MAYOR OF LONDON

London Environment Strategy

APPENDIX 1: GENERAL ASSESSMENT OF THE ENVIRONMENT

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Contents

Summary

This table provides a high-level overview of the state of London's environment at the time of publication of the final London Environment Strategy, performance in comparison with previous years.

Indicator	Current status	Performance (RAG)
Air quality		
Air pollutant concentrations	London is failing to meet the legal limit for NO_2 concentrations. We are meeting the limits for particulate matter, but as this pollutant is damaging to health at any level it is important to remain focused on reducing it.	
Air pollutant emissions	NO_2 emissions reduced by 25 per cent from 2013 compared to 2008. PM_{10} emission reduced by 20 per cent over the same period.	
Population exposure	The number of people exposed to the health risks associated with exceeding the EU limits for nitrogen dioxide decreased from the 2008 general baseline of 3.6 million people to 1.4 million in 2013 (based on the LAEI 2013).	
Green infrastructure		
Parks and open spaces	Increasing number of parks receiving the Green Flag quality mark, and the Area of Deficiency in access to open space has been reduced across London. However, this masks big differences between and within boroughs.	
Wildlife sites	Total area of sites has increased but overall quality of sites has declined due to reduction in targeted management and maintenance.	
Breeding birds	Overall no significant change, but this is a consequence of significant declines in populations of some species being balanced by increased numbers of other species.	
Tree cover	Overall no change. Tree cover is estimated at 20 per cent. Short-term changes are difficult to measure due to slow incremental changes to total tree cover across London.	
Green roofs	Significant increase (from <100 to >700 in central London) since the inclusion of a green roof policy in the London Plan in 2008.	
Water quality in waterbodies	Little improvement in water quality - under 10 per cent of London's waterbodies are classified as 'Good'. But an increase in the amount of river channel restored – over 15km since 2007.	

Climate change mitigation and energy		
Carbon dioxide emissions	25 per cent reduction on 1990 levels in 2015, a per capita reduction of 41 per cent. This is largely due to national grid decarbonisation.	
Energy consumption	London consumed an estimated 131,121 GWh of energy in 2015, a reduction of 19 per cent on 1990 levels. This is due to a more efficient use of energy.	
Scope 3 emissions	Consumption-based emissions are almost triple those of scope 1&2. Scope 3 CO_2 emissions increased by less than 1 per cent between 2010 and 2013.	
Waste		
Local authority collected waste (LACW) arisings	Arisings have fallen by 10 per cent since 2000. Londoners produce the lowest amount of waste per head in UK.	
LACW to incineration	Incineration rates have doubled since 2001. This is largely a result of waste being diverted from landfill.	
LACW recycling performance	Performance has flat-lined since 2010 at 30 per cent, compared with 43 per cent nationally in 2016.	
LACW to landfill	There has been a 70 per cent reduction in LACW to landfill since 2001.	
LACW CO_2e performance	LACW activities avoid around 121,000 tonnes CO_2e per year. However, significant improvement is needed to meet future targets.	
Construction, Demolition and Excavation waste	The construction sector achieves an estimated up to 85 per cent recycling rate. Arisings are expected to increase with the large construction projects planned in London. Better data is needed to inform the likely trend.	
Commercial and Industrial waste – arising's and recycling	Estimated 48 per cent recycling rate. Better data is needed to inform the likely trend.	
Adapting to climate change		
Sea level (flood risk)	London has world class tidal flood defences that, with some alteration and proper maintenance, will continue to provide protection until at least the middle of the century.	
Properties at risk of flooding (flood risk)	The majority of properties in London are at low risk of flooding. However, approximately 48,000 properties are at medium and high risk of flooding from fluvial or tidal sources.	

Water supply / demand balance	Water consumption in London is 10 per cent higher than in the rest of the country and leakage rates are at 25 per cent. London is at risk of drought if there were to be two successive dry winters.	
Heat risk	Temperatures in London are likely to increase in line with climate change projections, exacerbated by the Urban Heat Island effect, with resulting increases in risk of mortality and illness (particularly cardio-vascular and respiratory illnesses). Disadvantaged groups, such as the elderly or those with underlying health conditions are most at risk.	
Ambient noise		
Noise complaints	TfL received 1,271 noise complaints in 2014/15. This is an increase of around 20 per cent from 2013/14 and reflects the increased level of construction activity.	
Population exposure to transport noise	Expected increases in population, transport movements and development pressure in London, suggest that the risk of exposure to road and rail transport noise will increase for many Londoners. There is also a need to further develop the London evidence base for this indicator.	
Low noise road surfacing	This indicator is for TfL roads only. The percentage of TfL's network with low noise road surfacing continues to increase year on year. This means that the proportion of noise emitted from the tyre and road interface is reducing.	
Electric (quieter) bus fleet	The number of buses emitting noise 2dB below the legal limit is increasing. A further increase in the number of electric buses is likely to improve this further.	

Current status	
	Good
	Fair
	Poor

Introduction

The Mayor is required by the Greater London Authority Act 1999 to publish an environment strategy for Greater London (the "London Environment Strategy" or "LES"). This sets out the Mayor's policies and proposals in relation to a number of environmental areas into a single strategy. These were previously set out in six separate thematic strategies. The subject areas that must legally be covered by the new integrated LES are; biodiversity, municipal waste management, climate change mitigation and energy, adaptation to climate change, air quality, and ambient noise. It may also include policies and proposals in relation to other matters relating to London's environment, as the Mayor considers appropriate.

The LES must contain a 'general assessment' of London's environment. This document sets out the proposed text of that general assessment.

The quality of London's environment is improving, despite the challenges from a growing population and climate change. This report presents a series of indicators to illustrate the current situation and expected future changes in the environment within six chapters. Each chapter introduces the theme and identifies the indicators best suited for this theme.

The report looks at the current state of London's environment and highlights the improvements that have been made in the last few years.

The report has identified some big improvements to London's environment since 2000, principally in waste and recycling, public transport, wildlife habitats and urban greening.

Air quality

Since the passage of the Clean Air Act sixty years ago great progress has been made in improving air quality in the capital. There have been historic reductions in the levels of benzene, lead and sulphur dioxide pollution, which have greatly improved health and quality of life. London now meets eight of the nine legal limits set by the National Air Quality Regulations[1] and this underlines the ability of effective and coordinated action to improve the air we breathe.

Yet while we may no longer see air pollution, and the Great Smogs of the 1950s and 1960s are thankfully a thing of the past, this does not mean the problem has gone away. In fact, the latest health evidence suggests that the smaller particles and gases that are invisible to the human eye may be even more deadly, with a wider range of health effects. A GLA commissioned report estimated that around 9,500 equivalent deaths were caused by long-term exposure to air pollution in London in 2010.

Worse still, these health impacts fall disproportionally on our most disadvantaged communities, affecting the poorest and those from minority ethnic groups more acutely. Tackling air pollution is not, therefore, just about the environment or about protecting public health. It is also about social justice and there is an urgent need to do more to tackle the public health inequalities associated with air pollution in London.

Two pollutants remain a specific concern. These are particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2). London, along with a large number of other UK and European cities, is failing to meet the legal limit for NO_2. We are meeting the limits for particulate matter, but as this pollutant is damaging to health at any level it is important to remain focused on reducing it. The Mayor also recognises the need to go beyond legal limits, as these reflect political and economic considerations as well as health impacts. These should therefore be treated as a starting rather than an end point. World Health Organization (WHO) guidelines, meanwhile, were driven solely by the available health evidence and as a result are set much tighter for PM_{10} and $PM_{2.5}$.

The indicators provide us with a mechanism to monitor our performance in improving air quality. Concentrations are the gold standard and are linked to our legal obligations. However, emissions provide a better proxy for the performance of the measures implemented by the Mayor. Given the overriding focus on health outcomes, a population exposure metric is also used to see how concentrations fall on the population as a whole and how this changes over time.

INDICATOR: AIR POLLUTANT CONCENTRATIONS

Overview of current position

This indicator is a measure of the levels of air pollutant concentrations in London.

London, along with a large number of other UK and European cities, is failing to meet the legal limit for NO_2 concentrations. We are meeting the limits for particulate matter, but as this pollutant is damaging to health at any level it is important to remain focused on reducing it, and we are not yet meeting the WHO guideline limits.

In recent years there has been a disconnect between reported emission reductions and improvements in air pollutant concentrations, partly caused by issues with Euro standard performance and dieselisation of the vehicle fleet. This explains why there has been a greater fall in PM concentrations (where the EU standards have worked more effectively) compared to NO_2 concentrations (where the emission standards for diesel cars have not performed as expected).

Trends

For NO_2, the graph in Figure 1.1 shows that there has been a general downward trend in pollution concentrations, accelerating in recent years as measures such as transforming the bus fleet have been felt. However, many roads still exceed the NO_2 EU annual mean limit value of 40 µg/m^3 by a large margin.

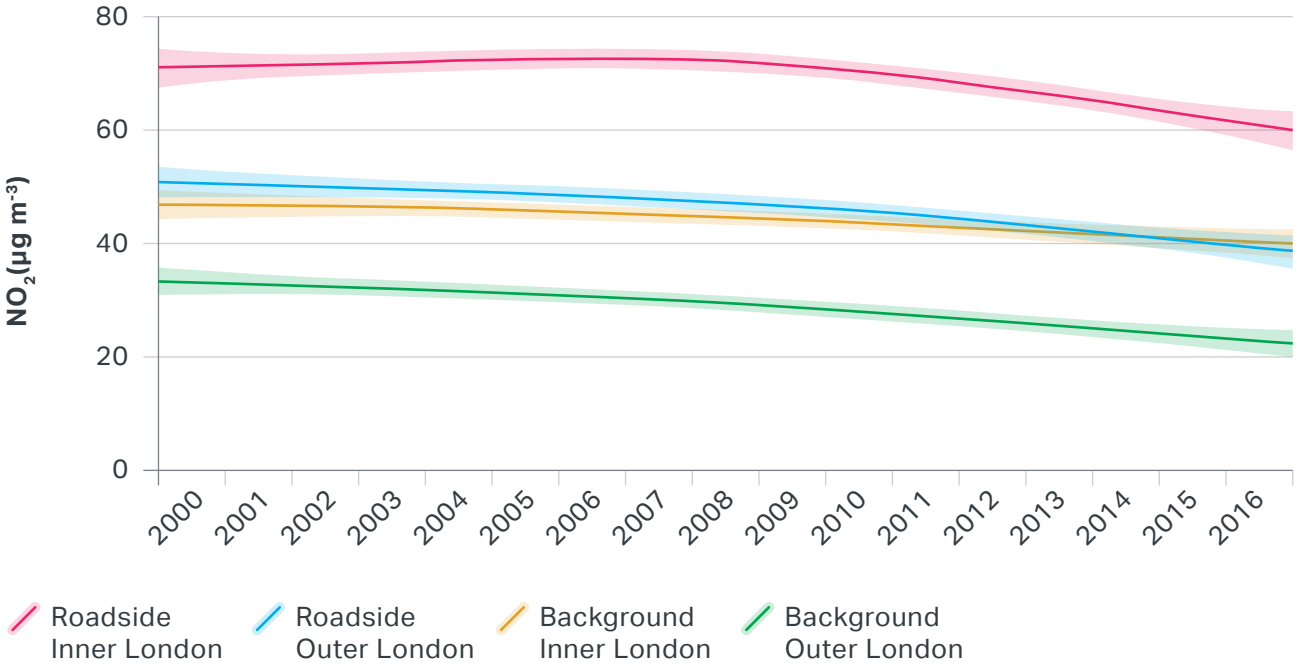
For PM_{10}, the graph in Figure 1.2 shows that there has been a more rapid reducing trend. Unlike for NO_x emissions, Euro standards have been more effective at reducing PM emissions from vehicles and this is reflected in the above graph. The introduction of tighter LEZ standards (Euro IV PM) in 2012 for HGVs, buses and coaches and the inclusion of vans (Euro III PM) for the first time have also had a beneficial effect.

The trends in $PM_{2.5}$ are less certain, as there are fewer monitors available to measure this pollutant. The higher uncertainty is represented by a wider shadow around the central trend lines. However, Figure 1.3 shows that there has been a reducing trend. As with PM_{10}, the vast majority of roads in London meet the $PM_{2.5}$ EU annual mean limit value of 25 µg/m^3. However, most locations still exceed the WHO guideline limit of 10 µg/m^3.

Likely future trend

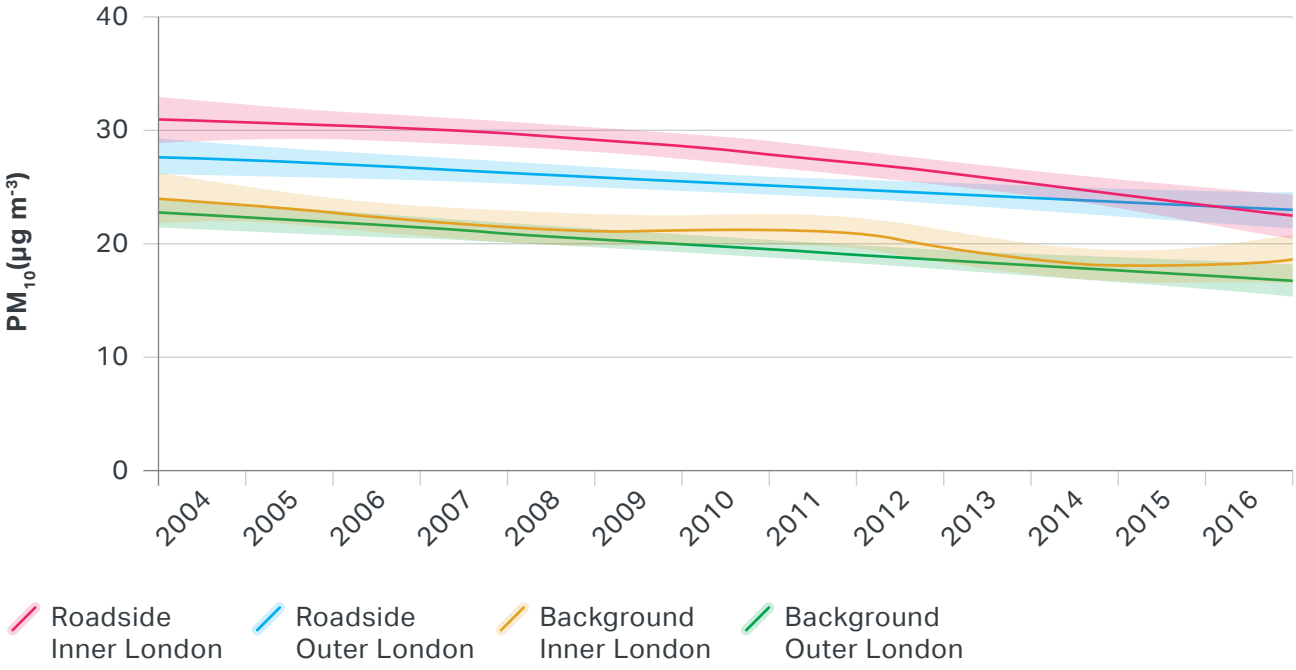
The Mayor has set out a bold package of measures to improve air quality in London, including a T-charge in central London from 2017, bringing forward the original Ultra Low Emission Zone from 2020 to 2019 and expanding the Ultra Low Emission Zone to the North-South circular for cars and vans, and London-wide for buses, coaches and HGVs. It is likely that this will accelerate reductions in pollutant concentrations, combined with improvements delivered by new Euro 6 vehicles.

Figure 1.1: Trends in NO_2 concentrations in London 2000 to 2016



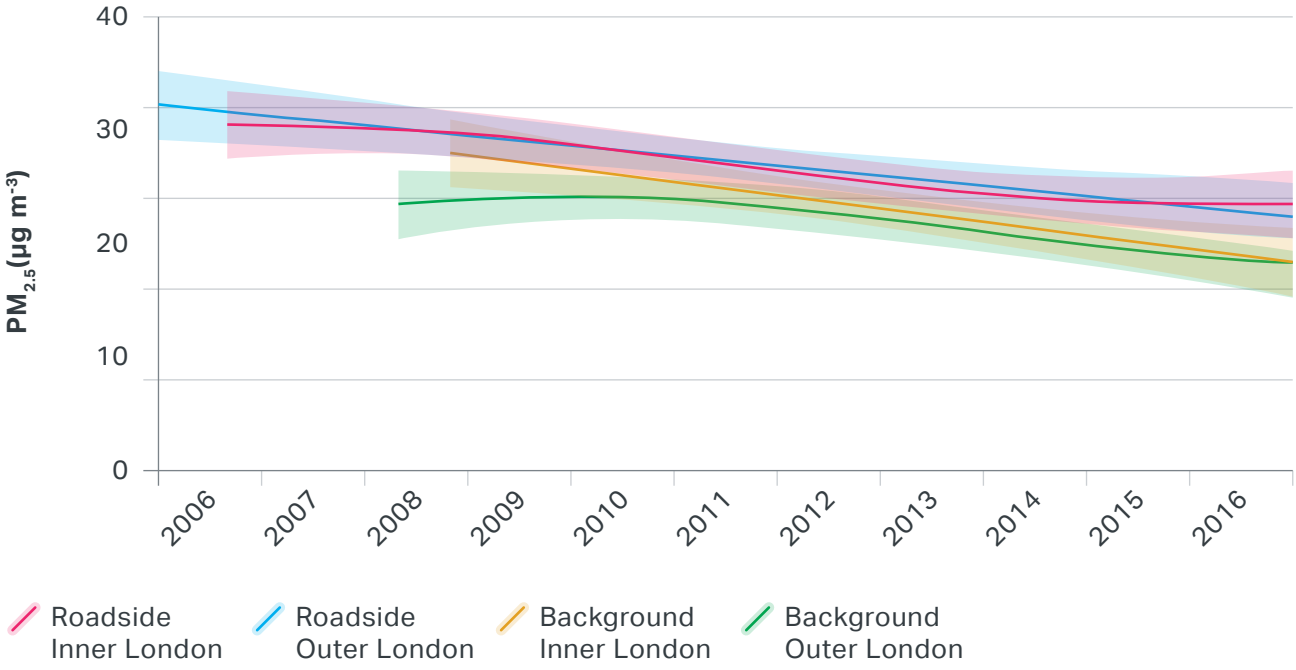
Source: GLA (2016), London Atmospheric Emissions Inventory (LAEI) 2013. Accessed from: https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013

Figure 1.2: Trends in PM_{10} concentrations in London 2004 to 2016[2]



Source: GLA (2016), London Atmospheric Emissions Inventory (LAEI) 2013. Accessed from: https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013

Figure 1.3: Trends in $PM_{2.5}$ concentrations in London 2006 to 2016[3]



Source: GLA (2016), London Atmospheric Emissions Inventory (LAEI) 2013. Accessed from: https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013

INDICATOR: AIR POLLUTANT EMISSIONS

Overview of current position

This indicator is a measure of the emissions levels in London.

