have fallen by 11% since 2000 despite a rising population. However, current emissions only represent a reduction of 1% on 1990 levels, due to rising emissions between 1990 and 2000. Progress with the Mayor's target to reduce carbon emissions to 60% below 1990 levels by 2025 [i] will be monitored.

At 5.9 tonnes per person, London's CO_2 emissions are 17% lower than the UK average of 7.1 tonnes CO_2 per person (2008). This is largely due to the efficient public transport system and lower use of private vehicles in the capital.

Energy use in the capital fell by 10% between 2000 and 2008. This reduction has been driven predominantly by changes in the industrial and commercial sector as businesses in the capital become less energy intensive. Energy use from this sector declined from 41% of the total use in 2000 to 35% in 2008.

The use of energy in our homes has stayed relatively constant since 2000, accounting for around 42% of London's total energy use in 2008. Making our homes more efficient can therefore make a significant impact on overall energy use in the capital. Initiatives such as the RE:NEW programme are looking at implementing energy efficiency measures in homes across London.

Chapter 2: Flood risk

High housing density and development on the floodplain means London has just below 517,000 properties in the floodplain. Around 40,000 of these have a significant likelihood of flooding; this is mainly from London's freshwater rivers.

Currently 85% of the properties at risk of flooding in London have a low likelihood of flooding due to the presence of flood defences. The most significant of these is the Thames Barrier, which has protected London from flooding 119 times since it became operational in 1982. As the climate changes, closures of the Thames Barrier are expected to become even more frequent; sea level at Sheerness in the Thames Estuary is rising by an average of 1.5mm each year and more frequent and heavy rain storms will increase rainwater run-off into the freshwater tributaries. However, the Thames Barrier will continue to protect London from tidal flooding until 2070 as plans are put in place to adapt to the changing climate.

In London, the most significant opportunities for reducing flood risk are

through redevelopment and improving flood defences. Schemes to improve existing defences and construct new ones have reduced the risk of flooding to around 60,000 properties in London over the last four years. A further 18,000 properties are expected to benefit from reduced flood risk in 2011/12.

London is particularly vulnerable to surface water flooding. After intense storms, the concrete urban surfaces prevent water from being absorbed into the ground and the drainage system can be overwhelmed by the additional volume. The Drain London Forum has assessed the risk and extent of surface water flooding in London, for the first time.

Chapter 3: Water quality

The River Thames and its tributaries provide valuable habitat, supporting a variety of wildlife, and providing a source of water for the capital. Protecting and improving the quality of the water environment is vital for people and nature.

The EU Water Framework Directive has changed the way we measure water quality. It takes a holistic approach to river basin management, and requires the assessment of the quality of all water bodies, looking at the status of the water chemistry, biology and ecology. One of the 47 river water bodies in London is classified as having good ecological status. A further 30 are classified moderate and 16 are poor (2009). Many organisations across London are involved in investigations and projects to improve the quality of London's water bodies over the coming years.

The water quality of the Thames Estuary in London is threatened by discharges of storm sewage and combined sewer overflows. These discharges occur following heavy rainfall to prevent the sewer network from being overwhelmed by the rainwater entering the system. On average, around 39 million tonnes of storm sewage are discharged into the Thames Estuary each year, reducing dissolved oxygen levels and the river's ability to sustain life.

Of the water pollution incidents that have an environmental impact, 4% are considered serious. Occurrences of serious incidents have fallen by 73% since 2002. These are predominantly caused by authorised discharges of storm sewage. The Thames Tideway Improvements Programme aims to improve background water quality and address the problems caused from storm sewage overflows.

Chapter 4: Water resources

Ensuring there is enough water available for people and the environment, as the climate changes and population increases, is critical to managing the supply and demand for water in the capital. The amount of water used in our homes is at a similar level to 2000/01, approximately 167 litres per person per day. This is 14% more than the England and Wales average, despite London being in one of the driest parts of the country.

Water lost through leakage in supply pipes is a wasted resource. Significant progress has been made to reduce leakage in London; since the peak in 2003/04 there has been a 33% drop in the amount of water lost per property per day. However, London leakage is still around 177 litres per property per day compared to a national average of 133. The old infrastructure, and the traffic disruption that results from replacing mains, mean leakage reduction is challenging in London, but significant progress is being made to reduce this.

London's rivers have enough water to support good biodiversity all of the time, except for the lower and middle sections of the River Lee. A large proportion of London's drinking water supply comes from the River Lee, which reduces the river flow. The changing climate is expected to affect river flows in future; as rainfall patterns change and temperatures rise. Managing the amount of water

abstracted is vital to ensure a balance between future supply and a healthy river.

Chapter 5: Waste

Prevention is the first stage of the waste hierarchy; where less waste is produced, less needs to be disposed of. Each year, Londoners are consistently reducing their household waste. The capital is now producing 10% less household waste than in 2000, and the household rate is lower than any other region in England. Alongside this, residents are recycling and composting more of their household waste than ever - 32% of all household waste.

Reducing the amount of waste sent to landfill will reduce the emissions of greenhouse gases produced as waste decomposes. Ten years ago, 72% of the capital's local authority collected waste went to landfill. Although significant steps have been taken to reduce this, it still accounts for 49%, with almost 2 million tonnes of London's waste land-filled.

Litter on London's streets is an issue of concern for residents – it has been identified as the primary issue affecting environmental quality in the capital[ii]. Levels of litter and detritus recorded on London's streets have reduced significantly but are still slightly higher then the national average. Sites with levels of litter that are below acceptable condition have fallen from 33% of sites surveyed in 2003/04 to 17% in 2009/10.

Chapter 6: Air quality, transport and noise

Air pollution has significant impacts on people and the environment; it can increase the risk of respiratory diseases and affect the biodiversity of roadside plants and trees. Progress has been made in reducing air pollution in London; however, the level of decline has slowed in the last 10 years. This is clear when looking at long term trends in concentrations of air pollutants, such as particulate matter and nitrogen dioxide, in the capital. Levels of nitrogen dioxide (NO_2) (which is mainly derived from road transport) in inner London exceed the ambient concentration annual limit of 40ug/m^3. Levels of particulate matter PM_{10} exceed the ambient concentration 24-hour limit value of 50ug/m^3. These problems are not specific to London; as these air pollutants are mainly derived from transport, they are experienced in many urban environments. Similar levels are often recorded in cities such as Paris, Madrid and Athens.

There has been a fundamental shift towards public transport use in the capital, despite a rising demand for travel. Public transport now accounts for 41% of all London's journeys, compared to 37% for private transport, and carbon emissions have shown a corresponding reduction. Improvements to public transport networks and provision of lower emission transport options, such as hybrid and hydrogen buses, and more cycle lanes and cycles for hire, have encouraged more residents and visitors to swap their car for a less polluting alternative.

Noise can affect health and quality of life. Exposure to noise from road traffic affects around 3.2 million people in the capital, with levels of 55 decibels or more represents 'significant community annoyance'. This is around 42% of the population. Around 29,000 are exposed to levels over 75 decibels. Fewer people in the capital are exposed to noise from railways, with around 453,000 exposed to levels of 55 decibels or more and only 2,000 people exposed to over 75 decibels. The number of people exposed to aircraft noise from Heathrow Airport has fallen by 10% over the last 10 years.

Chapter 7: Biodiversity

London supports many important species and habitats. As London's wildlife sites and habitats are enhanced, in both condition and extent, their biodiversity values increases. There are currently around 1500 Sites of Importance for Nature Conservation (SINC), covering 30,000 hectares (ha). This includes 36

Sites of Special Scientific Interest (SSSI). The condition of London's SSSIs has improved over the last 10 years, from 73% in favourable or recovering condition to 92%. There have been particular improvements from 2007 as the condition of large sites improved, like the wetlands of the Inner Thames Marshes, including Rainham Marshes, and Richmond Park.

All types of habitat in London are being restored and enhanced. The extent of all habitat types has increased over the last few years, with the exception of meadows and pastures. In particular, there has been 10.5km of river habitat improved, 228 ha of coastal and floodplain grazing marsh and 7.5 ha of reed beds. Measures are in place to meet the restoration targets outlined in the Biodiversity Action Plan.

Populations of bird and fish species have shown general improvements although, five bird species, including the house sparrow, have shown a declining trend compared to the surrounding areas. Fish populations have been impacted upon by pollution in London's rivers, particularly in the River Wandle, and also by obstructions blocking the movement to fish along rivers. Under the definitions of the EU Water Framework Directive, only six of London's water bodies have the expected diversity of fish species. Habitat enhancements will further help to strengthen fish populations and species diversity in London's rivers.

Chapter 8: Landscape and green infrastructure

Despite being a megacity, London boasts outstanding green spaces and parks which cover around two thirds of the capital. More Londoners now have access to greenspace in the capital. Areas deficient in access to nature have fallen from 34,240 ha in 2006 to 24,816 ha (16% of London) in 2010. Improvements in access to existing sites and developing access to sites that were previously inaccessible led to this change.

Brownfield land can be damaged or contaminated from previous use, but it can also have biodiversity value. However, developing on brownfield land reduces the pressure on London's green spaces and brings the land back into beneficial use. Development can also help to remediate contaminated land, improve the quality of the landscape and manage any loss of habitat through living roofs and other biodiversity projects. The total area of brownfield land in London has increased by around 200 ha since 2000, but there has been a significant reduction in the area of derelict land. In London 97% of new properties were built on brownfield land in 2008, well above the England average of 77%.

A recent study on private garden cover has shown that the overall area of vegetation in London's gardens has declined from 25,000 ha to 22,000 ha since 1998-99, as lawns and flowerbeds are replaced with hard surfaces, such as patios and parking areas. Hard-surfacing of front gardens is no longer permitted unless the surface is porous or greening measures are included. Urban greening measures, such as the implementation of green roofs, have increased significantly over the last few years, with an estimated 500,000m^2 now installed across London. Such measures will go some way to mitigate the impact of changes to garden design and management by providing replacement habitat and measures to reduce surface water flooding.

The number of green spaces in the capital that have been awarded the Green Flag has increased since 2000.

Allotments are increasing in popularity in London; there has been a 13% increase in sites but waiting lists are still long in some boroughs. Allotment land covers around 1,000 ha, providing vegetated land cover and urban wildlife corridors as well as food growing spaces in the capital.

Indicator summary table

The table below summarises the current status for each environmental indicator, progress with any targets and how it has changed over the last 10 years. The indicators used in this State of the Environment report were chosen to provide an overview of the current status, along with the changes identified over the last 10 years, for each environmental theme. We have chosen datasets that provide compelling evidence, which provides a snapshot of the current state of the environment and can be used to monitor future progress. The status of each indicator is also shown on the indicator pages throughout this report.

KEY

Declining trend (getting worse) | Improving (some progress) | Improving (significant progress) | No trend

No	Indicator name	Current status	Trend - last 10 years	Trend comment
1	Carbon dioxide (CO_2) emissions	44.7mt/CO_2 (2008). This is equivalent to around 5.9 tonnes per person per year.		CO_2 emissions in London have reduced by 11% since 2000; this is only a 1% reduction relative to 1990 levels.
2	Energy consumption	151,903 Gwh (2008)		Total energy use in London has reduced by 10% since 2000, and shows year on year reductions.
3	Properties at risk of flooding	40,000 (8%), of the 517,000 properties at risk of flooding from rivers and the sea, have a significant likelihood of flooding. 85% have a low likelihood due to defences.		Trends over time cannot be accurately drawn for this dataset – comparative data are not available due to changes in methodology. It provides an indication of the current situation.
4	Sea level change	Sea level in 2006 is 125mm higher than the 1915-21 average. The Thames Barrier was closed 5 times in 2010.		Sea level at Sheerness is rising by an average of 1.5mm a year (1834 to 2006); the Thames Barrier has been closed 119 times since 1983 to manage flood risk.
5	Flood warnings issued	No Severe Flood Warnings have been issued in London since 2000.		Overall fewer warnings have been issued than in 2000, but it is hard to determine clear trends for this indicator due to the influence of rainfall patterns.
6	Freshwater quality: Ecological status	1 of the 47 river water bodies in London currently has good ecological status. 30 are moderate and 16 are poor status.		No trend is available for this indicator as the 1st formal classifications were published in 2009. The next formal statuses will be published in 2015.

7	Estuarine water quality: Dissolved oxygen levels	On average around 39 million tonnes of sewage discharged annually. Oxygenating vessels were deployed 7 times in 2010.		Dissolved oxygen levels drop below threshold levels on average around 52 days per year. There are fewer days below the standard level in recent years, but dissolved oxygen levels are still a big issue in the Thames Tideway.
8	Serious water pollution incidents	16 serious incidents recorded in 2010: 1 category 1 and 15 category 2 incidents.		Serious water pollution incidents have fallen by 73% between 2002 and 2010. On average, major incidents occur less than 2 times a year and significant incidents are also declining.
9	Domestic water consumption	Average domestic water use is 167 litres per head per day (l/h/d).		A general reduction in demand is evident over the last 10 years. But consumption in London is 14% higher than the England and Wales average.
10	Leakage	London wide leakage is 177 litres per property per day.		Improvements in leakage mean rates, per property per day, have fallen by 5% since 2000 (and 33% since the peak in 2003/04). However, leakage in London is still the highest in England and Wales.
11	Water resource availability	London rivers support good ecology all the time, except for the middle and lower sections of the River Lee.		No trend is available for this indicator; the data identifies the current position. Future change will be based on the data presented.
12	Groundwater under London	Levels are -40 mAOD in central London, around 3m less than in 2000.		Management of groundwater levels in London means they are beginning to stabilise. However, levels have risen in west London by around 7 metres since 2000. Levels in central, east and south London have fallen.
13	Household waste prevention	906 kg of waste produced per household.		The amount of waste generated per household, each year, has decreased by 214kg/hh since 2000/01; from 1120kg/hh to 906 kg/hh in 2009/10.
14	Recycling and composting	27% of local authority collected waste is recycled or composted.		- Recycling and composting of local authority collected waste has increased from 8% in 2000 to 27%, increasing year on year. - Recycling and composting of the household only component has again increased year on year, from 9% to 32%, but is still the lowest in England and below the 2010 target of 35%.
15	Landfill	49% local authority collected waste sent to landfill.		Local authority collected waste sent to landfill has reduced year on year since 2000 (from 72%), but landfill still accounts for almost half of all waste.
16	Litter	17% of sites surveyed are in an unacceptable condition for litter.		Fewer sites are classed as below acceptable condition than in 2003/04; this reduced from 33% to 17% of sites assessed.
17	Annual, daily and hourly mean pollutant concentrations	The limit values were exceeded for the NO_2 1-hour, NO_2 annual mean, PM_{10} 24-hour, and compliance was achieved with the PM_{10} annual mean[iii]		The rate of improvement in concentrations of particulate matter (PM_{10}) has been slower in the last decade than in the 1990s. Similarly, levels of nitrogen dioxide (NO_2) in London fell until 2002 but have remained relatively stable.

18	Road traffic levels and public transport	Public transport makes up 41% of all transport modes at the journey stage.		Public transport is becoming more popular. Mode share for public transport has increased by 7 percentage points, from 34% in 2000.
19	Road and rail transport noise	Road noise: 3.2 million people (42% of the population) are exposed to more than 55 decibels (dB) L_{den}. Railway noise: 453,000 people (6%) exposed to more than 55 dB L_{den}.		No trend can be drawn since 2000 for this indicator – this is the first round of the noise mapping exercise so no comparative data are currently available.
20	Sites of Importance for Nature Conservation (SINC)	There are 1500 SINCs in London covering almost 30,000 ha and 92% of SSSIs are in favourable or recovering condition.		- The area of London SINCs has increased by 3% (~1,000 ha) between 2001 and 2010. - The percentage of SSSI area in favourable or recovering condition has improved from 73% in 2000 to 92% in 2010.
21	Improving condition and extent of London's habitat	For example, 10.5 km of river habitat has been restored and 7.5 ha of reed bed have been created since 2006/07.		Making good progress towards the delivery of some Biodiversity Action Plan habitat targets.
22	Bird populations	Populations are increasing faster in London than in surrounding areas.		Populations of 26 common bird species in London have increased by 33% since 1994 (data not available from 2000 as based on a 1994 index) but 5 common species have declined
23	Fish populations	40 species of fish are routinely recorded in the tideway each year.		Fish populations are generally improving in the tidal Thames and the freshwater tributaries, but many of London's water bodies are not yet achieving good fish status under WFD.
24	Green spaces	223 London parks and green spaces hold Green Flag awards. However, almost 25,000 ha of land are classified as areas of deficiency for nature.		- The number of Green Flag awards has increased from 12 to 223 over the last 10 years. - Areas of deficiency to nature have reduced from 23% to 16% of London (since 2005).
25	Brownfield land	Of the 3,730 ha of Brownfield land, 268 ha is derelict. New dwellings built on brownfield land account for 97%.		6% increase in the overall area of brownfield land in London since 2002 and a 42% reduction in the area of derelict land. New homes built on Brownfield land has increased and surpasses the England average of 77%, at 97%.
26	Allotments and food production	London has around 25,000 allotment plots, covering around 1000 ha and currently 1,030 capital growth spaces.		13% increase in the total number of allotment sites since 2003.
27	London's garden cover	London has around 37,900 ha of garden land; 22,000 ha (57%) is vegetated cover.		The area of garden vegetation in London has declined from 25,000 ha to 22,000 ha since 1998-99, as lawns and flowerbeds are replaced with hard surfaces, such as patio and parking areas.
28	Urban Greening	Approximately 500,000m^2 of green roof (2008) and 500,000 street trees.		Green roof cover has significantly increased since 2004. More street trees have been planted but it is not yet certain whether this has offset the loss of trees resulting from development, safety issues and natural causes.

Power and Energy Monitor. Source: Environment Agency

1

CLIMATE CHANGE IN LONDON

Carbon dioxide emissions in London are 1% lower than 1990 levels, at 44.7 million tonnes ($mtCO_2$). However, they have reduced by 11% since 2000.

Londoners are using 10% less energy than in 2000; 42% of all energy use is from the domestic sector.

Globally temperatures are rising. Projections for our future climate show that temperatures are likely to continue rising.

2000 to 2009 was the warmest decade on record (according to records dating back to the 1850s) and 2010 was the joint warmest year.

The 2009 UK Climate Projections (UKCP09)[iv] estimate that summers in London will be hotter and drier, and winters will be milder and wetter.

Climate change potentially poses a great threat to people and the environment in London. Rising temperatures and changing rainfall patterns mean that London could face an increasing risk of floods, droughts and heat waves. The changing climate will also affect the state of London's environment by adding further pressure to water quality, water resources and habitats.

