OF THE ENVIRONMENT REPORT

for LONDON

2001

ENVIRONMENT AGENCY

EA - Thames STA

Report contents

Foreword

The Environment Agency has wide ranging responsibilities to protect, enhance and report on the need to monitor the state of the environment in London to achieve our vision of 'a first class environment for a world class city'.

The report is our assessment of the state of the environment in London and highlights the environmental challenges we all face for which we in the Agency have a particular interest. If we are to progress towards a more sustainable society we need to be well informed about the current state of the environment and the pressures acting upon it. The baseline provided by this report will help us, along with the Greater London Authority, to assess the impact of future changes.

Chris Birks
Regional Director – Thames Region

EXECUTIVE SUMMARY

The Environment Agency has a remit under the Environment Act 1995 to report on the current and future state of the environment. In order to achieve our vision for London of 'a first class environment for a world class city', we need to monitor the state of the capital's environment and identify key changes and the causes behind them. London is under increasing pressure from a number of sources and balancing the economic wellbeing of the capital, with a healthy environment and society will be a significant challenge for all those involved.

This report sets out information on the current state of London's environment and the issues affecting it for which the Environment Agency has a primary interest. We see this report as making an important contribution to the sustainable development agenda and to the Greater London Authority's (GLA) forthcoming state of the environment report and strategies.

The following issues, which are of particular importance for London, are discussed in this report:

Air Quality – levels of air pollution frequently exceed those recommended for human health, the primary cause is vehicle emissions.
Water Quality – while considerable improvements have been made, combined sewer overflows still threaten London's rivers.
Biodiversity – London is home to a number of nationally and internationally important species, however flora and fauna are constantly under threat from development and pollution.
Water Resources – London relies on water from outside the city and demand for water is increasing and needs to be balanced with supply. Climate change poses an additional threat to supplies.
Waste Management – most of London's waste is transported to landfill sites in neighbouring counties and current waste management practices are unsustainable.
Flooding – significant areas of London are at risk from flooding and require our protection. The threat is likely to increase with climate change and sea level rise.
Riverside Development – valuable environmental assets are being lost as a result of encroachment along the Thames.
Transport – levels of traffic continue to rise, threatening the environment and human health.
Climate Change – climate change is an increasing threat that will impact directly on biodiversity, water resources and flooding.
Land Quality – the pressure for reuse of previously developed land will increase the threat of contamination from our industrial past.

Under each of these issues we have presented a number of indicators to enable us to monitor the future state of the environment and the pressures acting upon it. The recent trends shown by these indicators are summarised opposite. We hope that in the future we will be able to provide information on additional indicators, which we have also highlighted in the report.

Whilst the report focuses on the current state of London's environment, many of the issues raised have an influence over a much wider area. London is reliant on this wider environmental catchment for its basic resources, such as water, and to dispose of its waste. For all of these issues, the impacts of actions in London can have a direct effect on the surrounding region's environment and vice versa. Some of the indicators in this report have been included to reflect London's strategic importance.

The indicators illustrate the pressures that are currently placed upon London's environment. Balancing these environmental pressures with social and economic concerns will be a major challenge for the GLA, the Mayor and the other organisations working in the capital. The following key priorities, in particular, will need to be addressed:

- London needs to tackle its transport and resulting air quality problems;

- we need to plan for the future as climate change will affect a variety of issues, not least flood risk, water resources, water quality and biodiversity;
- floodplains need to be protected from inappropriate development;
- the agencies involved will need to work together to address public concerns over the reuse of contaminated sites. The identification of these sites and the risk they pose must be a priority;
- London needs to increase the current rates of recycling and waste minimisation and seek sustainable solutions to London's waste management;
- we need to manage demand for water, continue to tackle leakage and promote water efficiency. Future water

resource management is an issue that needs to be addressed on a scale wider than London and will impact across the whole of the south east of England;
- we need to continue to manage rising groundwater in London and utilise the available resource;
- the Thames and other rivers need to be protected from encroachment and opportunities to achieve environmental enhancements implemented;
- London's drainage problems, particularly combined sewer overflows, will require considerable investment and co-operation between a number of organisations to produce a long-term sustainable solution;
- valuable species and habitats need to be protected and conserved and opportunities for enhancement realised.

These issues and priorities can only be tackled through action by many different organisations in partnership with the Environment Agency. This report is therefore aimed at a number of audiences. We hope that it will be used to inform and influence a range of strategies, action plans and initiatives, particularly those undertaken by the GLA. By working in partnership with other organisations it is hoped that the integration of ideas and information will help deliver a more balanced and sustainable environment.

Summary of recent changes in indicators

positive progress/improving

- Emissions to air from IPC processes
- Chemical river water quality
- Compliance with EC Bathing Water Directive
- Reductions in water leakage levels
- Commercial traffic on the tidal Thames

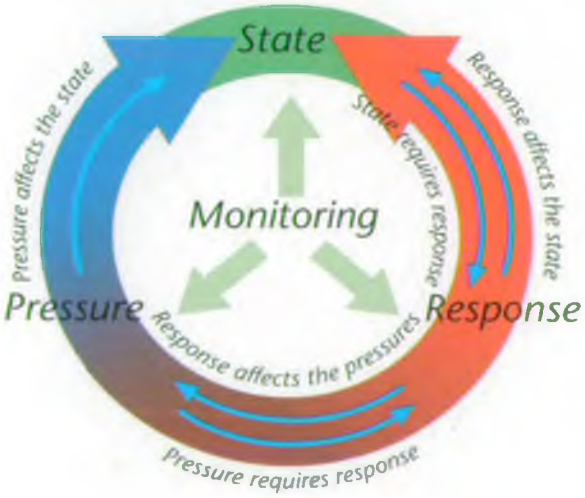
change uncertain or mixed

- Biological river water quality
- Tidal Thames water quality: dissolved oxygen
- Numbers of salmon returning to the River Thames
- Water levels in the River Thames
- Number of tidal flood warnings issued
- Number of heavy rainfall events

unfavourable progress/deteriorating/ no progress

- Levels of NOx and particulates pollution at key sites in London
- Distribution of key species and habitats in London – Water Vole, Reed Bunting, Coastal Salt Marsh
- Spread of alien invasive species – Chinese Mitten Crab and Floating Pennywort
- Rising groundwater under London
- London's waste production and management
- Number of Thames Barrier closures against tidal surges
- Average distance travelled by mode of transport
- Long-term change in temperature
- Change in sea levels

1. INTRODUCTION



The role of the Environment Agency

The Agency has a duty to contribute towards sustainable development and to take an integrated approach towards the management of the environment. These duties together with our other regulatory and advisory responsibilities, mean that we are well placed to offer a consistent approach for strategic planning to address environmental issues throughout London.

Our duties, powers and interests include pollution prevention and control, flood defence, water resources, waste regulation, fisheries, river navigation and the conservation and enhancement of the beauty and amenity of flora and fauna. In the case of many of these, including air pollution and the decontamination of land, we share a role with others, particularly local authorities. It is important to remember that we are not responsible for regulating every aspect of the environment and for certain issues other organisations are primarily responsible.

We have a responsibility to 'compile information on' and to 'form an opinion on' the state of the environment. Our first national overview *The Environment of England and Wales: A snapshot* was first published in 1996 and is now available, regularly updated, on the Agency's website which can be found at http://www.environment-agency.gov.uk. We have also recently published *Environment 2000 and Beyond* which considers how the environment in England and Wales may change in the future under the pressure of expected economic and social changes and of climate change. It identifies parts of the environment and places that will be put under the greatest stresses and strains. These present environmental data using a state-pressure-response format which is illustrated in the diagram.

In addition, a series of detailed assessments of the environment in England and Wales have been published by the Agency on:

- fresh waters;
- the land;
- the coast;
- the atmosphere.

As well as these national reports we have also produced two more documents which are of particular relevance to London:

- *State of the Environment Report: The Environment Agency's contribution to a better environment in the South East* (2000); and
- *State of the Environment Report for Thames Region* (1998), update to be published in 2001.

Purpose of the report

It is not the purpose of this report to provide a comprehensive assessment of all aspects of the environment within London. Rather, it aims to identify those aspects for which the Environment Agency has a responsibility and which we consider to be important in terms of contributing to a better quality of life in the capital. In some instances we have had to draw on data from other organisations to help put the issues in context.

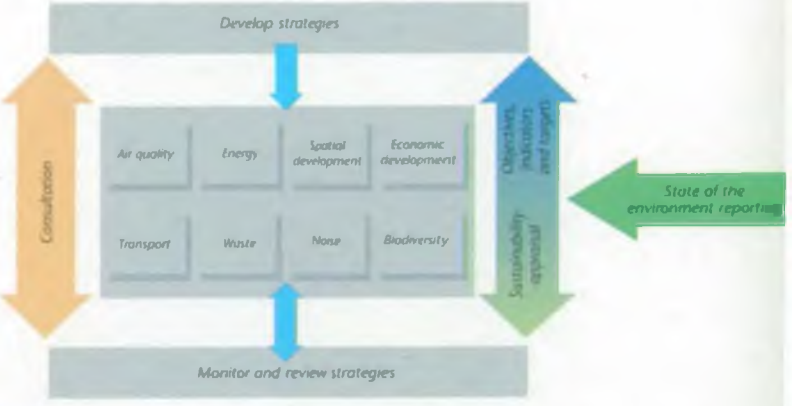
The report presents data and a selection of indicators, which are linked to a number of key issues for the Environment Agency.

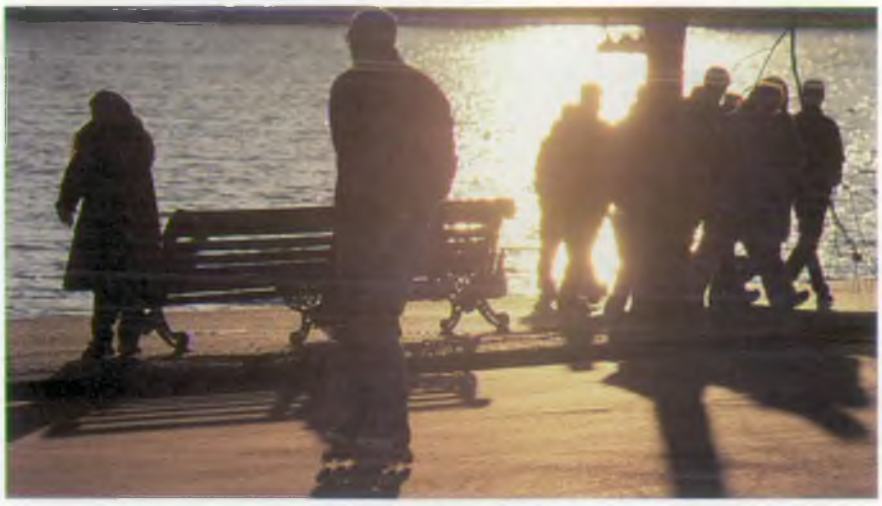
By setting out the baseline conditions and recent and likely future trends we can identify and quantify how the state of the environment is changing. This will enable us to monitor and report on our own performance and thereby contribute to the quality of life in the capital as a whole.

We hope that our report will assist the GLA in the production of its own state of the environment report and inform the process by which it develops its strategies for London. We consider state of the environment reporting to be an important element of developing, monitoring and reviewing the GLA's strategies.

The report also has the potential to be used to inform more local strategies and initiatives, in particular the London Boroughs' unitary development plans.

GLA strategies and state of the environment reporting





A sustainable future and putting people first

Our vision for the environment and a sustainable future is a healthy, rich and diverse environment in London. We also recognise that good environmental quality is a basic human right, essential to achieving a better quality of life. To work towards this vision, we need to monitor our progress and to assess how good the environment is now, how it changes over time and how much better it needs to be. We also need to understand the different driving forces in society and the economy, and how these may bring about change in the future.

There have been attitude surveys on environmental issues and although it is difficult to generalise their results as they are done for specific purposes, they do show that people have a concern for the environment. For example, in a DETR survey asking respondents what environmental issues or trends would cause them most concern in about 20 years time, traffic, global warming/climate change, air pollution and water pollution were all cited by about a quarter or a third of people (DETR, 1998).

The recent *State of London 2000*, a research study conducted for the GLA by MORI, showed that Londoners see reduction of traffic congestion and pollution as vital to improve living and working conditions in London.

Working with others, to achieve common goals, and developing a strong approach to education is essential. As a long term goal it will be necessary to demonstrate the economic links between environmental quality and the quality of life. This is particularly relevant in London where there are such marked contrasts in economic prosperity and environmental quality.

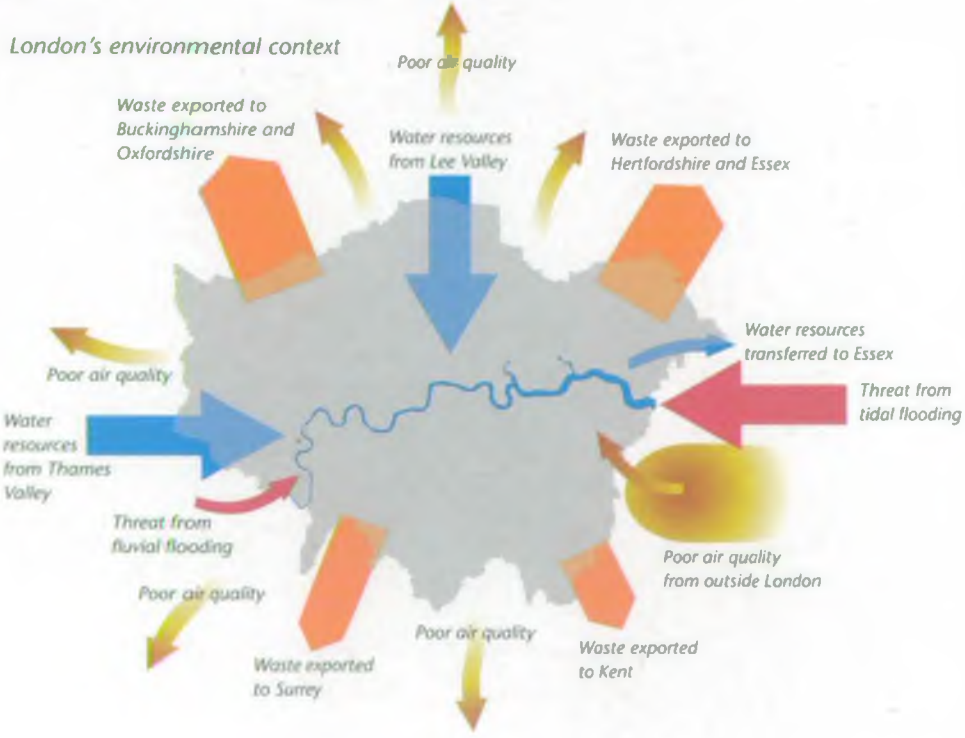
London's environmental context

London has an influence on the environment over a much wider area than that confined within its administrative boundary, therefore London's environment cannot be considered in isolation.

Air quality – Pollution from London, particularly from vehicles, has an impact on air quality in the wider south east region, and emissions outside London affect air quality within the city.

Waste management – An increasing amount of waste is exported to the immediate sub-region outside London. The city is unable to cope with its own waste, and is therefore reliant on the surrounding region for waste disposal.

Water resources – Five water companies supply water to London's residents on a daily basis. This resource comes from the wider Thames catchment, which extends from Gloucestershire in the west, Essex and Kent in the east, Buckinghamshire and Bedfordshire in the north and Hampshire in the south.



Population

London's current population is 7.2 million. It is, by a considerable margin, the most populated city in the European Union. It is also one of the most densely settled areas (4,554 persons/sq km in 1998), with only Paris and Brussels being more densely populated. The birth rate, at nearly 15 per thousand residents, is high compared with most cities on mainland Europe, while London's death rate at just under 9 per thousand residents, is average.

Deprivation

In compiling the 1998 Index of Local Deprivation across the 354 local authority districts of England, the Department of the Environment, Transport and the Regions (DETR) used 12 indicators. The indicators covered unemployment, low income, health, education, environment, crime and housing. The index allowed each London borough to be ranked alongside the other English districts. Five of the ten most deprived districts in the country, and 13 out of the 20 most deprived, were in London.

Most severely deprived districts in England[1]

Ranking	Districts
1	Liverpool
2	Newham
3	Manchester
4	Hackney
5	Birmingham
6	Tower Hamlets
7	Sandwell
8	Southwark
9	Knowsley
10	Islington
11	Greenwich
12	Lambeth
13	Haringey
14	Lewisham
15	Barking and Dagenham
16	Nottingham
17	Camden
18	Hammersmith and Fulham
19	Newcastle upon Tyne
20	Brent
21	Sunderland
22	Waltham Forest
23	Salford
24	Middlesborough
25	Dudley
26	Kingston upon Hull
27	Wolverhampton
28	Bradford
29	Rochdale
30	Wandsworth

[1] Based on the index of Local Deprivation
London Boroughs highlighted in red

Source: DETR

Tourism and leisure

London continues to be one of the most popular cities in the world for overseas tourists. In 1998 overseas visitors made 13.5 million trips to London, which is equivalent to two in every five trips made to the United Kingdom. This number has remained reasonably constant since 1995, but has increased by 24 per cent since 1990.

Source: ONS, GOL & LRC (2000)

Population change, 1971-1981

Population change, 1981-1991

Population change, 1991-1998

[1] Geometric mean

Source: Office for National Statistics
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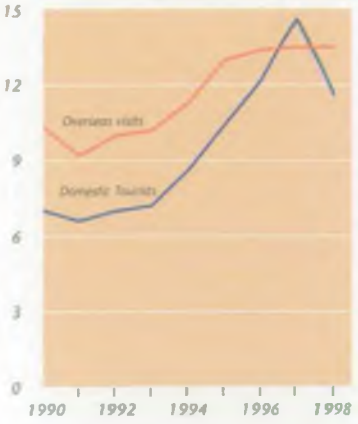
Number of visits[1] to London



[1] Staying one night or more. Figures for tourism by UK residents are rounded to the nearest 100,000 trips; figures for overseas tourism are rounded to the nearest 10,000 trips

2. KEY ISSUES FACING LONDON FROM AN ENVIRONMENT AGENCY PERSPECTIVE

Background to the key issues and indicators

The issues we have identified to be particularly important for London include:

Air Quality – levels of air pollution in London frequently exceed those recommended for human health. In 1996 alone, London's air quality fell below acceptable levels for health on 440 separate occasions at the 37 monitoring stations around London. Over the last 20 years emissions have risen steadily, primarily because of traffic growth, although emissions from industrial processes have declined. The largest source of pollution is exhaust fumes from motor vehicles.

Water Quality – the 'Big Stink' of summer 1858, which directly affected MPs in the House of Commons, awoke Victorian London to the gradual demise of the polluted Thames. Untreated sewage from London's population was poisoning the Thames and Londoners themselves. Huge improvements have since been made although most of London's rivers and the Thames itself still suffer from pollution and variable water quality and need further attention. Combined sewer overflows or CSOs still threaten London's rivers with sudden and potentially critical oxygen loss and severe aesthetic pollution.