We published the London Atmospheric Emissions Inventory in 2016 which provides us with a baseline of total air pollutant emissions. Currently London emits around 48,200 tonnes of NO_x, 4,420 tonnes of PM_{10} and 2,300 tonnes of $PM_{2.5}$ each year, with this forecast to reduce significantly with the introduction of the Ultra Low Emission Zone.

Trends

For NO_x, the graph in Figure 1.4 shows that there has been a significant reduction in emissions (down 25 per cent in 2013 compared to 2008) with significant reduction expected between 2013 and 2020 due to the introduction of the Ultra Low Emission Zone and other measures.

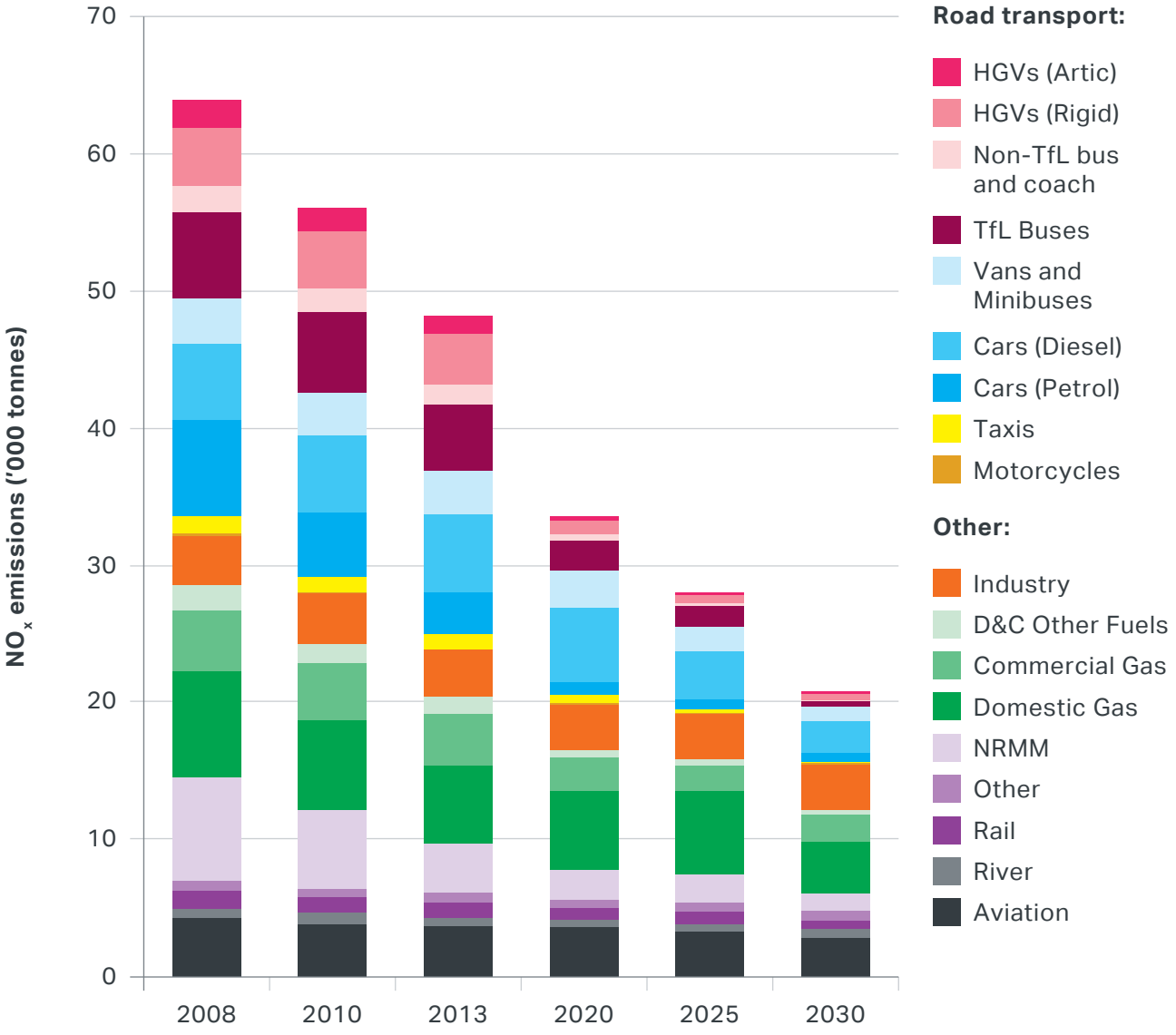
For PM_{10}, the graph in Figure 1.5 shows that there were slightly smaller reductions in emissions than for NO_x (down 20 per cent in 2013 compared to 2008). ULEZ will deliver some benefits between 2013 and 2020 but further work is required to ensure a continuing downward trend after 2020.

For $PM_{2.5}$, the graph in Figure 1.6 shows that there has been a significant reduction in emissions (down 27 per cent in 2013 compared to 2008). ULEZ will deliver some benefits between 2013 and 2020 but further work is required to ensure a continuing downward trend after 2020.

Likely future trend

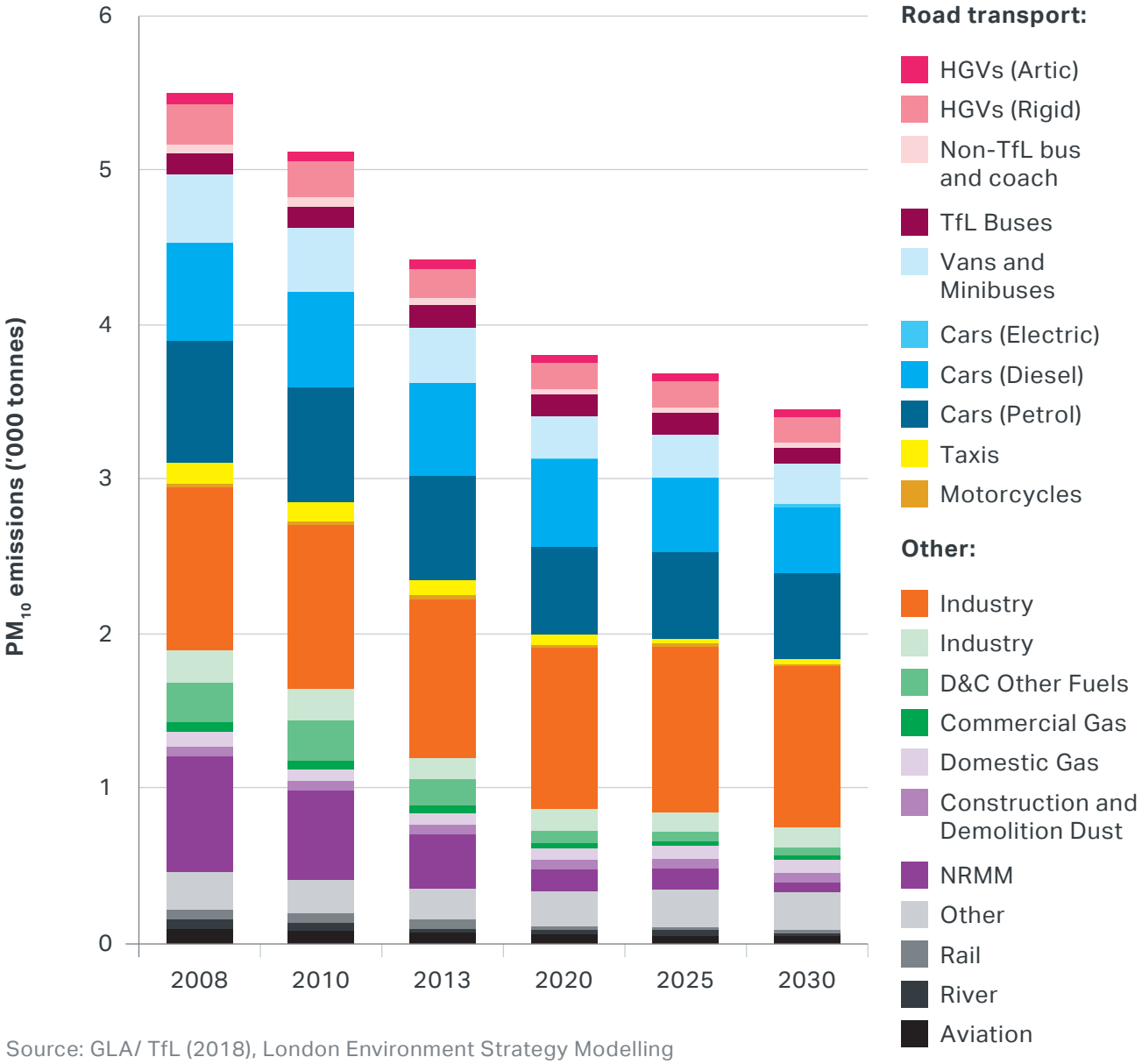
The Mayor has set out a bold package of measures to improve air quality in London, including a T-charge in central London from 2017, bringing forward the original Ultra Low Emission Zone from 2020 to 2019 and expanding the Ultra Low Emission Zone to the North-South circular for cars and vans, and London-wide for buses, coaches and HGVs. It is likely that this will accelerate reductions in pollutant emissions, combined with improvements delivered by new Euro 6 vehicles.

Figure 1.4: NO_x emissions by source type



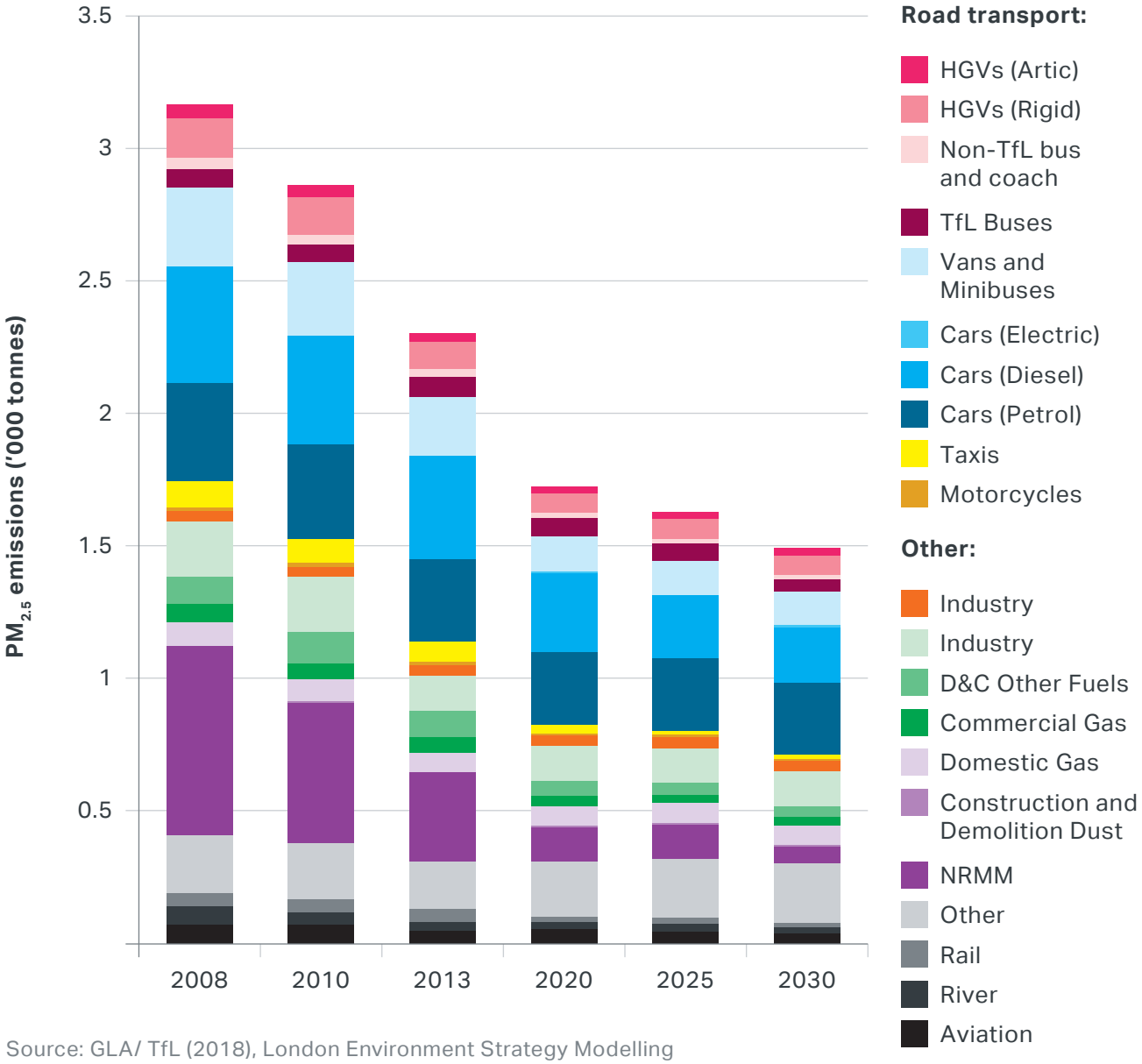
Source: GLA/ TfL (2018), London Environment Strategy Modelling

Figure 1.5: PM_{10} emissions by source type



Source: GLA/ TfL (2018), London Environment Strategy Modelling

Figure 1.6: $PM_{2.5}$ emissions by source type



Source: GLA/ TfL (2018), London Environment Strategy Modelling

INDICATOR: POPULATION EXPOSURE

Overview of current position

This indicator is a measure of human exposure.

Currently around 1 million people are exposed to concentration levels of NO_2 that exceed the EU legal limit.

Trends

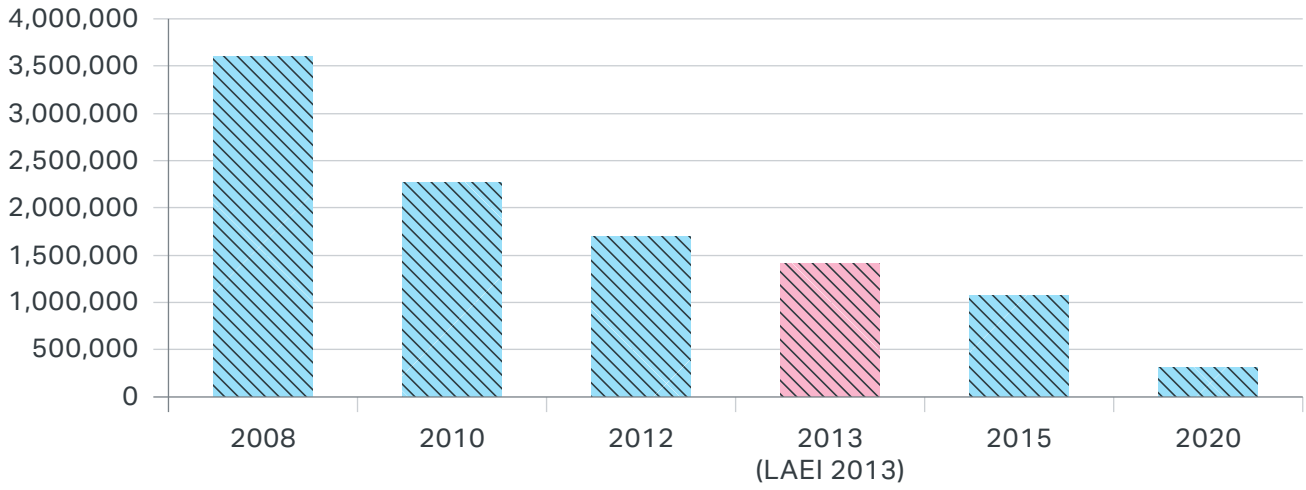
The number of people exposed to the health risks associated with exceeding the EU limits for NO_2 decreased from the 2008 general baseline of 3.6 million people to 1.4 million in 2013 (based on the LAEI 2013). Note: the figures for 2013 were not part of the original study and have been extrapolated from the general trend in the data.

Likely future trend

We project that by 2020 just over 300,000 Londoners will be living in areas that are exposed to levels of NO_2 that are higher than the EU legal limit.

Note: these figures are based on the LAEI 2010 and do not include the impact of measures announced by the Mayor since coming into office in 2016, or changes to the LAEI since 2010. The effect of these changes is likely to increase the rate of reduction in the number of people living in areas exposed to pollution higher than the legal limit.

Figure 1.7: Number of people exposed to NO_x above the EU limits



Source: https://www.london.gov.uk/sites/default/files/analysing_air_pollution_exposure_in_london_-_technical_report_-_2013.pdf

Green infrastructure

For almost a century, London has had a land-use planning framework that protects and conserves the best of London's parks, green spaces and natural landscapes. This approach has served the city well; providing Londoners with opportunities for outdoor amenity and recreation, and protecting the heritage of natural and designed landscapes. Consequently, London is widely regarded as one of the greenest of big cities, with an extensive network of parks and open spaces, a surrounding Green Belt and many detached and semi-detached suburban properties with gardens.

The current best estimate is that around 47 per cent of London's area is green[4]. About 33 per cent London is vegetated green space (including parks, woodlands and other semi-natural habitats) and an additional 14 per cent is green space in gardens[5]. New analysis of high resolution aerial imagery is being undertaken, which will provide a more accurate estimate of green cover across the city.

It is estimated that there are over 8 million trees in London, of which 700,000 are street trees. This results in an 'urban forest' with a canopy covering approximately 20 per cent of the city[6].

Areas regarded as valuable for wildlife are identified as Sites of Importance for Nature Conservation (SINCs). Almost 20 per cent of London's land area is identified as a SINC, variously graded as Metropolitan, Borough and Local depending upon its relative importance.

Tracking the changes in London's wildlife (i.e. fluctuations in the population and range of species) is more challenging due to the lack of effective and widespread monitoring. However, some national schemes, such as the British Trust for Ornithology's Breeding Bird Survey, can provide results that are meaningful in a London context, and specific surveys such as fish surveys undertaken by the Environment Agency to monitor the ecological health of waterways do provide a measure of the health of London's wildlife. These indicate some positive trends (for fish and some breeding birds) but the broad trend is a decline in both the variety of wildlife and overall numbers of more sensitive species.