There are two parallel approaches to address the impacts of climate change; limiting further impacts of climate change by reducing greenhouse gas emissions (mitigation), and preparing for changes and improving London's resilience to extreme weather and climate changes in the future (adaptation). The latter includes activities such as improving flood defences to withstand more extreme flood events, further urban greening to reduce overheating in the capital, and reducing water wastage to conserve water resources and limit the impact of droughts.

The indicators in this chapter represent activity on climate change mitigation. They assess trends in emissions of carbon dioxide (1 of the 6 primary greenhouse gases) from domestic, transport and industrial sources; and the consumption of energy through domestic activities, transportation and industry.

The reduction of emissions from the Olympic Park – through the Energy Centre - is highlighted in the chapter case study.

This report does not have explicit climate change adaptation indicators. Adaptation is notoriously difficult to measure; a minimum of a thirty year period is required to identify any climate (as opposed to weather) signal. A number of the indicators in this report however could serve as proxies for measuring adaptation e.g. flood risk (indicator 3) and water consumption (indicator 9). Activity in these areas can be representative of changes in the level of adaptation.

Indicator 1: Carbon dioxide emissions

Human activity – primarily the burning of fossil fuels (oil, coal, gas and petroleum) – has increased concentrations of greenhouse gases (GHGs) in the atmosphere since the industrial revolution. GHGs absorb the sun's energy reflected from the Earth and re-emit it towards Earth, resulting in a warming of the atmosphere. Carbon dioxide (CO_2) accounts for around 99% of all GHG emissions in London[v].

This indicator is a measure of London's CO_2 emissions, by sector. The London Energy and Greenhouse Gas Inventory (LEGGI) measures annual CO_2 emissions across London. It calculates emissions based on energy consumption statistics from the domestic, industrial and commercial, and transport sectors.

LEGGI uses data obtained from a number of organisations including the Department of Climate Change (DECC) and Defra. LEGGI applies to direct and indirect energy (scope 1, 2 and 3)[vi] emissions only. This covers CO_2 emissions from the combustion of energy sources in London and those associated with the combustion of electricity consumed. The latest data presented in LEGGI is for 2008.

The indicator focuses on the trend since 2000 but reference has been made to 1990 to indicate progress against the target levels set in the London Plan 2011 (policy 5.1) and in the Mayor's Climate Change Strategy. These aim to achieve an overall reduction of 60% on 1990 levels by 2025. The next interim target is to achieve a 22% reduction on 1990 levels by 2015.

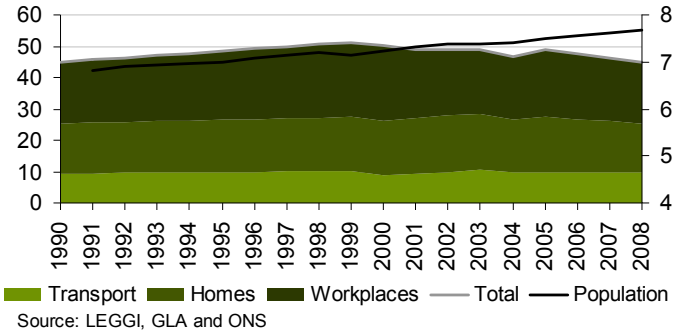
Analysis

- CO_2 emissions in London account for 8.4% of the UK total[vii].
- CO_2 emissions were 44.7 $MtCO_2$ in 2008. 43% were from workplaces (19.2 Mt CO_2). Homes accounted for 36% (15.9 Mt CO_2) and the transport sector accounted for the remaining 21% (9.6 Mt CO_2) (Figure 1).
- Since 1990, London's CO_2 emissions have fallen by 1%.
- Between 1990 and 2000 there was a 12% rise in CO_2 emissions - to 50.3 $MtCO_2$. This means London currently needs to reduce emissions by 21% to meet the 2015 interim target. The rise in the 1990s was due to growth in the workplace sector and rising emissions from homes, as a result of an increasing population and rise in single occupancy homes.

Despite a rising population in London, carbon dioxide emissions have fallen (Figure 1).

- Since 2000 the capital's annual emissions dropped by 11%. National electricity supply is less carbon intensive. There has also been a shift towards the service industry which is less energy intensive.
- At 5.9 tonnes per person per year, London's CO2 emissions are the lowest in the country (on a regional basis), well below the UK average of 7.1 tonnes. This is, in part, due to high usage of the public transport system compared to greater reliance on private cars outside the capital.

Figure 1
London's CO2 emissions by sector, against population
CO_2 emissions ($MtCO_2$/yr) / Population (millions



Source: LEGGI, GLA and ONS

Indicator 2: Energy consumption

This indicator is a measure of the amount of energy consumed in London. Energy is consumed through day to day activities in the home and workplace and through transportation and industry. Reducing overall energy consumption and being more efficient with the energy we do use is vital to reducing carbon emissions.

The rate of energy consumption and the type of energy consumed changes by season. In the winter months, consumption of gas is higher due to use of central heating to warm homes and businesses. However in the summer months, there is a general shift towards higher electricity use from air conditioning.

Data on energy consumption for London is recorded through the LEGGI. The data identifies the level of energy consumption across the domestic, industrial and commercial, and transport sectors in 2008, compared to 2000. Data is not available for 2007 for this dataset.

Analysis

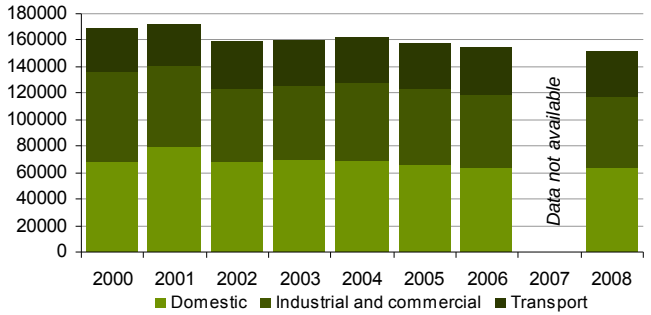
- London consumed 151,903 GWh of energy in 2008.
- 42% of the energy used in 2008 was consumed in London's homes (domestic), 35% from London's workplaces (industrial and commercial) and 23% from the transport sector (Figure 2).
- Gas consumption (from homes and workplaces) makes up 49% of the total energy consumed in London; a reduction from 53% in 2000.
- Electricity consumption (from homes and workplaces) accounts for 26% of all the energy consumed in London; an increase from 23% in 2000. However, because of its higher CO_2 content it contributes proportionally more to London's overall CO_2 emissions.
- Coal and gas (from homes and workplaces) make up 2% of the total energy used; a reduction from 4% in 2000.
- The remainder (23%) is from transport – including domestic aviation, domestic shipping, road and rail transport. Energy consumption from transport has increased from 19% in 2000.

There has been a 10% reduction in London's energy consumption since 2000.

The latest data available (2008) is during the height of the national recession, which may have implications on any trends evident.

Data on the production and use of renewable energy will be included in future updates to this report. The Greater London Authority is currently developing a methodology to measure and monitor the deployment of renewable energy in London.

Figure 2
Energy consumption in London by sector, 2000- 2008
Gwh



Source: LEGGI, 2010

Local case study

Reducing greenhouse gas emissions: The Energy Centre at the London 2012 site.

London 2012 aims to 'set new standards, creating positive, lasting change for the environment and communities'. The London 2012 Olympic Games will be the first summer games to embed sustainability in planning from the start.

The Olympic Stadium
Source: www.London2012.com

The goal is to deliver a low carbon games[viii] through a suite of measures based on a hierarchy of: avoid/eliminate (design out emissions at the source), reduce, substitute/replace (measures to introduce renewables/lower carbon technologies) and compensate (measures to deal with residual or unavoidable emissions and promote behavioural change).

Part of being a 'sustainable games' means minimising greenhouse gas emissions from its activities. The 'Energy Centre' for the Games will ensure efficient, low carbon heating, cooling and power for the venues and buildings across the Olympic Park. This successful method of decentralising energy could be replicated locally across London.

The Energy Centre:[ix]

- Supplies energy to local development, it is therefore more efficient because energy is not lost in transmission;
- Uses a Combined Cooling Heat & Power (CCHP) plant to capture the heat generated by electricity production, and will lead to carbon reductions of more than 1,000 tonnes per year.
- Has been designed to accommodate future energy demands – it has the capacity to supply energy to 10,000 homes and will therefore serve the new buildings and communities that will be developed after 2012, thereby delivering an early legacy of essential services.
- Has other environmental benefits, alongside reducing greenhouse gas emissions. These include:
  - Construction of the substation used crushed materials from the demolition of the former Kings Yard buildings – reusing waste materials on site.
  - A 'brown roof' that will allow wildlife to colonise naturally and enhance the ecological value and biodiversity of the Olympic Park.

Aerial view of the Energy Centre
Source: www.London2012.com

Useful links and further reading

- The Mayor's draft Climate Change Adaptation Strategy (Feb 2010). This identifies the key climate risks to London and proposes and range of actions for the Mayor and other partners to implement to manage these risks.

- The Mayor's draft Climate Change Mitigation and Energy Strategy (Oct 2010)

- RE:NEW – the Mayor's home and water efficiency improvement programme

- RE:CONNECT – Low Carbon Zones

- Carbon emissions: London Plan 2011. Policy 5.1 (climate change mitigation) and policy 5.2 (minimising carbon dioxide emissions)

- Energy consumption: London Plan 2011. Policy 5.4 (retrofitting) and policy 5.5 (decentralised energy networks)

- UK climate impacts programme

- Department of Energy and Climate Change (DECC)

- London Climate Change Partnership

Thames Barrier, Greenwich. Source: Environment Agency

2

FLOOD RISK IN LONDON

Around 516,000 properties (or 1 in 7) in London are in the floodplains of London's rivers. 85% of these are well defended but 40,000 properties (8%) have a significant likelihood of flooding due to lower standards of protection.

Sea level at Sheerness is rising by an average of 1.5mm a year. The Thames Barrier has been closed 119 times since 1983 to manage flood risk.

An average of 70 flood warnings have been issued annually in London since 2000; 90% of these are 'Flood Alerts' which advise that flooding is possible; none of the warnings have been 'Severe Flood Warnings'.

Flooding is a natural process and it is not possible to protect everyone and everything from flooding all of the time. London is particularly vulnerable to rapid river and surface water flooding after heavy storms. The risk of surface water flooding is exacerbated by the large area of impermeable urban surface in London - this increases the amount of rainwater run-off after intense rainfall and there are limited places for the water to go. The drainage systems and river channels in London can be overwhelmed by the high intensity of water entering them in a short space of time. This was particularly evident in 2000 and 2007 when homes and gardens in the capital were flooded.

The risk of tidal flooding in London, which results from a combination of high tides and stormy conditions, is very low due to protection from the Thames Barrier and associated tidal defences.

Effective management of flood risk will reduce the impacts of rising sea levels and increased storm intensity, as a result of climate change. In London, the two most significant opportunities for reducing flood risk are through redevelopment and the maintenance and improvement of existing defences. Planning policy encourages setting back developments from the river edge where there are particular flooding risks and to protect the effectiveness of defences. Planning for and adapting to climate change through methods such as the multi purpose use of open space, for example, parks will also help to reduce urban flood risk by allowing space for flood water during times of high flows.

The indicators in this chapter have been selected to give an overview of flood risk and its management in the capital. The risk of flooding to properties in London, from rivers and the sea, and the likelihood of flooding occurring is identified in this chapter. The management of flood risk is assessed through indicators on sea level change (including data on closures of the Thames Barrier) and the number of flood warnings issued, against possible tidal or fluvial flooding.

There is currently no indicator in this report on the number of properties affected by flooding in London. The data will be sourced from a project that aims to bring together data from a range of organisations including the Environment Agency, local authorities and the fire brigade, to provide a comprehensive assessment of properties affected. This data will be included in future reports.
A case study on the Drain London project is presented at the end of the chapter.

Indicator 3: Properties at risk of flooding

This indicator is a measure of the number of properties in London that are at risk of flooding from rivers, the sea or surface water, focusing on those with a significant likelihood of flooding. The high density of housing in the capital and the amount of development in the floodplain means London has a large number of properties at risk of flooding. Seven London boroughs[1] are within the top 20 local authorities in England with the highest number of properties at risk. However, for the majority the risk is tidal flooding, so the likelihood of it occurring is considered to be low due to protection from the Thames Barrier and other tidal defences.

Properties with a significant likelihood of flooding are predominantly in the fluvial floodplain; generally not as well defended as the tidal floodplain. As schemes are implemented to defend this floodplain, the number of properties with significant likelihood of flooding is expected to fall.

The data used for this indicator is taken from the Environment Agency's National Flood Risk Assessment (Nafra) 2009. It considers the area of floodplain and likelihood of flooding from rivers and the tidal Thames, taking into account protection from defences and likelihood of these failing or being overtopped. Nafra uses 3 categories to assess likelihood.

Table 2: Likelihood categories

Risk	Likelihood
Low	1 in 200 chance (or less) of a flood happening in any one year
Moderate	1 in 75 to 1 in 200 chance of a flood happening in any one year
Significant	1 in 75 chance (or more) of a flood happening in any one year

The Nafra 2009 dataset provides a snapshot of the current situation and is not comparable with previous releases due to changes in the datasets used to calculate the figures. For this reason, there are no trends presented in this indicator. The data is modelled so the figures provided have been rounded to the nearest thousand.

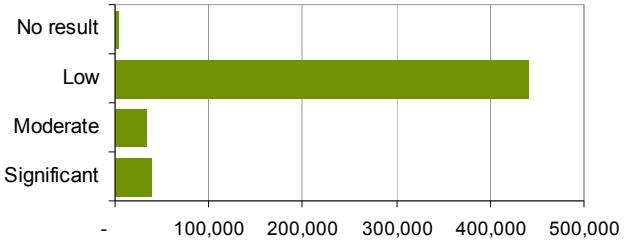
Analysis

- Just below 517,000 properties and 1 million people in London are at risk of flooding from rivers or the sea[x].
- 85% of the properties at risk have a low likelihood of flooding due to defences e.g. the Thames Barrier (Figure 3).

8% of properties at risk in London have a significant likelihood of flooding.

- The London boroughs of Richmond upon Thames and Merton have the highest number of properties with significant likelihood; around 5,000 each. They are ranked 25 and 28, of the top 50 local authorities nationally.
- Between 2007/08 and 2010/11, around 60,000 properties in the capital benefited from a reduced flood risk as schemes to improve and maintain defences were completed.
- The number of properties benefiting each year increased from around 8,500 properties in 2007/08 to around 11,500 in 2010/11. In 2009/10 it was around 3 times more, at around 32,500.

Figure 3
Properties at risk of flooding from rivers and the sea
No. of properties



Source: National Flood Risk Assessment (Nafra), Environment Agency 2009

[1] *These are Southwark, Hammersmith and Fulham, Newham, Wandsworth, Tower Hamlets, Westminster and Greenwich.*

Indicator 4: Sea level change

This indicator is a measure of the change in sea level at Sheerness, at the mouth of the Thames Estuary. Climate change is likely to increase mean sea levels, increase peak surge tide levels and increased wave heights. Rising sea level has the potential to increase flood risk. In London this is being managed through the Thames Estuary 2100 project.

The Environment Agency's TE2100 strategy looks at how tidal flood risk will be affected by changes in climate and development in the floodplain. The main findings of TE2100 are that London's tidal defences, including the Thames Barrier, will continue to protect London from tidal flooding up until 2070 as plans are put in place to adapt to future climate change.

London is currently defended from tidal flooding by nine tidal barriers, including the Thames Barrier, and a network of flood walls and embankments. The Thames Barrier is also used to protect London from fluvial flooding; preventing the tide from passing through the Barrier during periods of high flows over Teddington Weir.

This indicator uses data from the Proudman Oceanographic Laboratory to assess change in sea level at Sheerness (Kent). Sea level change is measured relative to the mean sea level during the period 1915-21; this was used to set a benchmark at Newlyn (Cornwall) and was transposed to other sites across the UK. The benchmark was set as zero and change is measured against it.

There are gaps in data collection, but a general trend can be established from the available data. Trends are determined over the data period (1834 to 2006), rather than directly to the report baseline of 2000, to provide a clearer picture of change over time.

The indicator is also a measure of Thames Barrier closures. There are a number of factors that affect the frequency of Thames Barrier closures; it is not solely due to sea level change. This data is taken from the Environment Agency and begins in 1983, the first year of data available.

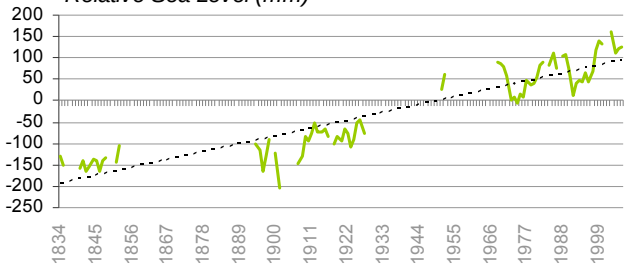
Analysis

- Between 1834 and 2006, sea level at Sheerness has risen by 253mm (Figure 4).
- The Thames Barrier has been closed 119 times since it became operational in 1982; 76 tidal closures and 41 fluvial closures (Figure 5).

Sea level at Sheerness is rising by an average of 1.5mm year.

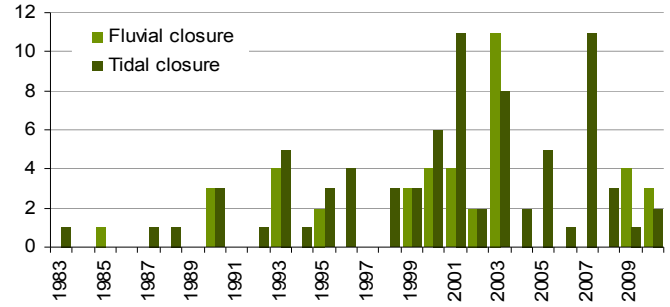
- Closures of the Barrier have become more frequent; two thirds of all closures have occurred since 2000. However, there are consecutive closures on successive tides, rather than individual events, which may affect the trend. This is particularly evident in 2000, 2001, 2003 and 2007.

Figure 4
Sea level change at Sheerness (1834-2006)
Relative Sea Level (mm)



Source: NERC - Proudman Oceanographic Laboratory

Figure 5
Closures of the Thames Barrier in London
Number of closures



Source: Environment Agency, 2010

Indicator 5: Flood warnings issued

Improving awareness of flood risk and ensuring we are prepared for flooding is fundamental to reducing the consequences of a flood when it does occur. This indicator is a measure of the change in the type and frequency of warnings issued for flooding in London, on an annual basis. The term warning is used in this indicator to refer to all types of warning codes unless specified.