Biodiversity – wildlife habitats, and the plants and animals that depend on them, are under particular pressure in the capital from continuing urbanisation, pollution, poor management and habitat fragmentation. The Government's drive to recycle brownfield sites may also

have an adverse affect on land which has naturally regenerated into valuable habitats.

Water Resources – most of London's water comes from outside the city. London's demand for public water supply is increasing and future water resources within the capital will depend on the extent to which demand can be managed within available or planned resources. Groundwater levels under London continue to rise as the amount used by industry has fallen.

Waste – each year London produces 11.2 million tonnes of waste. Most of the waste is transported to landfill sites in neighbouring counties, due to the lack of disposal facilities within the capital, but we are running out of space where London can dispose of its rubbish and we will face a shortage in the next few years.

Flooding – London, like many world cities, began life as a maritime trading port. Much of the city is built on low-lying marshland and is defended from daily flooding by an exhaustive network of walls, barriers and embankments, the centrepiece of which is the Thames Barrier. A major flood in London could cost the UK more than £30 billion in damages alone. Disrupted telecommunications and transport systems could rob the city of its dominance as Europe's financial centre. Repairs could take months, even years to complete.

Riverside Development – despite the importance of the Thames as one of the largest open spaces in London, developers have often taken little account of their impact on the river and environment. The attraction of the Thames, and other rivers, as a focus for development can result in encroachment onto the foreshore, the loss of natural river banks and development in the floodplain.

Transport – the number of cars on London's roads will continue to increase and traffic speeds will continue to fall. The average speed in central London today is 10 mph. Road transport is responsible for the majority of London's air pollution, causing a decline in local air quality and health problems. Congestion is also a major cost to the economy.

Climate Change – over £30 billion worth of property is protected from flooding by the Thames Barrier. Climate change, however, is predicted to cause sea levels to rise by between 25 and 50 cm by 2050, threatening the effectiveness of London's current tidal defences. Climate change could also affect London's wildlife, availability of water resources, air and water quality.

Land Quality – it is estimated that approximately 1 per cent of the capital's area is derelict land. This amounts to more than 1,600 hectares of contaminated land resulting from the city's industrial past. This legacy has potential implications for the health of Londoners and the quality of the environment.

Each of these issues is discussed in detail within the following sections. We have selected a limited number of key indicators to monitor these issues, based on criteria including:

- the importance of the indicator in illustrating a key aspect of London's environment;
- the ability of the indicator to record environmental change in a meaningful way;
- the availability of data for the indicator; and
- the regularity with which the data for the indicator is updated.

The table overleaf summarises the trends shown by the indicators in recent years and the expected trend in the future. Abbreviations and unfamiliar terms used in the table will be explained in the following sections and at the end of the report.

Summary of indicator trends

Issues and Indicators	Recent trend	Expected future trend
Air quality		
Levels of NOx and particulates pollution at key sites in London	Air quality is failing standards in many parts of London. The period for which data is presented is not sufficient to show a trend.	Future improvements are dependent to a large extent on the reduction of traffic emissions within the capital, along with technological improvements.
Emissions to air from IPC processes	Emissions from Agency-regulated processes have a limited impact upon London's air quality.	Tighter emission standards will mean that Agency-regulated processes will have a minimal effect on London's air quality.
Water quality		
Chemical river water quality	Chemical GQA has improved over the last two years. Further improvements could be seen with more regulated discharges, but this could be masked by fluctuations in rainfall across the region.	Improvements are expected owing to continuing water company investment, but these will be heavily influenced by rainfall variations.
Biological river water quality	Biological quality of London's rivers continues to be variable.	Biological quality will continue to fluctuate unless significant improvements are achieved in minimising the impact of urban runoff and effluent quality.
Tidal Thames water quality: dissolved oxygen	No trends are emerging from the current data sets. Levels tend to vary with the weather. Consequently fluctuations in the use of the Thames Bubbler and Vitality have continued.	Improvements are expected owing to the work being undertaken on CSOs as part of the AMP3 process.
Compliance with EC Bathing Water Directive	Designated bathing waters are getting cleaner. The trend is for increasing consistency of compliance. This is when a bathing water site has complied for three consecutive years.	Consistency in compliance is expected to continue to rise.
Biodiversity		
Distribution of key species and habitats in London		
Water Vole	In Greater London the Water Vole has disappeared from 72% of the sites occupied prior to 1997.	It is hoped that the decline will be halted by sensitive management of existing sites and where possible reintroduction to previous sites.
Reed Bunting	Numbers of breeding Reed Bunting have increased in some areas of Greater London and decreased in others.	With sensitive management of existing wetlands and the creation of new reedbeds, the breeding populations of Reed Bunting may increase in Greater London.

Issues and Indicators	Recent trend	Expected future trend
Coastal Salt Marsh	Salt Marsh is currently declining in London partly because of development pressures and erosion.	The current decline could be halted with future sensitive tidal defences and other developments.
Distribution of alien invasive species		
Chinese Mitten Crab	Distribution of the Chinese Mitten Crab within Greater London is currently increasing unchecked.	Until more is known about the biology and ecology of this invasive species, the numbers and distribution are likely to continue increasing.
Floating Pennywort	The distribution of Floating Pennywort within Greater London is currently increasing.	Improved control methods may see a fall in the spread of this invasive plant but a decline is only likely with new legislation to prevent its sale.
Numbers of salmon returning to the River Thames	Over the past few years the Thames has seen a steady decline in the number of returning salmon. A slight recovery in numbers seems to have taken place in 1999.	Trend is likely to increase over the next few years and then stabilise.
Water resources		
Groundwater under London	The past two years has continued to see groundwater levels rising. Levels in Central London are now at their highest since the 1890s.	The Agency is working closely with Thames Water, the Corporation of London and other interested organisations through the GARDIT project to develop a longer-term solution to this problem.
Reductions in water leakage levels	Over the past two years all the water companies within London have met the leakage targets set by OFWAT.	Thames Waters' targets will become harder to achieve over the next few years.
Waste management		
London's waste production and management	Over recent years growth in population coupled with the reducing size of household units has increased the amount of household waste generated in London.	Unless widespread recycling of waste within London is adopted it is unlikely that waste production will be reduced.
Flooding		
Number of Thames Barrier closures against tidal surges	Since 1990 the frequency of Barrier closures has increased.	The erratic nature of the weather makes it difficult to exactly predict future trends. However, the effects of sea level rise and climate change are predicted to make further closures more frequent.
Water levels in the River Thames	Whilst the data provides an interesting picture of flow rates over the past hundred years, it does not currently provide a clear indication of an increase in the number of flood events found.	Current data makes it difficult to predict a longer-term trend. However, the effects of climate change may influence future trends.

Issues and Indicators	Recent trend	Expected future trend
Number of tidal flood warnings issued	Whilst tidal flood warnings peaked in both 1995 and 1998 there seems to be no long-term trend emerging at present.	Current data makes it difficult to predict a longer-term trend. However, the effects of climate change may influence future trends.

Riverside development

There are no indicators available for this topic at present. Monitoring of encroachment is currently being undertaken and data should be available in the future.

Transport

Average distance travelled by mode of transport	There is an increase in road traffic growth at present, apart from in central London where congestion may have caused it to reach saturation.	There is no current trend for a decrease in road traffic in the near future.
Commercial traffic on the tidal Thames	Latest trends suggest that there will continue to be an increase in the use of the river for commercial traffic. However, this is unlikely to mean a reduction in the amount of freight traffic on the capital's roads.	The future trend for commercial traffic on the river is unclear. Whilst both the PLA and various Thameside businesses believe that commercial traffic will increase this longer-term trend does not seem to be substantiated by recent figures.

Climate change

Long-term change in temperature	Whilst there is still uncertainty over the causes, data suggests an increase in the overall background temperature in central England.	Temperature levels are predicted to rise.
Number of heavy rainfall events	The number of heavy rainfall events continues to fluctuate in an unpredictable manner.	The number of heavy rainfall events is likely to continue to be erratic. This indicator should provide a useful long-term reference to monitor the potential impact of climate change.
Change in sea levels	Levels continue to rise as a result of global warming and the sinking of south east England.	Levels are expected to continue to increase.

Land quality

There are no indicators available for this topic at present. New regulations require the production of inspection strategies from the individual London boroughs within the next few years.

Key:

positive progress/improving *change uncertain or mixed* *unfavourable progress/deteriorating/no progress*

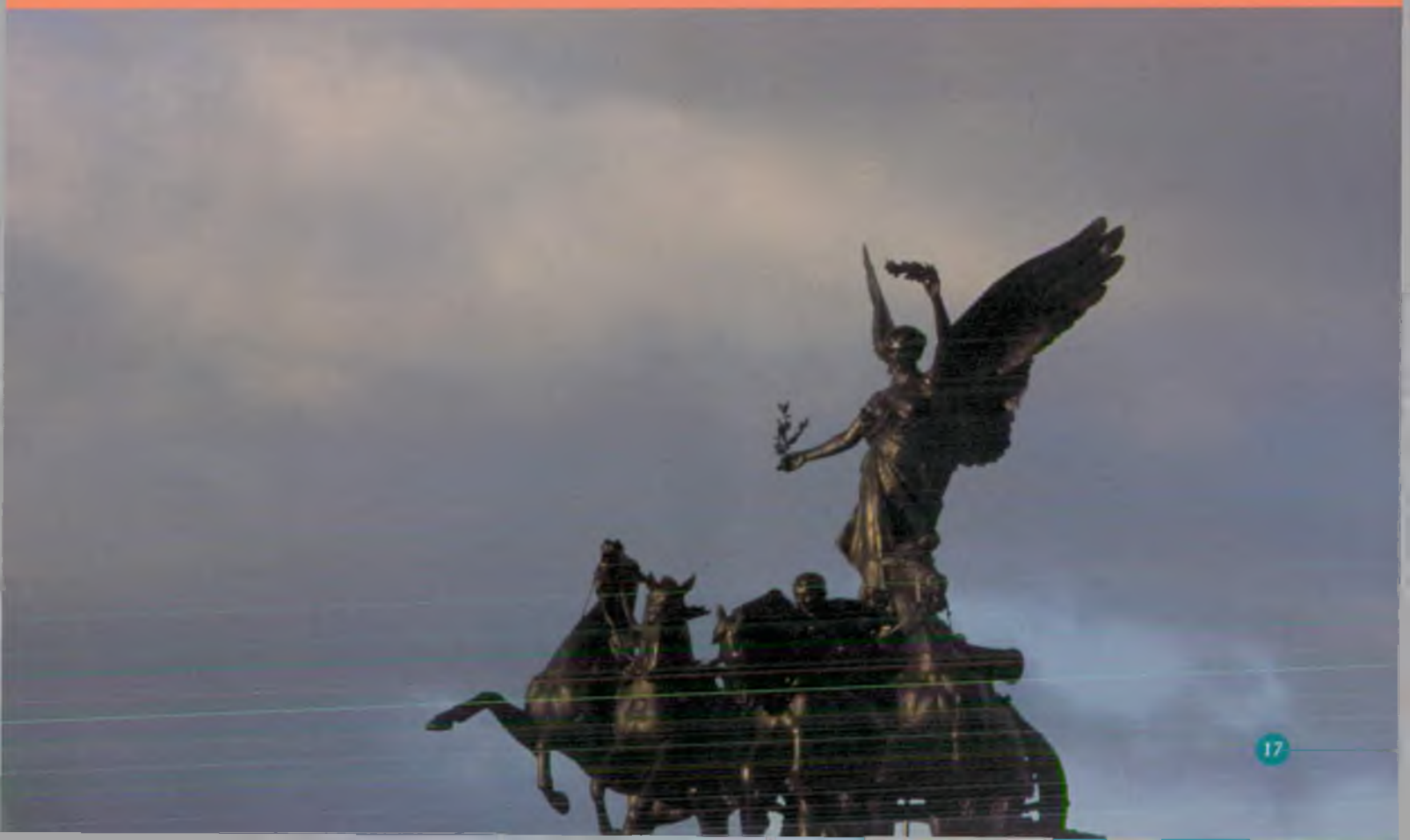
Future indicators

Throughout this report we refer to a number of sources of information that we believe will be available in the future and may make good indicators. This is particularly relevant to the production of the GLA's Noise and Energy strategies, as the Agency may be able to provide information in the future through its work under pollution prevention control and waste management legislation.

Air quality

Key messages

- London's poor air quality is closely linked to the levels of road traffic.
- Industrial processes regulated by the Agency have a minimal impact on London's air quality.
- The Agency will continue to improve any emissions through its regulatory powers.
- The Agency will work in co-operation with London Boroughs to ensure the successful operation of Air Quality Management Areas (AQMAs).
- Air pollution has an impact of flora and fauna and biological monitors will help determine the future impacts of air quality.
- Pollution from London has an impact on air quality in the wider south east region, and emissions outside London affect air quality within the city.



Background

The quality of the air that we breathe is crucial to us all. Air quality in the UK is generally good, but there are sometimes unacceptably high levels of pollution that can harm human health and the environment. The Government's Air Quality Strategy (AQS) describes plans to improve and protect ambient air quality in the UK. The Strategy sets objectives for protecting human health by limiting the eight main air pollutants. These pollutants are:

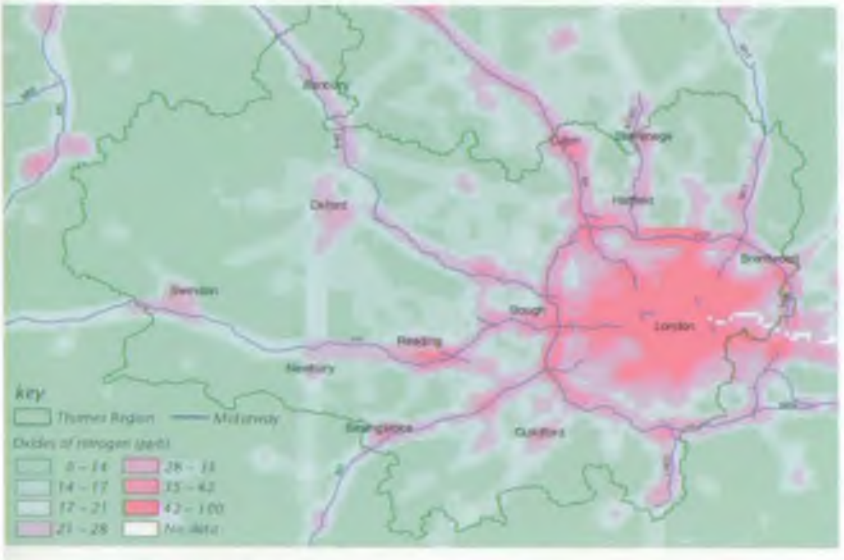
- benzene
- 1,3-butadiene
- carbon monoxide
- lead
- nitrogen dioxide
- ozone
- particulates (PM_{10})
- sulphur dioxide.

There are also two new Strategy objectives to protect vegetation and ecosystems, which will be monitored away from urban and industrial areas and motorways.

The major air quality problem in London is the failing of nitrogen dioxide and particulate targets due to traffic emissions. The most significant effect of the industrial processes regulated by the Agency is from sulphur dioxide to the east of London, where a number of power stations and a refinery lie beyond the London boundary.

Estimated emissions of nitrogen oxide, 1996

Annual average hourly oxides of nitrogen concentrations (ppb) in 1996



The Agency's role

The Air Quality Strategy describes the roles of the Agency, local authorities and industry in managing air quality. We play our part mainly through the regulation and control of emissions from the largest, most technically complex and potentially most polluting industrial processes under Integrated Pollution Control (IPC). Under the recently introduced Pollution Prevention and Control (PPC) regime we will take a wider range of environmental effects into account when determining permit conditions. These will include energy efficiency, noise and site restoration. All IPC processes will transfer to the PPC regime over the next seven years.

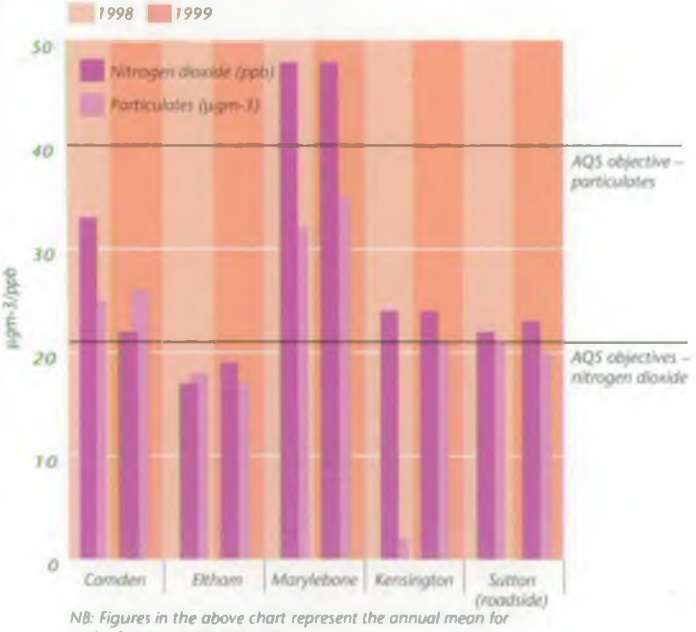
Local authorities (including London Boroughs) have the major role in implementing the Government's Air Quality Strategy. If the Strategy targets are unlikely to be met by 2005, as is likely to be the case in some parts of London, then the local authorities will have to declare Air Quality Management Areas (AQMAs) and develop Air Quality Action Plans (AQAPs).

The Mayor of London is required to produce an Air Quality Strategy for London with the power to direct local authorities in undertaking their responsibilities in respect of air quality management, and which will take into account individual AQAPs. We will be assisting local authorities to develop these AQAPs. We can also help identify factors affecting air quality in a local area and generate and evaluate options for air quality enhancement.

Levels of nitrogen dioxide and particulates pollution at key sites across London

As far back as the thirteenth century London suffered from air pollution problems. These were linked to the industrial processes which required the burning of large quantities of coal. Between the fifteenth and seventeenth centuries,

Levels of nitrogen dioxide and particulates pollution at key sites in London



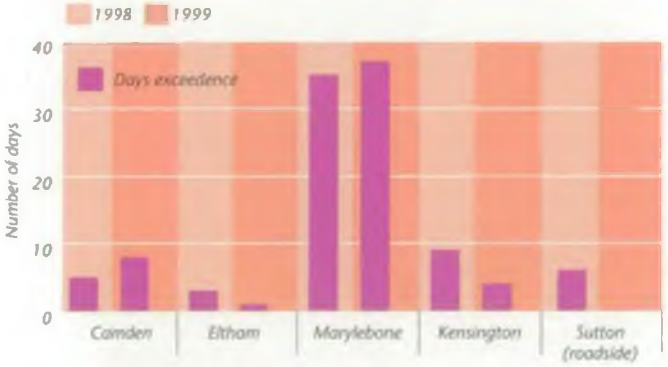
NB: Figures in the above chart represent the annual mean for each of these monitoring sites

shortages in the supply of fuel wood, coupled with an increasing population, brought a further increase in the use of coal and its associated air pollution problems. In December 1952, London suffered from one of the worst smogs it had ever experienced. It lasted for four days and led to an estimated 3,500–4,000 premature deaths.