Despite being a relatively green city the distribution of green spaces, natural areas and trees across London is uneven and some Londoners suffer from lack of access to a good quality natural environment[7]. People living in almost half of London do not have sufficient access to district or local parks[8].

Just as London's air is adversely impacted by emissions from our current transport and energy infrastructure, the quality of the water in London's rivers is poor as a consequence of the structure

of the urban environment. This results in: frequent discharges of stormwater into London's network of streams and rivers; chronic pollution of watercourses resulting from misconnections of domestic wastewater pipes; and occasional severe, albeit accidental, spillages of sewage from the sewer network or chemical pollutants from industrial facilities.

With the population of London set to grow, there is likely to be significant additional pressure on London's existing green spaces and natural environment. This is likely to have an adverse impact on both people and wildlife unless new approaches to the design and management of existing green space are adopted, and new ways of providing additional greening are found in order to ensure London remains a city in which parks, trees, gardens and natural spaces provide a functional green infrastructure are part of the fabric of the urban environment.

INDICATOR: PUBLIC PARKS AND OPEN SPACES

Overview of current position:
This indicator is a measure of the quality and accessibility of parks and open spaces.

About 18 per cent of London's area is designated as publicly accessible open green space. Although this is a large area for a city the figure alone does not give an indication of its quality; how accessible it is, or; how Londoner's perceive and use this space. Consequently, this indicator uses a number of datasets to provide a reasonable indication of any changes in the quality and accessibility of London's public green spaces. These datasets are:

- The Green Flag award. This is a national scheme that provides a measure of the overall quality or a park or public green space[9]. A quality score is assigned spaces based on 8 key criteria. It is not a systematic monitoring scheme as owners and managers have to apply for Green Flag status therefore it is likely that only the best sites are put forward. Trends depend on the number of applications as well as site quality.
- Areas of Deficiency in Access to Public Open Space. This identifies the distance people have to travel to access various types of public open space (e.g. regional parks, district parks and local parks)[10].

- Areas of Deficiency in Access to Nature. This identifies those areas of London where people have to walk more than 1 km to reach a SINC of at least borough grade importance[11].
- Monitor of Engagement with the Natural Environment (MENE) survey[12]. 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.
- The State of UK Public Parks (2016). This report by the Heritage Lottery Fund assesses the resources being allocated to the management and maintenance of parks[13].

Trends

- Since 2010, the number of parks or green spaces awarded Green Flag status has increased from 223 to 351. London has one of the highest concentrations in the country[14].
- 26 per cent of Greater London is deficient in access (i.e. >3.2km away from) to a Metropolitan Park
- 45 per cent of Greater London is deficient in access (i.e. >1.2km away from) to a District Park
- 50 per cent of Greater London is deficient in access (i.e. >400m away from) to a Local Park
- Since 2006, the Area of Deficiency in access to nature has fallen from 22 per cent to 16 per cent of London. [N.b. 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].

Headline results from the MENE survey based on data collected between March 2009 and February 2012 show that:

- Londoners take over 80 per cent of their outdoor visits within Greater London.
- Parks are of fundamental importance accounting for nearly 62 per cent of all outdoor visits.
- 29 per cent of outdoor visits are taken for health and exercise, much lower than for England as a whole (38 per cent).
- 82 per cent of Londoners feel that spending time out of doors (including their own garden) is important for their well-being.

Key indicators for London from the State of UK Public Parks report include:

- 88 per cent of parks are currently in good condition, but only 33 per cent are improving; whereas 44 per cent are stable and 22 per cent are declining in quality and facilities.
- There are ongoing reductions in the revenue budgets available for parks, with an expected 12 per cent reduction on average over the next three years.

- Reduction in staffing is continuing with an average 11 per cent cut in staff resources.
- London appears to be adopting the most commercial approach to generating income from its parks when combining figures for charging, commercial enterprises and events.

Although these figures illustrate an ongoing decline in the resources being committed to London's public parks and green spaces, the severity of the cuts is less than elsewhere across the UK. This demonstrates, to a degree, the importance given by London boroughs to limiting the adverse impacts of disinvestment in public open space.

Likely future trend

The quality and accessibility of London's publicly accessible green space is very much dependent on the resources provided to maintain and manage the space and the numbers of people using the space. Current indications are that the public funding allocated to managing green spaces is being reduced, which could result in a decline in the quality of parks and green spaces. Furthermore, the demand for parks and green spaces is likely to increase as London's population continues to grow: increased use exerts more pressure on these spaces. A more positive trend is the increase in local communities, often working with non-governmental organisations, taking on the ownership and management of some sites. This opens up opportunities for accessing new funding streams and the energies, ideas and skills of local communities.

INDICATOR: WILDLIFE SITES

Overview of current position

This indicator is a measure of the area of Sites of Importance for Nature Conservation (SINCs) and the condition of Sites of Special Scientific Interest (SSSIs).

There are just over 1,500 SINCs in London, which are identified through the land-use planning process. London Plan policy (and corresponding borough Local Plan policy) requires the nature conservation value of these sites to be a significant consideration in the land-use planning process. The SINC network includes the 37 nationally designated SSSIs, which contain nationally important habitats, species populations and geological formations. The protection of SSSIs is set out in law. The wildlife sites network covers around 30,000 hectares, or around one fifth of London's area. Increases or losses in the area, or the quality, of these sites are a reasonably good indicator of whether London's natural environment is improving or declining. This indicator uses two datasets to measure change: coverage (area and percentage) of SINC land and the condition of SSSIs.

Ideally, the condition and quality of SINCs would also be monitored, but there are no reliable and consistent data at the pan-London level to allow this. Prior to 2011 there was a formal requirement for Local Authorities to provide information on the number of SINCs in positive conservation management[15] as part of their reporting against a set of National Indicators. The requirement to report this information was rescinded by central Government in 2011. Defra continue to collect this information from Local Authorities on a voluntary basis. Some London boroughs have provided annual SINC management data post 2011. However, the number providing this information has reduced sharply since 2014. Unless this trend reverses it will not be possible to monitor the condition and quality of SINCs in the future.

Trends

- Between 2001 and 2012 there was a net gain of around 1,500 ha of SINC area. This equates to an increase of around 5 per cent[16].
- Although the net area of SINCs has increased, there will have been losses of individual sites at the local level. Furthermore, as the current indicator does not demonstrate quality the positive trend in site coverage may mask declines in actual nature conservation value of some sites.
- The percentage of SINC sites under positive conservation management increased from 42 per cent in 2009, to 50 per cent in 2010 and 59 per

cent in 2011. From 2012-2017 around 60 per cent of SINCs are reported as being in positive conservation management each year. This means approximately 500 sites are not being managed each year[17].

The majority of land within SSSIs in London is in good condition[18]. However, only 25 per cent is in a 'favourable' condition and 10 per cent is unfavourable or declining (see Table 2.1).

Likely future trend

SINCs are relatively well protected under the current London Plan, but increasing public pressure and the need to increase London's housing and associated infrastructure could result in small but cumulatively significant losses of SINC area. However, lack of, or inappropriate management is the most likely reason for decline in quality in the future. Current public funding constraints suggest that lack of management is likely to become more prevalent in the future.

The SSSI network is likely to see gradual improvements as there is a strong legal framework, supported by central Government grant-funding, to ensure these sites are effectively maintained and managed.

Table 2.1: The condition of SSSIs in London

Condition	Area (ha)	Percentage area (per cent)
Favourable	1,080.51	24.84
Unfavourable – recovering	2,795.16	64.27
Unfavourable – no change	194.68	4.48
Unfavourable – declining	265.68	6.11
Partially destroyed	7.71	0.18
Destroyed	5.59	0.13
Not assessed	0	0

Source: Natural England https://designatedsites.naturalengland.org.uk/

INDICATOR: BREEDING BIRDS

Overview of current position

This indicator is a measure of change in populations of the most common bird species in London.

Bird populations are an important proxy indicator of habitat quality in London. Changes in population numbers can be directly affected by the quality of their habitat. The British Trust for Ornithology publish trend data[19].

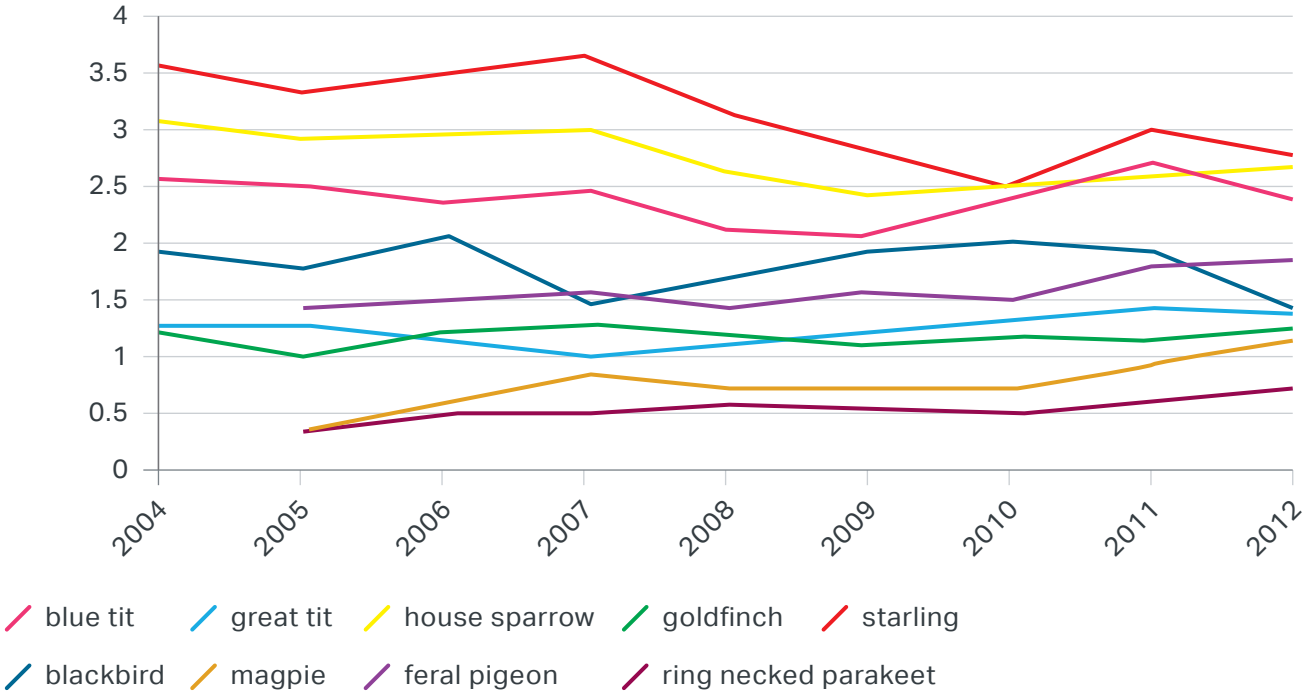
Trends

- Over 300 species of bird have been identified in London in recent years.
- Populations of common bird species in London, such as the starling, house sparrow and blackbird have been falling.
- The starling has been in decline in London for some time, with no sign of a change in the trend. Since 2004, populations have fallen by around 22 per cent.
- House sparrow numbers fell dramatically in London over the past couple of decades, and have fallen by around 11 per cent since 2004.
- Populations of goldfinch are doing well in urban parks and gardens possibly due to a greater readiness to take advantage of food such as Niger seed that is more frequently provided at bird-tables.
- Some previously rare species, such as little egret, have become more widespread in London due to the influence of climate change and a general improvement in the condition of wetlands and waterways in which they feed.
- Some previously more widespread species, such as skylark, have declined due to the diminishing amount of undisturbed, extensive open grassland in which this species breeds and the increasing intensification of farmland in London's Green Belt.

Likely future trend

Most of the changes in bird populations in London mirror national trends. However, a significant cause of national declines in many bird species is the intensification of agriculture in the wider countryside. This has a limited impact in London and, therefore, the increasing trend of managing London's parks and green spaces in more ecologically sensitive ways could result in the declines in London being less steep and/or increase the population of species (such as house sparrows and starlings) that have been in decline.

Figure 2.1: Trends in populations of common bird species in London



Source: BTO Breeding Bird Survey https://www.bto.org/volunteer-surveys/bbs/latest-results/population-trends

INDICATOR: TREE COVER

Overview of current position

This indicator is a measure of the canopy provided by London's trees in woodlands, parks, gardens and streets – collectively known as London's 'urban forest'.

There are approximately 8 million trees in London, which create a canopy that covers about 20 per cent of London's surface area[20]. Canopy cover is a more important measure than the number of trees, as it is the size of the tree and its canopy that largely determines the services (such as stormwater attention, cooling and filtering of particulates) that London's urban forest provides.

Determining the extent of London's canopy cover is not as easy as might be assumed. Measurement is reliant on remote sensing and/or sampling and extrapolation to estimate total canopy cover across London. This results in an inevitable margin of error that, because urban tree canopy cover expands or contracts quite slowly (because there is not wholescale felling of trees), makes it difficult to monitor trends over short periods of time. However, the different methodologies applied have all given a figure of between 18 and 22 per cent.

In 2015 the Greater London Authority published Measuring Tree Canopy in London[21] a report that sets out a methodology for measuring tree canopy cover that can be repeated at approximately five yearly intervals to get a better picture of long-term changes in canopy cover.

Trends

It has not been possible to determine a trend to date as the repeatable methodology for monitoring tree canopy cover was only developed in 2015. However, the GLA report published in 2015 provided a figure that was consistent with previous estimates indicating, if nothing else that there has not been any reduction in canopy in recent years.

Likely future trend

The likely future trend should be a gradual increase in London's canopy cover. Existing trees are reasonably well protected and there have been a number of tree planting initiatives in recent years which aim to increase canopy cover. Planning policy has encouraged developers and others to plant more trees when sites are redeveloped or subject to urban regeneration programmes.

INDICATOR: GREEN ROOFS

Overview of current position

This indicator is a measure of the area of green roofs in London.

In February 2008, the Greater London Authority published 'Living Roofs and Walls'[22], a report that provided the evidence base for a new policy in the London Plan promoting green roofs and walls. The report noted that green roofs and walls could play an important role in climate change adaptation (by storing stormwater and cooling buildings), as well as creating additional wildlife habitat and outdoor recreation space.

Since the inclusion of a green roof policy in the London Plan there has been a major increase in the number and area of green roofs installed, particularly in central London.

An analysis of aerial images of the roofscape of the Central Activities Zone (CAZ), undertaken by the Green Roof Consultancy for the Greater London Authority in 2013, showed that there are about 700 green roofs in the CAZ covering an area of 17.5ha[23]. This analysis is repeatable and can be applied to other parts of London in future years. The aim is to repeat the analysis every five years.

Trends

A significant increase since 2008. Prior to this date green roofs (and walls) were an idiosyncratic part of the urban environment installed primarily on self-build or bespoke developments or where a particular constraint (such as breeding black redstarts) required particular mitigation. Since then they have become a standard feature on many new developments, particularly in the most densely developed parts of the city where stormwater management, urban cooling and creating additional green space is needed most.

Likely future trend

There is likely to be a continuing increase in the installation of green roofs, green walls and other building-integrated green infrastructure as policy is strengthened and incentives are developed to maintain London's green credentials, despite an increasing density of development.

INDICATOR: WATER QUALITY OF LONDON'S WATERBODIES

Overview of current position

This indicator is a measure of quality in London's water bodies (i.e. rivers, lakes and reservoirs, as defined by the Environment Agency via the Thames River Basin Management Plan[24]).

The quality of water in London's rivers has been affected by pollution over many decades. Lakes and reservoirs have tended to fare better. Industrial pollution has largely ceased, however historic ground contamination from past heavy industry continues to affect river water quality. Furthermore, in parts of London, wrongly connected sewers are a significant issue leading to a chronic problem of untreated sewage being discharged into local tributary streams and rivers. Water quality problems are also caused when heavy rain flushes pollutants from roads and other hard surfaces into these tributary streams, resulting in a high intermittent pollution loading. Under such circumstances, rivers become degraded environments that cannot support their natural ecology.

Trends

There has been little improvement, and possibly some deterioration in the state of London's waterbodies over the past 10 years. In some localised cases, river restoration programmes have helped to deliver improvements, and there are a growing number of such projects being delivered. Over 15km of river have been restored since 2007[25].

The two sets of data presented are not directly comparable[26] but give an indication of the quality of London's waterbodies.

Likely future trend

There is scope to improve the quality of London's waterbodies. More concerted efforts on misconnected sewers, the increased use of sustainable drainage systems and delivery of river restoration projects have the potential to lead to localised improvements. Such programmes need to be rolled out to a catchment scale in order to make a significant and sustainable improvement to the waterbodies.

Table 2.2: 2009 Waterbody Quality

Not measured	Bad	Poor	Moderate	Good	Very Good	All Waterbodies
6	1	16	28	13	0	64

Table 2.3: 2016 Waterbody Quality

Not measured	Bad	Poor	Moderate	Good	Very Good	All Waterbodies
0	3	5	32	1	0	41

Source: Environment Agency

Climate change mitigation and energy

London must meet the energy demands associated with a growing population whilst simultaneously reducing greenhouse gas (GHG) emissions. Carbon dioxide (CO_2) is the most significant GHG in the UK and accounts for around 99 per cent of all GHG emissions in London. The Mayor has set an ambitious target for London to be zero carbon by 2050. GHGs absorb the sun's energy reflected from the Earth and re-emit it, resulting in a warming of the atmosphere.

To meet our CO_2 reduction targets for London we will need to make more effective use of the energy we currently consume. To do this requires retrofitting our homes and workplaces to make them more energy efficient. We aim to make the best use of London's existing energy supply, reducing the need for investment in new generation infrastructure. Where we do require new sources of energy production, in terms of electricity and heating, this must be low carbon, secure and affordable.

London is a global city and therefore has an important role in reducing GHG emissions, both within our boundary and outside of the capital. So, as well as measuring GHG emissions occurring as a result of energy use in London, we estimate London's total carbon footprint. This helps us to determine our overall impact on GHG emissions more widely across the UK and further afield.

INDICATOR: CARBON DIOXIDE EMISSIONS

Overview of current position

This indicator is a measure of London's CO_2 emissions generated by activities occurring within London. These are divided into emissions from the domestic, industrial and commercial, and transport sectors.

This indicator uses data on energy use from central Government and Transport for London. The energy data is presented on an "end user" basis; therefore, emissions from the production and processing of fuel are reallocated to the consumers, to reflect the total emissions for each fuel use. The fuel use is multiplied by a CO_2 equivalent (CO_2e) emissions factor. The latest data published is for 2015, where we estimate annual emissions of 33.9Mt CO_2e.