There are three stages in the Environment Agency's flood warning service – Flood Alert, Flood Warning and Severe Flood Warning. A 'Warnings no longer in force' message is issued to inform people who have received a warning that the situation is improving. The flood warning codes were changed in November 2010. The new codes are defined in table 3.

Table 3: Definitions of flood warning codes

Flood Alert	Flooding is possible. Be prepared.
Flood Warning	Flooding is expected. Immediate action is required.
Severe Flood Warning	Severe flooding. Danger to life.
Warnings no longer in force	No further flooding is currently expected in your area.

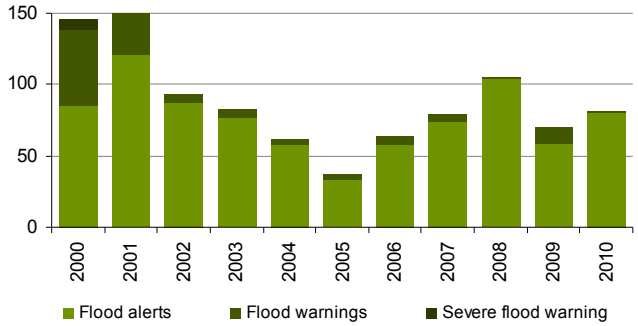
This indicator uses data on the number of each type of warning issued in London. Data are collated on an annual basis; therefore comparison with 2000 is available. Trends in warnings issued are indicative only as they are affected by changing rainfall patterns.

Analysis

- The total number of warnings issued has varied annually since 2000, with a decreasing trend between 2001 and 2005, from 150 to 37. Since 2005 the total number of warnings has fluctuated around 70, except for a peak of 117 in 2008 (Figure 6).
- Flood Alerts make up the majority of warnings issued each year, making up just under 90% (on average) since 2000.
- No Severe Flood Warnings have been issued in London since 2000.

Fewer Flood warnings were issued in 2010 compared to 2000.

Figure 6
All flood warnings issued in London, 2000 to 2010
Number issued



Source: Environment Agency, 2011

Local case study

Drain London

Following publication of the draft Flood Risk Appraisal and the severe surface flooding that affected many parts of the UK, including London, during summer 2007, it was clear that the threat from surface water flooding was poorly understood in London. Furthermore, there was a lack of consistent record keeping and unclear divisions of responsibility between numerous drainage asset managers, which underlined that this risk was not being quantified or properly addressed.

The GLA, Environment Agency, Thames Water and London Councils set up the Drain London programme, which brings together all the partners with responsibility for, and information on, surface water flooding in London to tackle this risk. During the project, the government introduced the Flood and Water Management Act 2010, which has placed additional requirements and responsibilities on the boroughs as Lead Local Flood Authorities. The Drain London project outputs have been adjusted to assist boroughs with their new roles.

When complete, Drain London will represent a change in understanding of surface water risk, with a programme of management measures over coming years, including innovative demonstration projects using vegetation and green spaces to manage flood risk.

The main outputs from the project will be:

- a draft surface water flood risk map and surface water management plan for every borough;
- a London wide overview of flood risk to identify local flood risk priority areas;
- funding to deliver demonstration green roofs in areas of known high surface water flood risk and to audit additional green infrastructure interventions;
- a Community Flood Plan Programme to help communities ‘at risk’ of flooding to develop and implement their own community level flood plans;
- at least three detailed flood risk management projects for high risk areas.

Addressing flood risk and improving adaptation is an increasing priority in London. This programme is part of an ongoing theme and over the coming years is intended to lead to further work.

Data on the number of properties that are vulnerable to surface water flooding, by borough, will be issued by the London Boroughs and will be available in the updated flood risk appraisal.

Surface water flooding in London following heavy rainfall on 20 July 2007.
Source: Environment Agency

Useful links and further reading

- Thames Estuary 2100
- London Regional Flood Risk Appraisal
- Drain London
- London Plan 2011. Policy 5.12 (flood risk management)
- Thames Catchment Flood Management Plan (page 26). December 2009
- The River Restoration Centre – details restoration projects that have occurred or are planned in London, including those with flood risk benefits.

Old Ford Lock, River Le Navigation. Source: Pete Rudd, Environment Agency

3

WATER QUALITY IN LONDON

One of London's 47 river water bodies meets 'good ecological status' under the Water Framework Directive; 30 are classed as 'moderate' and 16 are 'poor'.

Around 39 million tonnes of dilute but untreated sewage is discharged annually into the Thames Tideway. This causes dissolved oxygen levels to drop below threshold levels on average around 52 days per year, requiring remedial action.

Serious water pollution incidents have fallen by 73% between 2002 and 2010; there are less than 2 major incidents in London each year, and occurrences' of significant incidents are also declining.

The quality of London's water environment is vital to people and wildlife in the capital. The River Thames and its tributaries provide habitat for a wide range of species, recreation opportunities, and drinking water for public supply.

The biggest pressures on the water environment are from diffuse and point source pollution, changes to the river channel, and the flow and volume of water available to dilute any pollution entering the river. Addressing the sources of pollution that adversely affect the state of London's water environment will help to protect and improve London's water quality. This includes misconnections of sewer to surface water drains, contaminated urban run-off and discharges of storm sewage.

There are 57 storm sewage discharges and combined sewer overflows (CSOs) going into the tidal Thames.

These result in untreated sewage entering the tidal sections and some freshwater tributaries, such as the River Lee, after rainfall. These overflows are a legacy from the 1800s when Joseph Bazelgette designed a sewerage network for London in place of the permanent disposal of sewage directly into the river. This network was designed to deal with both surface water drainage and foul water (sewage), as a combined system, with the facility to overflow into the Thames when the sewers reached their capacity. At the time, this resulted in significant improvements in river quality, even though there were intermittent discharges of foul water. However, the increase in population and development in the capital has put pressure on this network and its ability to cope with heavy rainfall.

We have chosen three indicators to illustrate water quality in London, looking at both freshwater and estuarine quality. For freshwater quality, the indicator is a measure of the ecological status of London's water bodies. This is based on criteria used to assess compliance with the EU Water Framework Directive. The water quality of the Thames Estuary is represented using data on dissolved oxygen levels – the number of days below threshold levels and the frequency of use of oxygenating vessels to improve quality. We have also looked at data on water pollution incidents in London, focusing on those with major and significant impacts to the state of the water environment.

Case studies highlighting projects and schemes that demonstrate improvements to water quality, in London, are presented at the end of the chapter.

Indicator 6: Freshwater quality – Ecological status

Ecological status is determined using criteria to assess compliance with the EU Water Framework Directive. It applies to all surface water bodies, including lakes, rivers, estuaries, coastal waters and artificial waters such as canals and also applies to groundwater. For the purpose of this indicator we have focused on the status of river water bodies in London. Ecological status is determined using a range of biological, chemical and physical qualities of a water body.

The main objectives of the EU Water Framework Directive are to prevent deterioration in the status of water bodies and to protect, enhance and restore them The key concept underpinning the Directive is adopting a holistic view of river basin management and a series of measures and actions have been set in order to achieve good ecological status or potential for London's water bodies. These will be co-delivered by a range of organisations across London. An example of a project being driven by the Water Framework Directive, to improve the Mayes Brook, is shown in the chapter case studies.

Status classification is based on a 2009 baseline, published in the first River Basin Management Plan (December 2009). This covers the period 2009 to 2015. Analysis against the report baseline of 2000 is therefore not available for this indicator. The next formal classification will be against the 2015 targets and reported in the second River Basin Management Plan. We will assess progress with these targets when this data are published.

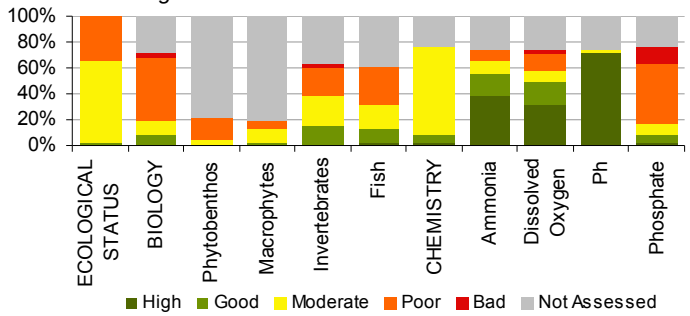
Analysis

- There are 47 designated river water bodies with all or part of their river length in Greater London[xi]. Figure 7 shows, of these:
  - One has 'good ecological status' and currently meets the requirements of the Directive. This is the Small River Lee (and tributaries) on the northern border of London.
  - 30 are currently assessed as moderate.
  - 16 are currently assessed as poor.

- The freshwater section of the River Thames, from Egham to Teddington, is classified as poor. The biology of the river is affecting the status achieved.

- Both sections of the Tidal Thames in London (from Teddington to Battersea, and Battersea to Mucking) are classified as moderate.

Figure 7
Status of London's river water bodies
Percentage



Source: Environment Agency, River Basin Management Plan 2009.

Indicator 7: Estuarine water quality – Dissolved oxygen levels

In the early 1950s long stretches of the Thames Tideway had no aquatic life and the river was classed as biologically dead as pollution reduced oxygen levels in the water. Major investment in sewage treatment in the 1960s and 1970s, along with a reduction in industrial inputs into the river, improved water quality and aquatic life began to return.

Dissolved oxygen (DO) is the most important indicator of the status of water quality in the Thames Tideway. It is affected by a number of factors including organic pollution (e.g. discharges of storm sewage), reduced freshwater flow, and temperature. These can reduce DO levels, reducing the quality of the estuary and its ability to support fish and invertebrates.

The Environment Agency has derived DO thresholds for management of the upper and middle sections of the estuary. For the upper estuary the threshold is 40% saturation, and for the middle estuary it is 30% saturation. These are considered the thresholds at which a detrimental impact is likely to be observed on tideway aquatic life, particularly fish. If DO saturation is below these thresholds, remedial measures are put into action.

The Environment Agency has a network of automatic water quality monitoring stations (AQMS) along the Thames Tideway which measure DO. AQMS feed live information on water quality, enabling a rapid response when water quality problems arise. This allows an accurate and timely assessment of water quality. Remedial measures include using Thames Water's oxygenation vessels, dosing hydrogen peroxide, reducing upstream abstraction rates to increase freshwater flows, and improving effluent quality from the large tideway sewage works during the summer months when the estuary is most sensitive.

This indicator uses the DO thresholds outlined above, along with the data from the AQMS, to determine the number of days DO is below standard in the Thames Tideway, and therefore having an impact on the state of the water environment. We have also assessed the number of days oxygenation vessels – the Thames Bubbler and Vitality - were deployed. Data are available from 2000 for both datasets used in this indicator so comparison has been made to the report baseline.

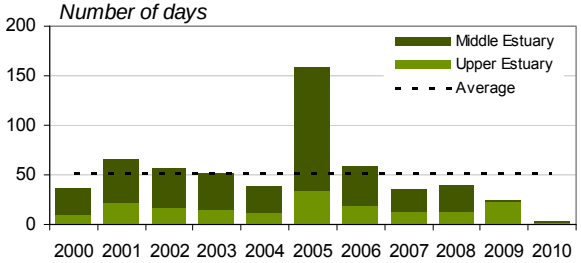
Analysis

- Storm sewage discharges into the Thames Tideway are directly linked to rainfall. The relative proportions of discharges from CSOs and sewage treatment works depends on where in the sewerage catchment the rain falls.

39 million tonnes of storm sewage is discharged into the Thames Tideway each year.

- Since 2000, DO saturation has been below standard on average around 52 days per year[xii] (Figure 8).
- The deployment of the oxygenation vessels shows a similar trend to that in Figure 8, demonstrating the number of times remedial action is required.
- Under the WFD, the DO status for the upper and lower sections of the estuary is good and high, respectively. The middle section, from Battersea to Mucking, is classified as moderate.

Figure 8
Days oxygen saturation is below standard in the Thames Tideway.
Number of days



Source: Environment Agency, 2011

Indicator 8: Serious water pollution incidents

Water pollution incidents can have a detrimental impact on the water environment. This indicator measures the number of recorded water pollution incidents that have a serious detrimental impact on the state of the water environment.

Common pollutants which cause water pollution incidents include: oil, fuels, organic pollutants (including crude and storm sewage), contaminated water (fire fighting run-off), chemical and pesticides. These pollutants can enter the water environment as a result of illegal or unauthorised discharges, accidental spillages, misconnections, containment and control failures, and sewer failures or overflows.

The Environment Agency is responsible for pollution control of all inland freshwaters and has a duty to respond to as many pollution incidents as possible, and act to contain the pollution and protect the water environment. Many other organisations have responsibilities for pollution incidents including water companies, local authorities and private landowners.

Each incident is given a classification based on the level of environmental impact. The classification ranges from category one, which are major incidents, to category four, which have little or no environmental impact. For this indicator, serious water pollution incidents are those classified as category one or two incidents and is referred to as major or significant incidents.

The first series of data recorded begins in 2002, therefore comparison to the baseline of 2000 is not possible for this indicator but trends will be drawn for the period available.

Analysis

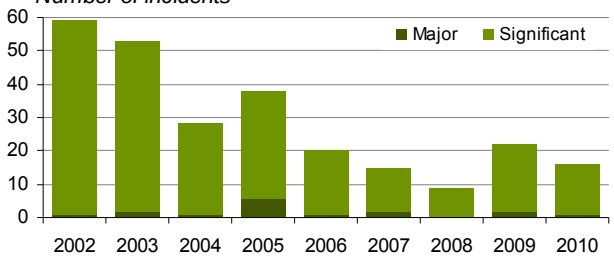
- Major water pollution incidents are low in London, with an average of less than two per year. In 2010, one major incident and 15 significant incidents were recorded.

- Since 2002, the main cause of major pollution incidents in London has been authorised discharges of storm sewage following periods of heavy rainfall. Whilst these are undesirable, they are authorised under certain circumstances to prevent sewage backing up into homes and streets. Improvements are planned to improve this unsatisfactory situation.

The number of serious incidents recorded in London has fallen by 73% between 2002 and 2010, from 59 to 16.

- There has been an overall reduction in the number of significant incidents in London, since 2002, although notable increases are evident in 2005 and 2009. Reported reasons for these incidents range from natural events including algae and the weather, to containment and control failures, accidental spillages or illegal activities and discharges.

Figure 9
Serious water pollution incidents in London (2002- 2010)
Number of incidents



Source: Environment Agency, 2011

Local case study

Water Framework Directive: Mayes Brook restoration

Approximately 800 metres of the river channel are being restored, in Mayesbrook Park in Barking. The project aims to improve water quality in the channel, create an area of floodplain wetland to improve biodiversity and flood storage capacity. These improvements will help the brook become more resilient to climate changes, improve the amenity value of the natural environment, and help increase resident's engagement with nature.

The brook has historically been re-aligned and straightened, and is fenced off from the surrounding Mayesbrook Park. Work to improve this stretch of Mayes Brook began in March 2011 and is expected to be complete by spring 2012.

Mayes Brook has the potential to be a fantastic open space. The restoration of this brook is a flagship restoration project under the London River's Action Plan. Another driver for improving Mayes Brook is the Water Framework Directive. It has been classified as a heavily modified water body, currently classified as moderate. Improvements are in line with measures in the River Basin Management Plan, to help improve the quality of this water body.

Mayes Brook prior to restoration
Source: Environment Agency

Local case study

Thames Tideway: Water quality improvements

Much of London has a combined drainage system, which carries both surface water and wastewater. This combined drainage system can be overwhelmed by as little as 2mm of rainfall, resulting in discharges of storm sewage to watercourses via overflows. On average 39 million cubic metres of dilute but untreated storm sewage is discharged into the Tideway each year from CSOs. These discharges can cause severe drops in oxygen levels, killing fish. Furthermore, sewage-derived litter deposited in the river and on the foreshore is polluting and unpleasant to see.

The proposed solution to this situation is to construct two tunnels to intercept flows from the identified unsatisfactory CSOs and upgrade existing tideway sewage treatment works (STWs).

- The proposed **Thames Tunnel** is being designed to capture flows from 34 unsatisfactory CSOs along the tideway for treatment at Beckton Sewage Treatment Works (STW). The proposed 20-mile (32km) Thames Tunnel will run from west to east London, beneath the River Thames. Its precise route has still to be determined. The target date for the submission of the planning application is late 2011. Initial construction of the Thames Tunnel is provisionally scheduled to start in 2012/13 and finish in 2020.

- The **Lee Tunnel** will prevent storm sewage from overflowing into the River Lee, a tributary of the River Thames. The tunnel will capture sewage from a single overflow point at Abbey Mills Pumping Station. Work began in spring 2010 and is due to be complete in 2014.

- **The Tideway STWs will be upgraded; these** include Beckton, Crossness, Mogden, Long Reach and Riverside. These improvements will provide additional treatment to improve effluent quality to meet Tideway water quality standards. These improvements will enable the site to deal with the increased sewage resulting from population growth until 2021. It will significantly reduce the amount of storm sewage that overflows into the Thames Tideway during heavy rainfall, when the STW becomes overloaded.

Discharge from the Abbey Mills pumping station into the River Lee.
Source: Environment Agency

Useful links and further reading

- River Basin Management Plan
- London Plan 2011. Policy 5.14 (water quality and sewerage infrastructure)
- The Thames Tideway Strategic Study
- Thames Tunnel 'Needs Report'. Thames Water. 2010.
- The Mayor's draft Water Strategy (April 2009)

Teddington Weir, Richmond upon Thames. Source: Environment Agency

4

WATER RESOURCES IN LONDON

At home, Londoners consumer around 167 litres of water per person per day (l/h/d), which is 20 l/h/d higher than the England and Wales average, and similar to the average consumption in 2000.

The volume of water lost through leaking water mains (per property per day) has been reduced by 5% since 2000/01, but remains the highest in England and Wales at around 177 litres.

Flow in London's rivers supports good ecology all the time, except for the middle and lower sections of the River Lee.

Management of groundwater levels in recent years has meant levels in London are beginning to stabilise. However, levels have risen in west London by around 7 metres since 2000. Levels in central, east and south London have fallen since 2000.

The availability of water resources in London depends on the balance between the amount of water taken for supply and the demand we put on the resources. About three-quarters of London's water supply comes from the rivers, primarily the River Thames and the River Lee. Groundwater directly supplies about a quarter of London's water, and more indirectly by supplying about 60% of river flow.

The South East of the UK receives less rainfall than many Mediterranean countries and this water has to be shared across a large population.