During the later part of the twentieth century, the occurrence of smogs declined, due to the marked decrease in the use of coal and heavy fuel oils, brought about by the creation of smokeless zones. Also the supply of London's electricity by power stations was relocated outside the capital. The combined effect has not only reduced smoke concentrations but also lowered levels of sulphur dioxide. However, one form of pollution has been replaced with another with the increase in motor vehicles.

Pollution levels from six monitoring locations across London which represent a cross-section of the current air quality have been selected as indicators. Data for these sites has been collected by the South East Institute for Public Health (SEIPH) since 1992.

Number of days when particulates exceeded AQS objectives, 1998-1999



Trend

Air quality is unacceptable in many parts of London. The period for which data is presented is not sufficient to show a significant trend. More detailed predictions of future air quality have been made by the London Boroughs under the local air quality management process. These show that air quality standards will not be met in many parts of inner/central London unless action is taken to reduce the pollution from transport.

Source: SEIPH / ONS, GOL & LRC (2000)

Emissions to air from IPC processes

The Environment Agency is responsible for consenting and monitoring the industrial processes which potentially could

Biological monitors of air quality

The Air Quality Strategy takes an effects-based approach to air pollution control to determine safe standards for the protection of human health. Similarly, biological monitoring examines the effects on flora and fauna from pollution exposure to determine appropriate concentrations for sensitive species.

If we are to develop a sustainable approach to air quality management we might benefit from using nature's own response in addition to our scientific measurements and modelling studies. As technology has advanced we have perhaps neglected some of the more obvious signals found in our local environment.

For decades plants and animals have been studied as pollution monitors: to assess the spatial distribution of sulphur dioxide in the UK; to highlight the damage from the accumulation of persistent pollutants in our wildlife; to understand metal deposition patterns from vehicle emissions; and to map radiation fallout from Chernobyl. Whilst the research is extensive some practical use has been made of these studies in recent years with funding directed towards the development of models and monitoring with sophisticated physico-chemical instruments.

Recent fieldwork that has been carried out within London includes:

- **Natural History Museum Wildlife Gardens** – A range of aquatic and terrestrial habitats containing native British plants and species are being monitored by museum staff. Specifically the relationship between lichens and traffic pollutants is being investigated.
- **London Borough of Bexley** – The distribution of sensitive lichens is being recorded along the A2 trunk road, a major roadway where flow rates regularly exceed 100,000 vehicles per day. The results will be compared with an extensive diffusion tubes monitoring programme and a modelling study also being undertaken in Bexley. Lichen diversity could therefore provide both a baseline against which to measure improved air quality and indicate areas of highest concentration.

Possible links have also been established between air quality and subsequent effects in the aquatic environment. For example, recent bioaccumulation studies in the estuary have indicated lead levels which are probably associated with past traffic emissions. Such studies need to be continued to see if the expected reduction in levels actually happens. It is hoped that over the next few years the Agency will be able to provide further information on this topic.

Source: APRIL / Environment Agency

bring the most harm to the environment. To help address the Air Quality Strategy, attention has recently been focused upon larger processes to the east of London, i.e. power stations.

The maps show data compiled in a recent report, Air Quality Assessment in London and the East Thames Corridor, that considers the cumulative impact of the current process emissions on London and the Thames estuary. Background levels of sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) are at their highest levels outside London. However, the levels of

sulphur dioxide, which is the more significant of the two pollutants, are not sufficient to cause exceedence of the AQS standards in London.

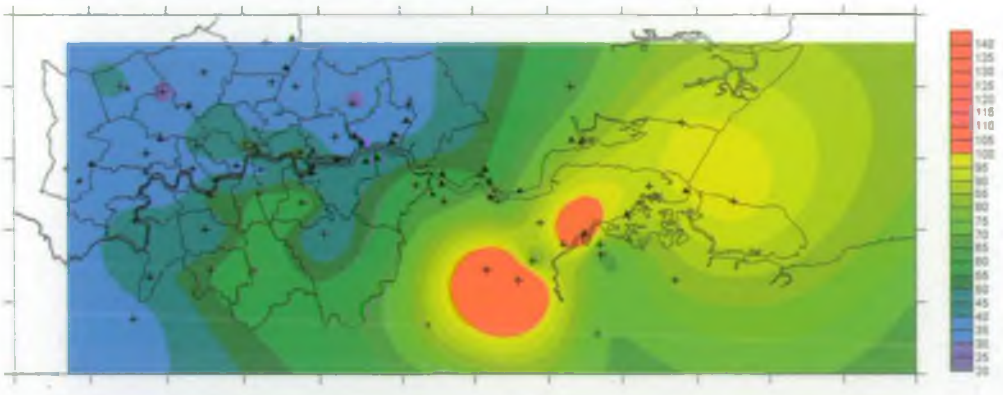
The maps also show the effect of the expected emissions in 2005. This shows that the predicted reductions will ensure that no exceedences of the AQS standards will be caused by IPC processes, even to the east of London.

Trend

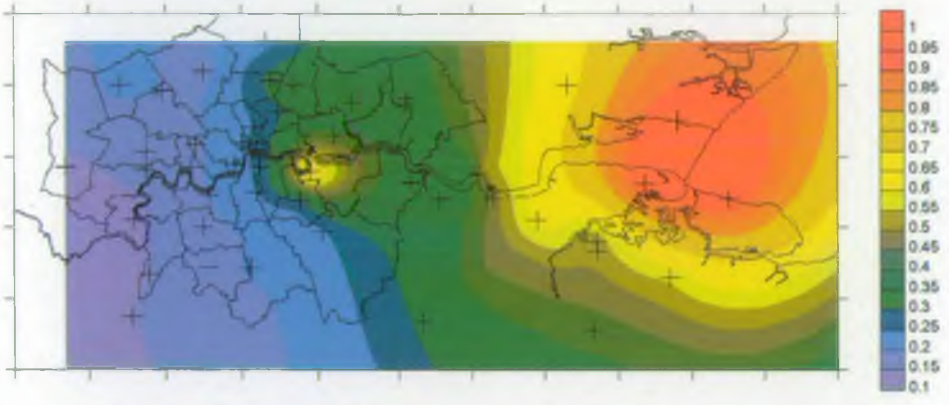
Emissions from Agency-regulated processes continue to have a minimal impact upon London's air quality. The trend for emissions is set to decline over the next few years, minimising the future impact of industrial processes upon London.

Source: Environment Agency

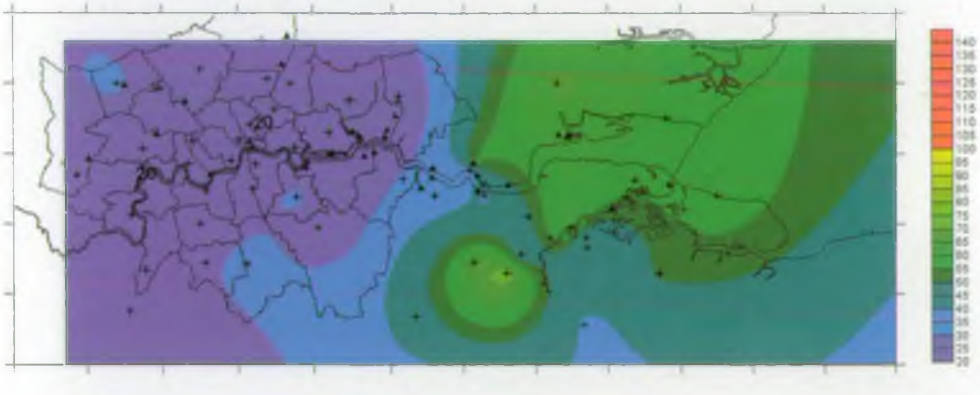
Predicted 99.9th percentile SO_2 concentrations (ppb) from Part A processes based on a 1998 emissions scenario and meteorology



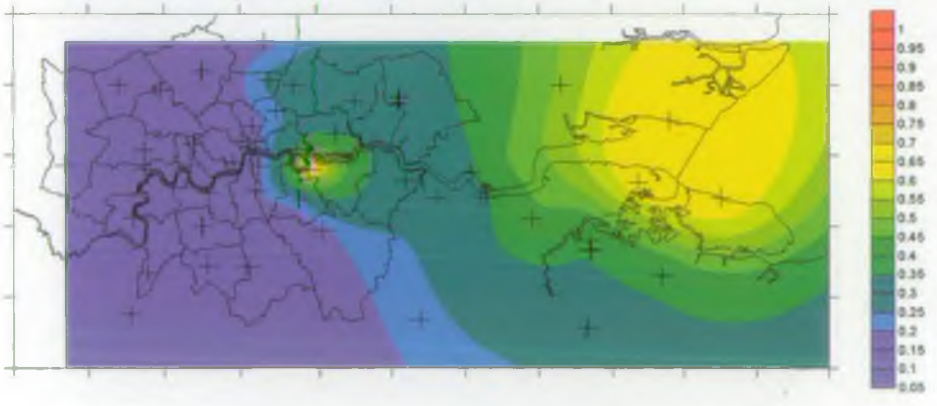
Predicted annual mean NO_2 concentration (ppb) from Part A processes based on a 1998 emissions scenario and meteorology



Predicted 99.9th percentile SO_2 concentrations (ppb) based on 2005 emissions and 1998 meteorology



Predicted annual mean NO_2 concentration (ppb) from Part A processes (2005)



Water quality

Key messages

- The Agency will work with Thames Water to implement the projects identified through the Asset Management Plan (AMP) process. In particular, attention will be focused on the issues surrounding combined sewer overflows (CSOs).
- Pollution prevention measures should be incorporated into any new developments to minimise their impact.
- New development should be served by adequate sewerage and drainage infrastructure.
- Development of brownfield sites should incorporate adequate measures to protect the underlying aquifer.
- Fluctuations in rainfall intensity and quantity have a significant impact on water quality.
- Climate change will have an even greater impact on water quality in the future.

Background

Rivers, lakes and estuaries support a variety of wildlife. Rivers can also act as wildlife corridors forming important links between otherwise fragmented habitats. Rivers are subject to numerous pressures including pollution, habitat degradation, low flows (caused by abstraction and climate change) and recreational activities. It is important that we monitor their health and manage the pressures on them.

The indicators contained within this chapter are selected from the best information available to the Agency at the current time. As new techniques and data are developed so we will endeavour to include more accurate indicators to represent London's water quality.

Water quality in the River Thames

The River Thames is London's greatest natural asset and is now regarded as one of the cleanest metropolitan rivers in the world. It is not only a site of great historical interest, but is also an amenity and recreational resource. It is only in the last 40 years that we have really begun to appreciate the value of the river. Before this, loss of habitat due to riverside encroachment and pollution had substantially downgraded the ecology of the Thames.

Despite the improvements that have been made, a public perception study of the tidal Thames we undertook confirmed that most Londoners still believe that the Thames contains little, if any life. Typically, the floating rubbish and muddy nature of the river are cited as evidence of its apparently 'inert' state. Rubbish can indeed be a problem at times, but it is almost entirely a cosmetic one, of no significant risk to human or animal life. The muddy colour of the river is simply a consequence of the natural estuary processes of erosion and deposition.

The maintenance and further enhancement of the tidal Thames is a major challenge, particularly as no single organisation is responsible for its comprehensive environmental management. The Thames Estuary Partnership (TEP) has the task of integrating the various interested organisations and co-ordinates actions through the Thames Estuary Strategy.

In addition to the River Thames, there is a large network of watercourses spreading across the capital. These rivers are also important as ecological, landscape and recreational features to the residents of the capital.

The Agency's role

The Agency is responsible for controlling discharges to the water environment under one of two regulatory systems, the Water Resources Act 1991 and the Pollution Prevention and Control Act 1999. More complex industrial processes that have a greater potential to pollute are authorised under the Integrated Pollution Control Regulations 2000.

Other discharges, including those from sewage treatment works (STWs), require a consent, which sets conditions for effluent quality. In addition to this regulatory work and more general pollution control activities, we carry out extensive monitoring to ensure that water quality is maintained and improved. We are also responsible for controlling discharges to estuarine and coastal waters, and for monitoring marine water quality for three miles offshore.

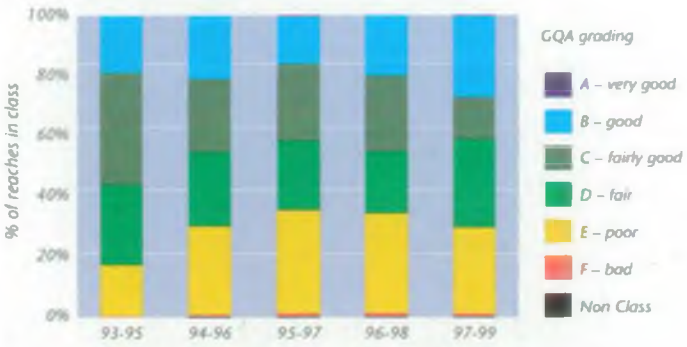
Chemical river water quality

The General Quality Assessment (GQA) scheme is used to assess the quality of rivers, to monitor trends over time and to compare rivers in different areas. The chemistry component of the GQA is made up of six grades (A to F) defined by standards of dissolved oxygen, biochemical oxygen demand and total ammonia.

Chemical river quality showed a marked improvement between 1990 and 1995. This was due to two main factors: first a significant improvement in the quality of specific discharges to the Thames and its tributaries; and secondly, a return to average flow conditions for the catchment as a whole following the 1989–91 drought. Between 1995 and 1997 river quality deteriorated

Chemical GQA, 1997-1999

London chemical GQA results, 1993-99



markedly. This was almost entirely due to the drought conditions, which increased in intensity after 1995, with flows in 1997 being some of the lowest on record.

Over the past two years rainfall has increased significantly. The resulting dilution has in turn helped to restore water quality to pre-1995 levels.

Trend

Chemical GQA has improved over the last two years within London and further improvements are expected owing to the continuing water company investment, but this could be masked by fluctuations in rainfall across the region.

Source: Environment Agency

Biological quality

Rivers

The GQA scheme for biology, introduced in 1995, provides a measure of water quality based on monitoring the macroinvertebrates (small animals including mayfly nymphs, snails, shrimps and worms) which live on the riverbed. The map shows the results for biological assessment of rivers in 1997. While the majority of rivers are classed as 'good to very good' those flowing through heavily urbanised areas tend to be of poorer biological quality.

Monitoring has shown that the biological quality of south London's rivers is variable, the highest quality being found in the headwaters. Most of the watercourses showed fair to poor biological quality, with the lowest quality occurring directly below sewage treatment works outfalls. The main influences on the diversity of invertebrate populations are treated sewage effluent, urban runoff and periodic flushes of poor quality water. Other factors include lack of suitable habitat for macroinvertebrates and poor channel construction.

History of the clean up of the Tidal Thames

1800	Up to 50,000 smelt landed per day between Hammersmith and Wandsworth.
1831	London's first cholera epidemic occurred resulting in over 6,000 deaths.
1843	Abolition of cesspits and the development of water closets, which discharged into the Thames, caused deterioration in quality.
1849	Fish had completely disappeared from the London reaches of the Thames.
1856	Stench from the river during heatwave provokes action from the House of Commons.
1864	Completion of interceptor sewers which carried London's sewage eastwards to be discharged on the ebb tide.
1878	The Thames pleasure steamer Princess Alice sank in the vicinity of Beckton outfall; deaths were accelerated by the septic conditions.
1882	A Royal Commission was set up and resulted in new treatment methods at Beckton and Crossness.
early 1900s	Further decline in water quality owing to industrialisation and increased population.
1939-45	Bomb damage to sewers and sewage works during the Second World War led to further pollution.
1920-64	River devoid of oxygen during summer.
1949	The Thames Survey Committee began investigations into siltation and pollution of the Thames.
1950s	Surveys confirmed that there were no established fish populations between Fulham and Tilbury.
1964	Completion of Crossness sewage treatment works (STW) eliminated anaerobic conditions in the Tideway and started the recovery in water quality.
1966	10% minimum dissolved oxygen standard implemented.
1974	Completion of Beckton STW (largest in Europe). Improvements at other STWs diversion of some industrial discharges and the introduction of biodegradable detergents accelerated the improvement in water quality and the return of the first salmon. First salmon for over 140 years found in the river.
1979	Salmon Rehabilitation Scheme commenced, involving introduction of young fish and construction of fish passes at weirs
1980s	Thames Bubbler introduced and Automatic Quality Monitoring Station (AQMS) installed.
1993	Record return of 338 adult salmon.

The ongoing improvements to the sewage treatment works and the implementation of river restoration schemes to improve habitat and channel form should result in an increase in the biological quality of London's rivers.

Thames Estuary

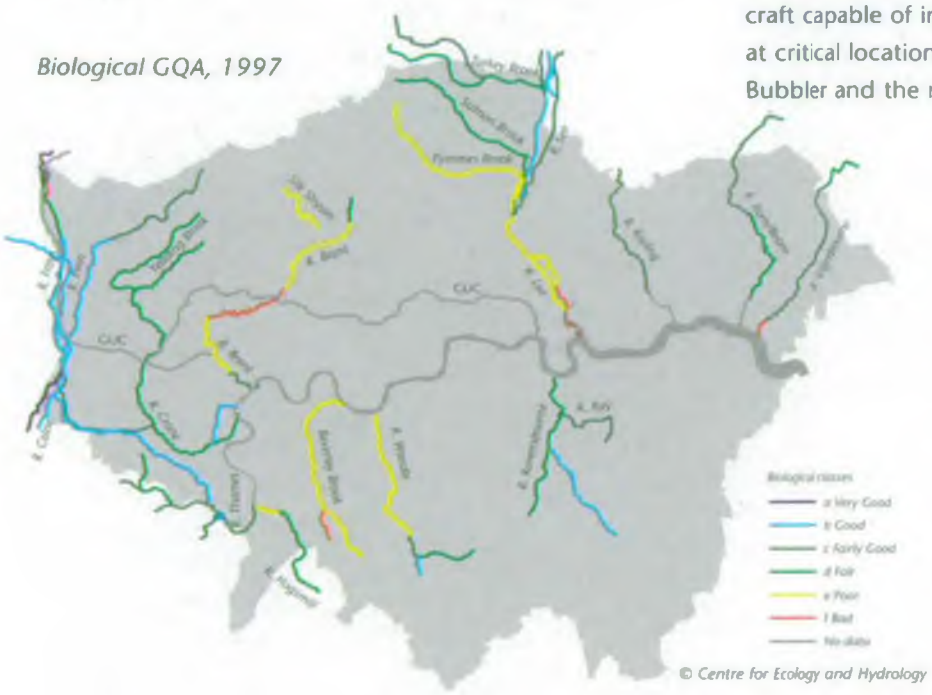
Invertebrates are sedentary, relatively long-lived and are therefore good indicators of water quality. Since 1989, the Agency has been undertaking a long-term monitoring programme to assess invertebrate quality at a range of sites throughout the estuary. The data generated is currently being reviewed, and will be used to develop a more appropriate set of biological standards for the estuary with respect to chemical quality.