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 and in the London Environment Strategy. London aims to be a zero carbon city by 2050 and the London Environment Strategy establishes carbon budgets to put London on track to achieving this.

Trends

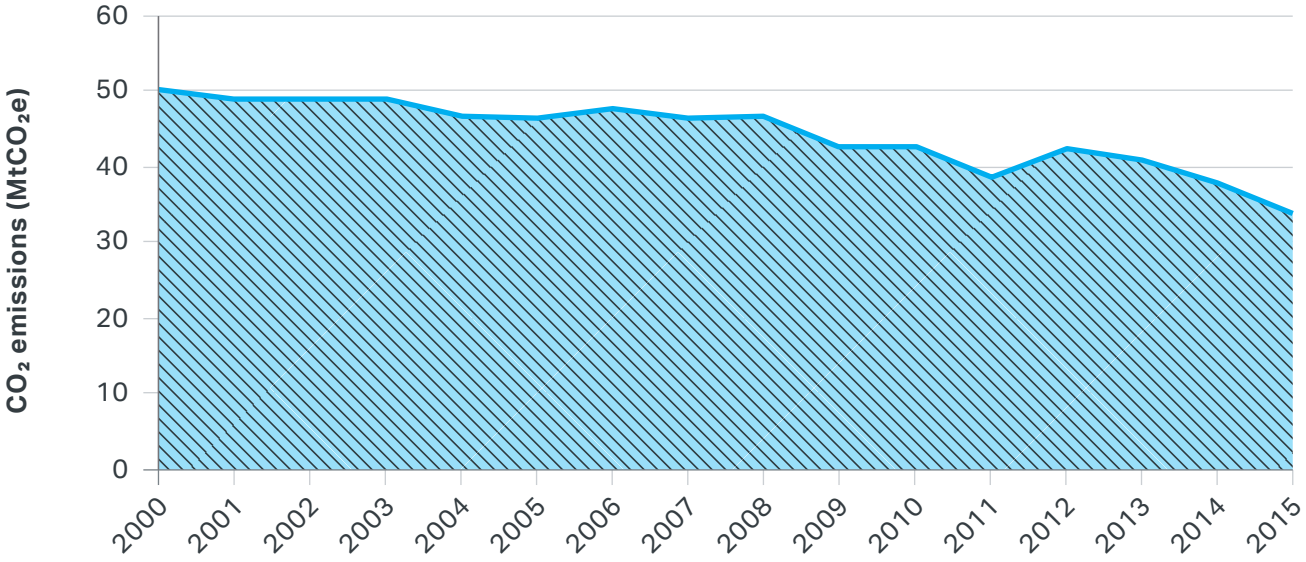
- CO_2e emissions in London were estimated at 33.9 Mt in 2015.
- This accounted for approximately 7 per cent of the UK's CO_2e emissions.
- 40 per cent of London's CO_2e emissions were from industrial and commercial sources (13.5 Mt CO_2e). Homes accounted for 36 per cent (12.1 Mt CO_2e) and the transport sector accounted for the remaining 24 per cent (8.3 Mt CO_2e).
- Since 1990, London's CO_2e emissions have fallen by an estimated 25 per cent.
- London's emissions peaked in 2000 (at 50.3 MtCO_2e) and 2015 figures are 33 per cent lower than this peak.
- This reduction in GHG emissions is largely due to a reduced carbon intensity of national electricity supply and a shift towards the service industry, which is less energy intensive than, for example, manufacturing.
- At 3.9 tonnes per person per year, London's CO_2 emissions are the lowest in the country (on a regional basis). This is, in part, due to high usage of the public transport system, compared to greater reliance on private cars outside the capital.
- Taking London's population growth since 1990 into account (an increase of over 25 per cent), emissions per capita have fallen by 41 per cent.

Likely future trend

Ongoing reduction in CO_2 as a result of a decarbonising national electricity supply, increased energy efficiency measures and more low carbon decentralised energy supply in London.

However, the trend in emission reductions needs to be considerably steeper over next 10 years to put London on track to becoming a zero carbon city by 2050.

Figure 3.1: London's CO_2 emissions - 2000 to 2015



Source: London Energy and Greenhouse Gas Inventory 2015 – https://data.london.gov.uk/dataset/events/leggi

INDICATOR: ENERGY CONSUMPTION

Overview of current position

This indicator is a measure of the amount of energy consumed in London, in gigawatt hours (GWh). 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 use is vital for reducing greenhouse gas emissions. Reducing energy consumption through more efficient buildings and appliances can also help to tackle fuel poverty.

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 workplaces. However, in the summer months there is a general shift towards higher electricity use from air conditioning. Consumption can also vary from year to year depending on the weather conditions experienced, and so a long term trend is the most effective method of discerning meaningful changes in energy consumption.

Data on energy consumption for London is taken from central Government and Transport for London. The data identifies the final energy consumption across the domestic, industrial and commercial, and transport sectors. The earliest data is 2000 for a sector breakdown, but the 1990 estimate of total energy use in London was 160,431 GWh.

Trends

- London consumed an estimated 130,121 GWh of energy in 2015.
- This represents a reduction of 19 per cent on 1990 levels of energy use, despite a population increase of over 25 per cent over this time period.
- 40 per cent of the energy used in 2014 was consumed in London's homes (domestic), 35 per cent from London's workplaces (the industrial and commercial sector) and 25 per cent from the transport sector (Figure 3.2).
- Gas consumption (from homes and workplaces) makes up 43 per cent of the total energy consumed in London in 2015; the 55,771 GWh gas consumed in 2015 represents a reduction of 37 per cent since 2000.
- Electricity consumption (from homes, workplaces and rail) accounts for 31 per cent of all the energy consumed in London; the 39,654 GWh represents a slight increase since 2000. However, because of its higher carbon intensity electricity contributes a proportionally larger amount to London's overall CO_2 emissions.
- Coal (from homes and workplaces) makes up <1 per cent of the total energy used; similar to levels in 2000.

Almost all of this is from the industrial and commercial sector.

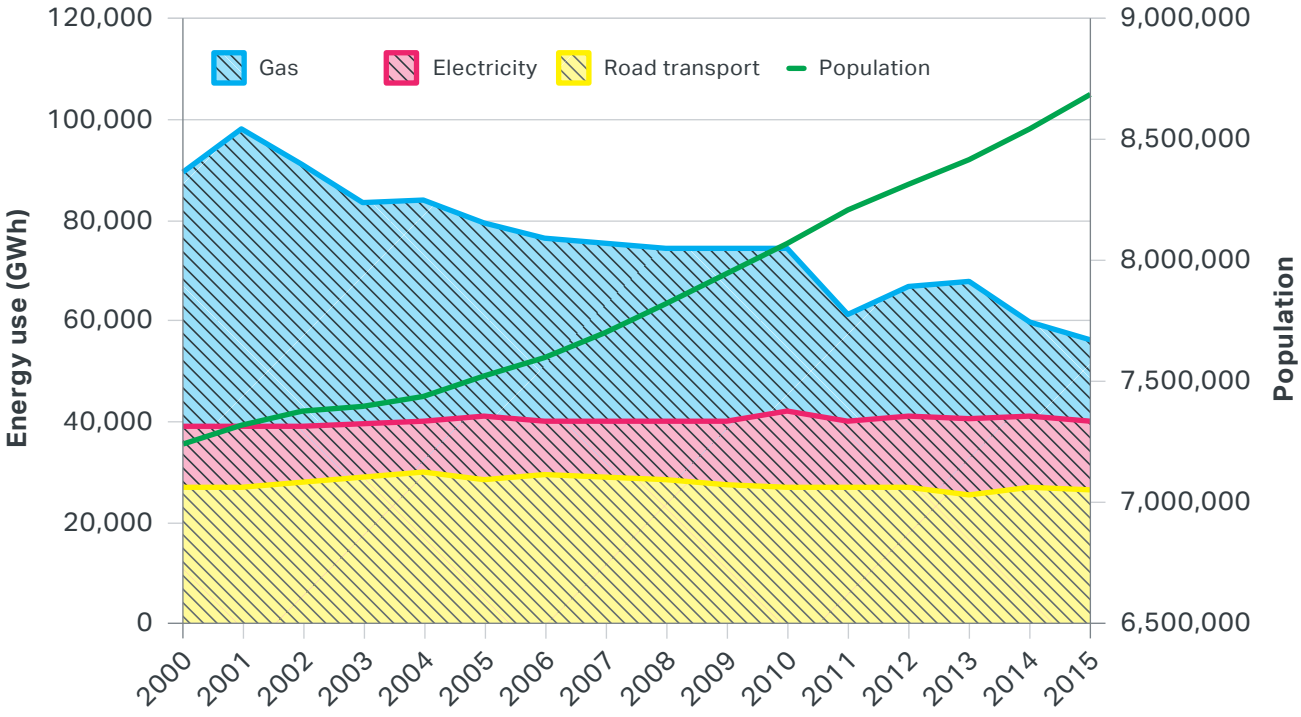
- 26,609 GWh of energy consumed is from road transport. Consumption of petroleum has reduced by approximately 10 per cent since 2000.
- Approximately 0.3 per cent of consumption is from renewable energy sources and waste. This has increased since 2005 in terms of GWh consumed, but not as a percentage.

Likely future trend

We expect London's overall energy consumption to remain fairly static in the short term, with reductions in gas usage and improvements in the energy efficiency of lighting and appliances offset by an increase in demand for electricity and a rising population.

Based on the London Infrastructure Plan growth projections to 2050, we expect demand for energy to increase over the coming decades to meet the needs of new homes, workplaces and infrastructure required for a growing population. We expect to utilise more renewable energy and heat networks to a greater extent, with local energy sources that will help reduce annual total demand for gas, as will a shift to using electricity to heat buildings and power our transport. The latest scenario modelling undertaken by the GLA can be found here.

Figure 3.2: Estimated energy consumption in London 2000 to 2015



Source: London Energy and Greenhouse Gas Inventory 2014 – https://data.london.gov.uk/dataset/events/leggi

INDICATOR: SCOPE 3 EMISSIONS (CO_2)

Overview of current position

London has a history in leading the way in developing city-level emissions inventories. Despite a growing interest in measuring scope 3 supply chain emissions (essentially a carbon footprint) there are a lack of international standards for cities. So, the Greater London Authority partnered with the British Standards Institute (BSI) and a steering group of experts to produce the 'PAS 2070 Specification for the assessment of greenhouse gas emissions of a city'. Published in 2014, the PAS 2070 is the UK's first standard produced for wider city-level emissions, and the London case study is one of the first of its kind internationally. Combined they provide an example that other UK, European and global cities can follow.

The London case study provides two methodologies for measuring a city's wider greenhouse gas emissions:

- the Direct Plus Supply Chain (DPSC) methodology includes all greenhouse gas emissions that occur within a city's geographic boundary, as well as the supply chains associated with the city's major products and services including waste and waste water, construction, food and transport.
- the Consumption Based methodology measures the greenhouse gas emissions from the products and services that London consumes. Therefore, greenhouse gases emitted as a result of products and services that are produced in London, but not consumed in London, are not included.

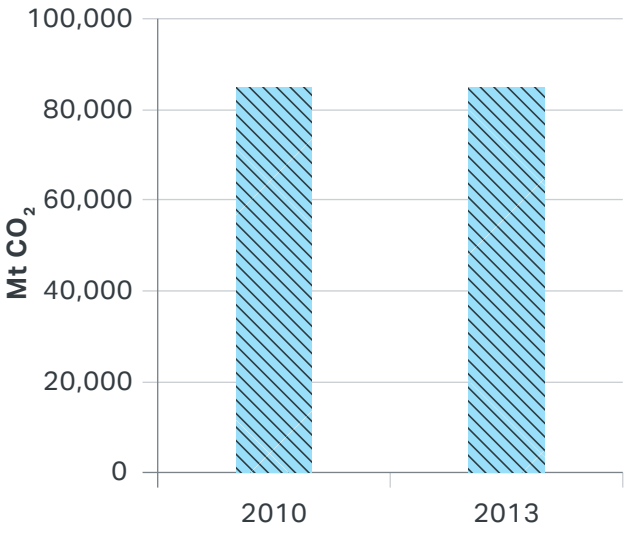
The results are not a formal measurement of London's emissions and do not assign responsibility for emissions. Rather the assessment is an indication of the potential wider scope of emissions which could be attributable to London and a tool for local authorities, policy makers and other stakeholders to assess the implications of these.

Trends

- Under the DPSC methodology CO_2e emissions attributable to London in 2010 were 81.1 million tonnes ($MtCO_2e$).
- Under the Consumption-Based methodology they were 114.1 $MtCO_2e$.
- Due to the differing methodologies, particularly boundaries and estimation methods, it is not advised that these are compared directly. Rather they should be seen as two separate indicators of the potential reach of CO_2e emissions attributable to London.

- For 2013 consumption based greenhouse gas emissions are estimated at 122.7 $MtCO_2e$. This is an increase of around 8 per cent on 2010.
- This change in estimated consumption-based emissions is predominantly due to an improvement in estimating non carbon dioxide greenhouse gases. When using a like for like comparison based solely on CO_2 estimates (Figure 3.3), emissions increased by less than 1 per cent between 2010 and 2013. This is negligible as it is within the margins of error for this calculation.
- London's consumption-based emissions per capita are around 7 per cent lower than the UK average.

Figure 3.3: Estimate of consumption-based scope 3 carbon dioxide emissions for London in 2010 and 2013



Source: https://www.london.gov.uk/sites/default/files/assessing_londons_indirect_carbon_emissions_2010_2014.pdf

Likely future trend

As London's direct (scope 1 and 2) emissions are reduced to meet the Mayor's GHG reduction targets, we expect to see scope 3 emissions fall too. However, increasing consumption of goods manufactured outside of London may result in scope 3 emissions falling at a slower rate than those of scope 1 and 2.

Waste

Reducing the amount of waste we produce, and reusing and recycling more are fundamental to improve waste management and the state of the environment in London. Waste arises from almost all activities and needs to be managed effectively to reduce disposal costs, grow green jobs, and protect the environment and human health.

London's waste presents a significant social and economic opportunity. Waste materials recovered locally through increased reuse and recycling performance deliver benefits to Londoners in the form of new products, jobs and low carbon energy. Boosting London's reuse and recycling performance will also play a key role in accelerating London's transition to a circular economy.

A circular economy is one in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end their life. It is a more efficient and environmentally sound alternative to the traditional linear economy in which we make, use and dispose of resources in landfill or to incineration.

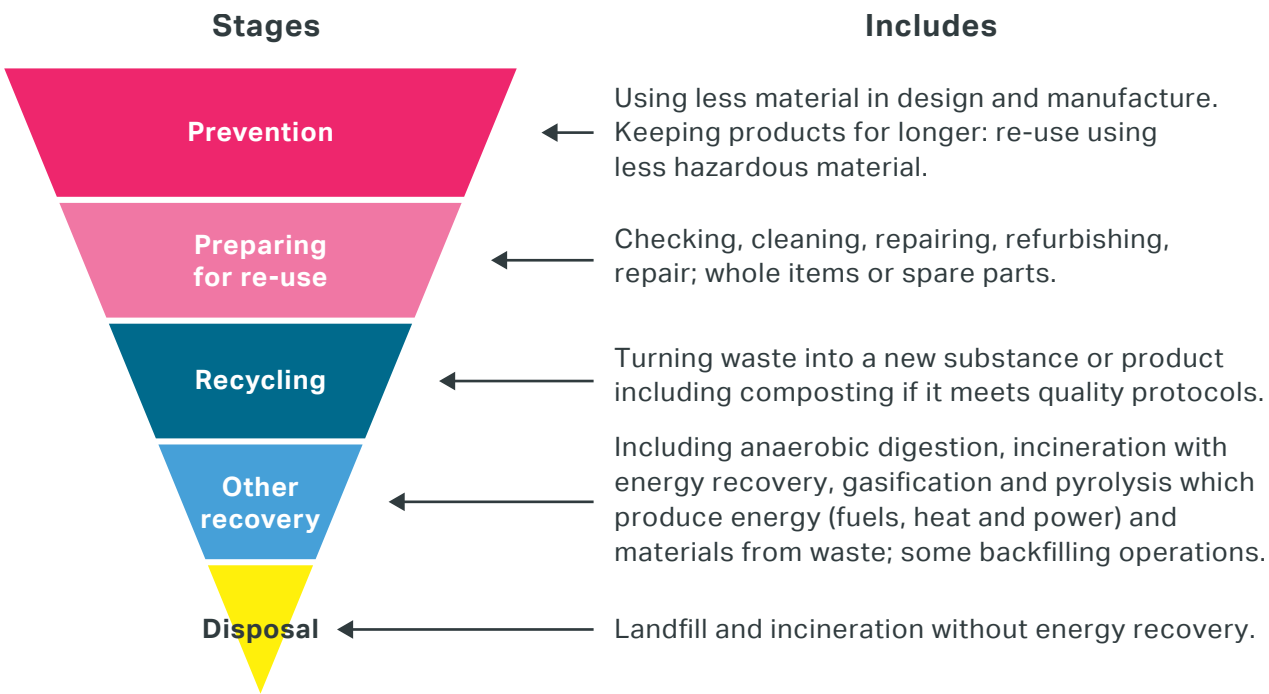
Both of these options are becoming increasingly undesirable and expensive. Incineration and landfill also places pressure on our land and increases greenhouse gas emissions from the breakdown and destruction of waste. Only truly residual waste should be sent to incineration and other thermal technologies to generate low carbon heat and power. In a circular economy waste is designed out of the system through innovative product design and new sophisticated supply chain management allowing products to re-circulate for new or different uses. Moving to a circular economy is expected to bring benefits of £7bn to London per year by 2036, including12,000 new jobs[27].

Historically, an increasing population and growing economy has generated greater quantities of waste. There are three main waste streams – local authority collected waste (LACW, primarily household waste), waste collected and managed by the private sector (including commercial and industrial (C&I) waste, and construction demolition and excavation (CDE) waste). Municipal waste is household waste and business waste that is similar to household waste.

In this chapter we have primarily focused on LACW, as the data sets for this subsection of municipal waste are robust and reliable. This chapter also focuses on who has control of the waste (local authorities and businesses), rather than its defined type (municipal), as data is made available in that format. Data for other waste streams have been included where available. Since the publication of the draft London Environment Strategy, more up to date C&I waste data has become available from the Environment Agency. We have therefore updated this General Assessment, the final London Environment Strategy, and its evidence base using this new data.

London's waste policy is guided by the EU waste hierarchy, where the greatest emphasis is first placed on reduction, followed by reuse and recycling, energy recovery, and finally disposal (landfill or incineration without energy recovery).