London has the most people living in the driest part of the country. In meeting our demand for water we are already taking more water out of the environment than it can sustain. 26% of homes in London currently have a water meter installed (2009/10) compared to an England and Wales average of 35%[xiii]. Metering and water efficient appliances can help reduce household demand and consumption of water. A case study on the RE:NEW project is presented at the end of the chapter.

During times of drought, low river flows or during periods of high demand, the Beckton Desalination Plant can provide additional supply to around one million people in London. As it is carbon intensive desalination is considered an 'emergency measure' and is not a long-term solution for future supply needs. We therefore need to manage the water we have to balance supply and demand.

The indicators chosen for this chapter provide an overview of the state of water resources in the capital. They consider what water is available, both in the rivers and groundwater, and how that water is both used and lost.

The first indicator in this chapter provides an indication of the changing demand on water resources, through data on the amount of water used in our homes, expressed as per capita consumption. To assess the amount of water lost from supply through pipes, we have presented an indicator on leakage.

The management of resources to ensure a balance between water for people and the environment is measured through an indicator on water resource availability. This uses data from Catchment Abstraction Management Strategies (CAMS) and also looks at flows in the River Thames from the hydrometric achieve. The final indicator in this chapter is a measure of the change in groundwater levels under London.

Indicator 9: Domestic water consumption

The amount of water we use in our homes is expressed as per capita consumption (pcc). This measures the average volume of water that each person uses every day. It is used by water companies to inform how they plan to maintain a balance between demand for water and their available supply over the next 25 years.

Thames Water covers the largest area of London, but the capital is also served by Veolia Water Central, Sutton and East Surrey Water, and Essex and Suffolk Water.

This indicator uses per capita consumption as a measure of water use since 2000. The figures used in this indicator have been calculated for London, based on water company data submitted to OFWAT for the water companies supplying London, and is proportioned for the Greater London area, rather than presenting figures for each water company individually. This provides an indication of London's water consumption.

Annual figures are available so comparisons have been made to the report baseline. In addition, the data are also assessed using five-year average periods. This is to smooth out annual fluctuations resulting from different weather patterns and subsequent drought or wet years. These average periods provide a clearer picture of patterns in household water use.

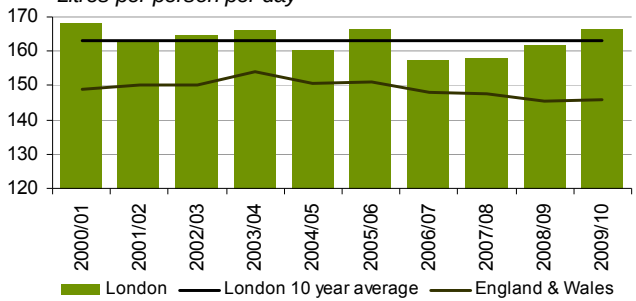
Analysis

- 74% of total water use is household use and 26% is non-household use.
- Domestic water use in London is around 167 litres per head per day (l/h/d).
- The per capita demand for water in our homes has fallen since 2000/01 (based on 5-year average use), but the latest 5-year average (05/06 to 09/10) increased by 1.2 l/h/d compared to the previous period[xiv].
- Annual water use, averaged across London, shows fluctuation over the last 10 years with current use (2009/10) similar to that in 2000/01. This is around 20 l/h/d more than the England and Wales average (figure 10).
  - Demand dropped in 2006 – this was a dry year with a hosepipe ban, reducing the amount of water people used.
  - 2007 and 2008 had lower use due to wet summers and less need for hosepipes.
  - Water use increased to higher than average levels in 2009. The summer was slightly drier increasing outdoor water use and water efficiency messages were less prominent in the media than in previous years.

London's domestic water use per person per day is higher than Paris (150 l/h/d) and Amsterdam (143 l/h/d)
www.eudeparis.fr and www.siemans.com

- The rate of household water use in London is currently 28% higher than the aspiration set out in Defra's Future Water Strategy, for households to consume on average 130 litres per person per day by 2030.

Figure 10
Domestic water use in London from 2000 to 2009
Litres per person per day



Source: Water company resource management plans

Indicator 10: Leakage in London

This indicator is a measure of the amount of water lost from leaking water mains and service pipes in London; known as 'leakage'. A large part of our water supply network was laid by the Victorians so they are now over 100 years old. Their age, combined with other factors, such as vibrations from road traffic and construction, weakens the pipes and joints, increasing the likelihood of leakage.

Leakage is not only a waste of natural resources (including wasting the energy used to abstract, treat and pump the water), but it also reduces the amount of water available for supply and the environment. The complex nature of the supply network means there will always be some level of leakage, but London is much higher than average.

Water companies are investing more and more to detect leaks and replace old pipes. For example, between April 2006 and March 2010, Thames Water invested £1126 million in reducing leakage and also aims to replace around 1,000km of water mains from 2010 to 2015. Opportunities to carry out this work have to be balanced against the implications for London's transport network (from digging up roads to access pipes) and the cost.

This indicator uses data on actual leakage levels (averaged for the London area), progress with leakage targets for water companies operating in London and the leakage rate per property per day. Data for this indicator is taken from Water Company's June Returns to OFWAT and is calculated for the London area using data from four water companies. Comparison with the report baseline of 2000 is available for this dataset.

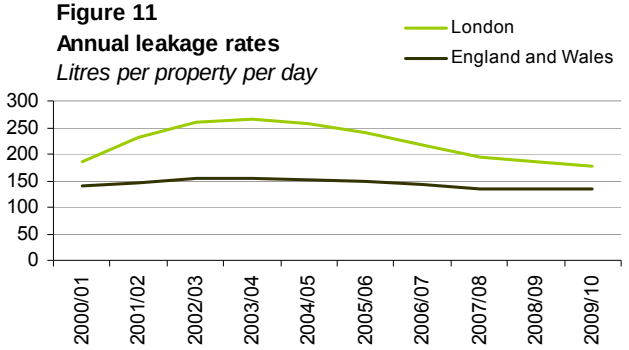
Analysis

- Actual leakage in London is at a similar level to 2000/01.
- A steady increase from 2000/01 to 2003/04 was evident. Following this peak, leakage in the London area declined from 853 to 589 mega litres per day (Ml/d).
- The overall change since 2000 has been relatively low, at 1%, although leakage levels have shown large variation in the interim.
- All the water companies operating in London have met their company-wide leakage targets since at least 2006/07, with the exception of Essex and Suffolk Water and Veolia Water Central whose leakage levels were slightly over their 2009/10 target.

Since the peak in 2003/04 London's leakage has reduced by over 105 Olympic swimming pools a day.

- Current leakage rates for water companies operating in London range from 186 litres per property per day for Thames Water, to 87 l/prop/day for Sutton and East Surrey Water. This compares to a national average of 133.
- Leakage per property per day in London as a whole is 177 litres, compared to 187 litres in 2000/01 (Figure 11). Current levels are 33% less than the peak in 2003/04.
- Since 2000, the leakage rate per property per day in London has got closer to the England and Wales average, but is still around 23% higher. This is equivalent to an average of 73 litres per person per day in London.

Figure 11
Annual leakage rates
Litres per property per day



Source: Water Company water resource management plans

Indicator 11: Water resource availability

This indicator is a measure of the amount of water available to meet our demand and the needs of the environment. About three quarters of London's drinking water comes directly from the rivers Thames and Lee. Flow levels affect the amount of water available for the environment and supply.

Changes in rainfall patterns and increasing temperatures, as a result of climate change, are expected to affect river flows in future. The UK climate projections (2009) estimate that by the 2050s summer mean rainfall could decrease by between 14% and 19% (low to high emissions scenarios), whilst mean winter rainfall is projected to increase by 12% to 16%.

Computer modelling by the Environment Agency has shown that there is likely to be less water available in the summer as flows become lower. This will exacerbate any existing ecological problems in rivers and could put further pressure on meeting the objectives of the Water Framework Directive (WFD) because there would be less water in the river to dilute pollution.

This indicator uses CAMS and flow data to look at resource availability in London's rivers. CAMS measures resource availability against licensed abstraction to ensure there is a balance between the amount of water for the environment and that required for supply. It shows the percentage of time London's rivers meet environmental flow limits; the minimum amount of water required to protect and maintain a healthy ecosystem. Flow data is taken from the River Thames at Kingston. The site is used to control London's major public water supply abstractions and is taken from the Environment Agency hydrological archive.

Analysis

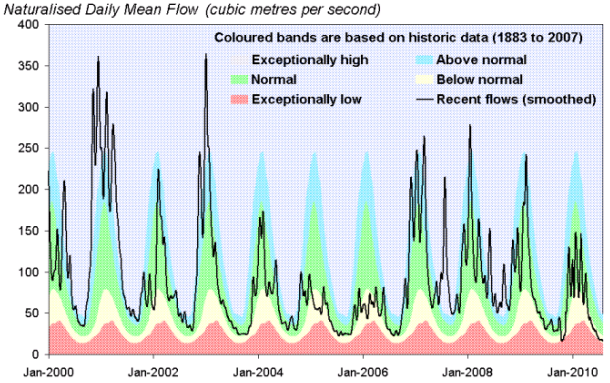
CAMS

- London's rivers have sufficient flow to support good ecology all year, except in the middle and lower River Lee.
- When looking at the volume of water actually abstracted from the river, the middle and lower sections of the River Lee only have resource available 44% and 27% of the time to support good ecology. These drops lower (18% and 10% respectively) for the maximum licensed abstraction volumes. Also, resource availability in the River Ravensbourne would drop to 73%.

Flows in the Thames at Kingston

- Over the last 10 years (Figure 12):
  - There were significant winter flood peaks in 2000/01 and 2002/03.
  - The dry period between 2004 and 2006 led to concerns about drought.
  - The exceptional summer rainfall in July 2007 was the wettest on record (since 1883) and led to extensive flooding. Flows at Kingston peaked at levels that would be considered "above normal" even in winter.

Figure 12
Flows in the River Thames At Kingston
Naturalised Daily Mean Flow (cubic metres per second)



Source: Environment Agency hydrological achieve, 2011

- Data over the last 50 years shows that there has been a subtle, seasonal shift in flows in the River Thames at Kingston. Autumn/winter flows have recently been slightly higher, with larger flood peaks, and spring/summer flows have been slightly lower. Increases in autumn rainfall probably help to explain the higher flows but these changes are not unusual in the context of the longer period of record.

Indicator 12: Groundwater under London

This indicator is a measure of the changing levels of groundwater under London. The chalk aquifer is the major groundwater supply source in London. The chalk is confined by overlying clays, which act as an impermeable layer preventing rainfall from replenishing the chalk groundwater levels.

Water levels in the chalk aquifer are maintained by groundwater flow into London from the Chilterns and North Downs. Management of groundwater levels is vital to ensure they are kept low enough to prevent flooding of London's underground infrastructure, whilst at the same time ensuring they are not lowered too far through unsustainable abstraction.

Heavy industry in London previously abstracted water from the ground to support their activities, peaking in the 1960s at 88 metres below sea level. As industry moved out of central London, ground water levels steadily recovered. However, by the 1990s rising levels began to cause concern.

The General Aquifer Research, Development and Investigation Team (GARDIT) developed a strategy to manage this by encouraging use of the aquifer for public water supply. Levels are currently still within the general parameters set by the GARDIT strategy but the situation is being monitored to ensure the required balance is achieved.

This indicator looks at levels of groundwater under London, using data from the Environment Agency's analysis of levels reported annually in the 'Management of the London Basin Chalk Aquifer'. The data are collected from London's network of observation boreholes, to monitor absolute levels and the rate of change.

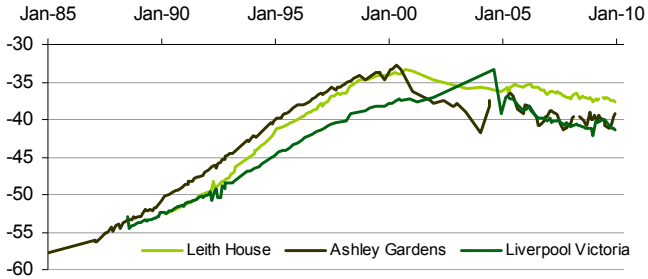
For this indicator we have shown data from 1985 to demonstrate the changing trend in groundwater levels over time, as the trend reversed in 2000. Groundwater levels are shown in metres above ordnance datum (mAOD) – this represents metres above the mean sea level.

Analysis

- Chalk groundwater levels are not uniform and will vary across the capital. These variations can result from the chalk's geology, actual abstraction rates and water level pressures from outside the area. These factors will have contributed towards changes in the water levels observed.

- In central London groundwater levels have fallen in the order of 3m since 2000, and up to 5m in east London as a result of increased abstraction[xv] (Figure 13).

Figure 13
Groundwater Hydrographs for Central London
Groundwater level (mAOD)



Source: Environment Agency

- Groundwater levels in west London have continued to rise by around 7m since 2000, due to limited abstraction in this area. However, this has levelled off in recent years.

- Groundwater levels have fallen more than 3m across much of south London, with drawdown to 10 m concentrated around the many large public water supply abstractions.

Local case study

Water and energy efficiency: The RE:NEW programme

The RE:NEW programme is a project to improve the water and energy efficiency of London homes. RE:NEW is a partnership between the Mayor, London Councils and the London boroughs.

The programme aims to install water efficiency and energy efficiency devices in up to 200,000 homes by 2012, and up to 1.2 million homes by 2015, at no up front cost to the householder.

The typical retrofit package of water efficiency measures is the installation of two tap aerators, one toilet dual flush device (or a cistern displacement device if the toilet cannot be adapted to dual flush), one aerator showerhead and one shower timer. This will mean installing 6 million water-saving measures by 2015, saving 100 million litres per day. It is anticipated that each installed package, assuming average usage, will save over 83 litres of water a day (30,000 litres of water a year), saving the householder £51 on water bills (if metered) and £33 on energy bills annually.

Potential savings that can be achieved from a RE:NEW water efficiency package include:

- 1,825 litres of water and £3.09 (from water bills) a year from installing shower timers
- 10,950 litres of water and £18.53 (from water bills) a year from installing water efficient shower heads

During 2009, three technical trials were undertaken to test the RE:NEW model. Devices were fitted in 817 homes in Croydon, Hillingdon and Southwark, saving around 600 tonnes of CO_2. These trials were followed by nine demonstration projects in Croydon, Harrow, Havering, Hillingdon, Southwark, Camden, Kingston upon Thames, Haringey and Lewisham. These helped to refine the model and develop a Good Practise Manual.

Findings from these projects are informing the roll-out of RE:NEW across all the London boroughs.

Achievements from the 9 projects included:

- 8,045 homes being retrofitted with energy and water efficiency measures
- 82,000 easy measures installed, of which 15,462 (19%) were water efficiency measures
- Net annual water savings totalling 47,297 m^3, translating into 471,629 m^3 over the lifetime of the measures

Net annual cost savings to householders (for combined water and energy bills) of £198,000, translating to net lifetime cost savings of £4 million.

Useful links and further reading

- The Mayor's draft Water Strategy (April 2009)

- London Plan 2011. Policy 5.15 (water use and supplies).

- Management of the London Basin Chalk Aquifer, Environment Agency 2010.

- Catchment Management Abstraction Strategies. Environment Agency.

- The Environment Agency's Water Resources Strategy for England and Wales and Regional Actions Plans

- Managing Abstraction. The Environment Agency, June 2010.

- The Energy Savings Trust

- Waterwise

- Defra's Future Water Strategy
- Thames Water: Water Resource Management Plan

Recycling plastic bottles. Source: Environment Agency

5 WASTE IN LONDON

The amount of household waste produced in London has declined by 11% since 2000, to 3 million tonnes in 2009/10. This equates to around 906kg per household.

Recycling and composting of household waste has increased from 9% in 2000/01 to 32% in 2009/10, but remains the lowest level in England.

There has been a 41% reduction in the amount of local authority collected waste sent to landfill in London over the last decade, from 3.2 million tonnes in 2000/01 to 1.9 million tonnes in 2009/10.

Fewer sites in London are below acceptable condition for litter; this has improved from 33% of sites in 2003/04 to 17% in 2009/10.

Waste arises from almost all activities and needs to be managed effectively to protect the environment and human health. Historically an increasing population and growing economy has generated greater quantities of waste. There are 3 main waste streams – local authority collected waste, waste collected and managed by the private sector (including commercial and industrial (C&I) waste and construction and demolition (C&D) waste).

In 2009/10 London produced approximately 3.8 million tonnes of local authority collected waste.

In this chapter we have focused on local authority collected waste, primarily household waste, and have included data for other waste streams where available. We have not used the outputs from the commercial and industrial waste survey, carried out by Defra, because work is not complete on analysing the trends between the surveys done in 1998/99, 2003 and 2009/10. There is scope for this to be included in future reports.

Waste activities can have a detrimental impact on the environment if not effectively managed. Resources are also being lost as materials that could be re-used, recycled or composted are being buried in landfill. The reliance on disposal to landfill can affect the quality of our land and increase greenhouse gas emissions from the breakdown of waste.

Reducing the amount of waste we produce, re-using and recycling more are fundamental to improve waste management and the state of the environment in London. In recent years less of London's local authority collected municipal waste has been produced, less sent to landfill and more recycled. This follows the waste hierarchy, found in the Waste Strategy for England.

Incineration falls between recycling and landfill disposal in this hierarchy. In London, the rate of incineration is influenced by capacity; therefore there has been no significant change in the rate over the last 10 years (around 20%). The incinerators generate electricity from the burning of waste, but do not utilise the heat produced as an energy source. Once the Belvedere incinerator comes online, the rate is expected to increase, further.

We have used four indicators to address the production and disposal of waste in London. They measure reductions in production of household waste, recycling, landfill and litter. Data for these indicators has been sourced from Defra and the Environment Agency. Re-use is a key priority but is not covered in the indicators due to limited data. We will monitor progress with this in future as more data becomes available. Case studies highlighting projects and schemes that demonstrate improvements are presented at the end of the chapter.

Indicator 13: Household waste production

Household waste is an element of local authority collected waste, and covers all the waste produced in the home that is collected by the local authority through the regular collection service, civic amenity sites and recycling. This indicator is a measure of the amount of household waste produced in London.

Waste prevention is defined as 'minimising the quantity (weight and volume) and hazardousness of household-derived waste, generated in a defined community'[xvi]. This includes avoidance (not producing the waste in the first place), reduction and reuse of waste. The chapter case study looks at Wandsworth's 'less in your bin, more in your pocket' campaign.

In the UK we throw away around 8.3 million tonnes of food and drink each year, with around five million tonnes (60%) being avoidable food waste. This equates to around £480 for the average household[xvii].

This indicator uses data from the WasteDataFlow database, which holds information from each borough on their waste activities. The indicator uses data on London's total household waste and the calculated volume per household. Data are recorded annually (by financial year), so comparisons with the report baseline of 2000 have been made.