Trend

The biological quality of London's rivers continues to be variable. A variety of factors including effluent quality and urban runoff will influence future improvements in the biological quality of both rivers and the estuary.

Source: Environment Agency

Biological GQA, 1997



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Tidal Thames water quality: dissolved oxygen

Dissolved oxygen is one of the main parameters used in assessing the chemical water quality of the tidal Thames (below Teddington). It is also a key component for assessing compliance with regional water quality standards. During the summer, when freshwater flows are low and river temperatures are high, water quality in the upper and middle reaches of the tideway is increasingly influenced by the discharges from the major STWs.

Nutrient Enrichment of the Tidal Thames

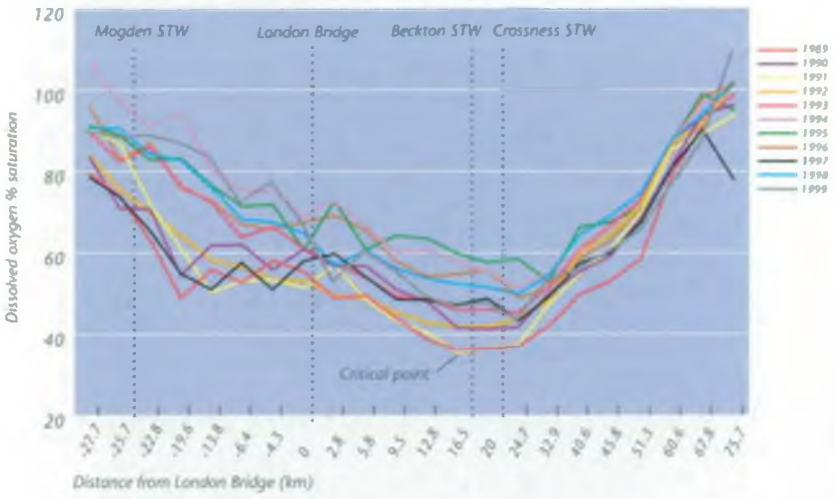
At the end of July 2000 extensive algal blooms were recorded between Tower Bridge and Putney. The extent of these blooms and their impact was greater than ever previously recorded. Around the same time most of the shellfish harvesting areas in the lower estuary were closed following an incidence of diarrhetic shellfish poisoning. This is often associated with increased algal populations resulting from nutrient enrichment due to the impact of combined sewer overflows.

We have an Operating Agreement with Thames Water which requires improved effluent quality at the major tideway STWs during much of the summer. This normally ensures that background dissolved oxygen levels are satisfactory. However, discharges from London's combined sewer overflows (CSOs) following rainfall can result in severe depletion of river oxygen levels (see the 'sag' at the critical point on the graph).

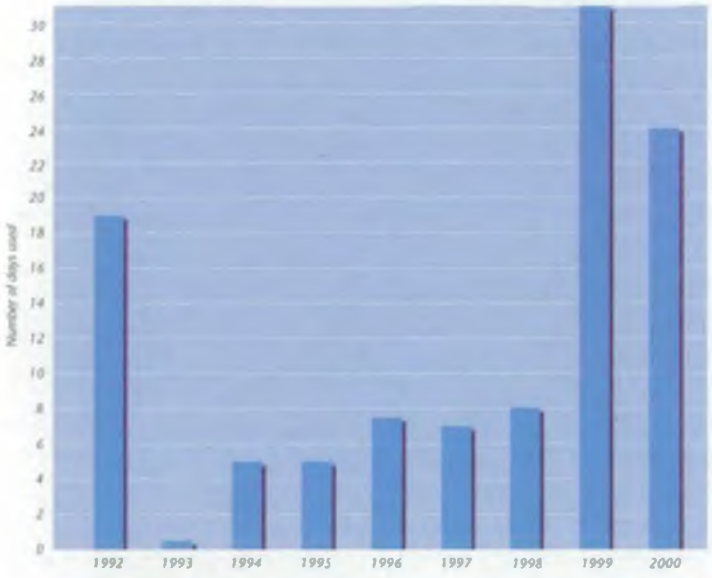
Severe deoxygenation following the operation of these sewage overflows caused several major fish mortalities between 1973 and 1986. In 1989, the Thames Bubbler, a craft capable of injecting up to 30 tonnes of oxygen per day at critical locations, came into operation. The Thames Bubbler and the more recently acquired oxygenation vessel, Thames Vitality, are owned by Thames Water and operated at our request. All aspects of their operation are funded by Thames Water. Data received from nine automatic water quality monitoring stations sited between Kew and Purfleet enables us to identify the high risk areas and deploy the oxygenation vessels accordingly. Rainfall and river flow data along with information from key pumping stations in the sewerage system also help us to manage these "storm events".

Five of the most problematic CSOs are scheduled for interim improvements by 2005 as part of Thames Water's obligations under the current National Environmental Programme (AMP3). This preliminary work at Hammersmith, Western, Lots Road and Abbey Mills pumping stations and at Putney Bridge should reduce the level of aesthetic pollution due to sewage-derived litter. There should also be some reduction in the organic load discharged during severe storms. As part of AMP3 the Agency, Thames Water and the GLA will be working together to produce a long-term sustainable solution to London's drainage problems.

Dissolved oxygen profile in the Tidal Thames, May – September mean



Number of days the Bubbler/Vitality was used, 1992-2000



Trend

Fluctuation in the deployment of Thames Bubbler and Vitality normally depends on climatic factors. In 1999 and 2000 the vessels were used on 31 and 24 days respectively, compared with an average annual use of 8 days over the preceding three years 1996–98. The recent increased usage was due to a combination of more frequent significant rainfall and some periods of non-compliance with operating agreement effluent standards at Beckton STW.

Source: Environment Agency

Compliance with the Bathing Water Directive

The mandatory standards set by the EC Bathing Water Directive (76/160/EEC) are to protect the public and avoid sewage contamination of bathing waters. There are currently four designated bathing waters in London.

The Environment Agency plays an important role in implementing the Directive. The bathing season runs from 15 May to 30 September and sampling begins two weeks before the start of the season. A minimum of 20 samples are taken at regular intervals to monitor the quality of each of the four designated bathing waters. All samples are taken at predetermined points where the average density of bathers has traditionally been highest.

London's Waterway Partnership

London's Waterway Partnership (LWP) was established in 1996 as an initiative between British Waterways, the Environment Agency, Groundwork, Lee Valley Regional Park Authority, London Tourist Board, Thames Water and 15 London Boroughs. Since then the partnership has developed a £28 million programme of five complementary themes, including Addressing the Quality of the Water Corridors.

The Agency has been involved in a number of projects to tackle water pollution and poor water quality. These include:

Hydrogen peroxide dosing station on Pymmes Brook – During severe storms polluted water draining into the brook reduces the quantity of dissolved oxygen. This lack of oxygen can result in the death of many thousands of fish. By installing the dosing station it has been possible to increase the quantity of dissolved oxygen in the brook, preventing the fish-kills that had previously been commonplace.

Drain labelling – The Agency, in partnership with the London Borough of Enfield, has carried out a drain labelling campaign in the borough. This has involved the spraying of a fish logo and the words 'Do Not Pollute' next to road drains and drains in industrial estates. The intention is to raise awareness of local people about the damage that can be caused to their local rivers by pouring chemicals, oils and other waste products down the drain. Several local authorities are now interested in undertaking a trial run of the scheme.

Each sample is then analysed and compared against the standards set out in the Directive to give an indication of the extent to which bathing water is contaminated by sewage. In order for bathing water to comply with the Directive, 95 per cent of samples taken must meet these standards.

Whilst all of the sites passed the required standards in 2000, the Serpentine in Hyde Park failed to meet the EC Directive in 1999. Its failure is difficult to explain, as there are no consented discharges into the Serpentine. Two possible sources of contamination have been identified and an action plan has been implemented to minimise contamination in the future.

Trend

London's designated bathing waters are generally getting cleaner. The trend is for increasing consistency of compliance, which is when a bathing water site has complied for three consecutive years.

Source: Environment Agency

National Estuary Classification Scheme

The Agency is currently working to develop a more robust set of biological standards for the estuary, and progress is being made on a National Estuary Classification Scheme. The forthcoming Water Framework Directive (WFD) also has major implications, as it requires Member States to achieve 'good surface water and ground water status'. Ecological quality will be the key means by which surface water status is measured. The development of the Estuary Classification Scheme will feed into this process. Chemical status will also be monitored, and Member States will be required to set European-wide Environmental Quality Standards (EQSs) and emission limit values for dangerous substances.

Bathing waters in London

Radioactivity in London's Sewers

The Environment Agency authorises and monitors the disposal of low levels of radioactive waste to sewers. These discharges are from non-nuclear sites such as hospitals, universities and research centres. Discharges are strictly controlled, with conditions and limits being placed on the disposer.

The Agency commissioned a study in 1997 to assess whether this current practice was still acceptable. One of the case studies used for this research was Beckton sewage treatment works in London, which was chosen because of its size and complexity.

The study looked at the impact of radioactivity upon both workers and the public and concluded that in all cases assessed radiation doses were a fraction of the acceptable public dose limit. The study also found that the disposal of radioactive waste to sewers remains the best option available to ensure the safety of both the public and the environment.

Groundwater quality in London

The groundwater quality in London is monitored using a network of public supply and private abstraction boreholes. The major aquifer under London is the chalk, which is covered by a confining layer of London Clay, thus preventing infiltration from the surface.

Large abstractions from boreholes and wells in London have sometimes resulted in the aquifer being recharged with saline water from around the tidal sections of the Thames. A combination of both geological and historical factors has produced relatively poor groundwater quality under central London with high concentrations of magnesium, sodium, chloride and sulphate in the water. The clay cover generally protects the groundwater from surface pollutants, so concentrations of nitrates, phosphates and total organic carbon are low. However, in places solvents and hydrocarbons have contaminated the groundwater via existing boreholes and other conduits.

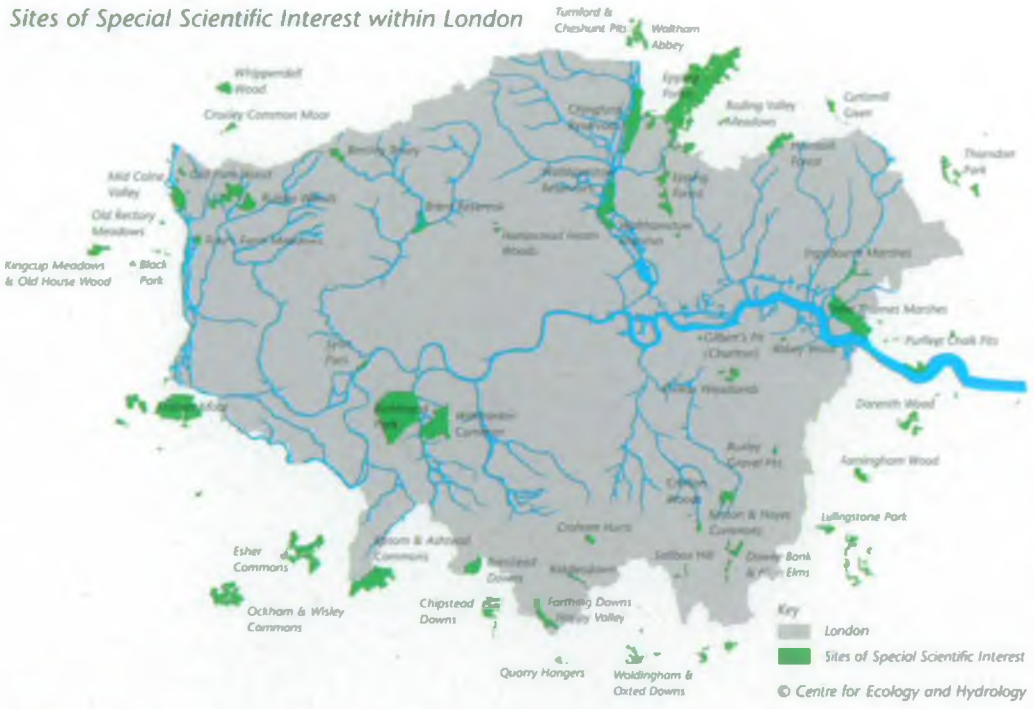
In some places London also has shallow groundwater within the gravels aquifer. Unfortunately the groundwater in the gravels shows the typical signs of urban contamination. A more detailed assessment of groundwater quality in London can be found on our website (www.environment-agency.gov.uk).

Biodiversity

Key messages

- Valuable habitats need to be protected from inappropriate development.
- The development process provides opportunities to realised environmental enhancements.
- New development should not be allowed to encroach into the River Thames.
- Redevelopment of brownfield sites may have an unforeseen impact on biodiversity within the capital.
- River corridors provide essential 'green corridors' throughout London and should be protected.
- Important populations of common and nationally rare fish species are present within London's rivers. These are generally recovering but remain fragile.
- Future policies should seek to minimise habitat fragmentation by 'expanding the best and linking the rest'.
- Climate change and sea level rise will have serious implications on salt marsh and coastal grazing habitats and on the distribution of certain species.

Sites of Special Scientific Interest within London



Background

'Biodiversity' broadly means the diversity and variety of wildlife and the habitats that support it. Conserving biodiversity is an essential element of the Agency's contribution towards achieving sustainable development. We seek to protect and enhance habitats and species through our day-to-day activities and this may include specific actions for the priority species and habitats identified by the UK Biodiversity Steering Group, for which Biodiversity Action Plans (BAPs) have been written. These actions have now been cascaded into individual Local Environment Agency Plan (LEAP) areas, based on current distributions of species and habitats, and they are summarised in our new Regional Biodiversity Strategy and Action Plan.

The London Biodiversity Partnership is currently in the process of writing Species Action Plans (SAPs) and Habitat Action Plans (HAPs) for the priority species and habitats for London. The Mayor will prepare a Biodiversity Action Plan which will draw on work carried out on biodiversity in London by partnerships such as the London Biodiversity Partnership, which includes the Environment Agency and the London Ecology Unit (now subsumed into the GLA).

Despite its built-up nature and the continuing development and pollution pressures, London is home to a number of nationally and internationally important species of animals and plants. Sixteen per cent of its area is covered by nature conservation designations and the Thames estuary is internationally important for wading birds and wildfowl. London's network of river corridors not only provides a valuable leisure amenity, but also plays an important role in the conservation of wildlife species and habitats within the city. Habitat fragmentation is a problem in London, as elsewhere in Britain. It is therefore important to improve degraded habitats to help link existing sites and make them viable.

The estuary itself is internationally important for wading birds and wildfowl, and commercial fishing for eels and sea fish takes place. London's other river corridors also play an important role in the conservation of wildlife and habitats. Improvements to these ecological networks will need to be maintained to meet with the aspirations for sustaining and improving biodiversity.

The rivers in London, such as the Thames, Wandle and Lee, are strategically important environmental assets, which require special consideration for planning and management. The importance of river corridors to nature conservation is illustrated by the distribution of Sites of Special Scientific Interest (SSSIs) across London.

Three of the UK priority species and habitats have been chosen for this report as indicators of the state of the environment for London (i.e. Water Vole, Reed Bunting and Coastal Salt Marsh habitat). The introduction and spread of certain alien plant and animal species has become a huge threat to some of our native wildlife and for this reason we have chosen two invasive alien species for this report (Chinese Mitten Crab and Floating Pennywort).

Biodiversity and climate change

Evidence of probable climate change can be seen in the recent colonisation and expanding distribution of certain insect species in the south and east of England. For example, dragonfly species such as the Red-veined Darter and the Lesser Emperor, which were formerly only vagrant in the UK, have bred at an increasing number of sites in recent years. Other insects such as Roesel's Bush Cricket and the Long-winged Conehead are rapidly expanding their range in a north-westerly direction across Britain, and now occur throughout much of the south east, after being very scarce and localised only 15 years ago. Both of the

latter species now occur on most of the suitable grassland sites in London.

Birds too may be reflecting subtle changes in climate, for example the Little Egret started breeding on the south coast only four years ago, but the population now exceeds 50 pairs. With increasing numbers being recorded in the south east it probably won't be long before this recent immigrant starts breeding successfully in the London area. Declines in species owing to climate change are also likely, but these will probably be associated with habitat loss and will therefore take much longer to detect.

The Agency's role

We have recently completed two years of research and data compilation culminating in the production of our Regional Biodiversity Strategy and Action Plan. This document details all the actions for which we have responsibility under the UK BAP, tabulated on a LEAP by LEAP basis according to the current and recent distribution of species and habitats. Our conservation, fisheries and biology staff are now using this document (which also contains distribution maps of all relevant species and habitats) to guide them on implementing biodiversity actions over the next three years. The same staff are also ensuring consistency between the UK BAP, the Agency's regional BAP and the London BAP through their presence on various local and regional biodiversity fora.

Distribution of key species and habitats in London

Water Vole

The Water Vole is a familiar and well-liked animal that was once a common sight along Britain's waterways. Unfortunately it has undergone a decline in recent years due to habitat loss and land-use changes associated with agricultural intensification. This decline has rapidly worsened due to predation by feral American Mink. The Water Vole has declined by 90 per cent throughout Britain while in Greater London alone it has disappeared from over 72 per cent of the sites it occupied prior to 1997. However, Greater London does support some strongholds for Water Vole with significant populations at Rainham Marshes, Crayford – Erith Marshes, the River Cray and the Lee Valley.

Distribution of Water Voles across London

The Water Vole is found in a wide range of habitats from high quality wetland SSSIs to heavily degraded habitats in urban situations. However, the absence of resident mink appears to be a common factor in determining where they occur naturally in the capital. Sensitive habitat management, enhancement schemes, mink control and ensuring development schemes do not affect the integrity of existing Water Vole populations, are all essential to the survival of this species. There is also national research currently underway investigating translocation and reintroduction as methods to aid the Water Vole's recovery. A three-year London Water Vole Project will commence in spring 2001, initiated and co-funded by the Agency, but hosted by the London Wildlife Trust.

Trend

In Greater London, the Water Vole has disappeared from over 72% of the sites occupied prior to 1997. Hopefully this decline will soon be halted with sensitive management of existing sites and reintroduction to previous sites. Long term trends are hard to predict prior to future monitoring and surveys.