THE EU WASTE HIERARCHY[28]



London has three incinerators generating electricity from the burning of waste, with a fourth planned in Beddington in Sutton. Only the South East London Combined Heat and Power (SELCHP) facility utilises waste heat produced as an energy source. Opportunities to maximise heat use to improve the overall efficiency and environmental performance of the other incinerators is being explored through local energy master plans and the London decentralised energy programme. More information can be found here.

There are four indicators to represent the performance of London's LACW using information from Defra datasets:

1. waste arisings
2. recycling levels
3. incineration levels
4. landfill levels
5. CO_2 performance

Indicators have also been produced for London's commercial and industrial (C&I) waste, and for construction, demolition and excavation (CDE) waste. Data for these indicators has been sourced from Defra and the Environment Agency and modelling undertaken to inform the Mayor's municipal waste management strategy and London Plan. Small amounts of re-use are not included in the recycling indicator due where good data is available.

The London Environment Strategy sets out policies and proposals for London to cut waste, significantly boost reuse and recycling rates, and generate low carbon energy from waste remaining. Unless specified, London's waste performance data comes from Defra's waste data sets[29].

INDICATOR: LOCAL AUTHORITY COLLECTED WASTE (LACW) ARISINGS

Overview of current position

This indicator is a measure of London's LACW arisings. In 2016 LACW accounted for 3,716,000 tonnes. Household waste makes up around 80 per cent (or 3,049,000 tonnes) of LACW, 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. The remaining 20 per cent (or 648,000 tonnes) of LACW is small business waste collected by local authorities, street litter, and some hazardous waste.

In the UK, households throw away around 8.3 million tonnes of food and drink each year, with around five million tonnes (60 per cent) being avoidable food waste. This equates to around £480 for the average household[30].

Trends

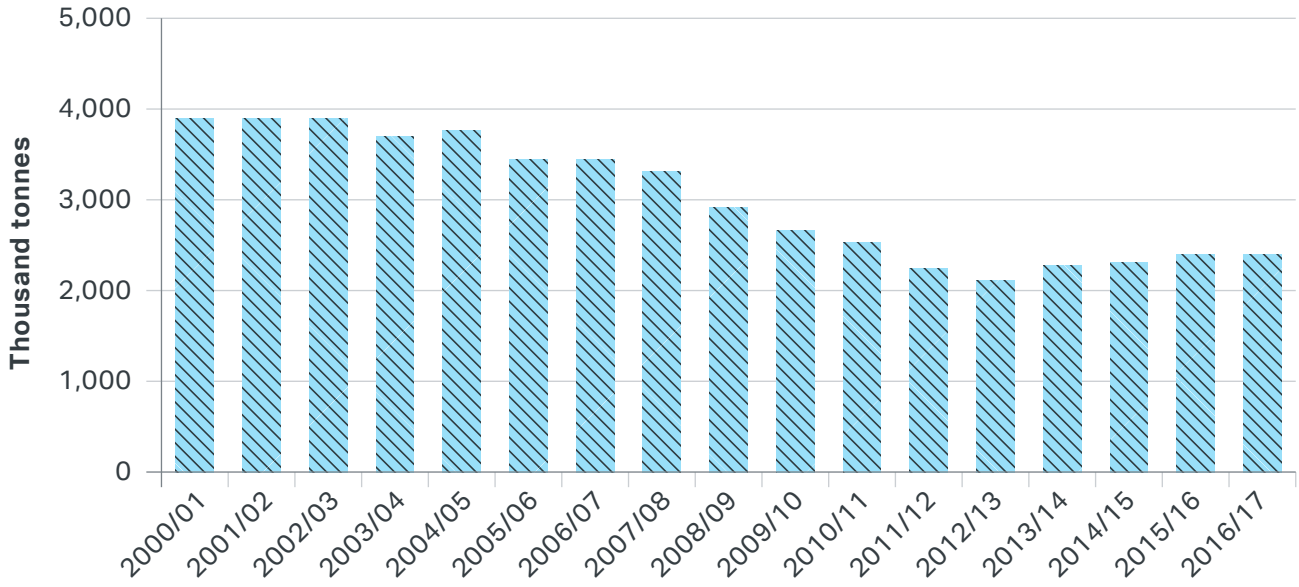
LACW waste arisings have been reducing year on year from 2002/3 until 2012/13 (except for a small increase in 2004/5). Between 2013 and 2016 London experienced an increase of about 76,000 tonnes. Household waste arisings per household have been reducing year on year from 2002/3 (except for a small increase in 2006/7 and 2016/17).

- The amount of household waste produced in London has declined by 10 per cent since 2000 from 3.4 million to 3 million tonnes in 2016/7. This equates to around 904kg per household.
- Recycling and composting of household waste has increased from 9 per cent in 2000/01 to 33 per cent in 2016/17, but remains the lowest level in England (44 per cent).
- London has the lowest household waste produced per head (354kgs) in the country. The London boroughs of Tower Hamlets, Lambeth, Islington and Ealing had the lowest production of household waste per head in 2016/17, ranging from 261kg to 287kg per head.
- Since 2000, the total amount of household waste generated each year in England has decreased by six per cent, while London's has decreased by ten per cent.

Likely future trend

Without interventions to reduce waste and boost recycling performance, waste arisings are expected to rise due to projected population increases and economic growth.

Figure 4.1: Total household waste arisings since 2000/01



Source: https://data.london.gov.uk/dataset/local-authority-collected-waste-management-london

INDICATOR: INCINERATION OF LACW

Overview of current position

This indicator is a measure of LACW Incinerated. In 2016, 2 million tonnes, or 54 per cent of total LACW arisings was incinerated.

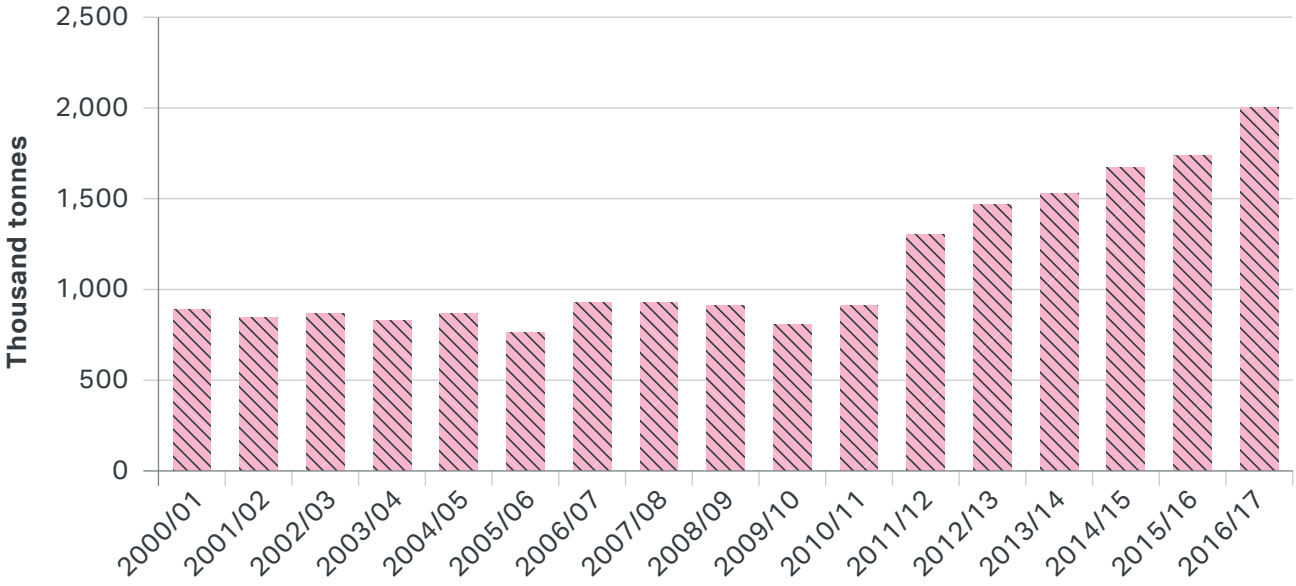
Trends

LACW sent to incineration has doubled from 886,000 tonnes in 2000/01 to 2 million tonnes in 2016/17. This is largely a result of increased amounts of waste diverted from landfill.

Likely future trend

This is expected to steadily decrease as incineration and landfill gets more expensive and recycling performance increases. However, interventions are necessary to recover more materials for recycling to reduce the amount of residual waste, for which incineration or landfill are the only alternative management options.

Figure 4.2: Total waste incinerated since 2000/01



Source: https://data.london.gov.uk/dataset/local-authority-collected-waste-management-london

INDICATOR: RECYCLING OF LACW

Overview of current position

This indicator is a measure of the percentage of LACW reused or recycled (including composting). In 2016/17 London achieved a 30 per cent LACW recycling rate (or 1.1 million tonnes) in 2016/17. London's household waste recycling rate is slightly better at 33 per cent. London has the lowest recycling performance in England (44 per cent in 2016/17). London faces many challenges to deliver cost effective, easy to use, and well participated recycling services. These include:

- every borough operating a different recycling collection system, which can be confusing for residents when moving across boroughs
- having a high amount of high density housing with limited space for recycling storage
- less space for gardens, and therefore less garden waste compared to other regions
- a highly diverse and transient population making communicating services difficult
- a lack of garden waste which makes it difficult to perform well in tonnage terms

Cost-effective, consistent and easy to use recycling services are essential to lift London off the bottom of the recycling ladder. London Plan policy requires new housing developments to make suitable and easily accessible provision for waste and recycling storage.

Trends

LACW recycling has increased year on year since 2001/2 (8 per cent) until 2011/12 (32 per cent) and has plateaued for the past 6 years at 30 per cent.

- London's household recycling and composting rate has increased from 9 per cent in 2000/01 to 33 per cent in 2016/17.
- Recycling of dry materials across London accounts for approximately 23 per cent of the household waste generated, whilst composting accounts for around 10 per cent.
- Bexley and Ealing have the highest household recycling and composting rates in London at 53 per cent and 51 per cent, respectively. In Bexley 23 per cent of its total recycling performance comes from composting alone.
- The lowest rates are in Newham and Westminster at 14 per cent and 17 per cent respectively. Lambeth had the highest increase in recycling in London between 2013/14 to 2016/17 – increasing 7 per cent from 21 per cent to 28 per cent
- The average rate of dry recycling (paper/card, tin/cans, glass, plastics, textiles) is similar for inner and outer London boroughs, at 21 per cent

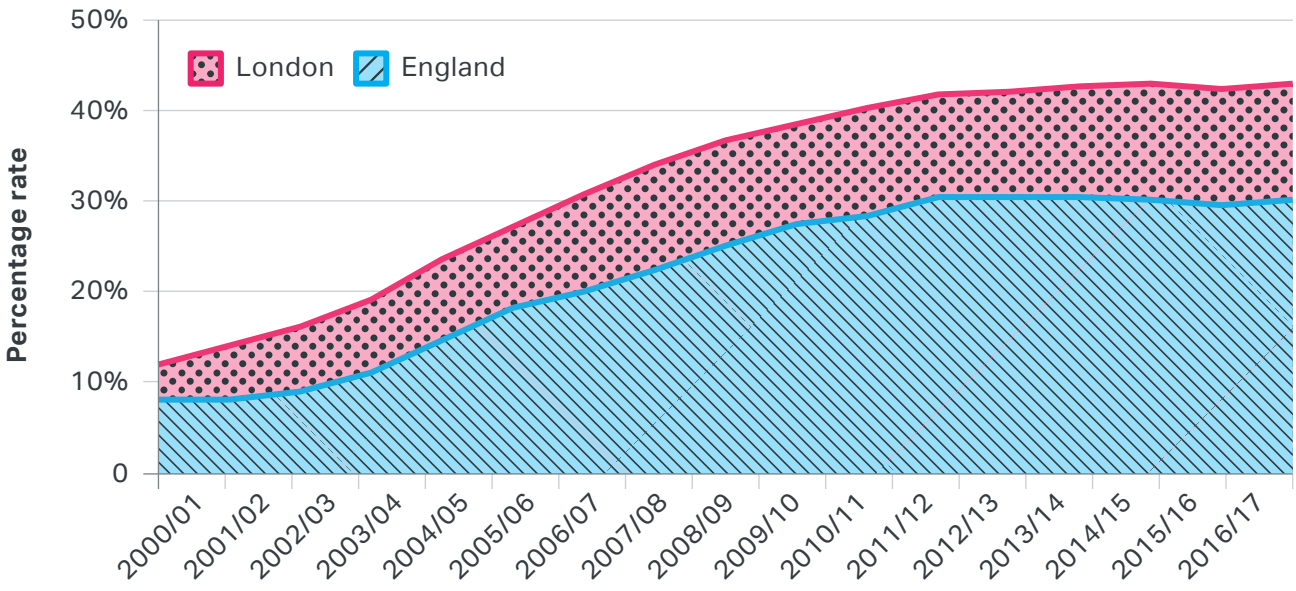
and 24 per cent respectively. However, outer London boroughs have an average composting rate of around 14 per cent, compared to just 4 per cent for inner London boroughs. This is due to variation in the organic waste collection services and more gardens in outer London boroughs.

- High recycling performance is influenced by a number of factors. In general boroughs with high proportion of high density housing and limited space or sufficient space to store recyclables perform worse than boroughs with more single houses served by separate kerbside collection services.

Likely future trend

Expected to increase as landfill and incineration get more expensive, more investment in recycling services, greater consistency in service provision across boroughs, and increased promotion and participation in recycling collection services.

Figure 4.3: Household recycling and composting rate in London since 2000/01



Source: https://data.london.gov.uk/dataset/local-authority-collected-waste-management-london

INDICATOR: LACW TO LANDFILL

Overview of current position

This indicator is a percentage of LACW landfilled. In 2016, 12.5 per cent (463,000 tonnes) were disposed of to landfill. Disposing of waste to landfill is expensive, unpopular and unsustainable – resources are being lost as materials that could be reused or recycled are not being recovered. There are two main landfill sites in London for local authority collected waste – Beddington Farmlands and Rainham. Capacity at these sites is rapidly being exhausted and they are expected to close in 2021 and 2018 respectively. This means that most of the capital's waste is transported and disposed of to landfills in other regions, particularly the south and south east of England. Landfills receiving London's waste are expected to close by 2025 and are not being replaced. The Landfill Directive targets aim to achieve reductions on the1995 biodegradable municipal waste (BMW) levels. These reduction targets were 25 per cent by 2010 (1.7 million tonnes), 50 per cent by 2013 and 65 per cent by 2020. The UK is on track to meet these targets. London-specific data is not available.

Landfills release 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 300,000 tonnes of CO_2 equivalent each year. Reducing the amount of waste produced and recycling what is produced instead of sending to landfill could create a net saving of around 1 million tonnes of CO_2 equivalent each year.

Trends

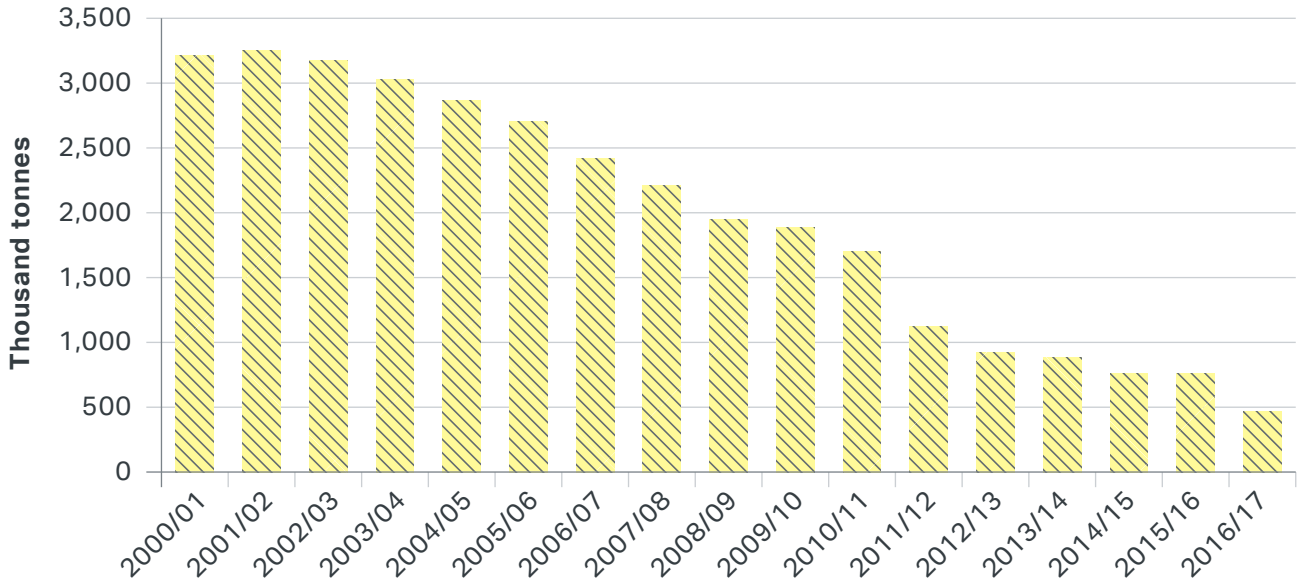
LACW to landfill has decreased steadily since 2001/2 with more rapid decrease since 2010/11:

- there has been a 70 per cent 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 463,000 tonnes in 2016/17
- between 2010 and 2015 lower amounts of London's LACW have been produced and less sent to landfill, however more continues to go incineration and recycling has flat lined at 30 per cent.

Likely future trend

LACW to landfill is expected to decrease as landfill becomes more expensive and more interventions are put in place to promote recycling.

Figure 4.4: Tonnage of local authority collected waste sent to landfill in London



Source: https://data.london.gov.uk/dataset/local-authority-collected-waste-management-london

INDICATOR: LACW CO_2 EMISSION PERFORMANCE

Overview of current position

London's municipal waste management activities, especially reuse and recycling, can deliver significant lifecycle CO_2e savings. CO_2 emissions can be saved by improvements in reduction and recycling that avoid emissions associated with the manufacture of virgin materials. CO_2e savings from recycling can then be netted off from emissions produced from incineration and landfill, presenting a net lifecycle CO_2 performance.

The Mayor has developed a CO_2e emissions performance standard (EPS) for all of London's LACW activities to work towards achieving. The EPS approach considers full lifecycle emissions associated with the production, reprocessing and final disposal of materials. Performance is considered on a CO_2e produced per tonne of waste managed metric.