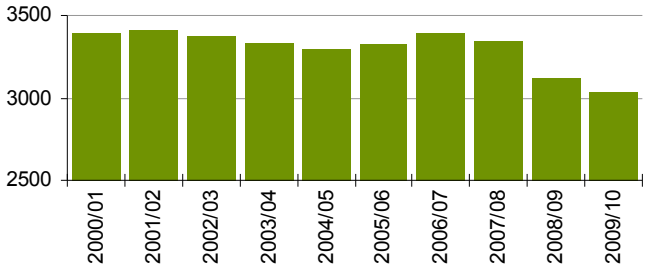
Analysis

- London produced 3 million tonnes of household waste in 2009/10[xviii], which is declining year on year (Figure 14). This accounted for 14% of all London's waste.
- Household waste makes up around 80% of the total local authority collected waste in London, which is currently 3.8 million tonnes.
- The amount of household waste produced in London has declined by 10% since 2000/01, from 3.4 million to 3 million in 2009/10.
- Total household waste arisings per household are around 906kg (2009/10)[2]. There is a target in the Mayor's draft Municipal Waste Strategy to reduce this to 790kg per household by 2031.

Despite a rising population in London, the production of household waste has fallen in recent years. This is due to behavioural change and in part reflects the recession of recent years

- London produces less waste per household than any other region in England.
- Since 2000, the total amount of waste generated each year in England has decreased by 6%, while London's household waste has decreased by 10%.

Figure 14
Total household waste arisings since 2000/01
Thousand tonnes



Source: Defra 2010

[2] *Calculated figure, based on the no of households that each waste authority used to calculate NI191*

Indicator 14: Recycling and composting

As waste is diverted away from landfill, more is being recycled and composted. Recycling and composting of waste forms the third tier of the waste hierarchy after prevention and reuse. This indicator looks at the rate of recycling and composting for all of London's local authority collected waste, and considers the household only component. It also addresses the recycling collection service available to households.

Targets to increase the amount of local authority collected waste that is recycled or composted are identified in the London Plan (KPI 19). The 2010 target to achieve at least 35% was not met; however plans are in place to meet the target of 45% by 2015.

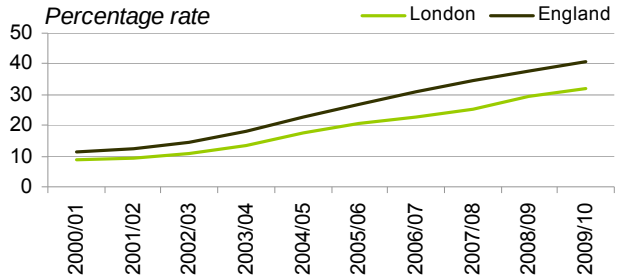
Data for this indicator is taken from the WasteDataFlow database.

Analysis

- London's household recycling and composting rate has increased from 9% in 2000/01 to 32% in 2009/10 (figure 15).
- Recycling of dry materials across London accounts for 22% of the household waste generated, whilst composting accounts for 10%.
- Bexley has the highest household recycling and composting rate in London at 51% – with 23% coming from composting alone. The lowest rates are in Newham and Lewisham, which are below 20%.
- The average rate of recycling is higher for inner London boroughs, at 21%, compared to outer London, which is around 15%. Rates vary by borough and therefore within the classifications of inner and outer London. Rates of recycling are affected by the density of housing, affluence, provision of services, space to store recyclables and behaviours.
- Outer London boroughs have an average composting rate of around 14%, but the rate of composting is much lower in Inner London at 4%. This is due to variation in the organic waste collection services and the presence of gardens.
- The percentage of London households that receive a recycling collection or have suitable access to recycling facilities has increased from 53% of properties in 2000/01 to 96% in 2007/08 (BVPI 91a). *Figures for 2008/09 onwards are not available.*

Recycling and composting of London's local authority collected waste has increased from 8% in 2000/01 to 27% in 2009/10, but London continues to have the lowest rate in England.

Figure 15
Household recycling and composting rate in London over the last 10 years.



Source: Defra 2010

Indicator 15: Landfill

This indicator is a measure of the change in the tonnage of London's waste disposed at landfill, from the main waste streams, along with data on the remaining capacity of London's landfill sites. Data for this indicator is taken from the WasteDataFlow database and the Environment Agency.

Disposing of waste to landfill is not sustainable – resources are being lost as materials that could be re-used or recycled are not being recovered. Around a quarter of all waste produced in London was sent to landfill in 2009; this accounts for 5.3 million tonnes.

There are two main landfill sites in London for local authority collected waste – Beddington Farmlands and Rainham. These receive around 23% of London's waste, but capacity at these sites is rapidly being exhausted. These sites are expected to close in 2021 and 2018 respectively[xix]. This means most of the capital's waste is transported and disposed of in other regions. This increases carbon emissions and costs, and these sites also have limited capacity.

The Landfill Allowances and Trading Scheme (LATS) began in April 2005 and set a limit on the amount of biodegradable municipal waste (BMW) any local authority can send to landfill. The Landfill Directive targets aim to achieve reductions on the 1995 BMW levels. These reduction targets were 25% by 2010 (or 1.7 million tonnes) and are 50% by 2013 and 65% by 2020[xx].

Landfill releases harmful greenhouse gases into the atmosphere, which damage the environment and contribute to climate change. London's local authority collected waste sent to landfill releases around 465,000 tonnes of CO_2 equivalent each year. Reducing the amount of waste produced and reducing the amount sent to landfill through increases in re-use, recycling and composting, could create a net saving of around 1.5 million tonnes of CO_2 equivalent each year[xxi].

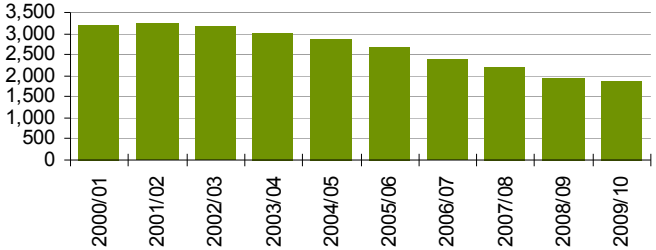
Analysis

- There has been a 41% reduction in the amount of local authority collected waste sent to landfill from London since 2000/01. It has reduced from 3.2 million tonnes to 1.9 million tonnes in 2009/10 (Figure 16).
- There is variability at borough level between the rates of landfill disposal. The City of London landfills almost 80% of their local authority collected waste; however this is expected to fall significantly in the coming years as more is incinerated as the Belvedere incinerator comes online. Whereas Westminster, Greenwich and Lewisham landfill less than 20% (NI193 2009/10) as the majority of the waste is incinerated.

Landfill currently accounts for 49% of the waste collected by the local authority.

- Landfill capacity within London has decreased since 2000/01, from 20 million cubic metres to 6 million cubic metres in 2008[xxii].
- In 2009/10 London sent 1.3 million tonnes of biodegradable municipal waste (BMW) to landfill. This is 75% of the allocated volume of 1.7 million tonnes, therefore meeting the 2010 LATS target.

Figure 16
Tonnage of local authority collected waste sent to landfill in London
Thousand tonnes



Source: Defra 2010

Indicator 16: Litter

Litter is not only experienced on London's streets; transport routes and stations are areas that need improving. Litter has detrimental impacts on the state of the natural environment. Its unsightly appearance can damage peoples' experience of the natural environment. Large volumes of litter entering storm drains and rivers can clog up waste screens, increasing flood risk after prolonged rainfall. Litter can also impact on local wildlife and damage habitats.

An example of the type of initiative in place to improve the cleanliness of London's streets is illustrated in the chapter case study; the 'Love Lewisham' and 'Love Clean Streets' campaigns.

This indicator is a measure of the litter on London's streets and highways, as a percentage of land below acceptable condition. For the purposes of this report, standards of street cleanliness are stated using the Best Value Performance Indicator, BV199, methodology calculated by Keep Britain Tidy. The BV199 indicator was used to measure street cleanliness between 2003/04 and 2007/08, and was replaced in 2008/09 with the National Indicator, NI195.

The method of calculating NI 195 differed from the method of calculating BV199, so data was not directly comparable over the full seven years.

To ensure consistency of data, this report uses annual returns data with 2008/09 and 2009/10 data calculated to apply the BV199 methodology, allowing for direct comparison between years.

The BV199 survey is conducted three times a year and reported annually as the percentage of land and highways that have deposits of litter and detritus (BV199a), graffiti (BV199b), and fly-posting (BV199c) that falls below an acceptable level. Therefore the lower percentage values reflect better condition of our streets. This indicator considers BV199a (litter and detritus) only.

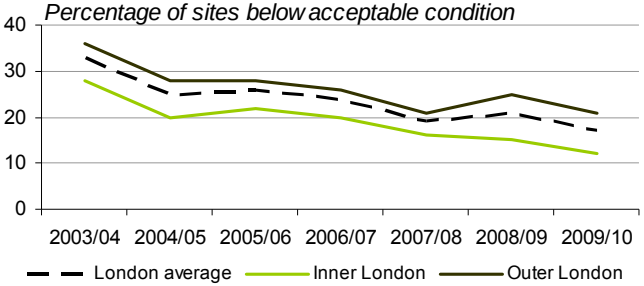
Analysis

- The percentage of sites surveyed that fall below acceptable condition has improved from 33% of sites in 2003/04 to 17% in 2009/10[xxiii] (Figure 17), when considering the London average.

- In Inner London sites below acceptable condition have improved from 28%, in 2003/04, to 12% of sites in 2009/10.

- The percentage of land below acceptable condition is much higher in outer London than in Inner London, at 21% in 2009/10.

Figure 17
BV199a litter and detrits in London
Percentage of sites below acceptable condition



Source: Keep Britain Tidy, 2010

Local case studies

Waste prevention: Wandsworth borough campaign 'less in your bin, more in your pocket'.
Wandsworth borough launched the 'less in your bin, more in your pocket' campaign in August 2009, to raise awareness of how much waste residents produce, and linking it to disposal costs and council tax. The campaign identified that 'one kilo less in the bin can save taxpayers around £500,000 per year'[46]. However, it is estimated cost savings would be higher due to the increasing costs of landfill.

The aim of the campaign was to encourage residents to reduce the amount of residual waste they throw away, recycle as much as possible and provide tips to reduce their waste production through posters, articles and adverts in local publications and adverts on council vehicles.

Analysis of Wandsworth's waste data has shown the residents reduced the amount of residual waste going into their bins by more than 3 million kilos in 2009/10 (or around half a kilo per household per week) and reduced council disposal costs by around £300,000[xxiv].

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Street Cleanliness: Love Lewisham – Love Clean Streets
The 'Love Lewisham' campaign was first introduced in 2004, allowing the public to share information about issues in their local environment.

This is a free, online tool that holds information uploaded by members of the public detailing occurrences of fly tipping, litter or graffiti in their community. Information can be uploaded direct to the 'Love Clean Streets' website, or via mobile phones. All that is required is a photo of the issue, the location and details. The local authority street teams use the information to target known problems. A live map tracks progress with all issues and identifies when action has been taken.

Statistics from the Audit Commission have shown that the campaign has had huge success in reducing complaints for graffiti in Lewisham – a reduction of 30% from June 2007 to August 2009 – and in reducing the amount and frequency of graffiti – by 8%. The scheme has reduced costs and time spent on paperwork, with the latter reducing by 21% in Lewisham between 2008 and 2010. Clean up times have been reduced, leading to an increase in resident satisfaction and engagement with their local environment. Fly-tip removal times have reduced from 2.5 days in 2004 to less than one day[xxv].

The campaign has been such a success in Lewisham, that it was rolled out across all London boroughs under 'Love Clean Streets', in February 2010 and re-launched as 'Love Clean London' in March 2011 with a London specific phone application. The scheme is an example of 'localism' in action.

Useful links and further reading

- The Mayor's draft Municipal Waste Strategy
- London Plan 2011. Policy 5.16 (waste self-sufficiency) and 5.17 (waste capacity)
- The Waste Strategy for England
- Landfill Allowances Directive (LATS)
- Defra waste statistics
- Environment Agency waste data
- London Remade – waste efficiency

Bus and Bike in London. Source: Thinkstock.com

6

AIR QUALITY, TRANSPORT AND NOISE

The rate of improvement in levels of particulate matter (PM_{10}) has been slower in the last decade than in the 1990s. Similarly, levels of nitrogen dioxide (NO_2) in London fell until 2002, but have remained relatively stable since then.

The proportion of journeys on public transport increased from 34% in 2000 to 41% in 2009, compared to a drop from 43% to 37% for transport by private car.

3.2 million people (42% of London's population) are exposed to a noise level of 55 decibels (dB) L_{den}, or more, from road traffic, and over 450,000 (6% of London's population) from railway noise.

Air quality is a public health issue and has impacts on the environment. Improving air quality in London is a priority. It is clear that long-term exposure to high concentrations of air pollutants (that is, exposure across the entire life span of an individual) can contribute to: shortening of life expectancy, the development of chronic diseases, and increase the risk of respiratory illness. Poor air quality can affect biodiversity, causing damage to roadside vegetation and in the long term, affecting growth and development of plants and trees, and species' diversity. The main pollutants are nitrogen dioxide (NO_2) and particulate matter (PM_{10}), with road transport being a major source. A case study on a trial to reduce air pollution in London is presented in this chapter.

Under the Local Air Quality Management framework set by the Government, the boroughs must regularly review and assess air quality and designate Air Quality Management Areas (AQMAs) where UK objectives are currently not being met. Where a Borough has declared an AQMA, an Air Quality Action Plan is required to be produced that works towards achievement of the air quality objectives. All 33 Boroughs have designated AQMAs.

The changing climate will have implications for air quality in London as it is affected by weather patterns. Increasing summer temperatures generally result in an increase in natural emissions of air pollutants such as methane, carbon dioxide and volatile organic compounds (VOCs), from wetlands and vegetation. Increased summer levels of ozone are expected with increasing temperatures, as seen in the heat wave of 2003; so increasing the likelihood of summer smog. Higher temperatures may increase energy demand from air conditioning use.

Public transport is becoming more popular ; there has been a rise in low carbon alternatives to the private car.

Low carbon schemes include the Barclays Cycle Hire Scheme (presented as case study at the end of this chapter), hydrogen buses and electric vehicles. Transport for London is introducing eight new hydrogen buses in London which emit only water vapour; there are no CO_2 or particulate emissions from the exhaust.

Noise (unwanted sound) can affect health and quality of life by causing disturbance, disrupted sleep and stress-related heath effects. Noise can be reduced through better management of transport systems, better town planning and building design.

This chapter uses 3 indicators to analyse trends in air quality, transport and noise in London. We have chosen to look at data on: the concentration of main air pollutants; changing transport patterns and the use of public transport; and the estimated number of people and dwellings exposed to excess road traffic, railway and aircraft noise.

Indicator 17: Air pollutant concentrations

Air quality is monitored in London through the London Air Quality Network (LAQN), a network of continuous air quality monitors funded by the London boroughs, at over 100 different locations (such as road side, kerb side, urban background, suburban, rural and industrial). These provide annual, daily and hourly mean values for each pollutant, particularly nitrogen dioxide and particulate matter. The network provides valuable data demonstrating the trends in air pollution in London dating back as far as 1997 in some locations.

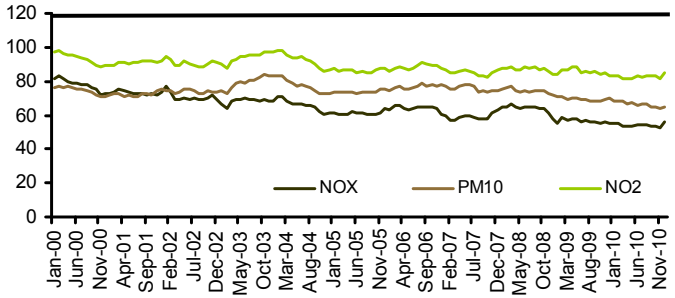
This indictor uses data from London's air quality monitoring stations and from the LAQN index. The LAQN index is developed by King's College Environmental Research Group and provides a long-term trend for London's air quality. The data are based on monthly and smoothed measurements at a mixture of roadside and background sites across London. A trial to reduce air pollutants in some of London's most polluted areas is outlined in the chapter case study.

Targets for air pollutants are outlined in the EU ambient air quality directive, UK air quality strategy and the Mayor's air quality strategy. The EU annual mean limit values are 40ug/m^3 for PM_{10} by 2011 and NO_2 by 2010. EU 24-hr PM_{10} mean limit value is 50ug/m^3 by 2011 and 1-hr NO_2 mean limit value is 200ug/m^3 by 2010. The UK Government's assessment of compliance with EU air quality limit and target values (2009) showed that London exceeded the NO_2 1-hour limit value, the NO_2 annual mean limit value and the PM_{10} 24-hour limit value, but were compliant with the PM_{10} annual mean limit value.

Analysis

- As concentrations of PM_{10} have reduced over recent years, incremental reductions have been harder to achieve.
- Concentrations monitored across London indicate the EU limit value for annual mean PM_{10} (40µg/m^3) has been consistently met since 2000 at the majority of monitoring sites in the London network[xxvi].
- However, the limit value for annual and daily mean PM_{10} concentration has been exceeded at a small number of sites in London; 3 industrial and 2 kerbside sites. The causes of exceedences vary by site.
- NO_x concentrations have continued to reduce over time but NO_2 concentrations have levelled off, although there have been some reductions since 2009.
- The EU limit value for annual mean NO_2 (40µg/m^3) has been consistently met since 2000 at urban background monitoring locations in outer London. Urban background sites near Heathrow Airport are generally below the EU limit value, except to the north of the airport.
- Urban background concentrations of NO_2 monitored in inner London, and at roadside locations, have exceeded the annual limit value since 2000. Measures, identified in the Mayor's air quality strategy, are being taken to reduce levels to meet the limit value.
- The slight decline in NO_2 concentrations, despite continued reductions to both emissions and concentrations of NOx, is a pattern that is typical of other urban environments in the UK and Europe.

Figure 18
LAQN relative annual mean index
% relative to year ending November 1996



Source: London Air Quality Network, Kings College

Indicator 18: Road traffic and public transport

Reducing the use of private cars, and increasing the use of public transport, in the capital helps improve air quality and the state of the local environment by reducing emissions of PM_{10} and NO_2 associated with transport.