Source: ITE (pre 1997), LMG (1997 survey), HBRC (1998 onwards), Environment Agency (1998 onwards) and SWT (1999)

Reed Bunting

The Reed Bunting is a small, streaky-brown bird that commonly inhabits reedbeds and other wetland habitats as well as drier farmland sites such as overgrown ditches and hedgerows. Reed Buntings are found throughout Britain and Ireland, but there has been a decline nationally in their numbers in recent years. This may be due to many factors, but includes deterioration of wetland habitats and the intensification of agricultural practices. The status of the Reed Bunting within Greater London is more difficult to assess, possibly because it is under-recorded in the breeding season. It is known to have increased in numbers in some areas and decreased in others and numbers do fluctuate in response to weather conditions. However, it breeds regularly in good numbers at Rainham Marshes, part of the inner Thames Marshes SSSI, and has also bred at Walthamstow Marshes, Walthamstow Reservoir and Brent Reservoir SSSIs.

Distribution of breeding Reed Bunting across London

Trend

Numbers of Reed Bunting in Greater London fluctuate each year, but with sensitive management of existing wetland habitats and the creation of new reedbeds, the breeding population may increase.

Source: London Natural History Society, 1990-1996

Coastal Salt Marsh

In the UK, coastal salt marshes comprise the upper, vegetated zones of intertidal mudflats and are dynamic habitats important for a variety of wildlife including plant communities, invertebrates, fish and wading birds. It has been estimated that in the last decade, the UK has lost approximately 100 hectares per year of coastal salt marsh through development pressures, erosion and over-grazing. These causes are all threatening the extent of salt marsh habitat along the tidal Thames and are exacerbated by the tidal defences that prevent the salt marsh communities from spreading as they would in a natural estuary.

Coastal Salt Marsh on the Tidal Thames

Trend

Salt Marsh habitat is currently declining in London, but this trend could be halted with future sensitive tidal defences and other developments.

Source: ITE, 1990

Distribution of invasive alien species across London

Chinese Mitten Crab

The Chinese Mitten Crab is an alien species native to eastern Asia, which has colonised parts of the tidal Thames and some if its tributaries. It was first reported in the River Thames in 1935 and since the early 1990s numbers have increased significantly. They burrow into natural river and intertidal mud banks, severely eroding them and leading to the eventual, sometimes irreversible, collapse of the banks. Natural banks are rare along the tidal Thames (only 1 per cent of the tideway) and are being lost because of the collapse of the banks as well as through the crabs eating the root systems of

common reed, for instance. The Chinese Mitten Crab poses a serious threat to this rare habitat. It is an omnivorous species, capable of eating a wide variety of aquatic plants, invertebrates and fish. Thus species such as the native White-clawed Crayfish, already in decline in the UK, may be threatened by the expansion of Chinese Mitten Crab populations into freshwater reaches.

Chinese Mitten Crabs are now established on the main River Thames as far upstream as Staines and they will undoubtedly continue to spread further upstream. They are also present on parts of the River Roding up to Ilford, the River Lee up to Enfield, the River Darent up to Sevenoaks, the River Cray up to Orpington, the River Mole up to Leatherhead and parts of the Rivers Crane, Brent, Hogsmill, Wandle, Quaggy and Ash.

Distribution of Chinese Mitten Crabs across London

Very little is currently known about the biology and ecology of the Chinese Mitten Crab in the Thames and research on these topics is urgently required, as is monitoring of their distribution. Effective methods of control also need to be identified and developed as, to date, their numbers are increasing unchecked.

Trend

The distribution of the Chinese Mitten Crab within Greater London is increasing unchecked and this trend is unlikely to change in the foreseeable future.

Source: Environment Agency, 1998-2000

Floating Pennywort

Floating Pennywort is one of a number of invasive, non-native aquatic plants that has been introduced and subsequently naturalised into Britain's waterways and wetlands. It was introduced from aquaria and garden ponds and was first recorded in the wild in 1980. It roots freely in sediment along the shallow margins of slow-moving rivers forming dense mats up to 50 cm deep and often completely covering river channels and lakes.

Such dense mats can cause huge problems, including competing successfully with our native plants and deoxygenating the water, which can lead to fish deaths. The plant may also restrict flow and hence reduce the integrity of flood defences, interfere with recreational activities and navigation, hamper surface water abstraction and disrupt or damage riparian structures such as footbridges. It spreads easily by fragments breaking off, and together with its rapid growth rate and the fact that few of our native animals eat it, this means that Floating Pennywort is currently spreading rapidly throughout our waterways.

Within Greater London, Floating Pennywort is now widespread on the River Lee system south of the M25 and is also found on the Rivers Roding and Wandle, on the Marsh Dykes system, on Brent Reservoir SSSI and at the Wildfowl and Wetlands Trust Wetland Centre at Barnes, as well as on lakes and ponds in Epping Forest.

Distribution of Floating Pennywort across London

Trend

The short-term trend will undoubtedly be an increase in the distribution of this invasive species throughout Greater London. Improved control methods may see a halt in its spread, but a decline is only likely with new legislation preventing its propagation and sale.

Source: Environment Agency, 2000

Enhancing and managing fisheries

Freshwater

All of the rivers in London represent important recovering ecosystems. Most have some history of angling but little current practice. Given the past degraded conditions, the recovering systems provide some important fish conservation issues. For example, the only minnow population remaining in south London lives in a small tributary of the Ravensbourne. Similarly, the only bullhead in south London reside in one small part of the Wandle. Recovery provides substantial potential for angling in urban rivers, particularly on the Wandle, which is a recovering chalk stream in an urbanised setting with mass access available throughout.

Urban lakes and ponds provide another major challenge. Most are poorly managed with little riparian knowledge of sustainable fisheries management. Excessive fish populations regularly suffer mortalities in warm weather, whether the water is fished or not. The problems are not new and the Agency has always supported fishery managers and owners. Recently public tolerance of fish mortalities has reduced markedly as environmental awareness grows. Through a national Urban Stillwater Fisheries Project, we are now engaged upon a major new support, enhancement and education programme with local authorities across London.

The estuary

The estuary now supports 118 species of fish, of which at least 50 are reported each year. The freshwater reaches support an important recreational fishery for dace, roach and a range of other species. Sea angling is now becoming a major recreational pursuit below Rotherhithe, for flounder, sole, bass, whiting and eel. Dace, smelt, sand-smelt, gobies, sole and the sea lamprey all now spawn in the estuary. The estuary is a premier nursery ground in UK terms for bass and flatfish, particularly the sole. Twaite shad are now regularly captured as far up as Mucking. There is a commercial eel fishery below Tower Bridge, one for grey mullet below Woolwich and one for sole below Gravesend.

We use data from our survey programmes to press for further improvements to water quality and to engage with our partners on habitat enhancement and joint management strategies.

Salmon returning to the River Thames

There is evidence that the River Thames once supported a healthy salmon population with catches landed and sold at the Billingsgate fish market. However, as London grew as a city during the Industrial Revolution, pollution of the tidal river contributed to the extinction of the salmon population by 1833.

Number of salmon returning to the River Thames, 1974-1999

Happily the population showed signs of returning during the 1970s and the Thames Salmon Rehabilitation Scheme began in 1979 with the long-term objective of restoring a self-sustaining population to the river. Since then good progress has been made and every year adult salmon do pass through London on their journey upstream to find suitable areas to lay their eggs.

In 1986 the Thames Salmon Trust was formed to provide finance for the Scheme and has been a great success with more than £1 million raised to date. The Rehabilitation Scheme includes fish rearing and stocking, construction of fish passes and monitoring programmes to evaluate progress.

The confirmed minimum number of returns is based on fish taken in traps, rod and line, mortalities and electro-fished. This probably represents 60–70% of the total numbers. The presence of salmon in the river is an excellent indictor of water quality in the River Thames and all the way through London.

Trend

The numbers of returning salmon in the Thames declined from 1993 to reach a low in 1998. This is believed to be at least partially due to the recent dry summers and the effect of these on river flows. Since 1998 the numbers have increased.

Source: Environment Agency

It is hoped that in the near future alternative tideway fish species such as smelt could be utilised as biological indicators. Currently our tideway-monitoring programme for fisheries is unique within the EU and leads the way in developing estuarine monitoring techniques.

Estuarine invertebrates

Invertebrates are good indicators of water quality because they tend to stay in one place and unable to avoid incidents of pollution. The presence of sensitive animals implies that good conditions have persisted throughout their lifetimes.

Distribution of invertebrates is mostly linked to salinity, tidal exposure and to the nature of the riverbed. Freshwater animals are found at the top of the river and marine ones lower down. A variety of specialised animals that can tolerate the estuarine conditions are found in between the freshwater and marine zones. The twice daily tidal inundation of the foreshore has a strong effect upon distribution up and down the shore, with those species that can tolerate exposure to the air being found further up the shore. The progressive changeover in species from low to high water marks and beyond into areas of land is a particularly important part of the natural variety found in healthy habitats.

The nature of the riverbed has a bearing on the types of invertebrates that can live there. Huge numbers of small worms are found in mud whilst a great variety of larger animals can be found in more mixed substrates. Any alterations to the sediments will have an impact upon the invertebrates inhabiting them, therefore any developments that affect water currents can affect the invertebrate make-up.

We monitor these habitats at a number of sites along the estuary in order to be able to detect non-natural changes.

Water resources

Key messages

- The sustainable management of water resources for the capital will depend on the extent to which demand can be managed within available or planned resources.
- Aggressive leakage reduction and mains replacement may cause disruption to the capital and require real increases in charges to customers.
- Water-efficient techniques should be incorporated into all new development and encouraged where practicable elsewhere.
- Rising groundwater levels in the confined aquifer beneath London pose a potential threat to the city's infrastructure but also provide an opportunity for water resources. New schemes continue to be explored to manage rising groundwater and utilise the available resource.
- If demand cannot be managed, enhancement of the capital's water resources will require the development of major new strategic schemes elsewhere in the region.

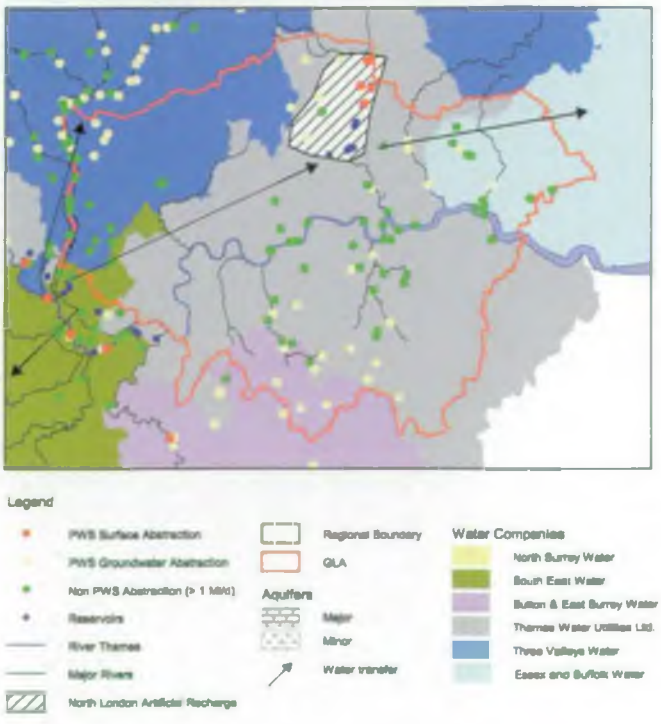
Background

The Rivers Thames and Lee have been major sources of water supply for Greater London since the early eighteenth century when the advent of steam power revolutionised both the abstraction and distribution of river-derived water. Before then supplies were reliant on water being piped in from spring sources such as the Tyburn (since 1237) and especially the New River, completed in 1613 to bring supplies from Amwell in Hertfordshire.

The Thames has since been developed into a major resource supporting much of the demand of today's population in the capital. Managing supply shortages in London is a theme that has continued to the present day. In the 1960s, a major tunnel was constructed under London to take raw water from the Thames to the Lee Valley, followed by the London Water Ring Main, a tunnel which allows the flexible distribution of treated water under much of London.

Regional water resources and transfers

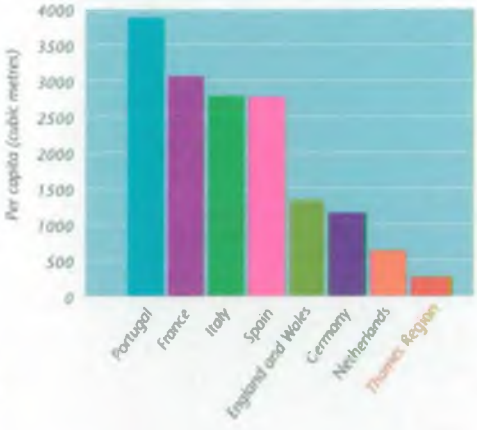
London's water resources



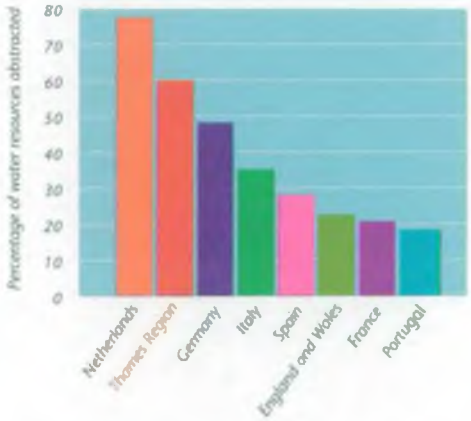
Five Water Companies: Thames Water, Sutton and East Surrey Water, North Surrey Water, Three Valleys Water and Essex and Suffolk Water now meet the demands of the 7.2 million people in Greater London, supplying on average approximately 2,400 megalitres (million litres) of water for public water supply each day for domestic, commercial and industrial uses. About 90 per cent of the total demand for public water supply in Greater London is supplied by Thames Water. River abstractions account for approximately 90 per cent of the total water supplied in Greater London principally through the abstractions and reservoir systems on the Thames and Lee operated by Thames Water.

Source: Environment Agency

Annual internal renewable water resources



Annual abstraction, 1997



Note: London mainly falls within Thames region

Source: England and Wales – Environment Agency

Rest of the world data table by World Resources Institute 1998-99. Freshwater resources and withdrawls

Increased demand for water has to be balanced with the availability of the resource. The graphs show how the Thames Region, within which London is located, has a lower per capita availability of water compared with the average for England and Wales and with many European countries, and that it also abstracts a high proportion of what is available. This is caused by the high density of population found within the Region, rather than the low

level of rainfall. The first graph outlines annual internal renewable water resources available, which identifies the quantity of effective rainfall (i.e. the amount of rainfall reaching surface and groundwater after the losses to the air by evaporation) available per capita. The second illustrates the percentage of the available water resource abstracted within a country or region.

Source: Environment Agency

The Agency's role

Even though fresh waters have long been used for human activities, abstractions have only been regulated since the Water Resources Act 1963. The Act led, first, to the setting up of 29 river authorities to provide regional catchment-based integrated management of water resources and, secondly, to the introduction of abstraction licensing.

Today, the Environment Agency is responsible under the Water Resources Act 1991 for achieving sustainable management of water resources, and balancing the needs of the environment and abstractors. We set the overall framework for water resources planning and development through national and regional water resources strategies. Effective management of water resources is principally secured by a system of abstraction licensing and enforcement. There are a number of other key stakeholders involved in the management of water resources, in particular the Office of Water Services (OFWAT), the economic regulator of the water companies, and the water companies themselves that supply treated water to households, commercial and industrial premises through the supply network.

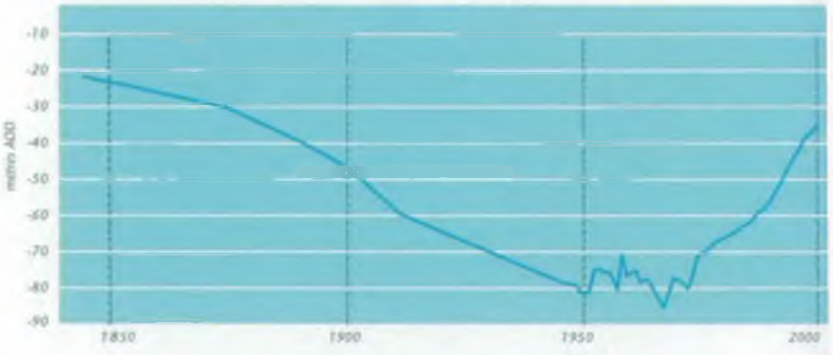
Groundwater under London

London is located at the eastern end of the London Basin Syncline, one of the major geological structures in south east England. Present throughout this trough-like structure is the Chalk, the most extensive aquifer in Britain, overlain firstly by sands and then, predominantly, by the London Clay.

Since abstraction from the aquifer started nearly two centuries ago, there have been major changes in groundwater levels and hence the state of groundwater storage. Increasing abstraction, mainly for commercial and industrial purposes in the nineteenth and early twentieth centuries, led to progressive decline of levels reaching a maximum fall of 90 m in the centre of the basin. Starting in the Second World War and continuing ever since, abstractions have declined, leading to a reversal of the downward trend in 1965–70, to a rise which continues to this day at up to 2.5 m per year.

Whilst levels are now rising, the earlier decline in groundwater levels caused dewatering of a large volume of the aquifer over substantial areas. A realisation of these events led the Metropolitan Water Board to experiment with the idea of artificially recharging this dewatered volume to store water instead of building another surface reservoir. The recharge water is treated mains water, a surplus of which is available in the existing distribution system at times of seasonally low demand.

Groundwater level in London at Trafalgar Square, 1850-1999



The technique was explored further in the 1970s and 1980s leading eventually to Thames Water's North London Artificial Recharge Scheme which is now in operation (see diagram on previous page). In broad principle the scheme will be used to meet drought deficiencies in the surface water resources supplying London. Between major abstraction operations, the aquifer will be recharged by a combination of natural recovery and artificial recharge.

Today's rising groundwater presents a threat to tunnels and building foundations built into the dewatered aquifer, particularly in central London. Controlling the rise by pumping offers a potential resource, which, the Agency considers, could produce 30–50 Ml/d of additional water. Thames Water have embarked on a programme to utilise it as far as possible but private, smaller abstractors are also showing interest and may have a part to play in filling in around and between Thames Water's larger abstractions. Some of the water is of poor quality and may be more suited for non-potable use, e.g. cooling, toilet flushing, rather than for public water supply requiring expensive treatment.

Trend

The past two years have continued to see water levels rising. Levels in central London are now at their highest since the 1890s. The Agency is working closely with Thames Water, the Corporation of London and other interested organisations through the GARDIT project to develop a longer-term solution to this problem.

Source: Environment Agency

Lower river flows and the environment

In dry summers when river flows are low, the abstractions operated by Thames Water and the other companies can take up to 80 per cent of the natural flow of the Thames. As the river is impounded behind weirs for navigation, levels change very little but there is increasing concern that the loss of flow volume and velocity may be having undesirable effects. There are fears that loss of habitat for instream wildlife generally, reduction in fish populations and very poor salmon migration may at least in part be due to the high degree of abstraction. Navigation between Kew and Richmond at very low tide can be affected. Some alleviation of these conditions has been achieved through the formal Operating Agreement but more may need to be done.