This approach is considered more appropriate than traditional weight based recycling targets because chasing the heaviest materials, like glass and green garden waste, doesn't always achieve the greatest economic and environmental benefits. Recycling lighter, carbon rich materials like plastics, metals and textiles can deliver high CO_2 savings and fetch higher prices on the reprocessing markets, which can provide a revenue stream to local authorities.

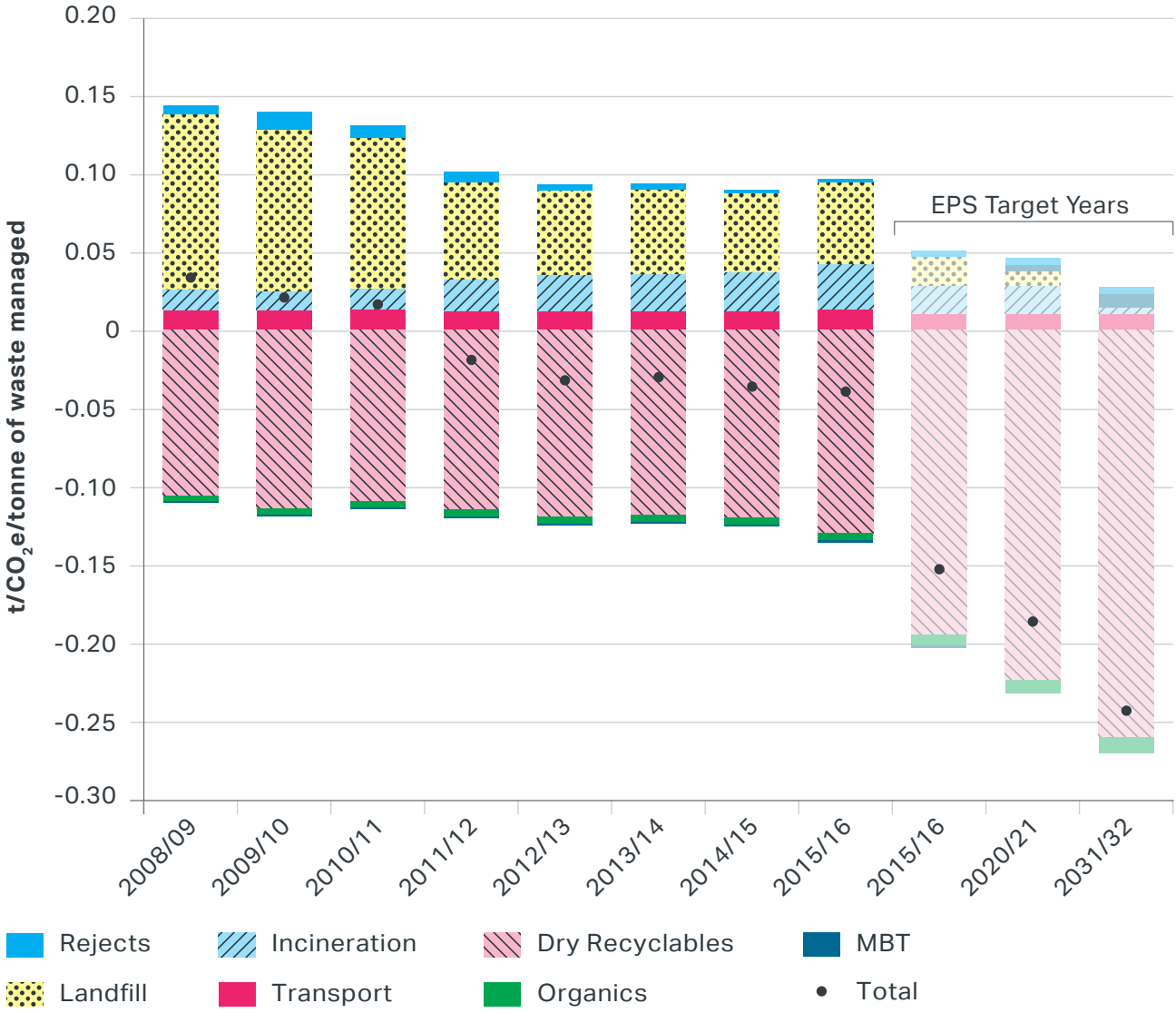
Trends

London's performance has improved steadily between 2008 and 2015 from being a net producer of 135,000 tonnes CO_2e in 2008 to a net saver of 121,000 tonnes of CO_2 in 2014/15, when considering lifecycle emissions. This represents a combined 255,000 tonne CO_2e saving over this seven year period. There was a slight increase in performance in the amount saved in 2014/15. There is a long way to go to meet the Mayor's target of 770,000 tonnes CO_2e saved per year by 2020 and 1.1 million tonnes by 2031. Reducing waste and significantly boosting recycling rates, particularly of high embodied carbon materials present the greatest opportunities for achieving the EPS targets. See Figure 4.5 for London's performance since 2008 on a per tonne of waste managed basis.

Likely future trend

Lifecycle CO_2 emissions are expected to decrease as London's recycling performance increases and waste authorities focus more on targeting high value, carbon-rich materials, including plastics, metals and textiles.

Figure 4.5: London's performance on a per tonne of waste managed basis



Source: https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/emissions-performance-standard-eps-annual

INDICATOR: CONSTRUCTION, DEMOLITION AND EXCAVATION WASTE

Overview of current position

This indicator is a measure of construction, demolition and excavation arisings in London.

It is estimated London produces around 9 million tonnes of CDE waste per year. Actual amounts will depend on the amount of construction activity happening. Construction and Demolition waste achieves relatively high recycling performance of between 60 - 85 per cent, mainly through reuse of soils and inert materials. Less is known about excavation waste recycling performance. However, much of this material is not suitable for recycling and has to go to landfill/landfill capping.

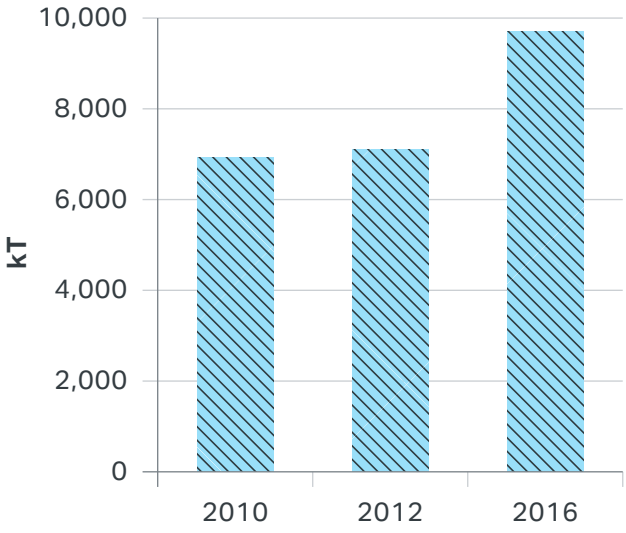
Trends

London's CDE arisings are estimated to have increased from 6.9 million tonnes in 2010 to 9.7 million tonnes in 2016. New CDE waste arisings estimates and forecasts have been undertaken in preparing the London Plan in 2016.

Likely future trend

CDE waste arisings is expected fall slightly from 9.7 million tonnes in 2016 to 9.2 million tonnes in 2036 as more waste is reused and recycled on site, achieving the Mayor's 95 per cent recycling target by 2020.

Figure 4.6: CDE arisings estimates



Source: London Plan Waste modelling, GLA 2016

INDICATOR: COMMERCIAL INDUSTRIAL WASTE

Overview of current position

This indicator is a measure of commercial industrial arisings in London, estimated at 5.1 million tonnes estimated to be produced in 2015. These figures are considered as a minimum for GLA waste planning purposes to help ensure that sufficient land is identified and safeguarded for as much as possible the management of this waste happens in London.
It is estimated that C&I waste activities achieve a 48 per cent recycling rate.

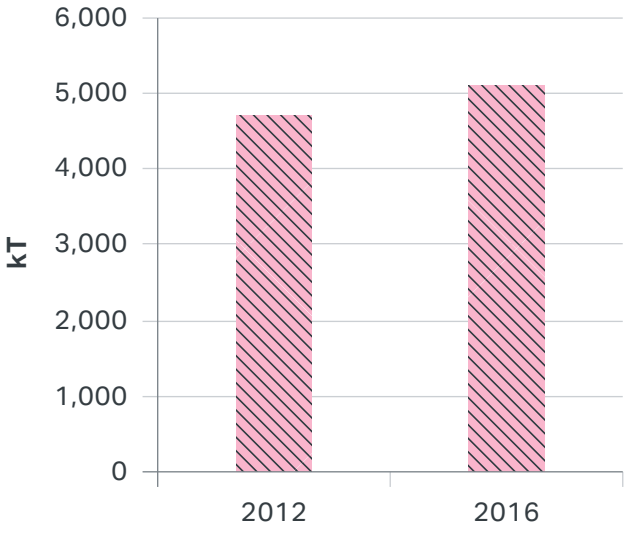
Trends and future trends

Limited robust data is available to present recent trends. However, a 2009 survey estimated C&I arisings to be 40 per cent less than previous estimates undertaken in 2002. This data is to be treated with caution and considered to be a low growth scenario.
Using 2011 census data The London Plan has projected C&I waste arisings will grow by 2.5 per cent p/a to 2036 in line with projected population and employment growth rates. The London Plan sets a target to recycle 65 per cent municipal commercial waste by 2030.

Likely future trend

The London Plan has projected that C&I waste arisings will grow by 2.5 per cent p/a to 2036. It is anticipated that a new national waste C&I arisings study will be undertaken in preparing the London Plan post 2019.

Figure 4.7: C&I arisings estimates (kT)



Source: London Plan Waste modelling, GLA 2016

Adapting to climate change

Our changing climate and associated extreme weather events are applying pressure to London's infrastructure including transport, homes, public buildings, businesses and the livelihood of Londoners. The impacts of climate change are set to increase, and with this we will face the following risks:

- flood risk - London is relatively well protected against tidal flooding, but parts of London are vulnerable to river, surface water, groundwater and sewer flooding.
- drought - if we have two consecutive dry winters, London is at risk of drought conditions and water supply restrictions.
- heat risk - London is getting hotter. Extreme hot weather events are occurring more frequently and changing demographics and increased urban development are increasing heat risk in London.

The Thames Barrier provides a high level of protection against tidal flood risk in London. However, many areas of the city remain vulnerable to surface water and river flooding and some areas are at risk of flooding from sewers and groundwater. We know that 47,613 existing homes are at high or medium risk of tidal or fluvial flooding in London. London has also experienced the impact of heavy rainfall and associated surface water flooding affecting homes, business and the transport networks. This can lead to the loss of productivity, economic impacts and the social and potentially health impact of being flooded. Poorer communities tend to be most adversely affected by flooding, being more likely to be located in risk areas, less able to invest in protection measures, and less able to recover from a flooding incident.

Climate change predictions are that we will get more intense storms which will increase the risk of surface water and fluvial flooding. Increased flooding in London will cause problems in homes, businesses and infrastructure. An important consideration is the inter-connectivity of our infrastructure systems. Even systems that may be thought not to be at risk of flooding can be affected – for example mobile phones rely on transmitter stations/masts that can lose power if the local electricity supply is affected by flooding.

It is difficult to report evidence that gives a clear indication of flooding impacts as these are inherently linked to localised weather patterns and can also reflect local conditions such as river or drainage blockages or even vehicles driving through floodwaters. Therefore, this chapter focuses on the number of properties identified within flood risk areas and on sea level rise.

London and the south east of England are in a water stressed part of the country, because the total rainfall is relatively low and the population is relatively dense. If we have two consecutive dry winters, London is at risk of a drought situation with restrictions on water use. Such restrictions can quickly have a significant economic and social impact. We are slowly becoming more water efficient but the rise in population and economic activity is increasing our total water consumption. The climate is predicted to become warmer, which is likely to lead to increased water use and more intense rainfall patterns will also make capturing rainwater more challenging. Therefore, meeting increased water demand will be more challenging in future. In this chapter we present the key indicators used to monitor London's water balance. This includes the amount of water lost through leakage and average rates of water consumption.

London also generates its own microclimate, known as the Urban Heat Island (UHI), which can result in the centre of London being up to 10°C warmer than the rural areas around London, increasing the effects of hot weather. Summer heatwaves may make our homes, workplaces and public transport uncomfortable, and can have health impacts, particularly for disadvantaged people.

We must also recognise the impact that climate change will have on existing and new infrastructure. Our future homes and businesses must be resilient to the impacts of climate change in order to allow London to be a safe and attractive place to live, visit, and work.

INDICATOR: SEA LEVEL (FLOOD RISK)

Overview of current position

This indicator is a measure of London's tidal flood risk. Sea levels are steadily rising. This has long been understood, for example by the designers of the Thames Barrier in the 1960s-70s, even though they didn't fully understand the reasons. Thanks to this understanding, the Thames Barrier and other gates, barriers walls and embankments, were designed with an allowance for sea level rise. This has given London world class tidal flood defences that, with some alteration and proper maintenance, will continue to provide protection until at least the middle of the century.
The Environment Agency has developed the Thames Estuary 2100 plan to monitor and manage Thames Tidal defences throughout the century and to respond to changes in sea level and risk, as appropriate.

Trends

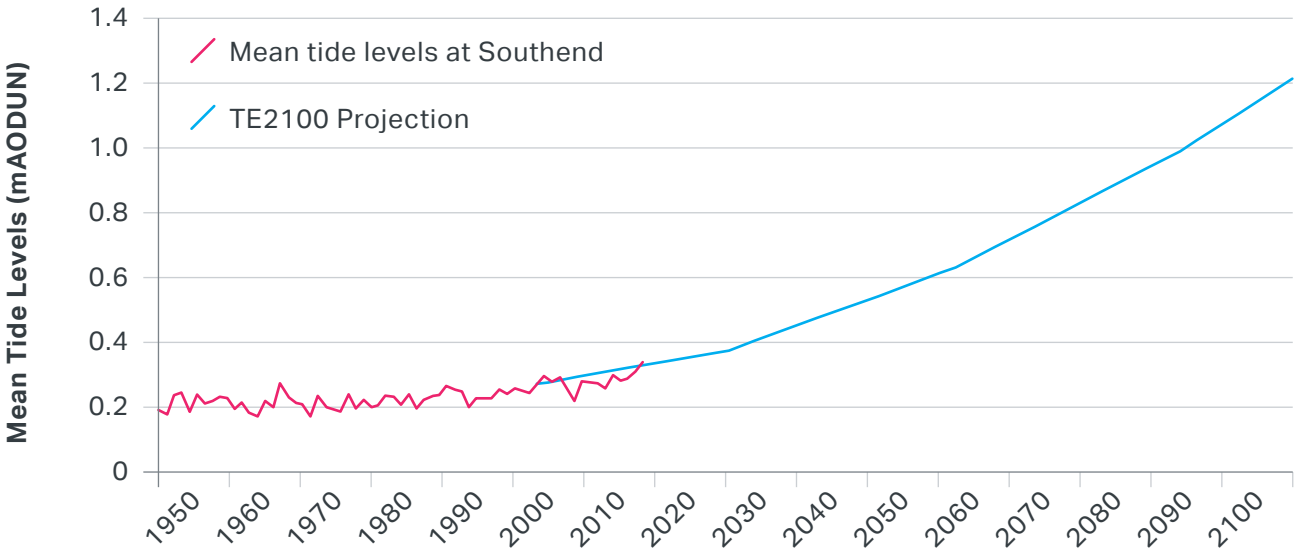
To date, sea levels are rising broadly in line with what was predicted in the TE2100 plan

The trend in the number of closures of the Thames Barrier shows a general slow increase, with some particular peaks relating to "fluvial" based closures. Detailed information on the TE2100 5 Year Review can be found here.

Likely future trend

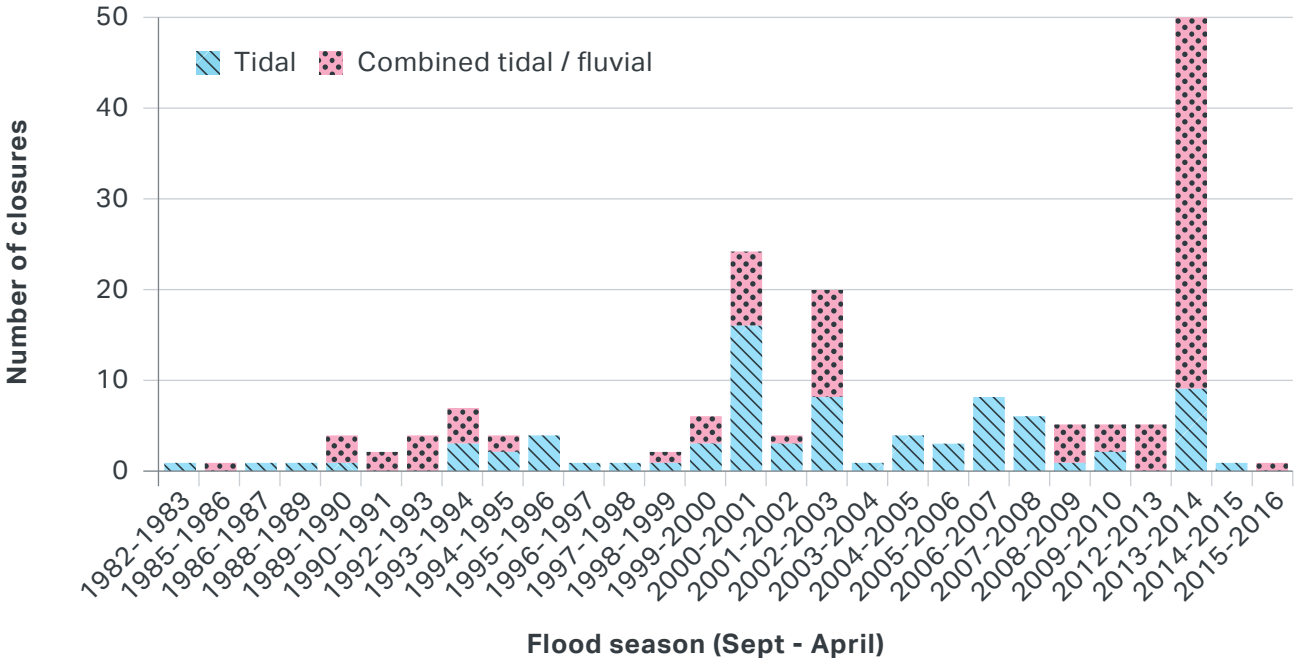
There is considerable uncertainty with sea level predictions. The rate of ice melt in both the Arctic and Antarctic regions is higher than expected. There is concern about the thermal expansion of the oceans and the potential implications of the loss of large ice sheets. Therefore, the medium to long term trends are hard to predict, and the planning for tidal flood defences up to the end of the century allows for a wide range of potential sea level scenarios. It is, however, almost certain that the number of closures of the barrier will increase. This will mean that it will no longer be possible to close the barrier to protect west London from the effects of "fluvial" flood risk.