London has seen a growth in the demand for travel over the last decade, due to population and employment growth. Daily trips have increased by 1.8 million since 2000, from 22.6 million to 24.4 million. However, there has been a shift away from use of private transport towards more sustainable public transport[xxvii]. Changes to transport policy, transport networks, and transport operational practice over the last decade have contributed towards the increasing use of public transport. The congestion charge in central London and the London Low Emissions Zone, have helped reduce the volume of traffic and the emissions from some transport sectors.

The data for this indicator is taken from the Transport for London (TfL) annual 'Travel in London' report. The data shows road traffic levels, the number of daily trips (by main mode of transport), and the share in mode of transport at the journey stage level, and transport related carbon dioxide emissions. Targets are set in the Mayor's Transport Strategy and in the London Plan (KPI 13) to see the use of public transport increase faster than use of the private car.

Analysis

Road traffic levels have shown an overall reduction since 2000[xxviii] (Figure 19).

- Traffic from all motor vehicles has fallen from 32.5 billion kilometres to 30.4 billion kilometres in 2009.
- Particular declines are evident in central and inner London over the last 10 years, with traffic levels falling by 19% and 10% respectively.
- Road traffic in London has reduced by around 6% between 2000 and 2009, with the greatest change being on minor roads.

Looking at the main modes of transport (at the journey stage): [xxix]

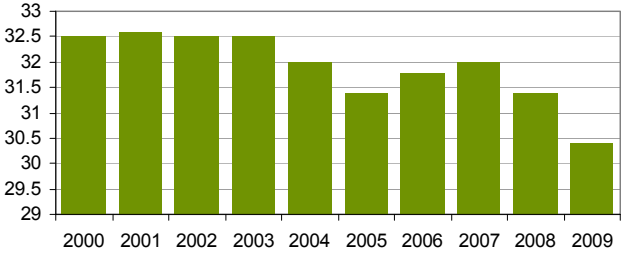
- Public transport increased from 34% in 2000, to 41% in 2009 (Figure 20).
- Private transport, including car and motor cycle use, has reduced from 43% in 2000 to 37% in 2009.
- Cycling increased from 1% to 2%.

Emissions of CO_2 from ground-based transport in London were 9.56 million tonnes in 2009 having fallen by 4% since 2008.

- CO_2 emissions from road transport, diesel rail and shipping have reduced by 10% since 2003.
- Road traffic accounted for 80% of the ground based transport total (6.64 million tonnes); 11% less than in 2003.

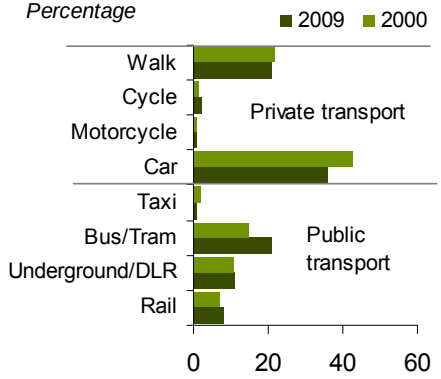
Despite an increase in the demand for travel over the last decade, there has been a shift towards more sustainable travel; public transport increased by 7%

Figure 19
Total annual traffic for all motor vehicles
Billion vehicle kilometres



Source: Transport for London, 2010

Figure 20
Mode share for transport in London at the journey stage
Percentage



Source: Transport for London (TfL), 2010

Indicator 19: Road, rail and air transport noise

This indicator is a measure of the estimated number of people and dwellings exposed to excessive road traffic and railway noise, and the impact of noise from aircraft using Heathrow and London City Airports.

European law requires noise maps of the larger agglomerations in Europe to be produced every five years. In London the first 'round' of noise mapping was completed in 2007. The results of the noise mapping can be viewed in full on the Defra website. The exercise provides an estimate of numbers of people and dwellings exposed to various levels of noise from road transport and railway noise. It uses the noise index 'L_{den}' (level day evening night) which is a special European noise index relating to an annual average day in the given year. The END (Environmental Noise Directive) noise mapping relates to the London agglomeration[3].

The Mayor's previous State of Environment Report for London included data for the numbers of people and dwellings exposed to various levels of road traffic noise. This data was drawn from a pilot study that was completed in 2004 and which preceded the END noise mapping exercise. Due to differences in methodology, however, it is not possible to make comparisons between the datasets.

Heathrow publishes the area and population contained within the average daytime noise contours on an annual basis. While some contours are published annually for London City Airport, figures on area and population are currently only published every five years to meet the END requirements.

The area and population contained within the 'daytime average noise' contour are widely used for assessing for planning purposes. Planning guidance (PPG 24) indicates that a level of 57 decibels (dB) represents the 'onset of significant community annoyance'. Some argue that 'noise averaging' does not fairly represent changes in perception of the noise impact due to changes in the number of aircraft noise events. For these reasons, the 57 dB daytime average contour alone does not provide a complete picture of the absolute extent of air traffic noise, but is considered suitable for observing changes in noise impact from the two airports.

Noise from water transport was not covered by the END and noise from industrial sources was not mapped because the policies for addressing industrial noise sources were deemed to be adequate. Indicators for these noise sources have therefore not been implemented.

Analysis

The numbers of people and dwellings affected by different levels of both road transport and railway noise in the London agglomeration are presented in the tables over the page.

- The estimated number of people exposed to a noise level of 55 decibels (dB)*, or more, due to road traffic (Table 4) accounts for around 42% of London's population. In comparison, the people exposed to 75 dB, or more, accounts for around 4%.
- The estimated number of people exposed to a noise level of 55 decibels (dB)*, or more, due to railways (Table 5) accounts for around 6% of the London population. The number of people exposed to 75 dB, or more, is too low to register a percentage of the London population, for railway noise.

* the dB level is in L_{den}

[3] *The London agglomeration is defined by specific criteria and as a result its extent is not precisely the same as that of the Greater London Authority. The results are, however, relevant to London and the best currently available for the indicator.*

The tables include the values based on the results of the first round of noise mapping.

Subsequent reports are anticipated to contain updated data driven by the END which will then allow comparisons to be drawn.

Table 4: Estimated number of people and dwellings in London above various noise levels due to road traffic

Noise level	No. of dwellings	No. of people
≥55	1,417,000	3,246,000
≥60	965,000	2,182,000
≥65	582,000	1,296,000
≥70	191,000	413,000
≥75	14,000	29,000

Table 5: Estimated number of people and dwellings in London above various noise levels due to railways

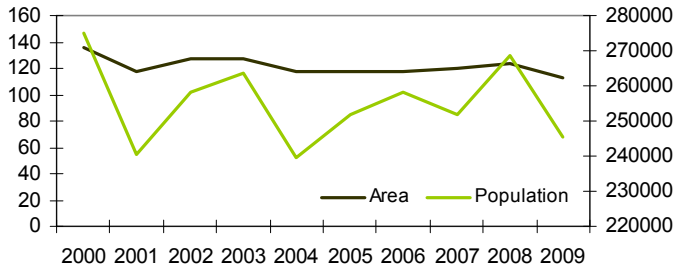
Noise level	No. of dwellings	No. of people
≥55	200,000	453,000
≥60	119,000	269,000
≥65	54,000	120,000
≥70	14,000	29,000
≥75	1,000	2,000

Heathrow Airport

The area and population contained by the 57 dB $L_{Aeq,16h}$ noise contours[4] for Heathrow since 2000 are presented in Figure 21. It should be noted that part of the area and population enclosed by the contours is outside the Greater London area.

Overall, since 2000, the area enclosed by the 57 dB $L_{Aeq,16h}$ noise contour has reduced by 17%, and the enclosed population has reduced by over 10%.

Figure 21
Area and population enclosed by the Heathrow Airport 57 decibel Lden noise contours
Area / Population



Source: Heathrow Airport, 2010

London City Airport

Contour area and population data has been presented in the airport's Draft Noise Action Plan, which is awaiting formal

adoption by Defra[5]. The available data includes the population contained within the 57 dB $L_{Aeq,16h}$ daytime noise contour, and the area contained within the 55 dB $L_{Aeq,16h}$ contour[6].

In 2006, the 55 dB $L_{Aeq,16h}$ annual average daytime noise contour enclosed an area of 7.41 km^2. The 57 dB $L_{Aeq,16h}$ annual average daytime noise contour enclosed a population of 6,700 people.

The Draft Noise Action Plan is the first of its kind and reports on contour data relating to operations in 2006. As such, this indicator has been used as a baseline against which to compare future data.

[4] *Noise levels calculated as daytime averages for the 92 days of the standard summer period which runs from 16 June to 15 September inclusive*

[5] *It is understood that the population data in the published version of the Draft Noise Action Plan has since been updated by London City Airport, and that the version awaiting approval contains the updated data which is also presented here.*

[6] *Both based on an annual average day rather than a 92-day summer average day*

Local case studies

Reducing air pollution: London trials pollution eating surfaces

A 6-month trial to reduce air pollution in some of London's most polluted areas was launched in November 2010. It is hoped the trial will reduce levels of PM_{10} recorded at these sites by 10-20% over the trial period.

High levels of particulate matter (PM_{10}) – which mainly comes from vehicle emissions and tyre and brake wear - mean London risks failing EU legal limits at some sites in central London. The trial took place at two sites in London where levels of PM_{10} are identified as being high. These are the A3211 from Waterloo Bridge to Tower Hill and the A501 Marylebone Road and Euston Road. The road surface is sprayed with a dust suppressant several times a week; the particulates stick to the surface and are not re-circulated into the air.

Results from this trial will be reported by Transport for London in summer 2011.

Delivering a Cycling Revolution: Barclays Cycle Hire scheme

Cycling helps us tackle many of the issues facing London – issues like congestion, air quality and health inequality. The most visible change to London's transport network during the past year has been the introduction of the Barclay's Cycle Hire Scheme. The main aim of this scheme is to provide opportunity and access to cycling in the capital, creating a modal shift in transport. The blue bikes are quickly becoming a familiar part of our landscape.

Phase 1 has delivered 6,000 bikes and 400 docking stations, available 24 hours a day, seven days a week. The bikes cover 45km^2 of the capital, from Notting Hill Gate to Wapping and from Regents Park to Kennington. Since the launch, the bikes have helped commuters, visitors and others get from A to B more than 4.5 million times and now has 121,000 members. On the busiest day, there were 27,500 cycle journeys covering more than 124,800 kilometres.

In March the Mayor announced that the scheme will be extended east in time for the London 2012 Games. 2,000 more bicycles and 4,200 docking stations will be installed across an area stretching up as far as the edge of the Olympic Park and down to the Isle of Dogs.

Barclays Cycle Hire Scheme
Source: Greater London Authority

Useful links and further reading

- The Mayor's Air Quality Strategy - Clearing the air
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland
- Air quality: London Plan 2011. Policy 7.14 (improving air quality)
- London Air Quality Network (LAQN)
- Defra air quality information pages
- Directive 2008/50/EC – Ambient air quality and cleaner air for Europe. European Commission, 2008.
- Health study report commissioned by the Mayor of London. Report on estimation of mortality impacts of particulate air pollution in London (June 2010)
- The Mayor's Transport Strategy
- Transport in London. Transport for London's Annual transport report (2010).
- Transport: London Plan 2011. Policies 6.1 to 6.13
- Noise: London Plan 2011. Policy 7.15 (reducing noise and enhancing soundscapes)
- Defra Noise Action Plan for the London agglomeration
- The Mayor's Ambient Noise Strategy (2004)

Red Deer Stag grazing in Richmond Park. Source: Paul Glendell, Natural England

7 BIODIVERSITY IN LONDON

Sites of Importance for Nature Conservation (SINCs) increased by around 1,000 hectares between 2001 and 2010 and now cover 30,000 hectares of land in the capital. 92% of Sites of Special Scientific Interest (SSSI) are in favourable or recovering condition; an increase from 73% in 2000.

London's habitats are improving; progress is being made towards delivery of some Biodiversity Action Plan habitat targets.

Fish populations are generally improving in the tidal Thames; smelt populations have been relatively stable and salmon and eels have returned to the river.

Populations of a range of common bird species have increased by 33% since 1994, but 5 species have seen a decline.

London supports a wide range of biodiversity and habitats, including woodlands, parks, wetlands and marshes, and the River Thames and its tributaries – the largest continuous habitat in London. The capital boasts sites of local, national and international importance and in addition to its designated sites; London has an array of Biodiversity Action Plan (BAP) habitats and species that are considered to be of principle importance to the conservation of biodiversity in the UK[xxx].

Underpinning London's biodiversity is its geodiveristy – its rocks, minerals, fossils, soils, landforms and natural processes. Seven of the 36 SSSIs in London are designated for their geological importance.

Biodiversity is under pressure from the increasing demand for new development, increasing population, loss and fragmentation of habitat, invasive species and climate change.

Indicators in this chapter have been selected to give an overview of the state of biodiversity in the capital, assessing change over the last decade. The indicators address the coverage and condition of London's wildlife and geological sites (including all those considered to be of international, national and regional importance); improvements to the condition and extent of London's wildlife habitat; and changes in London's fish and bird populations and species diversity.

Case studies highlighting projects and schemes that demonstrate improvements to biodiversity and habitat, in London, are presented at the end of the chapter.

Indicator 20: Sites of Importance for Nature Conservation (SINC)

This indicator is a measure of the area, management and condition of SINCs, including Sites of Special Scientific Interest (SSSIs). There are almost 1500 SINCs in London. These include 36 nationally designated SSSIs; 29 are designated for their biological interest, containing nationally important habitats and species. The remaining 7 are designated for their geological interest[xxxi]. In addition, 5 of these sites are designated under European law and are part of the Natura 2000 site network[xxxii].

The protection of international and national designations is set out in law; whilst locally designated sites (e.g. SINCs) are protected through London's planning policies. London's SINCs cover around 30,000 hectares (ha) or around one fifth of Greater London. They are divided into 4 grades of importance: Sites of Metropolitan Importance (SMI), Sites of Borough Importance (SBI), which has 2 tiers, and Sites of Local Importance (SLI).

Designated wildlife sites are important to determine the state of the natural environment in London. They identify the amount and type of land in the capital that is of high enough quality to support a diverse range of habitats and species. Any gains in the number of designated sites and/or their coverage, demonstrates an improvement in environmental quality.

This indicator uses three datasets to measure change in London's SINCs; coverage (area and percentage) of SINC land, condition of SSSIs and the percentage of SINC sites in positive conservation management. Data used in this indicator is available to the report baseline of 2000, with the exception of data on the coverage of the SINC network, which was first collated in 2001, and data on sites in positive management (across the wider SINC network) which was only commissioned in 2009. The government set a target for 95% of SSSIs in England to be either in favourable or recovering condition by December 2010.

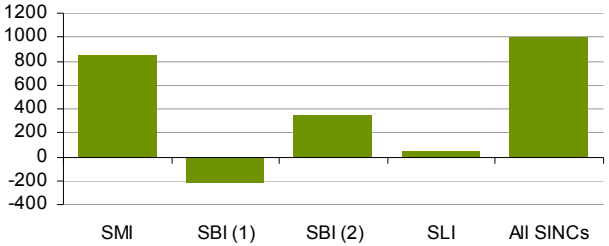
London's Foundations' was published in 2009 and the Geodiversity Action Plan finalised in 2010. These will provide invaluable baselines for future reporting.

Analysis

- Between 2001 and 2010 there was a net gain of around 1,000 ha of SINC area. This equates to an increase of around 3%[xxxiii] (Figure 22).
- Net SINC coverage has increased, but there may have been losses at specific sites and the figures do not indicate quality. SINCs are semi-natural so require constant management to maintain their wildlife value.

The percentage of land designated as SSSI, considered to be in favourable or recovering condition has increased from 73% in 2000 to 92% in 2010.

Figure 22
Change in area of SINC land in London, between 2001 and 2010
Hectares



- The percentage of SINC sites under positive conservation management has increased from 44% in 2009, to 48% in 2010. London is the highest performing part of the country, but there is still much potential for improvement.
- The majority of the improvement in SSSI condition occurred from 2007 onwards, at some of the larger sites e.g. Inner Thames Marshes and Richmond Park [xxxiv].

Indicator 21: Improving the quality and extent of London's habitats

This indicator is a measure of the restoration and enhancement of different habitats in London, using data taken from the Biodiversity Action Reporting System (BARS). London's key wildlife sites, and the extent to which they are under appropriate management, provides the necessary protection to conserve London's biodiversity. However, they do not tell the whole story. If biodiversity is to be effectively conserved and resilient to pressures such as climate change, the extent of wildlife habitat needs to be expanded and the connectivity between it increased. Restoring the quality and extent of habitat in London is important not only for conserving the capital's wildlife – it contributes to improving quality of life for Londoners. The Three Rivers Clean-up case study illustrates some of the action being taken in London to improve habitats.

Woodland habitat covers around 8% of London's total area, with around seven million trees providing around 20% canopy cover. Increasing canopy cover from street trees will help London adapt to the impacts of climate change, by helping to reduce the urban heat island effect, as well as providing habitat for woodland wildlife. The London Tree and Woodland Framework, a joint strategic overview produced by the Forestry Commission and the Mayor of London, sets objectives for improving the care and provision of London's trees and woodlands, and measures to retain and enhance them to benefit from increased canopy cover.

This indicator looks at data on the improvement of habitat condition and extent. Habitat condition looks at the area where quality has been improved, and extent looks at increasing habitat size or creating new habitat. Due to the nature of the reporting, some of the figures in the table may be underestimated. BAP targets are set for the creation and enhancement of BAP habitat, and are published on BARS to monitor progress.

Analysis

London is making good progress in improving the extent and condition of BAP habitats.

Work carried out to achieve these improvements include: the creation of a 4ha reed bed near Heathrow Airport; the restoration and expansion of 3.5ha of heathland at Mitcham Common, West Wickham Common, and Bostall and Sandmore Common; and the restoration of 0.7km of the River Roding.

Table 7: Improvements to the condition and extent of habitat (2006/07 to 2010)

Habitat type	Condition improved	Extent improved
Acid grassland	0 ha	1.8 ha
Calcareous grassland	0 ha	15 ha
Coastal and floodplain grazing marsh	192 ha	228 ha
Lowland heathland	0 ha	6.7 ha
Meadows and pastures	0 ha	10 ha
Ponds	3	13
Reed beds	0 ha	7.5 ha
Rivers and streams	0 ha	10.5 km
Woodland	0 ha	16.7 km

Focus on ….. river habitats

Between 2000 and 2010, 32.25 km of river habitat in London has been enhanced – including 14.74km that has been restored[xxxv].

- Projects completed in 2010 enhanced 12.72km of the 32.25km. The removal of floating pennywort on the River Wandle contributed 2km of this.
- 10.5km of river habitat have been restored since 2005, achieving 70% of the 2015 target of 15km.