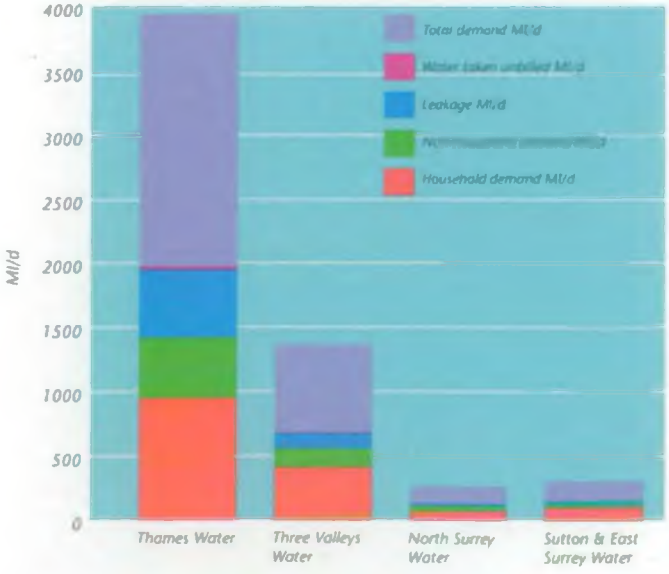
A long-term monitoring programme, which assesses ecological quality at a number of sites in relation to the Operating Agreement, is being undertaken by the Agency. The data is currently being reviewed in order to determine whether there is a significant impact on the ecology in low flow years.

Water resources to meet future demands

Key factors influencing future demand for water include:

- the underlying growth in demand for water and expectations of standards of service;
- opportunities for demand management, e.g. reducing losses through leakage, and promoting water efficiency;
- the needs of the environment;
- development pressures and sustaining of economic activity;
- climate change.

Demand for London's water



Until the early 1990s, demand for water increased at a rate of approximately 1.7 per cent each year and that trend was forecast by water companies to continue. Although there remains an underlying trend of growth in demand, the anticipated rate of growth is now less than 0.3 per cent each year. This reflects growing pressures on companies to reduce leakage and trends in efficiencies in water use by industry and commerce, set against underlying trends of increasing demand for water in the home.

The longer-term strategy for the sustainable management of water resources for the capital hinges on the balance that can be struck between the underlying rate of growth in demand (including environmental demands) and the opportunities through leakage reduction and water efficiency to manage our demand for water. The extent to which this balance is struck will determine the need for further sustainable development of water resources. Although Thames Water have recently proposed the development of a major new pumped-storage reservoir, the need, over the longer term, for major strategic new water resources schemes to support supplies for the capital remains uncertain. Should such a scheme proceed, it would rely on water being abstracted from the River Thames during periods of high flows which would then be used directly to supply the upper Thames area or to augment flows in the Thames to supply London. As envisaged by the company, the scheme at some 150,000 Ml storage could provide a substantial resource but would also clearly have wide-ranging environmental impacts. Alternatives to this proposal will also need to be carefully examined.

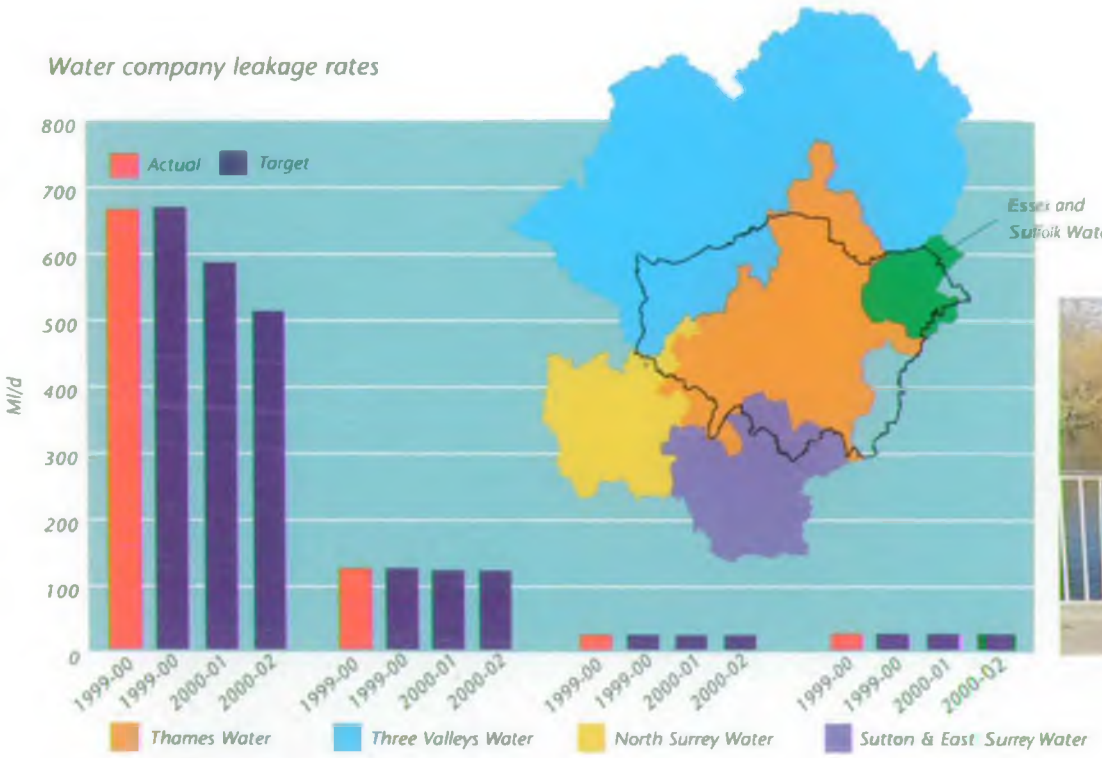
Source: Environment Agency and water companies

Leakage

Despite significant progress against targets set by OFWAT, leakage remains a key concern for the region, particularly in London. Data reported by OFWAT (1999) illustrates significant gains made by Thames Water but leakage remains at some 665 Ml/d, or about 26 per cent of the water supplied by the company, and the majority of this occurs in the capital. OFWAT has set more challenging targets for 2001. The scope for making significant inroads into leakage in the capital remains a significant issue for the region. New and emerging technologies will undoubtedly help, combining the benefits of telemetry with new, in-pipe intelligent technologies for leak detection. However, whilst location of leaks will be easier and faster, this does not avoid the inevitable and unpopular disruption caused by the need to repair or replace leaking mains.

Source: OFWAT and water companies

Water company leakage rates



Note: Thames Water leakage for the London area only is 529 Ml/d

Trend

Over the past two years all the water companies within London have met the leakage targets set by OFWAT. Pressure will be placed on Thames Water to continue their trend of improvements over the next few years.

Climate change

Climate change will add to the complexities and uncertainties of water resources management in the capital. Whilst the region's water resources may benefit to some extent from the prospect of wetter winters and increased recharge of groundwater, hotter and drier summers are likely to lead to both the needs of the environment and our own demands upon water resources changing significantly. Because of the high level of uncertainty about the impacts of climate change upon water resources, supplies and demands, we cannot justify the need to take actions yet on the basis of climate change alone. However, where projects with long lead times are being considered, such as new reservoirs, it may be prudent to consider the potential effects of climate change alongside other drivers affecting our water resources management decisions.

Waste management

Key messages

- London will need to reduce the overall quantity of municipal waste by 3.7 million tonnes by 2020.
- Greater self-sufficiency and adherence to the 'proximity principle' should be integral in dealing with the future of London's waste.
- Current levels of recycling and recovery will not be adequate to support the 2010 landfill diversion target.
- Consideration needs to be given to the strategic location of waste management facilities to minimise the burden from the transportation of waste.
- Existing river transfer stations and rail heads must be protected.

Background

The amount of waste produced is a result of both the goods produced and consumed, and the inefficient use of materials. Costs and environmental impact are incurred throughout the chain of production and consumption, including the handling, treatment and disposal of the waste. Waste needs safe handling, treatment and disposal to ensure protection of the environment and human health. To help achieve this, controlled waste is regulated from its collection to its disposal.

Household waste includes dustbin waste and waste from civic amenity sites, as well as wastes from recycling schemes, litter collections and street sweepings. In London, approximately 20 per cent of municipal waste is non-household waste (largely commercial waste collected by local authority rounds from offices and shops). Recycled household waste is collected from sites such as bottle and paper banks and increasingly from kerbside collections using bins or boxes.

Approximately 74 per cent of all municipal waste produced in London in 1998–99 was sent to landfill and most of it was exported to surrounding counties. There are two major waste-to-energy plants in London that dealt with 19 per cent of all municipal waste produced. This is a higher proportion than other regions, which reflects the lack of landfill sites in London.

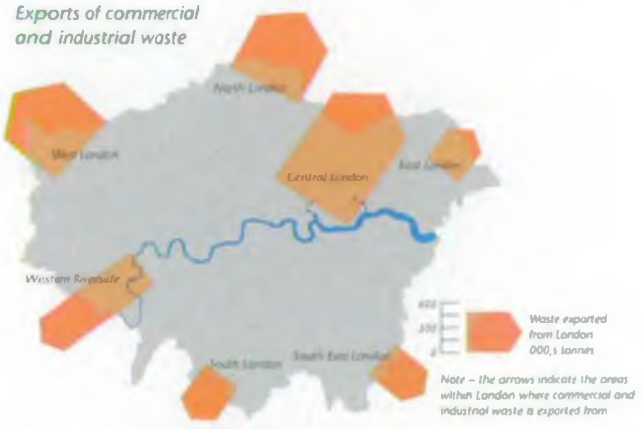
The Landfill Directive and the targets within the Government's *Waste Strategy 2000* will require London to reduce the amount of waste going to landfill through increased waste minimisation, recycling and recovery. Greater self-sufficiency and adherence to the 'proximity principle' should also be a key objective in dealing with London's waste.

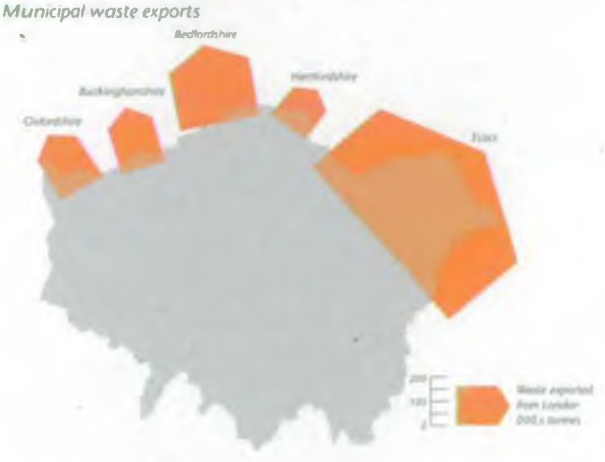
The Mayor will produce a municipal waste management strategy covering such issues as the recovery, treatment, disposal and recycling of waste, with the power to direct local waste collection authorities and waste disposal authorities to ensure that the strategy is delivered.

Government targets

The DETR has set targets for the recovery of waste in its *Waste Strategy 2000 for England and Wales*. This requires that 45 per cent of waste is recovered by 2010 and that the landfilling of industrial and commercial waste is reduced to 85 per cent of the 1998 level by 2005. The Strategy also proposes household waste recycling targets of between 10 per cent and 33 per cent for local authorities, to deliver an overall recycling rate of around 17 per cent by 2003.

The Landfill Directive requires the diversion of municipal biodegradable wastes from landfill and the complete ban on co-disposal (hazardous with non-hazardous waste) landfills. The diversion targets for biodegradable municipal waste are 75 per cent, 50 per cent and 35 per cent of the amount produced in 1995 by 2010, 2013 and 2020 respectively. These targets will require London to reduce the overall quantity of municipal waste landfilled by 2.7 and 3.7 million tonnes by 2013 and 2020 respectively (relative to 1998, assuming that recycling continues at current rates, and no additional incineration capacity is provided). If municipal waste continues to grow in quantity, current levels of recycling and recovery will not be adequate to support the 2010 landfill diversion target.





Monitoring waste

The *Strategic Waste Management Assessment for London* published in November 2000 presents information on the types and quantities of waste produced within the Greater London Authority. It also contains forecasts, where appropriate, of future waste production at intervals in line with the Government's Waste Strategy and the diversion targets in the Landfill Directive. In time, data will be produced to show changes in the total amount of waste generated and the changes in management practices.

The Agency's role

We are responsible for regulating the treatment, transport, storage and disposal of controlled waste. This consists of municipal, industrial and commercial waste. The key objectives for waste management are to minimise the production of waste, to make the best use of waste that is produced and to minimise pollution arising from waste.

We have selected the following indicators to monitor waste management across London in the future:

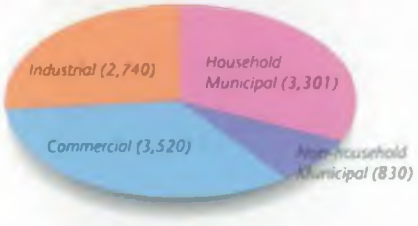
- London's waste production;
- municipal waste production and recycling in London;
- the amount of London's waste disposed to landfill.

London's waste production

This indicator shows the amount of controlled waste produced and the tonnage of waste disposed of at licensed waste management facilities in London.

The total quantity of municipal, industrial and commercial waste produced in Greater London in 1998–99 was approximately 11.2 million tonnes, including 653,000 tonnes of 'special waste'. This can be compared to England and Wales, which produces approximately 400 million tonnes of waste each year. Around 100–130 million tonnes of this comes from industry, commerce and households.

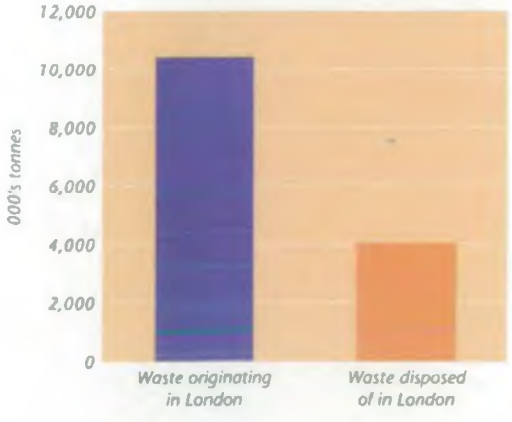
Municipal, industrial, and commercial waste generated in London (000's tonnes), 1998-99



Total 10,391 tonnes

Note: commercial and industrial waste produced includes 652,000 tonnes of special waste

Municipal, industrial and commercial waste originating and disposed of in London, 1998-1999



Our research has shown that in 1999, 6.6 million tonnes of construction and demolition waste was produced, arising from the construction, repair, maintenance and demolition of buildings and structures, with over one million tonnes of this disposed of at sites exempt from licensing.

As economic prosperity increases, so does the production of waste, and this is particularly so where manufacturing and development takes place. The costs involved with waste disposal, including fiscal policies, can make companies look towards reducing their waste. Public awareness can help consumers make informed choices and this in turn can put pressure on manufacturers to consider the waste implications of their products and their packaging. Legislation can also be used to bring about changes in waste generation and disposal methods.

Source: Environment Agency, London SWMA

Municipal waste production and recycling in London

This indicator considers the amount of municipal waste that local authorities have to dispose of including collected household and non-household waste, civic amenity site waste and recycling. Data has been collected by the DETR

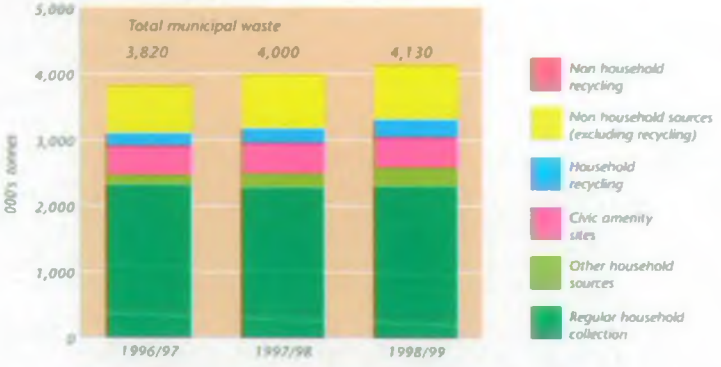
Fly tipping in London

Unlicensed dumping of waste or fly-tipping is an ongoing problem within urban areas and especially within London. Fly tipping affects the amenity of the areas where it takes place, it can attract pests and vermin, and can involve potentially flammable or toxic materials.

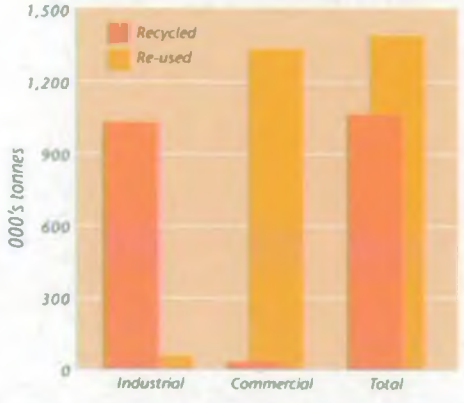
We already deal with this on a day to day basis, using surveillance cameras and taking enforcement action where it is necessary and practical to do so. To address the issue of fly tipping a Fly Tipping Stakeholders Forum has been set up. The Forum represents a partnership approach to the problem of fly tipping between the Country Landowners Association, the National Farmers Union, the Federation of Small Businesses, Railtrack, British Waterways, the National Trust, Tidy Britain Group, the Local Government Association, the Scottish Environment Protection Agency and the Environment Agency. The Forum has produced guidance to help landowners, managers and members of the public combat fly tipping.

On 11 August 1998 the Local Government Association and the Environment Agency signed an agreement ('The Fly Tipping Protocol') which detailed the situations where the public could expect the Environment Agency to respond and Local Authorities to respond to incidents of fly tipping. Fly tipping is viewed as being a serious offence. A person convicted of fly tipping at a Magistrates Court is liable to a fine of up to £20,000 or up to 6 months imprisonment or both. At Crown Court this rises to up to two years (5 years in the case of special waste) or an unlimited fine or both.

Municipal waste production and recycling, 1996/97-1998/99



Recycling and re-use of industrial and commercial waste produced in London, 1998-1999

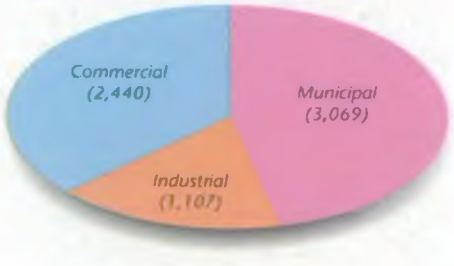


from waste disposal authorities on the quantities of waste they had to manage.

Around 8 per cent of London's household waste is recycled or composted. This is far short of the Government's Waste Strategy target of 25 per cent set for the recycling of household waste by 2005.