Figure 5.1: Mean tide levels at Southend with TE2100 Projection (1950-2100)



Source: Environment Agency 2017

Figure 5.2: Thames Barrier Closures by Flood Season



Source: Environment Agency TE2100 Plan: 5 Year Review[31]

INDICATOR: PROPERTIES AT RISK OF FLOODING (FLOOD RISK)

Overview of current position

This indicator is a measure of London's tidal and fluvial flood risk.

Approximately 15 per cent of London is within natural floodplains, much of it within the tidal floodplain of the Thames. Much of this land has been built on and we have good systems of flood risk management to reduce the likelihood of flooding occurring. Therefore, the majority of properties are at low risk of flooding. There are, however, still a significant number of properties (47,163 residential and non-residential properties) that are at medium and high risk of flooding from fluvial or tidal sources.

Trends

The number of properties at low risk of flooding is increasing. Much-needed new development is being built behind flood defences. Some properties that were at medium to high risk will have their risk levels reduced to low by new flood risk management projects.

Likely future trend

The number of properties at low risk of flooding is likely to further increase as much-needed new development is built behind flood defences. New development at medium to high risk should be limited to water compatible development. The number of properties at medium to high risk should decrease with the construction of flood risk management projects, although any significant increases in storm intensity could put more properties at risk of flooding.

Table 5.1: Non-Residential Properties at Risk

Risk Level	Tidal	Fluvial	Tidal and Fluvial	Total
High	448	2,153	154	2,755
Medium	225	4,413	478	5,116
Low	36,756	11,299	4,058	52,113
Very Low	11	804	59	874
Total	37,440	18,669	4,749	60,858

Table 5.2: Residential Properties at Risk

Risk Level	Tidal	Fluvial	Tidal and Fluvial	Total
High	1,084	8,826	705	10,615
Medium	702	26,115	1,837	28,654
Low	297,489	74,090	27,744	399,323
Very Low	100	2,086	9	2,195
Total	299,375	111,117	30,295	440,787

Source: Environment Agency National Flood Risk Assessment data, 2015

INDICATOR: WATER SUPPLY/ DEMAND BALANCE

Overview of current position

This indicator is a measure of London's exposure to drought risk and water efficiency.

London's population has grown by over 2 million people over the past 30 years. London's water supplies, however, have not grown significantly over the same period, although advances such as the ring main and Victorian mains replacement means that the water we do have is managed more effectively. The result is that the balance between available supplies and demand has become increasingly tight, to the extent that we are at risk of drought conditions following two dry winters. Thames Water has identified that a significant new water resource will be required by the late-2020s in order to maintain a satisfactory supply/demand balance for London and the south east of England.

Using water more efficiently in our homes and businesses can reduce the scale of additional water resource required in the future. Currently, water consumption within London is approximately 6 per cent higher than the average for England & Wales. This figure is slightly surprising given the prevalence of flats in London compared to houses, which usually consume more water, but may demonstrate that there is an opportunity for reductions to this consumption to be made.

Water leakage from the distribution system is an important aspect in the supply/demand balance. The rate of leakage within London is currently over 600 million litres/day or 24.4 per cent of all water put into supply. This is a huge wasted resource that costs both money and energy and results in more water being abstracted from the environment than is needed. However, the practicalities and cost of replacing all old pipework and fixing all leaks mean that there is in effect an economic level of leakage that we have to accept.

Leakage rates vary with weather conditions. Long periods of dry or wet weather tend to lead to increases in the number of leaks are the ground shrinks or swells. Occasional pipe strikes from other building and utilities works can result in dramatic pipe bursts occurring, and it can be expected that thousands of minor sub-surface leaks go undetected.

Trends

It is notable that metered properties use nearly 25 per cent less water than un-metered properties.

There has been a slight downward trend in water consumption, but London remains above the national average.

The leakage rate has fluctuated over recent years but has shown a general level of improvement.

Likely future trend

The water supply/demand balance will get tighter over at least the next 10 years as London's population continues to grow. Beyond 10 years, a significant new source of water supply is expected to become available that will restore the supply/demand balance to a more secure level.

New developments in London will be water efficient and this will mean that water consumption for these homes and businesses will be lower than for existing buildings. The installation of water meters in properties should mean that we see reductions in household water consumption.

Leakage rates are expected to continue to fall as significant leaks are repaired and sections of very old pipework are replaced. However, the leakage rate is not expected to fall below 20 per cent in the foreseeable future and this will have to be taken into consideration when planning additional water resource for the city.

Table 5.3: Water company supply data for the GLA area

Water Company	No. of households supplied	No. of businesses supplied	Average daily household consumption l/p/d		Average leakage amount & rate (Ml/d & %)	
			2000	2016/17	2000	2016/17
Thames Water	2,729,587	148,925	n/a	146.39	n/a	579.29 Ml/d 26.52 per cent
Affinity Water[32]	450,201	20,138	173.6	164.83	45.3 Ml/d 21 per cent	45.75 Ml/d 18 per cent
Essex & Suffolk Water[33]	186,186	9,502	160.1	154.62	38.37 Ml/d 18 per cent	23.5 Ml/d 16 per cent
SE Water	122,140	5,219	162.73	164.8	9.7 Ml/d 14.68 per cent	10.2 Ml/d 14.13 per cent

INDICATOR: HEAT RISK

Overview of current position

This indicator is a measure of heat risk in London and the impact extreme hot weather events have on people, properties and business.

The indicator includes the following datasets:

- population age
- external temperature and future predictions of external temperature across the London Urban Heat Island
- propensity of a dwelling to overheat due to its building geometry and physical characteristics (thermal insulation, air tightness, etc.)

A study by University College London shows that the highest levels of mortality due to excess heat in London were found in areas with larger elderly populations, towards the outskirts of London.
This study also shows that building characteristics cause a larger variation in temperature exposure (and therefore risk) than the Urban Heat Island (UHI) effect.

This baseline data on the UHI effect provides a way of identifying the areas in London and parts of the population that are most at risk from increased temperatures in the city. It can be used by the GLA, local authorities, and health and government departments in; assessing the suitability of planning applications, better evaluating the likelihood and potential impact of identified heat risk at local and/or London-wide level, and commissioning appropriate services. The analysis can be found here.

Trends

The Urban Heat Island map indicates that temperatures rise from outer London and peak in the city centre. The map also shows how temperatures can vary across the city – this depends upon the nature of the land cover, with urban parks and lakes being cooler than adjacent areas covered by buildings. The higher urban temperatures are caused by the increased capacity of the urban land surface (e.g. roads, buildings, pavements) to absorb and trap heat.

Likely future trend

In the summer of 2003 the highest temperature of 37°C was recorded in the UK. It is possible that this could be considered an average summer day by the 2040s and a cool summer day in the 2050s.

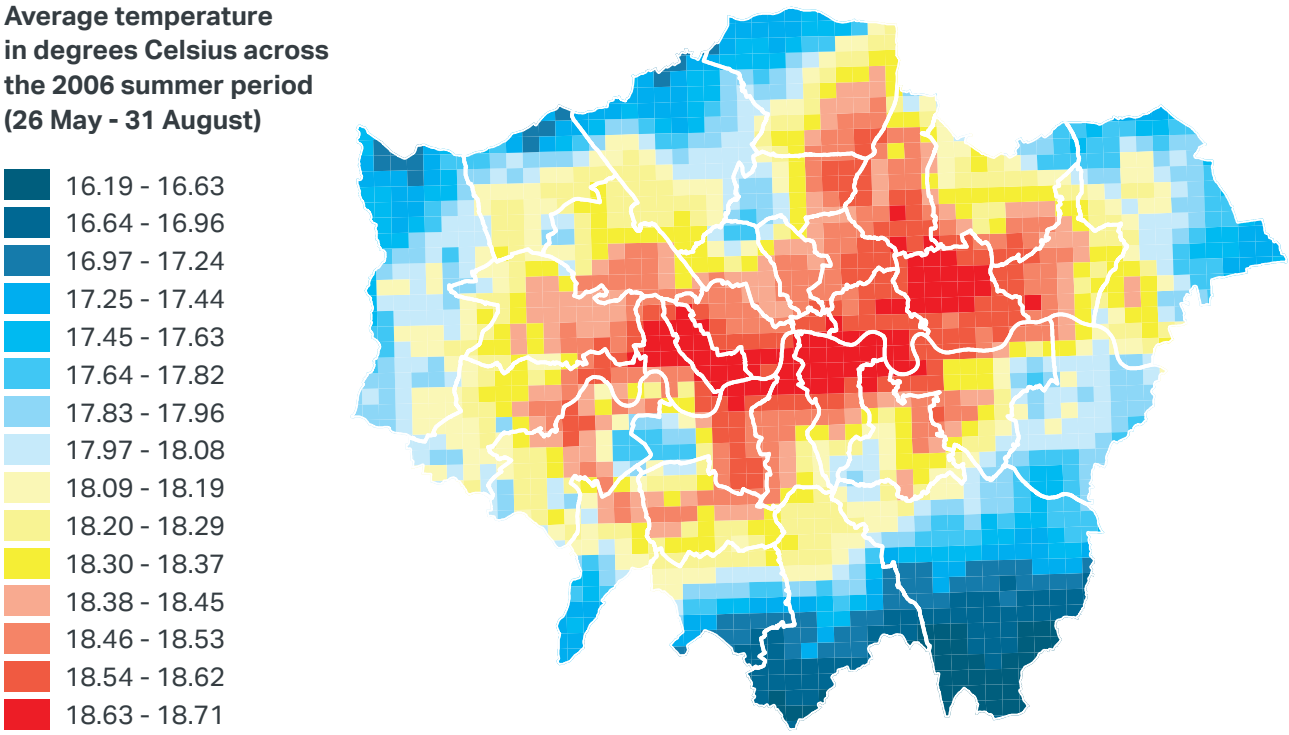
The UK Climate Projections UKCP09 show that by the 2050s one third of London's summer temperatures may exceed the Met Office current heat wave temperature threshold (day time

temperature of 32°C and night time temperature of 18°C)[34].

In addition, a threefold increase in man-made heat emissions could raise minimum night time temperatures by about 0.5°C, which would aggravate heat discomfort[35].

This demonstrates that the risk of overheating is likely to increase and further development in London to accommodate a growing population will increase the Urban Heat Island effect by changing land use from open space to developed areas.

Figure 5.3: Temperature distribution in London, August 2006



Source: https://data.london.gov.uk/dataset/london-s-urban-heat-island

Ambient noise

The Mayor plays an important role in minimising and mitigating against ambient noise in London. In this context, ambient noise includes noise from road, rail, air and water transport, and any other noise that the Mayor considers appropriate. Noise includes vibration and certain types of noise are specifically excluded, such as noise from sources that may be controlled by a local authority.

Various information resources exist that provide an indication of noise exposure in London. This includes resources such as strategic noise maps produced by Defra under the Environmental Noise Directive, noise exposure statistics that are derived from the strategic noise maps, noise attitude surveys, and records of complaints recorded by TfL.

Many of these resources have been developed as national projects, or designed to meet the reporting obligations associated with European directives. As such, the principal purpose of these projects has not necessarily been to provide a robust evidence base for input to London noise policy development. As a consequence, much of the information that might support a London noise evidence base contains significant limitations for that purpose, in terms of geographical coverage not relating directly to the London area, such as low statistical confidence associated with London noise survey results and inconsistent methods over time limiting the usefulness for trend analysis.

INDICATOR: NOISE COMPLAINTS

Overview of current position

This indicator is a measure of London's rate of complaints about noise.

Transport for London (TfL) monitors the number of noise-related complaints received each year. TfL received 865 noise complaints in 2016/17 (the most recent year for which records are available). This is an increase of 39 per cent from 2015/16. This reflects the increased noise from London Underground since the launch of the 24 hour Night Tube on the Central and Victoria lines in August 2016. The Night Tube network has since been expanded across several other lines. Approximately 29 per cent of all complaints relate to the noise from PA announcements at stations. The remaining 71 per cent relates to complaints about noise and vibration on London Underground.

Public Health England (PHE), through the Public Health Outcomes Framework, reports the rate of noise complaints received by all English local authorities on an annual basis. This particular analysis indicates that the rate of complaints about noise for the London Region (viewed as complaints per 1,000 people) has remained relatively steady but is significantly higher than the rate of complaints for England. The last recorded data is 2014/15 so does not show recent trends. This analysis can also be undertaken at borough level, allowing comparisons within London.

It should be noted that the underlying data reported by PHE is collated and analysed by the Chartered Institute of Environmental Health (CIEH) from local authority returns. The complaints figures from the CIEH have been a traditional source of fairly reliable data on noise complaints made to LAs, including many of the boroughs who voluntarily record and submit information on an annual basis.

Trends

Table 6.1 shows trends against TfL's noise performance indicators since 2014/15. Figure 6.1 shows the Public Health Outcomes Framework rate of noise complaints in London.

Likely future trend

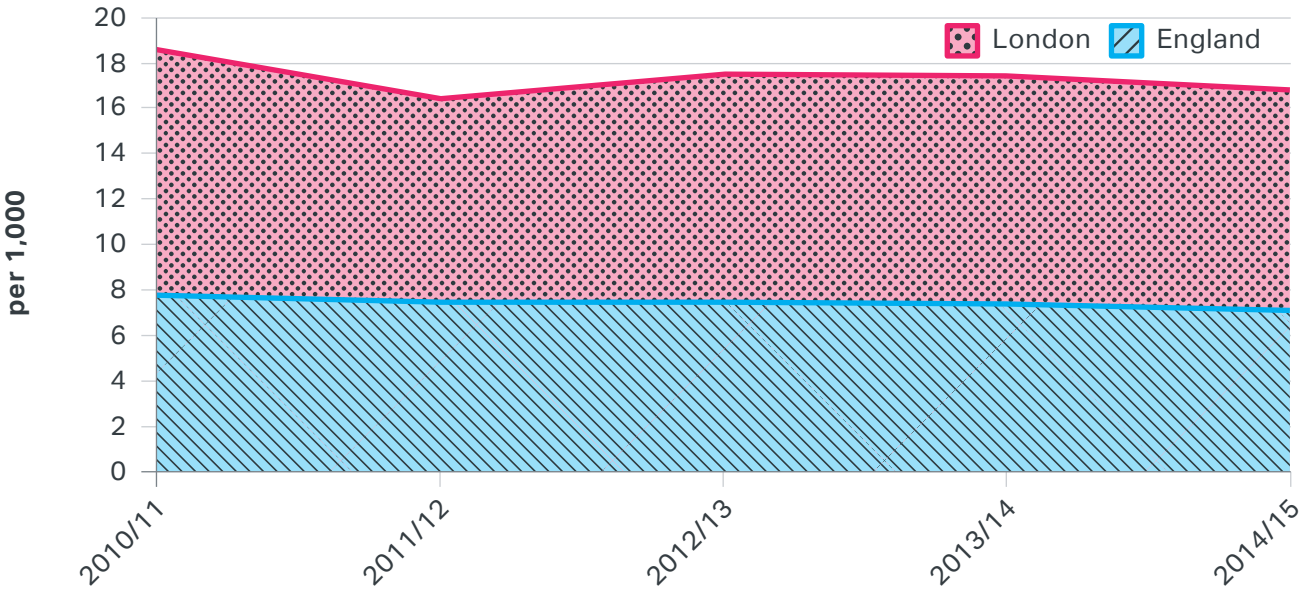
As London continues to grow and activity intensifies, it is expected that the number of noise complaints will increase. With major construction projects in the pipeline, such as Crossrail 2, HS2 and the Bakerloo Line extension, it is likely that a significant number of construction noise related complaints will continue to be received. Moreover, the move to a 24 hour economy, and initiatives such as the expansion of the 24 hour Night Tube, could generate additional noise complaints.

Table 6.1: Noise performance indicators (TfL recorded noise complaints by year)

2014/15	2015/16	2016/17
613	736	1,025

Source: Transport for London

Figure 6.1: Public Health Outcomes Framework rate of noise complaints in London



Source: Public Health Outcomes Framework http://www.phoutcomes.info/search/noise#page/4/gid/1/pat/15/par/E92000001/ati/6/are/E12000007/iid/11401/age/1/sex/4

INDICATOR: POPULATION EXPOSURE TO TRANSPORT NOISE

Overview of current position

This indicator is a measure of Londoners, exposure to noise from road, rail and air transport sources.

There are a number of direct and indirect links between exposure to noise and health and well-being outcomes. Exposure to noise can cause disturbance and interfere with activities, leading to annoyance and increased stress. Furthermore, there is increasing evidence that long term exposure to high levels of noise can cause direct health effects, such as heart attacks and other health issues. These in turn present an economic cost to society.

Defra, through two strategic noise mapping exercises required under the Environmental Noise Directive (END, Directive 2002/49/EC) in 2007 and 2012, has identified exposure to environmental noise from major roads, major railways and major aircraft noise and from roads, railways, air noise and industry in agglomerations (N.b. agglomerations are urban areas defined under the END. The Greater London agglomeration is not geographically consistent with the GLA area). Noise from helicopters, water transport, construction and entertainment venues are not included. The next round of noise mapping is expected to take place in 2018.

The 2007 and 2012 noise maps have been used to underpin other policy programmes. The results were used to identify Important Areas (road and railway noise hotspots) as part of Defra's Noise Action Planning process, and the results of the road, rail and air noise maps were used to inform 2 health based indicators reported as part of the Public Health Outcomes Framework (PHOF).

The PHOF indicators use combined (summed) noise exposure results for road, rail and air as follows:

- Day noise: the percentage of the population exposed to road, rail and air transport noise of 65 dB(A) or more, $L_{Aeq,16}$ per local authority (16h is the period 07:00 – 23:00), and
- Night noise: the percentage of the population exposed to road, rail and air transport noise of 55 dB(A) or more, Lnight ($L_{Aeq,8}$) per local authority (8h is the period 23:00 – 07:00)

Although the 'acoustic' methodology is consistent between the 2007 and 2012 noise maps, there are some differences in noise source 'input' data in the road and rail maps. In particular, the road traffic noise map in 2007 was based on a road noise source input dataset that is in line with air quality and emissions modelling in London (the LAEI). However, in 2012, it should be noted that a different road input dataset was used, which omitted some of the noise sources previously included in 2007 –

this typically related to B class roads and other local roads. As a consequence, Defra's 2012 road traffic noise map, for the London agglomeration, systematically under-predicts noise levels relative to 2007, especially at noise levels around and below 65dB for the various indicators produced by Defra. The road sources are also inconsistent with those used for London air quality and emission assessments.