Indicator 22: Bird populations

This indicator is a measure of change in populations for the 26 of the most common bird species in London. Bird populations are an important proxy indicator of habitat quality in London. Birds require shelter, food and places to feed. Changes in population numbers can be directly affected by the quality of their habitat. We can encourage the protection and creation of suitable habitat by incorporating sustainability initiatives.

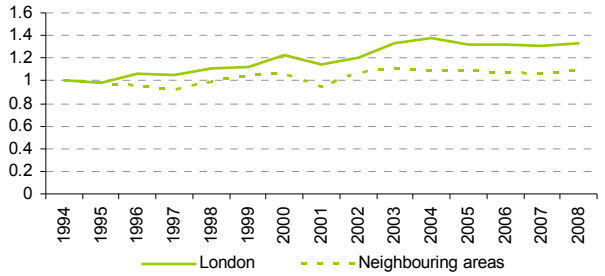
The data used in this indicator is based on an annual update report by the British Trust for Ornithology, commissioned by the GLA. The report uses change calculated as a proportion of 1994 levels. Populations have been compared to the same set of species in the neighbouring areas in the South East and East of England. Direct comparison to the report baselines is therefore unavailable.

Analysis

- Over 300 species of bird have been identified in London in recent years[xxxvi].
- Bird populations are rising. This increase exceeds that of areas surrounding London (Figure 23).
- Unfortunately 5 species are falling in numbers in London, with House Sparrows recording the greatest decline between 1994 and 2008. Since 2000, the decline has been less pronounced and even saw a slight improvement in 2004, but the general trend is still downward. The reasons for these species declines are not fully understood.
- Mistle Thrush and Song Thrush numbers have declined both within and outside London. Despite the declining trend for these thrush species in London, several other common garden birds (particularly the Great Tit, Goldfinch, Greenfinch, Chaffinch, Robin and Wren) seem to be increasing in London, compared to relatively stable populations in the surrounding counties.

Bird population numbers in London have increased by 33% between 1994 and 2008

Figure 23
Changes in bird populations (26 species)
Index (1994=1)



Source: British Trust for Ornithology, 2009

Indicator 23: Fish populations

This indicator is a measure of the change in fish populations in the tidal Thames and fish status of the freshwater tributaries. Fish populations in the tidal River Thames have significantly improved since the early 19th century when major industry and polluting discharges limited the river's ability to sustain life. It now supports a diverse range of wildlife and provides a key fish nursery for many species such as sole, herring and bass which supports North Sea fish stocks. Since 1964 the tidal River Thames has recorded 125 species of fish along its length, from Teddington to the outer estuary at Tilbury, including BAP species such as eels, smelt, shad, lamprey and salmon. Each year around 40 of these species are regularly found in the river.

The freshwater tributaries of the River Thames support populations of mostly coarse fish. Historic land drainage, flood control, urbanisation and milling activities have created very artificial and culverted river channels that can seriously affect fish populations. The largest and most diverse populations are often found in the remaining pockets of natural channel and where river restoration projects have been undertaken. Recently, more sensitive flood risk management schemes are helping to improve fish populations in the freshwater tributaries. This is particularly evident in areas where culverts and concrete river channels, which were designed to assist the flow of water, are being restored to more natural river conditions and improving habitat.

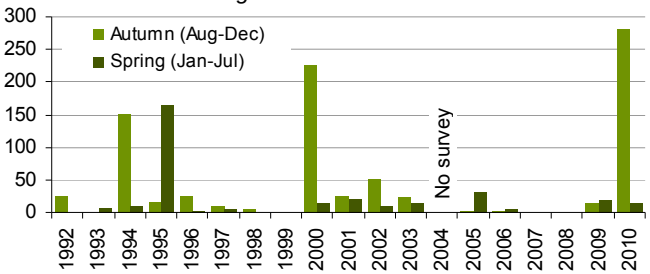
Fish stocks are sensitive to pollution, habitat changes and human activities, and therefore are a good indicator to assess the quality of our rivers. Data from routine fish surveys has been used to assess changes in smelt populations in the tidal Thames. Data has been used from 1992. To assess fish populations in the freshwater tributaries, data has been used from the Water Framework Directive assessments published in the River Basin Management Plan (2009). This uses survey data to classify the river depending on what species are found against those that might be expected.

Analysis

Tidal Thames (Figure 24)

- **Smelt**, a relative of the salmon which is very sensitive to water quality, complete their lifecycle in the tidal Thames. Populations fluctuate year on year, sometimes quite widely, but they have been relatively stable since 2000 (except some autumn peaks).
- **Salmon** populations died out in the River Thames in the 1830s due to pollution and habitat loss. Salmon returned to the river in the 1970s but remains at a low level.
- **Eels** re-colonised in the River Thames in 1960s after the improvements to water quality and habitat. A commercial eel fishery was established in the 1980s. Eel catches are relatively stable in the tidal Thames.

Figure 24
Smelt caught by Seine Net Surveys: Richmond to West Thurrock
Number of fish caught



Source: Environment Agency, 2010

Freshwater tributaries of the Thames

Under the WFD 6 river water bodies are currently achieving good or higher status for fish, 9 have moderate status, 14 have poor status and 18 are unclassified. Poor fish status includes parts of the Ravensbourne, Lee, Wandle, Rom/Beam, Quaggy, Brent, Shuttle River, Hogsmill, Pool, Beverley Brook and Crane.

Local case study

Improving habitat: The Three Rivers Clean up

The Three Rivers Clean-up took place on the rivers Quaggy, Ravensbourne and Pool in Lewisham, Greenwich and Bromley. Following success of the first programme in 2009, it was continued for a second year.

The programme delivered volunteering opportunities to benefit the local environment. The aim was to remove non-native invasive species such as Himalayan Balsam from the river banks and carry our litter picks.

Himalayan Balsam was introduced into Britain in 1839 as an ornamental garden plant. It escaped from gardens and quickly began to grow and colonise river banks, changing the natural characteristics of riverside vegetation, and impacting on the wildlife living in and around the rivers. It can also increase flood risk, when it dies back leaving the banks bare.

At the end of the nine day programme, over 350 volunteers had collected approximately 1,200 bags of Himalayan Balsam and around two truckloads of rubbish.

Environment Agency staff removes Himalayan Balsam and litter from the river as part of the Three Rivers Clean-up programme.
Source: Environment Agency. June 2009.

Useful links and further reading

- London Rivers Action Plan
- The Mayor's draft Biodiversity Strategy
- London Plan 2011. Policy 7.19 (Biodiversity and access to nature) and 7.20 (Geological conservation)
- The London Biodiversity Partnership – action plans and targets for London
- The River Restoration Trust

Children enjoying the natural environment. Source: Natural England

8

LANDSCAPE AND GREEN INFRASTRUCTURE IN LONDON

Areas classified as deficient in access to nature have fallen in London, from 23% to 16% of the capital (since 2005).

The number of parks and green spaces awarded the Green Flag have increased from 12 to 223. Awarded parks now cover 5,907 hectares of land in the capital.

Although total brownfield land has increased marginally, there has been a 42% reduction in the area of derelict land in London from 460 hectares (2002) to 268 (2009).

London is one of the greenest cities in the world. Viewed from the air, more than half of the area is green or blue – amazing for one of the world's major cities. Glass skyscrapers coexist with allotments, rivers, reservoirs, parks and gardens often supporting a surprising variety of wildlife.

London has 8 Royal Parks and numerous other garden squares, council parks and other green spaces such as Hampstead Heath. London's greenness is one of its strengths and should be supported and enhanced.

London's green infrastructure comprises the natural and designed green spaces and vegetated surfaces across London. Green infrastructure is the network of connected, high quality, multi-functional open spaces, corridors and the links in between that provide multiple benefits for people and wildlife[xxxvii]. These include:

- Improving health and general well-being by providing contact with nature, and places and spaces for recreation, leisure and food production.
- Managing flood risk by absorbing rainfall and slowing its eventual discharge into the surface water drainage system.
- Moderating the urban heat island through shading and evaporative cooling.
- Supporting a diverse range of wildlife.
- Reducing energy demand through shading and thermal insulation.
- Buffering noise and other forms of pollution.

The 'All London Green Grid' provides a green infrastructure framework that encourages increased wildlife habitat and ecological connectivity alongside other green infrastructure functions such as climate change adaptation and productive landscapes. This is explored further in the case study.

This chapter uses five indicators to look at the trends in landscape and green infrastructure in London. Focus is given to: London's green spaces (their quality, accessibility and use); Brownfield land (particularly the reduction in derelict land and its use for development); London's allotments and community food growing schemes; and urban greening in London (including green roofs and street trees).

Case studies highlighting the 'All London Green Grid' project and a green roof scheme in London are presented at the end of the chapter.

Indicator 24: Green spaces

This indicator is a measure of the change in quality and accessibility of London's green spaces. For this indicator, green space includes all areas which are predominantly vegetated - natural green space. It doesn't include areas of open space that are primarily hard surfaced, such as urban squares, or areas whose function is exclusively limited to activities other than informal recreation (e.g. sports grounds), although there will be some overlap in these categories as green spaces can, and should, aim to fulfil different functions.

London's publicly accessible green spaces make up 16% of the capital. Although this is a significant area of London, the figure alone gives no indication of the quality of green space, access to it or people's engagement with them. This indicator uses the following datasets to measure change in London's green spaces.

- The Green Flag award. This scheme provides a measure of overall quality; recognising good quality parks and green spaces and associated site management based on 8 key criteria. However, trends are dependant on the number of applications coming forward as well as site quality.
- Areas of Deficiency in Access to Nature (AoD). This looks at the areas in London where people have poor access to nature. AoD is defined as a community where people have to walk more than 1 km to reach a SINC of at least borough grade importance.
- Monitor of Engagement with the Natural Environment (MENE) survey. This was commissioned by Natural England, Defra and the Forestry Commission in 2009 to provide a measure of how people use the natural environment across the country.

Comparison to the report baseline is only available for the Green Flag Award, which is reported annually. All other datasets used present the current position.

Analysis

- Since 2000, the number of parks or green spaces awarded the Green Flag has increased from 12 to 223. They now cover 5,907 hectares; one of the highest concentrations in the country[xxxviii].

- Since 2006 (the 1st comprehensive dataset), the area of AoD in London has fallen from 22% to 16% of London.[xxxix]
  - 24,816 ha are classified as AoD in London (2010), a reduction of 9,423 ha since 2006.
  - The majority of this decrease is likely to have been achieved either by creating access to sites where there has previously been none or creating new access points to sites already accessible to the public.

22% of London's publicly accessible parks and green spaces hold the Green Flag Award

The MENE survey[xl] showed that:
- Londoners made 275 million visits to enjoy the natural environment during the survey period.
- Levels of interaction were significantly lower amongst people over 65 years, within the black and minority ethnic (BAME) population, and lower income households.
- Infrequent visitors to the natural environment were most likely to indicate a lack of time (e.g. being too busy at work) as the main reason for not visiting the natural environment more often.

Indicator 25: Brownfield land

This indicator is a measure of the change in different types of brownfield land in London. Brownfield land describes land that was previously developed, and is now either derelict, vacant or currently in use with the potential to be redeveloped. There are currently 3,730 hectares of Brownfield land in London (2009) – around 2% of the capitals' land area.

Some brownfield land in London may be damaged or contaminated from previous uses, and may therefore require treatment before it can be turned into beneficial use. Redevelopment provides the opportunity to remediate this land. However, Brownfield land is not always contaminated and often provides important wildlife habitat and public open spaces. It is important to recognise the habitat and biodiversity value of brownfield land, and manage loss of habitat through development, e.g. through living roofs.

The redevelopment of Brownfield land can bring benefits to local communities and the environment, by reducing the pressure on London's green spaces from development and reducing the area of derelict land in the capital. There is a national target for 60% of all new dwellings to be on brownfield land. London currently exceeds this target, with a rate of 94% in 2009.
The data for this indicator is taken from the National Land-use database, held by the Homes and Communities Agency (HCA). The data are collected from local authorities on the amount of Brownfield land, of each category, that they have identified in their area. The latest data available is 2009. Data are not available for 2000, so comparison to the report baseline is not provided. Comparisons will therefore be made to 2002, the earliest and most robust dataset available.

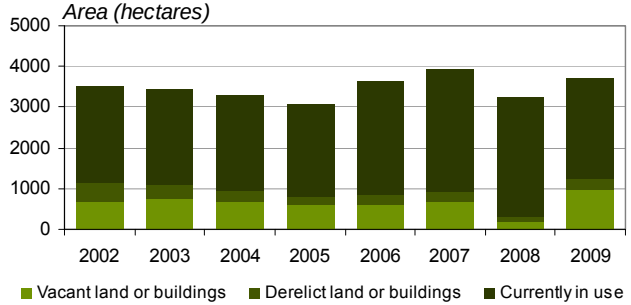
Analysis

- The area of derelict land or buildings in London has decreased by 42% since 2002, from 460 to 268 hectares (ha) (Figure 25).
  - There has been a shift in the boroughs that have the largest areas of derelict land or buildings. In 2001 Greenwich had 107 ha (30% of the London total). In 2009 Newham borough had the largest area, at 56 ha (21% of the London total).
  - 8 London boroughs have no reported derelict land or buildings.
- The area of vacant brownfield land in London has increased by 47% since 2002, from 670 ha to 982 ha in 2009.

At 94%, the proportion of new properties built on brownfield land in London is much higher than the England average of 77%.

- The area of brownfield land currently in use in 2009 is 2,481 ha, an increase of 100 ha since 2002.
  - The area currently in use with planning permission or allocated in a local plan increased by 11%, from 1,920 ha (2002) to 2,132 ha (2009).
  - The area with known redevelopment potential decreased until 2005, and has since increased to 349 ha.
- New properties built on brownfield land have increased from 89% in 2000, to 97% in 2009[xli].

Figure 25
Brownfield land in London
Area (hectares)



Source: HCA

Indicator 26: Allotments and food growing spaces

This indicator is a measure of the number and coverage of London's allotments and food growing spaces. Over recent decades there has been a reduction in allotment sites, in London, with many being sold for development. However, data from the London boroughs suggests this trend is being reversed with numbers of allotment sites increasing in the last few years. Some allotment sites in the capital have a waiting list of several years.

Local allotments and food production improves the state of the environment by increasing the area of green space, creating wildlife havens in urban centres and reducing carbon emissions associated with transporting food as residents reduce the amount of food purchased by growing locally. It also has the added benefit of improving community cohesion.

The Capital Growth scheme was launched in November 2008. This is an innovative scheme to turn 2,012 pieces of land into thriving food growing green spaces by 2012. The scheme aims to identify suitable patches of land around London and offer financial and practical support to groups of enthusiastic gardeners or organisations who want to grow food for themselves and for the local community. By the end of May 2011, there were over 1,030 Capital Growth spaces; including land in schools, hospitals, housing estates, utility companies and parks.

This indicator uses data on London's allotments and food growing spaces. Due to the irregularity of surveys, there is no consistent data available to analyse a clear trend over time. Data are taken from different surveys and reports to create a picture of London's allotments. In particular, the indicator uses data supplied by the boroughs, to the Greater London Authority. For 2010, only 22 boroughs provided data so the trend has been calculated based on these boroughs for previous years to allow comparison.

Analysis

- A 2007 study by the Greater London Authority suggests that allotments in London cover around 1,000 hectares.
- There are 507 allotments sites in the 22 boroughs the Greater London Authority have received 2010 data for. Previous assessments with complete data (in 2007) estimated that within all 33 boroughs there are over 700 allotment sites in London, containing around 25,000 plots[xlii].

Allotment sites in London increased by 13% between 2003 and 2010, from 448 to 507 sites.

- However, the 2006 London Assembly Environment Committee report 'A Lot to Lose' estimated that 1,534 allotment plots were lost over the last decade. This was estimated to be over 35 hectares of allotment land[xliii].
- Londoners currently grow over 8,000 tonnes of fruit and vegetables per year[xliv].
- Levels of interest in people growing their own food are at the highest level for decades; partly due to environmental concerns over the way food is produced.

Demand for allotments is increasing in London
Source: Environment Agency

Indicator 27: London' garden cover

This indicator is a measure of the area of land in London that is garden. Almost one quarter of Greater London's surface area is private, domestic garden land – it is calculated that around 3.8 million garden plots (including fronts and backs) make up the total area of almost 37,900 hectares[xlv].

Private gardens provide many people with daily contact with nature and form a pleasant component of residential areas. A single garden may provide habitat for a range of plants and wildlife. Notable gardens species in London are the hedgehog, house sparrow, common frog and stag beetle.

On a broader scale, gardens significantly contribute to the green infrastructure of a city. Their habitats are becoming an important resource for conserving some species, they absorb rainfall reducing the effects of flooding and their vegetated areas help to keep the city cool. Each of these roles is important to London and likely to become more so with predicted effects of climate change.

A new study by London Wildlife Trust, Greenspace Information for Greater London (GiGL) and the Greater London Authority, due to be published in spring 2011, examines the change in private garden land cover between two time periods, 1998/99 and 2006-08. Land cover was determined by comparing colour aerial photographs taken in 1998 and 1999 with ones taken in 2006 and 2008, using random sample plots taken from each borough. From the photographs it was possible to see the area covered by lawn, tree canopy or hard surfacing in each sample plot and then scale this up to estimate the total areas in London.

Analysis

- The composition of London's gardens is changing at a significant rate. An area of vegetated land around 2.5 times the size of Hyde Park is being lost every year and the amount of hard surfacing in the capital's gardens has grown significantly.

- 57% (22,000 hectares (ha)) of London's garden land is vegetated cover - lawn, tree canopy and other vegetation (2006-08).

- The study shows that between 1998-99 and 2006-08:
  - The area of vegetated garden land declined by 12%, a loss of 3,000 ha.
  - The amount of hard surfacing in London's gardens increased by 26% or 2,600 ha.
  - The area of garden buildings (sheds etc.) increased by 55% or 1,000 ha.
  - The amount of garden lawn decreased by 16% or 2,200 ha.

The changes in garden cover are primarily due to many small changes to individual gardens as part of their management and use by homeowners, rather than large scale changes or housing development on garden land (although this can result in significant loss of garden land at a local level)[xlvi].

Gardens in the Clapton Park Estate, Hackney
Source: John Little

Indicator 28: Urban greening

This indicator provides a measure of the level of urban greening in the capital, with a focus on green roof cover and street trees. 'Urban Greening' refers to green infrastructure that is incorporated into the most densely developed urban areas. This includes tree planting, soft landscaping and green roofs and walls.

Urban greening measures offer numerous benefits to the environment and are encouraged through the London Plan. These include increased biodiversity, improved health and wellbeing, energy savings, reductions in CO_2 emissions and air quality improvements, and surface water management.