With the current growth in population coupled with the reducing size of household units, London faces a considerable challenge to achieve an overall reduction in household waste. Nationally, amounts of total household waste have increased. This is linked to various social, economic and demographic factors, including the number and size of households, the economic climate and levels of employment. New housing development in the south east will further increase the total amount of household waste generated.

Volume of London's municipal, industrial and commercial waste disposed of to landfill (000's tonnes), 1998-1999



Total 6,616 tonnes

However, a reduction in household waste is the primary aim while an increase in reuse and recycling, provided it can be demonstrated to be the Best Practical Environmental Option, would help to reduce the environmental impact of the waste. Until these changes stabilise, efforts in waste minimisation are expected to have little noticeable impact.

Source: Environment Agency, London SWMA

The amount of London's waste disposed of in landfill sites

London is currently very reliant on landfill for waste management, with 74 per cent of its municipal waste, and 50 per cent of its commercial and industrial waste being landfilled in 1998–99. The Landfill Directive and the targets in *Waste Strategy 2000* will drive the need for increased waste minimisation, recycling and recovery, and alternative treatment and disposal facilities for London's waste.

Source: Environment Agency, London SWMA

Overall trend

This increase in waste production must be slowed, then halted before a reduction can be achieved. The hazardousness of waste produced must also be reduced as well as the distance waste is moved to comply with the 'proximity principle' and to minimise impacts on adjoining regions. Consideration should be given to the strategic location of waste management facilities to minimise the environmental burden arising from the transportation of waste. Existing river transfer stations and railheads must be safeguarded and waste should be transported where practicable, taking account of the preference hierarchy of water and rail routes before road transport.

Municipal solid waste is set to increase by almost 85 per cent over the next 20 years if the current national average waste growth of 3 per cent per annum is maintained. By 2020 more than 3.7 million tonnes of municipal solid waste will have to be diverted from landfill each year.

Flooding

Key messages

- Climate change and continued urbanisation will increase the risk of flooding across London.
- London Boroughs need to work with the Agency in restricting development within the floodplain.
- Where appropriate Sustainable Urban Drainage techniques should be adopted.
- New flood defence schemes which will aim to minimise environmental impact may become necessary.
- Tidal defences should be protected from new development.
- Public awareness activities have an important role to play in getting the flood warning message across.
- Floodplain mapping is now available on the Internet and people will be able to find out whether they live within an indicative floodplain.

Background

Flooding of land adjacent to rivers and the coast is a natural process that can have far-reaching effects on people and property. There are considerable costs associated with the damage it causes. These costs are not only financial and economic, such as damage to property and flood defences and disruption to business, but can also include distress, injury and loss of life as well as extreme demands on the emergency services and loss of public confidence in the planning services. Flooding, however, can also have many benefits to the environment, for example it is essential to maintain certain important habitats.

In London, rivers can react to rainfall very quickly due to the nature of the channels and the increase of surface water runoff from urbanised areas. It is especially important to ensure culverts are free from blockages all year round. London can actually also trigger thunderstorms in summer months because of turbulence caused by buildings and because of temperature differences between the city and the countryside.

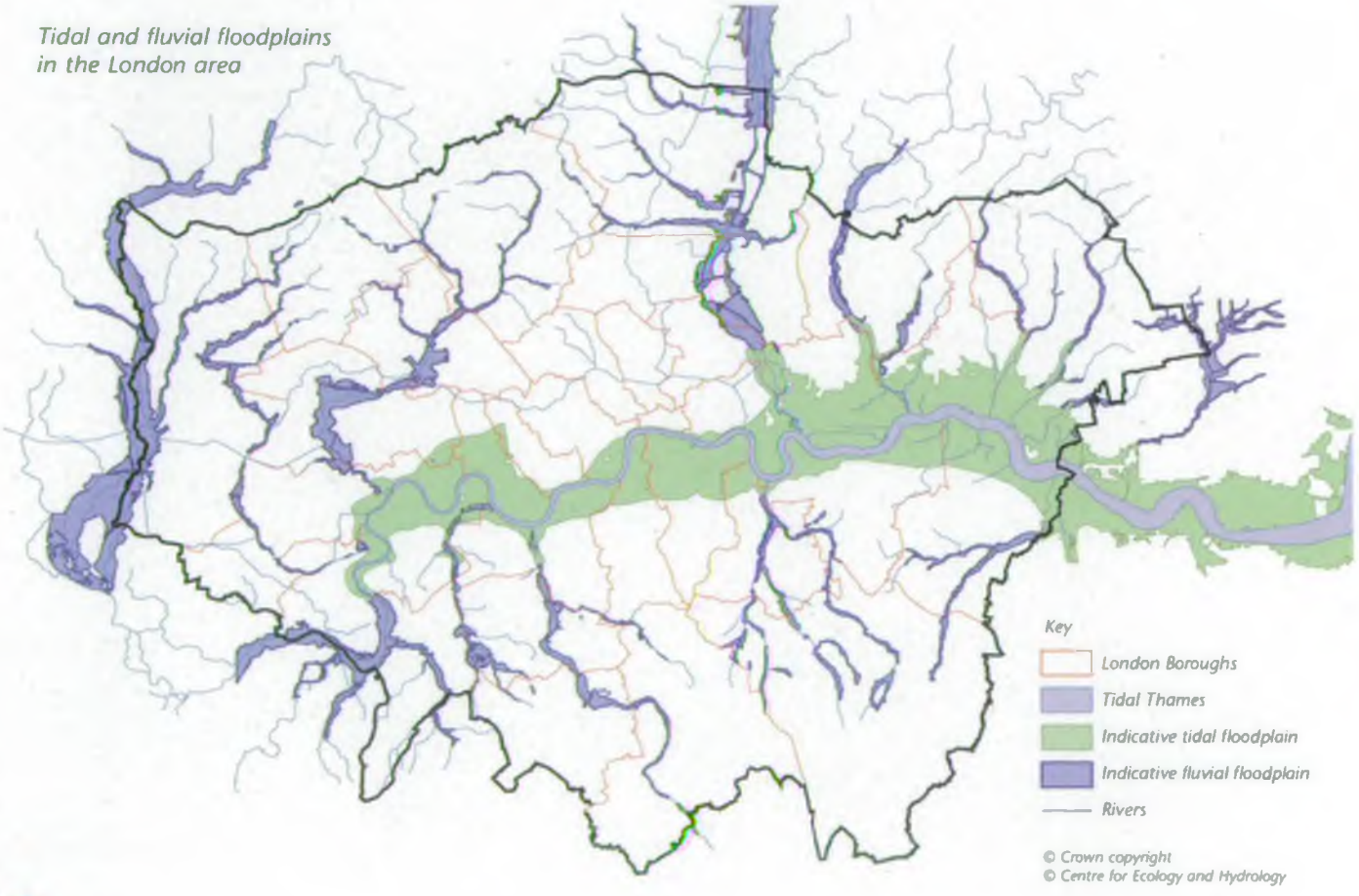
Causes of flooding

The recent Consultation Paper on *Development and Flood Risk* (PPG 25, DETR, 2000), identifies the principal cause of river flooding as the excessive rainfall or snow melt within a limited period, which overwhelms the drainage capacity of land, particularly when the ground is already saturated or when channels become blocked. Some areas, such as London, are subject to combinations of both tidal and river impacts. Flooding can also be aggravated by:

- the growth of built development in catchments and other changes in land use, which increase the rate and volume of runoff;
- sediment movement that has changed river cross-sections and affected flood levels;
- inadequate maintenance of flood defence systems, watercourses, culverts (including the flood relief areas around them) and road gullies, particularly where this leads to channel blockage;
- canalisation, modification and diversion of rivers and watercourses, which increase the rate of flow and decrease the time taken for water to travel within a catchment; and
- building of structures (e.g. embankments) which reduce storage and restrict flows over historical floodplains and thereby create additional flood risks both upstream and downstream.

Flooding is, therefore, a combination both of human activity and natural physical conditions.

Tidal and fluvial floodplains in the London area



The Agency's role

Flood defence

The Agency makes a significant contribution to river basin management through works related to flood defence. Improvement works aimed at reducing the risk from flooding to life and property might take the form of channel alterations, storage provision, river control structures or raised defences. Such works will always take into account environmental considerations during their design and construction. Schemes may tackle past insensitive or inappropriate works, or they may be needed to address increased risk arising from new development within the floodplain.

Extensive essential maintenance works to watercourses and previous improvement schemes are carried out by our internal workforce. In addition, channels are kept free from debris and blockages, and excessive growth from vegetation is controlled where required. The workforce is also deployed on emergency response work that includes operating defences and control structures and ensuring that flows are maintained without blockages occurring. The Thames Barrier is by far the largest of these structures and together with the Thames tidal defences protects the homes and businesses of 1.2 million people.

Flood warning

The risk of flooding from rivers and the sea is with us all the time. It can happen very quickly and without warning. Since September 1996 the Agency has taken the lead role in issuing flood warnings. We conduct detailed flood forecasting and make the decision whether or not to issue a flood warning.

The Agency commissioned an independent review (the Bye Report) following flooding across Wales and central England during Easter 1998. This identified the need to strengthen the flood warning capability and raise the public awareness of flood risks. We are responding to these recommendations by making significant investments over the coming years. One of the many recommendations was to change the way we issue warnings to the public:

> 'Colour-coded warnings appear to be misunderstood by nearly all who receive them'
>
> 'The interests of the public are not well served by warnings given on the colour-coded basis'
>
> *(Bye and Horner, 1998)*

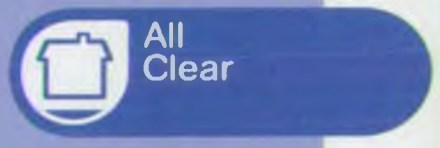
Since 12 September 2000 a new four-staged warning system has been introduced, replacing the old colour-coded system of yellow, amber and red. The new flood warning codes are:

Flood Watch: Flooding is possible in the area, be aware, be prepared, watch out!

Flood Warning: Flooding of homes, businesses and main roads is expected in the area, act now!

Severe Flood Warning: Severe flooding is expected in the area, there is imminent danger to life and property, act now!

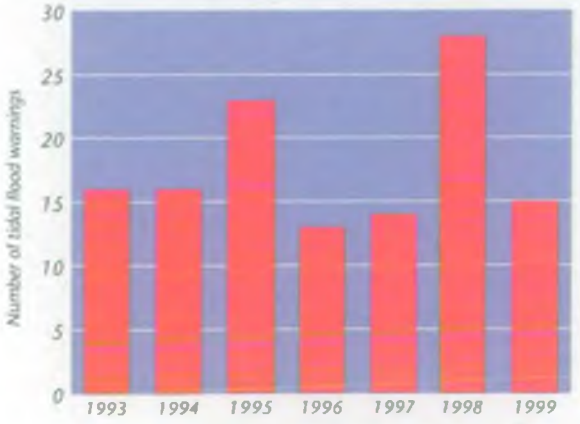
All Clear: There are no Flood Watches or Warnings currently in force in the area.



The number of warnings have to be treated with some caution as a measure of potential flooding, as the areas for which warnings are issued vary in terms of their size and number of properties covered.

Significant investments are being made to improve our ability to forecast and warn of imminent flooding. Future developments will enable more rigorous assessment of performance as our knowledge of flood warning risk areas and properties at risk improves. Thus the analysis of flood warnings used in this report is offered as an interim step.

Number of tidal flood warnings, 1993-1999



Trend

Several factors could affect the number of flood warnings and flooding in the future, including the effectiveness of flood defences, the amount of development in the natural floodplain and in risk areas, and the weather conditions. Climate change scenarios predict an increase in winter rainfall, which could result in increased river flooding during the winter.

Source: Environment Agency

Climate change and flood risk

London is a third of a metre lower, in relation to sea level, than it was at the end of the Second World War. In conjunction with climate change, which is predicted to cause sea levels to rise by 25–50 cm by the year 2050, the effectiveness of London's current tidal defences is brought into serious question. By the year 2100, forecasts indicate that the Thames Barrier will need to shut about 200 times each year to protect London from tidal flooding.

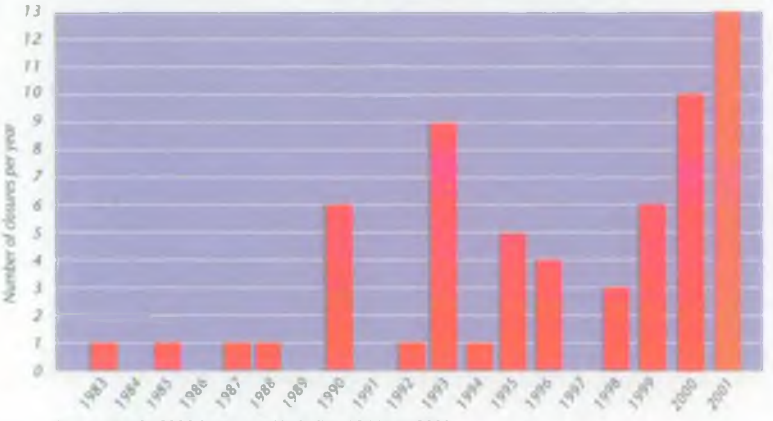
The longer term presents an unwelcome picture for London with regard to flood risk related to climate change. Beyond 2100, London's sea defences are predicted to be unsustainable in their current location. However, by achieving the stabilisation of greenhouse gases in the atmosphere at sustainable levels, London will be spared some of the risks that flooding would pose.

Number of Thames Barrier closures against tidal surges

The control of flooding in the lower part of the River Thames, where the main threat is from the sea, is one of our important responsibilities. Under certain weather conditions surge tides occur and these can present a major threat when combined with a high spring tide. The main defences are a number of movable flood gates, the most notable of which is the Thames Barrier, as well as sea walls upstream of the Barrier and 32 km of embankments downstream.

Without effective defences, when the surge enters the Thames Estuary, there is danger of flooding along most of the tidal river as far as Teddington. Such a flood could engulf much of central London, presenting a threat to life, flooding the underground system, disabling freshwater and sewer systems, power, gas and vital telephone and data services and causing severe damage to thousands of homes, shops, business and buildings in the heart of the capital. It is currently estimated that a major flood within London could cost in excess of £30 billion in damages alone.

Number of Thames Barrier closures against tidal surges, 1983-1999



Note – data for 2001 is up to and including 13 March 2001

High tide levels in central London are rising by some 60 cm each century. This is a result of factors including rising sea levels, increasing storminess and tidal variation, the downward tilting of the south east corner of England and the settlement of London on its bed of clay.

The Thames Barrier was closed 49 times to protect London from tidal flooding between 1983 and 2000. The graph shows a significant increase in the number of closures during 2000. However, this number of closures has already been passed during the first few months of 2001. Between 1 January and 13 March 2001 the Barrier has been closed on 13 occasions. It is not possible to categorically state that this is due to climate change and sea level rise, but it is an indicator of the possible trend in the future.

Trend

Since 1990 the frequency of Barrier closures has increased. The erratic nature of the weather makes it difficult to predict future trends exactly. However, the effects of sea level rise are expected to make further closures more frequent.

Source: Environment Agency

Flooding in London – October / November 2000

The past few months have seen a great deal of flooding across London and the rest of the country.

Between 29 October and 30 November 2000 a total of 3 severe flood warnings, 28 flood warnings, 81 flood watches and 64 all clears were notified by the Agency. Extreme conditions have been seen across London with some parts of the city receiving over three times the normal monthly average rainfall in October.

The Lower River Lee area in London recorded the wettest October in 82 years and the River Roding catchment had – provisionally – its highest daily rainfall total in 40 years recorded on 29 October.

Water levels in the River Thames

Accurate records of newsworthy floods occurring along the River Thames and its tributaries date back to 6 November 1091, when the following incident was chronicled by J. Thornton:

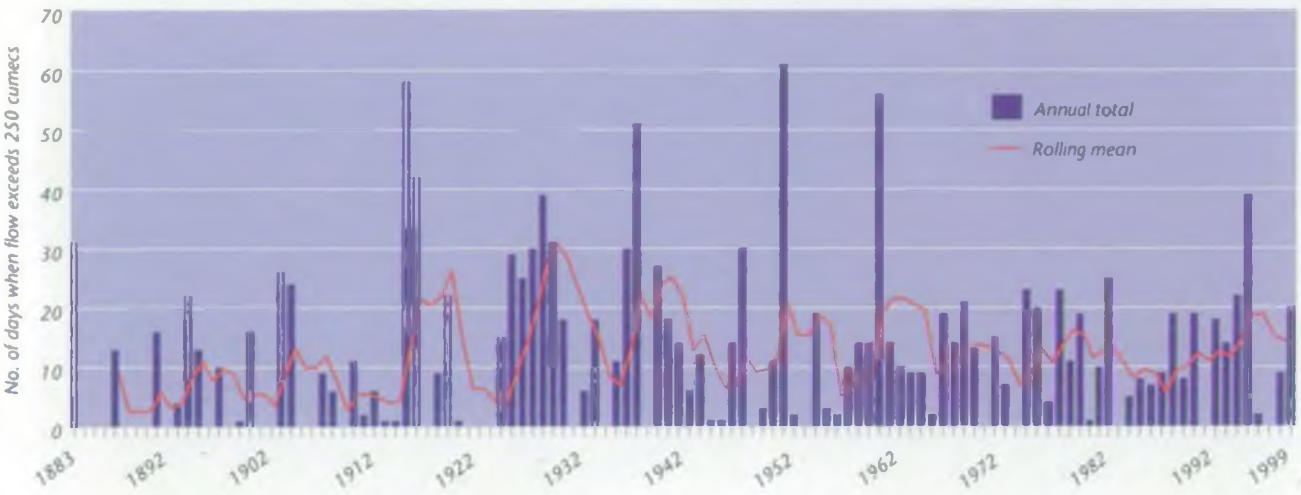
> 'Owing to the perpetual downpour of 1091, the Thames rose with alarming rapidity and the old wooden 'London Bridge' was swept away, the lands on each side being considerably flooded.'

Some records date back to flooding in AD 9, 48, 479 and 973, but no further details are supplied on their extent.

Regular flow monitoring data at Teddington Lock is available back to 1893. Information was collected prior to this but less frequently.

The bar chart shows the number of days when the daily mean flow was above 250 cumecs (cubic metres per second).

River Thames flow at Teddington, 1893 – 1999



Trend

Whilst the data provides an interesting picture of flow rates over the past hundred years, it does not provide at present a clear indication of an increase in the number of flood events found in this location. What is noticeable, however, is that the number of years when no flooding took place has decreased since 1893.

Source: Environment Agency

Riverside development

Key messages

- The River Thames and the other waterways in London are important ecological, recreational, visual and archaeological assets.
- Unitary development plans for the London Boroughs adjoining the River Thames should include policies prohibiting development upon the Thames foreshore.
- The development process provides opportunities to realised environmental enhancements.
- The value of river corridors as natural green chains should be recognised within all unitary development plans.