Caution should be taken when analysing the PHOF indicators for any trends, especially if the indicator is based upon noise levels below 65 dB. It is also useful to disaggregate the 3 noise sources to assess whether exposure tends are different for each transport source.

Trends

Table 6.2 shows the percentage of the population in London authorities exposed to road, rail and air transport noise of 65 dB $L_{Aeq,16}$ or more, as reported in the PHOF.

Table 6.3 shows the percentage of the population in London authorities exposed to road, rail and air transport noise of 55 dB L_{night} or more during the night-time, as reported in the PHOF.

Figures 6.2 and 6.3, show road traffic noise exposure comparisons between the round 1 (2007) and round 2 (2012) strategic noise maps for the Greater London agglomeration.

The results show an increase in noise exposure over the five year period for levels 70-74 dB L_{den} and from 60-64 dB L_{night} respectively.

Lower noise exposure levels show a decrease over the same period. However, this can largely be attributed to changes in modelling methodology and the removal of a number of roads in the R2 assessment.

Figures 6.4 and 6.5 show railway noise exposure comparisons between the round 1 (2007) and round 2 (2012) strategic noise maps for the Greater London agglomeration. The results show an increase in noise exposure over the five year period for all noise exposure classes. However, these results should be treated with caution due to changes in the modelling specification between round 1 and round 2.

Likely future trend

It is difficult to determine a clear trend in noise exposure using currently published data.

The PHOF data indicates shows little change for L_{Aeq16} noise exposure levels between 2007 and 2012, however it is also known that some noise sources were not included in the latter assessment. Limitations in underlying information are further highlighted by the L_{night} exposure classes, which report at a 5 dB lower class range.

Analysis of the END road L_{den} exposure results indicates an increasing trend in road traffic noise exposure at high noise levels. The decrease in exposure at lower levels may again be explained by inconsistencies in modelling, which will affect lower exposure levels more significantly than higher levels. A similar pattern is demonstrated for road traffic exposure at night time.

Railways noise exposure levels as reported from the END assessments demonstrate an increasing trend in railway noise exposure between 2007 and 2012.

There are understood to be inconsistencies with the underlying data that limit the ability to draw robust conclusions in relation to transport noise exposure across London. However, with an ongoing increase in road traffic and increasing population density and house building programme, it is likely that there will be a risk of increased exposure to road and railways transport noise.

In addition to the next round of noise mapping expected to take place in 2018, there is a need to further develop the London evidence base in this area.

Table 6.2: The percentage of the population exposed to road, rail and air transport noise of 65dB(A) or more, during the daytime as reported in the PHOF

Period	Count	Value (per cent)	England (per cent)
2006	943,740	12.5	5.4
2011	941,680	11.5	5.2

Table 6.3: The percentage of the population exposed to road, rail and air transport noise of 55 dB(A) or more during the night-time as reported in the PHOF

Period	Count	Value (per cent)	England (per cent)
2006	1,429,420	18.9	12.8
2011	1,252,840	15.3	8

Source: Public Health Outcomes Framework http://www.phoutcomes.info/search/noise#page/4/gid/1/pat/15/par/E92000001/ati/6/are/E12000007/iid/90357/age/1/sex/4

Figure 6.2: END R1 and R2 population noise (L_{den}) exposure results for road traffic noise in the Greater London agglomeration (reported by classified band according to the END)

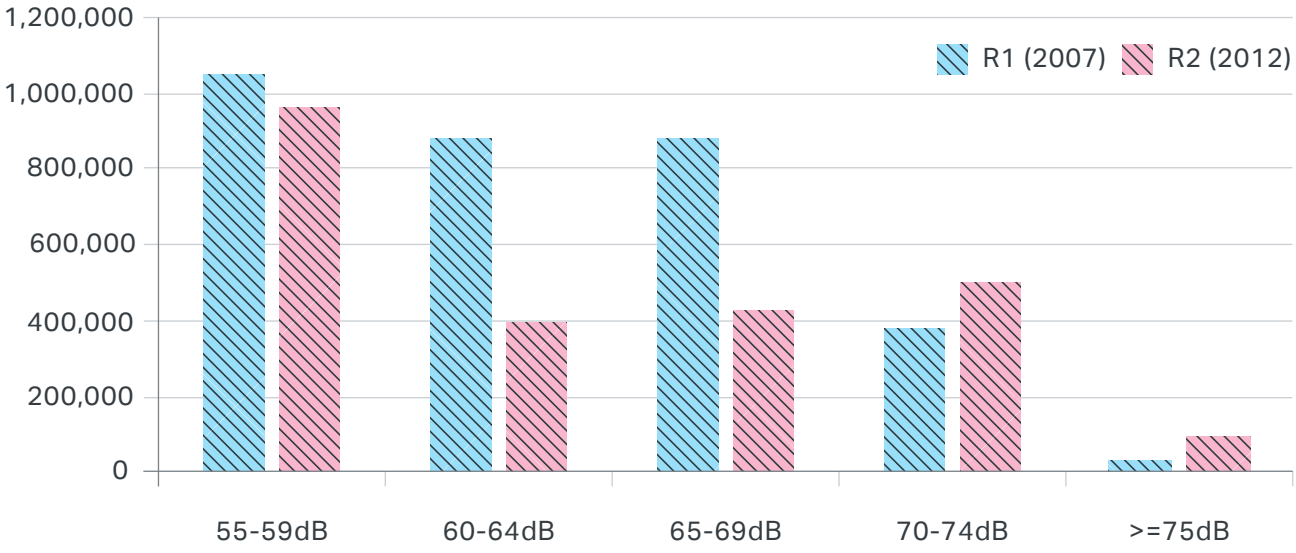


Figure 6.3: END R1 and R2 population noise (L_{night}) exposure results for road traffic noise in the Greater London agglomeration (reported by classified band according to the END)

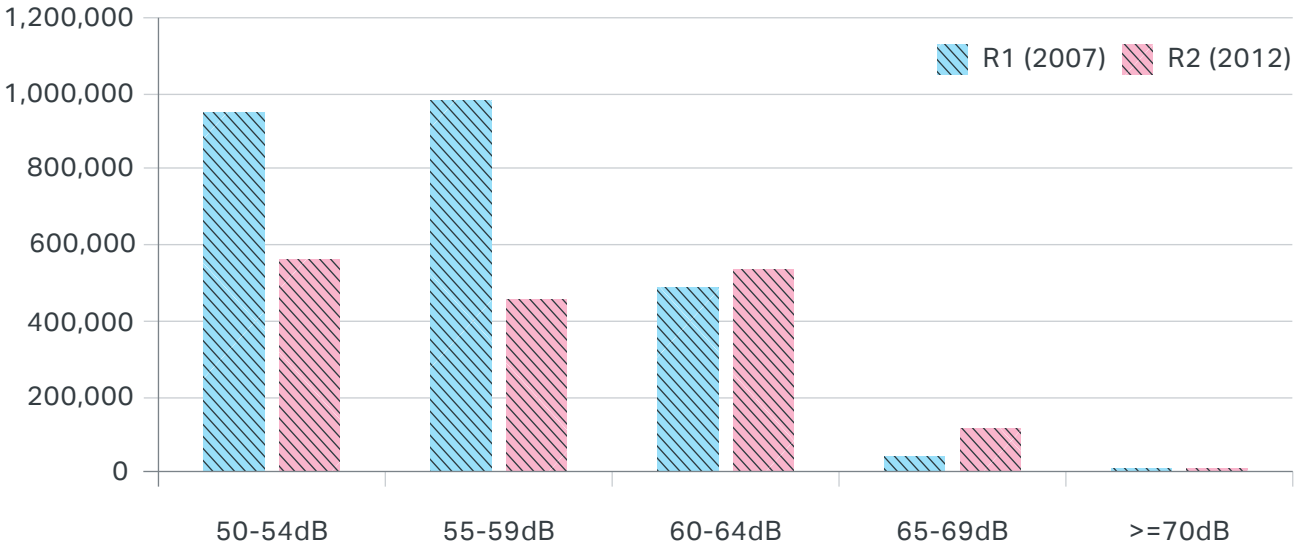


Figure 6.4: END R1 and R2 population noise (L_{den}) exposure results for railway noise in the Greater London agglomeration (reported by classified band according to the END)

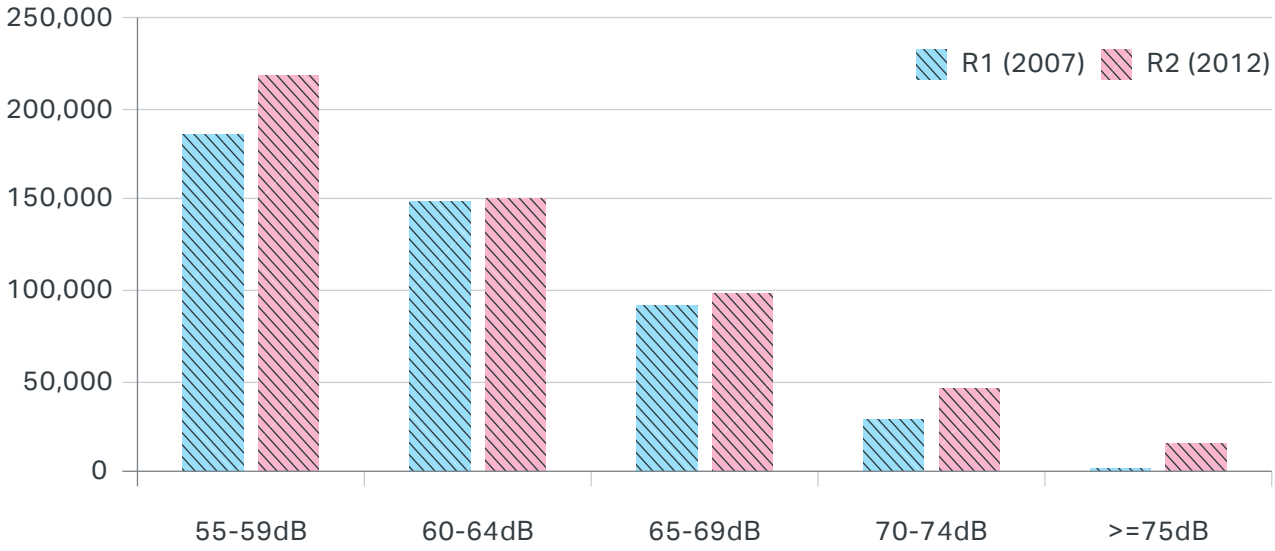
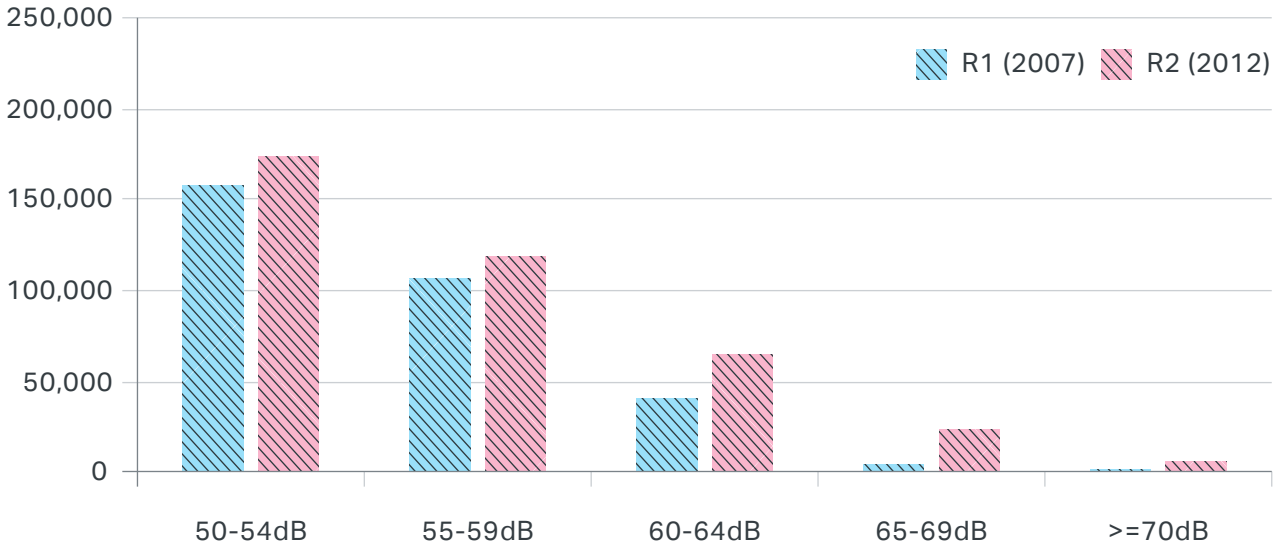


Figure 6.5: END R1 and R2 population noise (L_{night}) exposure results for railway noise in the Greater London agglomeration (reported by classified band according to the END)



Source: https://data.gov.uk/dataset/noise-exposure-data-england and http://www.eea.europa.eu/data-and-maps/data/data-on-noise-exposure-2

INDICATOR: LOW NOISE ROAD SURFACING

Overview of current position

This indicator is a measure of the proportion of London's strategic road network covered by low noise road surfacing.

Tyre-road noise is typically dominant at speeds above 40 miles per hour, but is becoming more significant at lower speeds, down to 30 mph or even lower as tyres on many cars have become wider as the weight of vehicles increases.

Transport for London, who is responsible for the Transport for London Road Network (TLRN), aims to use low noise surfacing materials wherever appropriate.

Note that the TLRN carries one third of London's road traffic, and consists of 5 per cent of London's total roads – 580 kilometres in total. The remaining 95 per cent of public roads and streets are also managed by the boroughs. No data exists for all London roads.

Trends

Table 6.4 shows TfL's performance on low noise road surfacing since 2011.

Likely future trend

The most recent record shows that 60 per cent of TLRN roads are surfaced with lower noise surfacing materials, suggesting a trend towards meeting this target by 2020.

There is a need to maintain future records to support potential expansions of this policy, or measure non-TfL road coverage across London.

Table 6.4: Low noise road surfacing as a percentage of the TLRN

2011	2012	2013	2014	2015	2016	2017	2018
26	N/A*	39	42	45	51	56	60

*KPI not recorded in this year.

Source: TfL

INDICATOR: ELECTIC (QUIETER) BUS FLEET

Overview of current position

This indicator is a measure of the proportion of London's bus fleet emitting noise 2dB below legal limit.

70 per cent of buses satisfied the TfL target in 2014/15, following a rapid improvement in this area in recent years.

Trends

Table 6.5 shows TfL's performance on a quieter bus fleet since 2005/06.

Likely future trend

Further improvements are expected as hybrid/electric and zero emission buses are introduced. Pure electric buses offer the potential for much lower noise and vibration levels compared to diesel vehicles.

Low Emission Bus Zones are one of a number of measures the Mayor has asked TfL to lead by example on to reduce emissions from the capital's bus fleet, including:

- making sure all buses operating in the central Ultra Low Emission Zone comply a year earlier by 2019, meaning each of the 3,100 double-deck buses operating in the zone will be Euro VI hybrid.
- expanding the ULEZ retrofit programme up to 3,000 buses outside the central zone.
- procuring only hybrid or zero emission double-decker buses from 2018.

Table 6.5: Percentage of the bus fleet 2dB below the legal limit

05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15
0	4	8	14	28	37	54	61	64	70

Source: http://content.tfl.gov.uk/health-safety-environment-report-2015.pdf (page 66)

References

1 Which reflects the requirements set out in the EU Ambient Air Quality Directive.

2 Due to monitoring methodological changes a time series can only be derived for PM_{10} from 2004.

3 Due to monitoring methodological changes a time series can only be derived for $PM_{2.5}$ from 2006

4 http://www.gigl.org.uk/our-data-holdings/keyfigures/

5 Domestic gardens cover about 24 per cent of Greater London but 10 per cent of this is comprised of hard surfaces.

6 https://www.london.gov.uk/sites/default/files/measuring_tree_canopy_cover_2015.pdf

7 https://data.london.gov.uk/dataset/access-public-open-space-and-nature-ward

8 Calculated on the basis of the Public Open Space hierarchy in the London Plan.

9 http://www.greenflagaward.org.uk/about-us/

10 http://www.gigl.org.uk/our-data-holdings/open-spaces/areas-of-deficiency-in-access-to-public-open-space/

11 http://www.gigl.org.uk/our-data-holdings/designated-sites/areas-of-deficiency-in-access-to-nature/

12 https://www.gov.uk/government/collections/monitor-of-engagement-with-the-natural-environment-survey-purpose-and-results

13 https://www.hlf.org.uk/about-us/news-features/parks-matter-%E2%80%93-great-public-asset/state-uk%E2%80%99s-public-parks

14 http://greenflagaward.org/award-winning-sites/london/

15 Defined as "those sites which are being managed in order to conserve their nature conservation interest." This would be the responsibility of the site owner. https://www.gov.uk/government/statistics/local-sites-in-positive-conservation-management--2

16 Figure calculated from GiGL SINC dataset (May 2015).

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24 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500548/Thames_RBD_Part_1_river_basin_management_plan.pdf

25 Data reported under Key Performance Indicator 23 in London Plan Annual Monitoring Report https://www.london.gov.uk/sites/default/files/amr12_july_update.pdf

26 Between 2009 and 2016 the number of WFD waterbodies changed. The 2016 data considers only surface water bodies.

27 http://www.lwarb.gov.uk/wp-content/uploads/2015/12/LWARB-circular-economy-report_web_09.12.15.pdf

28 http://www.nortonrosefulbright.com/knowledge/publications/127576/the-circular-economy-revolution

29 https://data.gov.uk/dataset/local_authority_collected_waste_management_statistics

30 WRAP 2014

31 Only years that experienced barrier closures are depicted.

32 The number of households and businesses supplied is specific to Affinity's London customers, however the consumption and leakage data represents the Pinn Water Resource Zone, which is not perfectly aligned with the London boundary.

33 The data from Essex & Suffolk Water is based on the Essex Water Resource Zone, which includes areas outside the London boundary. It is likely that the leakage rate is closer to 20-30% within the London boundary.

34 http://ukclimateprojections.metoffice.gov.uk/

35 Climate UK, A Summary of Climate Change Risks for London http://climatelondon.org.uk/wp-content/uploads/2012/01/CCRA-London.pdf

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