There are two types of green (vegetated) roof in London. Intensive green roofs are principally designed to provide amenity and are normally accessible for recreational use. They may be referred to as roof gardens or terraces. Generally intensive green roofs comprise a lush growth of vegetation and are based on a relatively nutrient rich and deep substrate. Extensive green roofs generally provide greater biodiversity interest than intensive roofs, but are considered to be less appropriate in providing amenity and recreation benefits since the substrate depth is considerably shallower, therefore only supporting smaller plants.
Green roofs offer numerous environmental benefits including energy saving, storm water management and biodiversity enhancement. An example of the implementation of green roofs on a school building has been illustrated in the chapter case study; looking at the Ellen Wilkinson School in Ealing.

Street trees are another important component of urban greening, providing environmental and economic benefits as well as making our public spaces more attractive. Initiatives like the Mayor's street tree programme are helping to increase London's street tree cover. The species mix of street and urban trees, planted in London, is changing in favour of smaller, shorter lived species. This is likely to affect future canopy cover if left unchecked.

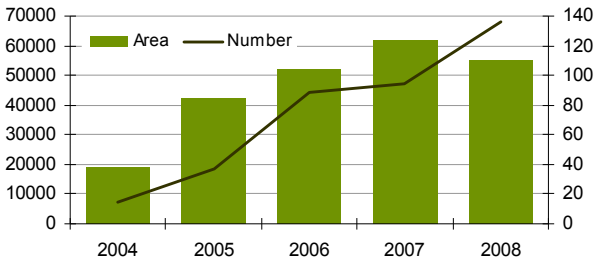
This indicator looks at the number and area of green roofs in London and the numbers of street trees. The data on street trees is taken from Livingroofs.org and the Greater London Authority, and was first collected in 2004. Comparison with the report baseline is therefore not available, but trends have been drawn from 2004. The data on street trees is taken from the London Assembly report 'Branching Out – The future of London's street trees' (April 2011). This provides current figures; trends are not available.

London has around 500,000 street trees

Analysis

- The number and area of green roofs installed in Greater London has increased substantially since 2004 (Figure 26).
- It was estimated that London had approximately 500,000m^2 of green roof cover at the end of 2008; equivalent to around 70 football pitches.
- Transport for London removed 1,787 trees between 2008 and 2010 along their networks, primarily due to health and safety and the removal of dead or diseased trees. They planted 2,287 new trees to offset this, creating a net increase of 28% (500 trees).

Figure 26
Green roofs in London
Total green roof area (m2) / No. installed



Source: Livingroofs.org and the Greater London

Local case studies

The All London Green Grid

The green grid concept aims to provide Londoner's with a multi-functional network of open space, improving quality of life. This project has two key drivers: climate change and regeneration. The aim of the green grid is to create a network of interlinked, multi-functional and high quality open spaces that connect with town centres, public transport nodes, the countryside in the urban fringe, the River Thames and major employment and residential areas. It envisages the creation of new public spaces, the enhancement of existing open spaces and improvements to the links in between.

The All London Green Grid has its origins in East London and the East London Green Grid, which was awarded the 2008 Landscape Institute's President's Medal and Strategic Landscape Project Award. This success has been recognised by the Mayor and as a result, the London Plan 2011 (due for publication in summer 2011) contains a specific green infrastructure policy which endorses the All London Green Grid.

The All London Green Grid will develop a governance structure, comprising a Project Board and Steering Group alongside 11 Area Working Groups that provides cross boundary partnership working. It will promote a range of green infrastructure functions based on the following strategic objectives:

- Enhancing green infrastructure skills capacity for climate change.
- Promoting sustainable food production.
- Promoting quality of design, management and maintenance.
- Enhancing heritage features and landscape character.
- Enhancing distinctive visitor destinations and boosting the visitor economy.
- Improving air quality and sound scapes.

Green roofs: Living Roof - The Ellen Wilkinson School for Girls (Ealing)

Dry grassland and brownfield habitats play a key role in supporting urban wildlife, including invertebrates, plants and birds. In London brownfield sites have been the focus of redevelopment and regeneration. Consequently, it is likely that the majority of existing brownfield habitats will have disappeared within the next decade. The incorporation of green roofs (amongst other measures), into new and existing developments, can help offset this loss.

Wishing to actively encourage biodiversity in its neighbourhood, the Ellen Wilkinson School for Girls in Ealing, decided to support the living roof initiative in the design of its new Learning Resource Centre. Steps were taken to ensure that the new roof would incorporate a range of habitats suitable for rare invertebrates and birds, with the substrate chosen offering the greatest benefit for invertebrate conservation and diversity.

The new 275 m^2 roof, laid in October 2010, joins six other living roofs across London which is being monitored for their ecological performance. Partners of the project include the Sita Trust, Living Roofs and Buglife.

Data gathered by this project will contribute to existing knowledge on managing habitats for brownfield invertebrates, as well as helping to inform the development of a regional mitigation strategy for the conservation of the nationally important invertebrate resource.

The project will deliver national, regional and local Biodiversity Action Plan targets, including the national ‘Open Mosaic Habitat on Previously Developed Land’ Habitat Action Plan (HAP); the London Wasteland HAP; the Brown Banded Carder Bee Species Action Plan; and the London Biodiversity Partnership’s Built Environment Action Plan.

In recognising the importance of a green roof in attracting local wildlife and contributing to the educational experience of pupils, the school believes its living roof will encourage the next generation to look after the environment.

Useful links and further reading

- Green spaces: London Plan 2011. Policy 2.18 (green infrastructure: the network of green and natural spaces) and 7.18 (protecting local natural space and addressing local deficiency)

- Allotments: London Plan 2011. Policy 7.22 (land for food)

- Urban greening: London Plan 2011. Policy 5.10 (urban greening), 5.11 (green roofs and development site environs) and 7.21 (trees and woodlands)

Glossary

The adopted London Plan is the Spatial Development Strategy for London that first published in 2004 and later updated in 2008. It provides a spatial framework for Mayoral strategies up to 2026.

The London Plan 2011 is the new London Plan, put forward by the Mayor following a complete review. It looks forward to 2031. It has replaced the adopted London Plan, and will form part of the statutory development plan for Greater London.

Climate change

- **The London Energy and Greenhouse Gas Inventory** is a tool which provides data on greenhouse gas emissions and energy consumption in London.
- **Scope 1 emissions (direct)** are defined by Defra as 'emissions from activities and sources you control, such as vehicles you own and operate'.
- **Scope 2 emissions (energy indirect)** are defined by Defra as 'emissions associated with your consumption of purchased electricity, heat, steam and cooling, for heating your offices, for example. They result from your use of energy but take place somewhere else and are not under your direct control'.
- **Scope 3 emissions (other indirect)** are defined by Defra as 'emissions that are a consequence of your actions, which occur at sources which you do not own or control (other than scope 2), such as your suppliers emissions'.
- **UKCP09** are the UK climate projections released by the UK Climate Impacts Programme in 2009. They provide projections of our future climate taken from climate models, at a national and regional level. They use three different scenarios: high, medium and low emissions to look at different variations in climate. This is an update to the projections released under UKCP02.
- **RE:NEW** is a scheme that aims to improve the energy efficiency of homes across London, through advice and installation of energy efficient appliances like energy saving light bulbs, insulation for hot water tanks and shower timers.
- **RE:FIT** is a scheme that helps public bodies retrofit their buildings to be more energy efficient and reduce their carbon emissions and costs.
- **The Code for Sustainable Homes** is 'the national standard for the sustainable design and construction of new homes'. The code aims to reduce our carbon emissions and create homes that are more sustainable'[xlvii]. It has levels one to six, each with standards for water and energy.
- **Decentralised Energy (DE)** describes the generation of energy 'on-site' or closer to the point of consumption, often via smaller scale sites. This reduces the distance energy is transported and reduces loss during transportation.

Flood risk

- **Impermeable** describes a surface that does not allow the flow of water through it, for example concreted roads or pavements.
- **Tidal floodplain** describes the area of land alongside an estuary that can experience flooding.
- **Fluvial floodplain** describes the area of land alongside rivers that can experience flooding during high flows when the flow exceeds the channel capacity.
- **Planning Policy Statement 25 (PPS25)** is the government's spatial planning policy on development and flood risk.
- **Thames Estuary 2100 (TE2100)** is a project led by the Environment Agency to develop a long-term tidal flood risk management plan for London and the Thames Estuary.

- **Drain London** is a project set up following the Pitt Review, to assess the risk of surface water flooding in London.
- **Peak surge tide levels** describe the highest level of the tide following a storm

surge. This occurs as a result of low pressure weather systems rising water levels out at sea as high winds raise the level of water on the sea's surface.

- **The Flood Risk Appraisal** is the regional appraisal for London carried out by the Greater London Authority. It is related to the flood risk policies in the London Plan 2011, and makes recommendations to improve understanding and management of flood risk in London.
- **The Flood and Water Management Act 2010** implements the recommendations made by Sir Michael Pitt following his review of the 2007 floods. More information can be found on the Defra website.

Water quality

- **Diffuse pollution** comes from scattered or dispersed sources that are collectively significant but to which effects are difficult to attribute individually.
- **Point source pollution** describes pollution arising from an identifiable or localised point such as a discharge pipe or landfill site.

- **Combined Sewer Overflow (CSO)** occur when the overflow pipes connected to the combined sewerage system overflow. Heavy rain puts pressure on the drainage system as the volume of water passing through it increases. When the volume exceeds the capacity of the pipes, discharges of diluted sewage are made into rivers or the sea, through outfalls.
- **The EU Water Framework Directive** (WFD) is a major piece of European legislation that was written into UK legislation in December 2003. It aims to improve the health of the water environment and promote the sustainable use of water.
- **The River Basin Management Plan** sets out the environmental objectives for all the water bodies within the River Basin District and identifies how they will be achieved. The plans are based on a detailed analysis of the pressures on the water bodies and an assessment of their impacts. The plans must be reviewed and updated every 6 years.
- **Ecological Status** applies to surface water bodies and is based on the following quality elements: biological quality, general chemical and physico-chemical quality, water quality with respect to specific pollutants (synthetic and non synthetic) and hydromorphological quality. There are five classes of ecological status: high, good, moderate, poor and bad.
- **Ecological Potential** identifies the status of a heavily modified or artificial water body measured against the maximum ecological quality it could achieve given the constraints imposed upon it by those heavily modified or artificial characteristics necessary for its use. There are five ecological potential classes for heavily modified or artificial water bodies: maximum, good, moderate, poor and bad.
- **Heavily Modified Water Body** is a surface water body that does not achieve good ecological status because of substantial changes to its physical character resulting from physical alterations caused by human use, and which has been designated in accordance with criteria specified in the Water Framework Directive as 'heavily modified'.

Water resources

- **Catchment Abstraction Management Strategies (CAMS)** look at the amount of resource available against the amount licensed for abstraction to ensure a balance.

- **The hydrometric achieve** is a database containing river flows, levels, groundwater levels and rainfall data from

continuous monitoring stations across England and Wales .

- **The Future Water Strategy** is a Defra strategy, published in February 2008 that identifies the government's vision and priorities for water in England.
- **The Water Company June returns to Ofwat** is a report made each year to the regulator Ofwat, giving information on various aspects of performance (e.g. different types of consumption, leakage, population served), as well as various compliance indicators, all accompanied by an overview and review by an independent consultant.
- **Retrofitting** describes the installation of measures or devices, e.g. to reduce water use, in existing developments that don't currently have them.

Waste

- **Local authority collected waste** describes all the waste collected by the local authority (formerly referred to as municipal solid waste (MSW). It is household waste and local authority collected commercial waste. Defra have recently revised the definition of MSW to ensure the UK is meeting landfill diversion targets under the Landfill Directive.

- **Commercial and industrial waste (C&I)** describes all the waste that is produced as a result of commercial or industrial activities, and can also be referred to as 'business waste'.
- **Construction and demolition waste (C&D)** describes all the waste produced directly or indirectly through construction and demolition activities. It includes, brick, wood, concrete and other building materials.
- **The Landfill Allowance Trading Scheme** is a government initiative aimed at reducing the amount of biodegradable municipal waste going to landfill. Each local authority has an allowance for the amount of biodegradable waste they can send to landfill in a given year. They can then decide how to allocate this allowance – whether to use it, trade it with other local authorities or save it to use in the future.
- **Biodegradable Municipal Waste (BMW)** is predominantly household food waste and green waste that is biodegradable and will break down within a landfill site.
- **The Best Value Performance Indicators** are a series of indicators set by the government to measure local authority performance on a range of issues. The data is collected and reported by the Audit Commission on an annual basis.

Air, transport and noise

- **Nitrogen dioxide (NO_2)** is an air pollutant which predominantly comes from road transport and power stations.
- **Particulate matter (PM_{10})** describes the tiny particles of solid matter, suspended in the air, with a diameter of 10 micrometers or less.
- Transport mode share at **journey stage level** brings together the different segments of a trip, with each stage using a single mode of transport. This is different to the trip level, which only relates to the mode of transport used for individual trips.
- An **Air Quality Management Area (AQMA)** is declared where a local authority has assessed an area as unlikely to achieve air quality objectives, following assessment of current levels and predictions for future change.
- **The London Air Quality Network** holds air quality information, providing hourly or daily updates from monitoring sites around the capital.
- **The London Low Emissions Zone** is a charging scheme, introduced in 2008, that aims to reduce the most polluting vehicles in central London. There is a charge for those vehicles with particulate emissions over a set standard. These standards will become more stringent from January 2012.

- **Airport noise contours** are a graphical indication, displayed as lines on a map, of places around an airport that are exposed to particular noise levels.
- **Planning guidance (PPG24)** is a planning guidance document for local authorities on minimising the adverse impacts of noise.

Biodiversity

- **The Biodiversity Action Plan (BAP)** was published in 1994 and aims to help conserve and protect the UK's most threatened species and habitats. Local actions plans have been established within this, to address biodiversity at a local level. Progress with these plans is measured every 3 years.
- ***Sites of Metropolitan Importance*** **(SMI)** are the most important of the capital's wildlife sites such as Rainham Marshes and the chalk downlands of South London. They include all the SSSIs as well as some of London's premier parks and green spaces, such as the Royal Parks. They cover just over 10% of Greater London.
- ***Sites of Borough Importance (SBI)*** are sites that are important within the context of the borough and include woodlands, meadows, rivers and ponds. There are two grades which indicate differences in quality. They cover just over 7% of Greater London.
- ***Sites of Local Importance (SLI)*** includes some of the smaller sites which are nevertheless extremely important to local communities in enabling them to experience nature close-by. They cover just over 1% of Greater London.
- **The Biodiversity Action Reporting System (BARS)** allows the assessment of progress with the Biodiversity Action Plan.

Landscape and green infrastructure

- **Green infrastructure** describes the network of connected, high quality, multi-functional open spaces and corridors in London and the links between them that provide benefits for people and wildlife.
- **The All London Green Grid** is an extension of the original project on the East London Green Grid. This aimed to create, improve, manage and maintain high quality of open spaces and green infrastructure for people and wildlife.

Appendix

Appendix 1: List of topics the Mayor is required to monitor under State of the Environment (GLA Act 1999)

The Act states that the Mayor's State of the Environment report must include information on the following:

1. air quality and emissions to air, including particular emissions from road traffic
2. road traffic levels
3. water quality and emissions to water
4. groundwater levels
5. energy consumption and the emission of substances which contribute to climate change
6. land quality
7. biodiversity
8. the production, minimisation, recycling and disposal of waste
9. noise
10. natural resources
11. litter

Appendix 2: Areas of Responsibility

Climate change: Greater London Authority, Department for Energy and Climate Change, London Boroughs, Defra

Flood risk: Environment Agency, Greater London Authority, London Boroughs, Defra

Water quality: Environment Agency, Defra, Water Companies operating in London, British Waterways, Port of London Authority

Water resources: Environment Agency, Greater London Authority, Defra, Water Companies operating in London, OFWAT

Waste: Environment Agency, Greater London Authority, London Waste and Recycling Board, London Boroughs, London Waste Authorities, Defra

Air quality: Greater London Authority, London Boroughs, Defra

Transport: Transport for London, Greater London Authority, London Boroughs

Noise: Greater London Authority, London Boroughs

Biodiversity: Natural England, Environment Agency, Greater London Authority, Forestry Commission, London Boroughs, Defra, Royal Parks, Port of London Authority

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Project leads

Annette Figueiredo (Greater London Authority)
Lucy Allum (Environment Agency)

Project Steering group

Annette Figueiredo (Greater London Authority)
Clare Sandels (Environment Agency, up to March 2011)
Dominic Coath (Natural England)
Evie Kingsmill (Environment Agency)
Gareth Piggott (Greater London Authority)
Lucy Allum (Environment Agency)
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Public Liaison Unit
Greater London Authority

City Hall
The Queen's Walk
More London
London SE1 2AA

Telephone **020 7983 4100**
Minicom **020 7983 4458**
www.london.gov.uk

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Chinese
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Vietnamese
Nếu bạn muốn có văn bản tài liệu này bằng ngôn ngữ của mình, hãy liên hệ theo số điện thoại hoặc địa chỉ dưới đây.

Greek
Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος εγγράφου στη δική σας γλώσσα, παρακαλείστε να επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυδρομικά στην παρακάτω διεύθυνση.

Turkish
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Punjabi
ਜੇ ਤੁਹਾਨੂੰ ਇਸ ਦਸਤਾਵੇਜ਼ ਦੀ ਕਾਪੀ ਤੁਹਾਡੀ ਆਪਣੀ ਭਾਸ਼ਾ ਵਿਚ ਚਾਹੀਦੀ ਹੈ, ਤਾਂ ਹੇਠ ਲਿਖੇ ਨੰਬਰ 'ਤੇ ਫ਼ੋਨ ਕਰੋ ਜਾਂ ਹੇਠ ਲਿਖੇ ਪਤੇ 'ਤੇ ਰਾਬਤਾ ਕਰੋ:

Hindi
यदि आप इस दस्तावेज की प्रति अपनी भाषा में चाहते हैं, तो कृपया निम्नलिखित नंबर पर फोन करें अथवा नीचे दिये गये पते पर संपर्क करें

Bengali
আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি (কপি) চান, তা হলে নীচের ফোন্ নম্বরে বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

Urdu
اگر آپ اِس دستاویز کی نقل اپنی زبان میں چاھتے ھیں، تو براہ کرم نیچے دئے گئے نمبر پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

Arabic
إذا أردت نسخة من هذه الوثيقة بلغتك، يرجى الاتصال برقم الهاتف أو مراسلة العنوان أدناه

Gujarati
જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં જોઈતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.

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