Background

The tidal Thames is one of London's greatest assets. Cleaner and healthier now than it has been for nearly 150 years, the Thames and tidal creeks once again support a wide variety of wildlife. If this wildlife is to continue to thrive, the river and its habitats, including the remaining foreshore and marshes, must be protected.

Over the centuries, urbanisation has taken its toll and this is increasingly apparent as the river makes its way through London. The Thames is now far narrower that it was when the Romans first settled on its banks. Vertical concrete and sheet pile walls now confine much of the river down to the flat grazing marshes of the lower estuary. Consequently, the remaining areas of tidal foreshore are irreplaceable feeding and resting places for increasing number of fish, birds and countless invertebrates. If the process of building onto the bed of the river or 'encroachment', continues these valuable habitats will disappear forever.

Research is also beginning to demonstrate much more subtle aggregate effects resulting from the loss of the foreshore. Small fish and invertebrates migrate by selective tidal transport. A continuous foreshore is vital for this capability to be maintained. Even without the total foreshore loss associated with large solid encroachments, the aggregate increase in water velocities associated with a large number of small piers, jetties and other small non-solid encroachments will impede and may finally stop all such migrations.

The network of other rivers across the capital, such as the Lee, Wandle, Ravensbourne, Crane and Brent, is also an important environmental asset. Riverside locations are especially attractive to developers as they provide an ideal landscape and visual focus for development. However, development adjacent to river corridors must be sensitive to the environment and where appropriate incorporate suitable enhancement measures.

The Agency is particularly concerned about further encroachment of development on the Thames foreshore. Encroachment can have impacts on flood risk, river hydrology, wildlife, landscape and visual amenity, heritage and archaeology, recreation and access. New development proposals should seek to enhance the riverside environment, rather than detract from it, with buildings complementing, rather than dominating their location. Realising opportunities to create improved public access and space for habitat can have benefits for a developer in terms of property values, as well as benefits for the environment.

The Agency's role

The Agency is responsible for consenting works under the Land Drainage Act 1991 for development in, under or over 16 metres of the tidal flood defences or 8 metres of a non-tidal flood defence. The Agency is a consultee on applications for riverside development under the Town and Country Planning Act 1990. However, we rely on local authorities to take our advice when determining planning applications and setting any conditions.

We also seek to work with developers and local planning authorities to protect river corridors and promote and enhance their ecological visual and recreational value.

The Agency's encroachment policy

In 1995, the Thames Region of the National Rivers Authority (now the Environment Agency), in partnership with the London Ecology Unit (now absorbed by the GLA),

Millennium site, Greenwich

British Gas and English Partnerships worked closely with the Environment Agency to create the best practice riverbank scheme at the Millennium site. A length of 1.24 km of the existing riverside frontage was known to be in bad condition. It had an estimated life expectancy of less than five years and would need to be replaced as part of any redevelopment. The Agency encouraged the developer to provide an innovative flood defence wall, incorporating some setting back to create enlarged beaches, an 'ecological sculpture', tidal terraces, timber fendering on vertical flood defence walls, beach replenishment/creation and improved habitats for a potential multitude of wildlife.

As part of the riverside scheme, education signage, riverside paths and cycleways were incorporated as a feature of the site.

The design of the tidal defences incorporated retreating 130 m inland to create an additional 10 m of intertidal habitat; boardwalks for public access; viewing points; an area of salt marsh with a series of terraces over a width of 7 m between the site and existing flood wall; planting of newly created habitats; and the use of timber fenders to improve the appearance of the wall and provide some habitat for estuarine animals and plants.

The innovative and environmentally sensitive riverside designs presented a completely new set of opportunities and constraints to be addressed by the developer, planners and ecologists alike. The Millennium site is a unique illustration of a new approach to riverside design that the Environment Agency is striving to promote. Here the competing demands of a large-scale commercial riverside development had to be effectively balanced with ecological considerations, providing a site which is both commercially and environmentally beneficial.

published *The Tidal Foreshore*. This leaflet highlighted the environmental value of the Thames foreshore as a habitat and feeding ground, and as a resource for London. It raised public awareness of the dangers of encroachment and was a useful tool in raising awareness throughout the development planning process. However, since 1995, pressures to encroach on the tidal Thames have continued and, in response to these pressures, we have recently updated our policy on tidal encroachment.

Encroachment and the loss of the foreshore has been described by the London Ecology Unit as *'a needless waste of a nationally important and irreplaceable asset'*. While it is sometimes seen as bringing social and economic benefits, we consider that its environmental disadvantages generally outweigh these advantages. Encroachment falls into two main types, both of which aim to maximise the area next to and over a river that can be developed:

- **Solid encroachment** – reclamation of land from a river by building riverward of the flood defences. It includes the infilling of docks, bays and wharves.
- **Non-solid encroachment** – building over the river channel. Examples include piers, jetties and boardwalks or floating structures such as pontoons. This type of development overshadows the foreshore and can threaten its ecological survival. Intensification of the riverside also narrows the river corridor.

Archaeology and heritage

The Thames itself is slowly uncovering numerous archaeological sites with every ebb and flow of its tide. These sites are vital to the study of the river's development, from the floodplain that formed at the end of the last Ice Age, to one of the busiest waterways in Europe. The river's tidal action leaves an interesting, but sometimes confusing picture, with nails left on the foreshore by eighteenth and nineteenth century shipwrights lying scattered directly on Bronze Age peats. Anglo-Saxon river piles are also found rising vertically between the roots and branches of a neolithic forest.

The Thames Archaeological Survey is a joint project between the Environment Agency, Museum of London, English Heritage and University College London. Materials spanning a vast date range have been discovered including a submerged forest, prehistoric structures, medieval fish traps, Tudor wharves and jetties, multi-period access and ferry points, ship yards, quaysides and the remains of ships, boats and barges.

Access and recreation

The Thames, along with the other river corridors within London, forms an important recreational asset. Opportunities exist for a large number of formal water-based activities at locations in the Lee Valley, Royal Docks and to the west of London. The Thames Path is a national trail launched in 1996, which extends from its source to the Thames Barrier. Similar to many other riverside routes across London, it is not possible for the Thames Path always to follow the river and opportunities to enhance the route as part of redevelopment proposals should be promoted.

Open space in London

More than 20 per cent of urban London is protected open space and accessible to the public. Waterways play an important role in linking this network, providing opportunities for active leisure pursuits, together with space for peace and quite reflection. The protection and enhancement of London's open spaces will be a vital part of the urban renaissance in order to sustain a healthy quality of life with the proposed increase in urban densities.

Landscape and visual amenity

The landscape of the tidal Thames has a varied and complex character. Differences in character along the river arise from the interaction between the different adjacent land uses, the relationship between built form, open space and the river, and the patterns of activity along its length. The importance of the Thames landscape has been recognised and has promoted, first, the *Thames Landscape Strategy*, which provides a 100-year management plan for the Thames from Hampton to Kew and is currently being extended downstream to Chelsea; and, secondly, the *Tidal Thames Landscape Assessment and Design Guidelines* published by the Agency. *The Thames Estuary Management Plan* promotes a similar approach and this is being taken forward by the Thames Estuary Partnership for the whole estuary.

Future indicators

We are currently developing an approach to monitoring encroachment along the tidal Thames and hope to be able to use this as an indicator in the future.

Landscape status of London's river channels

The increasing expansion of London over the past 200 years has left a legacy of urban development upon the river landscape. Very few rivers have escaped the influence of urbanisation, with many being artificially controlled to reduce the risk of flooding. Of the river channels surveyed between 1992 and 1996, 29 per cent were natural, 56 per cent were artificially surfaced and 15 per cent were culverted. The 'lost rivers" within central London such as the Fleet, Tyburn and Effra are of particular note, as they have long since been culverted and in most cases now form part of the sewerage network.

The landscape status of London's river channels

Transport

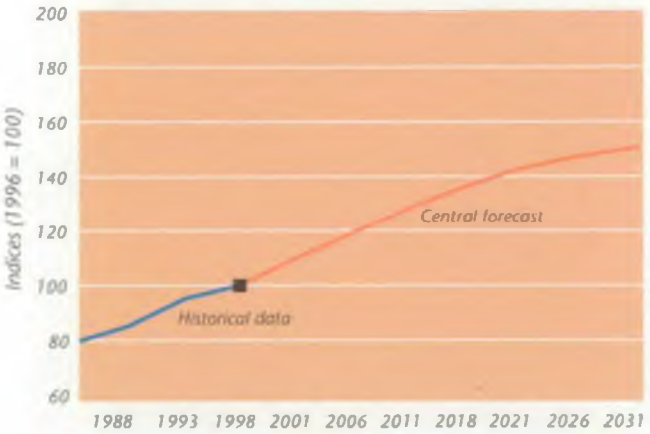
Key messages

- Public resources need to be directed towards an integrated mass transport system.
- Companies need to take steps to reduce vehicle use through the development of green commuter plans.
- Action is needed to take the pressure off London's roads by improving provision of alternatives.
- The River Thames is one of London's most under-valued and under-used resources.
- Expanding water-borne transport must not happen at the expense of a river's ecological and conservation value.

Background

Transport exerts pressures on the environment in many ways. Road transport accounts for over 90 per cent of passenger travel and 80 per cent of the freight moved within Great Britain Vehicles emit gases, particulate materials and other substances into the atmosphere. Although this is not directly an Agency responsibility, we need to understand the different sources and relative quantities of different chemicals in order to assess the general state of the environment. Road construction also places pressures on the environment and traffic noise is a major nuisance in some areas.

Forecast of motor traffic in Great Britain, 1996-2031



On average 1.07 million people are estimated to come into London on a weekday morning. Around 82 per cent of these people use public transport. The average traffic speeds in central London have fallen to about 10 mph.

Overall, in 1996–98, London residents typically travelled a third less far than those in the rest of the south east, and around a quarter less than far than in Great Britain as a whole. Londoners travelled twice as far by bus as residents in the rest of the south east, and two and a half times as far by rail than the national average. Inner London residents walked 21 per cent further that those living in outer London in 1996–98 although distances everywhere have fallen compared with ten years ago.

The Mayor will produce an integrated transport strategy, the central objective of which will be to increase the efficiency and quality of London's transport system. The delivery of the strategy will primarily be through Transport for London (TfL), a new body, accountable to the Mayor.

Environmental effects of transport

There are two key environmental impacts resulting from increasing levels of traffic.

- **Air quality** – road transport emissions and industrial processes have a major impact on air quality, producing more that 90 per cent of air pollution in London. Levels of air pollution frequently exceed those recommended for human health. More than 24,000 people die prematurely in Britain each year because of air pollution, and one in seven school children has asthma.

  Poor air quality not only damages London's environment and adversely affects people's health, but also contributes to a worldwide environmental problem.
- **Climate change** – vehicular emissions form 20 per cent of the greenhouse gases produced in the UK. Carbon dioxide accounts for 93 per cent of these emissions. Climate change is predicted to cause sea level rises of between 25 and 50 cm by 2050, threatening the effectiveness of London's current tidal flood defences.

The Agency's role

The Agency has a limited role to play in managing transportation across the capital. This responsibility lies predominantly with the GLA (through Transport for London) and the Mayor's Transport Strategy, London Boroughs and the various transport operators across the capital. However, we have a general duty regarding sustainable development and we have to assist the Government in delivering its Air Quality Strategy. Thus we are interested in transport generally and road transport in particular. We also provide assistance and information to London Boroughs in establishing Air Quality Management Areas (AQMAs). These tackle local pollution hotspots, often caused by road transport.

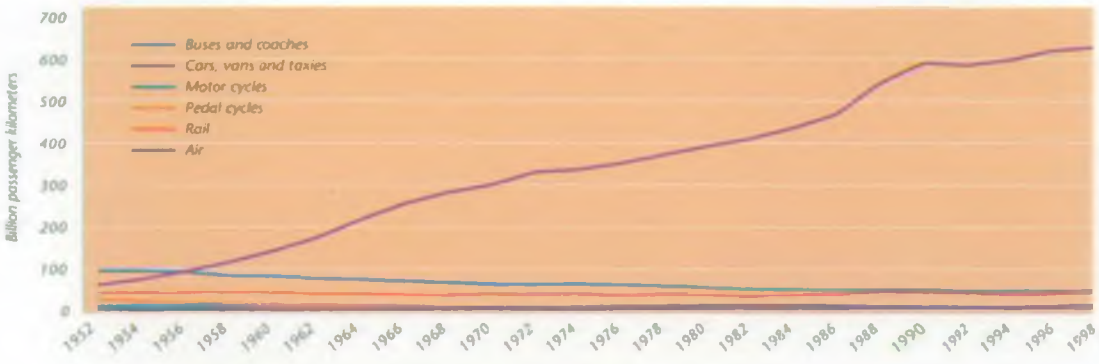
Traffic congestion across London

Forecasts for the increase in vehicle movements continue to rise. By 2031 the DETR predicts that the private use of cars and taxis will increase by 48 per cent. Perhaps of more concern is the forecast for goods vehicles which are predicted to increase from between 57 per cent and 105 per cent, with overall motor traffic set to double over the next 30 years.

The total number of miles travelled by individuals has declined slightly. Across the south east there has been a decline of 3 per cent, whilst across London this decline has been recorded at 4 per cent. This drop in miles travelled for London residents continues the declining trend for the past 12 years.

Increasing traffic congestion is perhaps illustrated best by average traffic speeds found in different parts of London. With some minor fluctuations it can be seen that traffic speeds averaged across London have fallen gradually

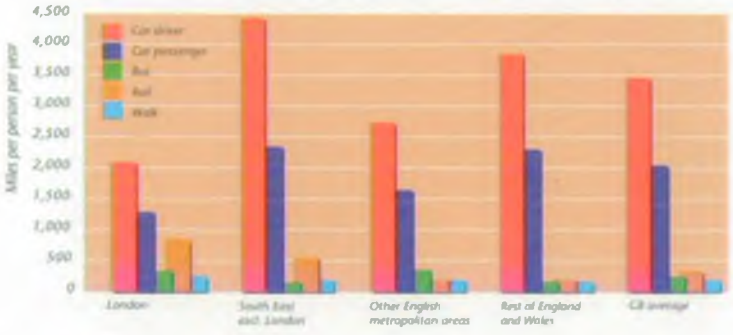
Passenger transport and vehicle traffic in Great Britain, 1952-1998



Trend

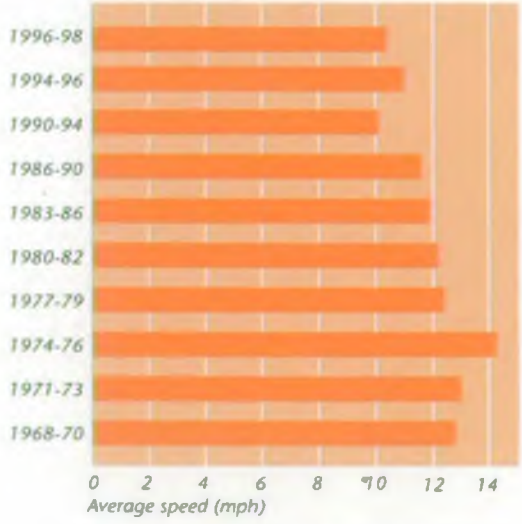
There seems to be no slow-down in the current growth of road traffic. The only noticeable decrease seems to be in the length of people's journeys, which may be due to the increasing levels of congestion found upon the road network.

Average distance travelled per person per year by region of residence, 1996-1998



by about 2–3 mph since records began in 1968. Speeds in central London have fallen to 10 mph, with little difference between morning and evening peaks, and the daytime off-peak. Speeds in inner London outside the centre have fallen to 12 mph in the peaks, and to 15 mph off-peak. Outer London speeds are more variable, reaching 17 mph in the morning peak, 19 mph in the evening peak and just under 23 mph off-peak.

Average traffic speeds, 1968-1998



Information is for morning peak, 7.45am-9.15am in the centre of London

Source: DETR

Commercial traffic on the Tidal Thames

The Port of London is the largest port in the United Kingdom. It includes over 100 wharves and terminals, of which 82 are presently operational. Each year over 3 million visitors, both pleasure boat passengers and private boat owners, use the river's facilities from one of the 37 launching sites between Canvey Island and Twickenham.

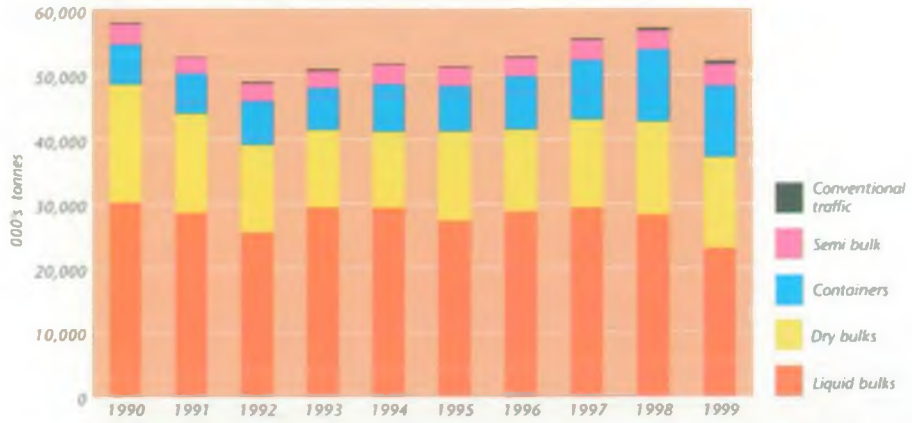
The Port of London Authority (PLA) has statutory responsibility for the regulation and control of the navigation on the River Thames between Teddington in west London and the sea. It owns much of the riverbed and foreshore to the high water mark. In undertaking its duties, the PLA provides navigational services for ships using the port including vessels' traffic maintenance, the maintenance of shipping channels and moorings and the placement of buoys and markers. Other responsibilities include registration of craft and licensing of watermen and lightermen. River works extending into the Thames below mean high water level require a PLA licence. The PLA is also the pilotage authority for the tidal Thames.

The Port of London generates employment for 37,000 people across the adjoining London Boroughs. This generates £2.7 billion per year virtually all of which arises from business in the riverside boroughs. The river therefore is a critical resource both economically and socially to London.

In 1999, 52 million tonnes of cargo were shipped through the Port of London, 35 million tonnes of which came from abroad. A recent survey of operators outlined confidence in the market, with a third of respondents expecting to see increased growth in cargo within the port.

When compared with other forms of freight transport entering London, water-borne traffic presents a variable trend. Road freight tonnage delivered in London increased during the 1980s, before falling back sharply in the recession of the early 1990s. There has been some recovery although the level in 1998 was still lower than that in 1988.

Commercial traffic on the Tidal Thames, 1990-1999



Liquid bulks – petroleum, chemicals, animal and vegetable oils
Dry bulks – fruit and vegetables, fertiliser, minerals and aggregates
Containers – includes roll on/off traffic
Semi bulk – unitised forest products

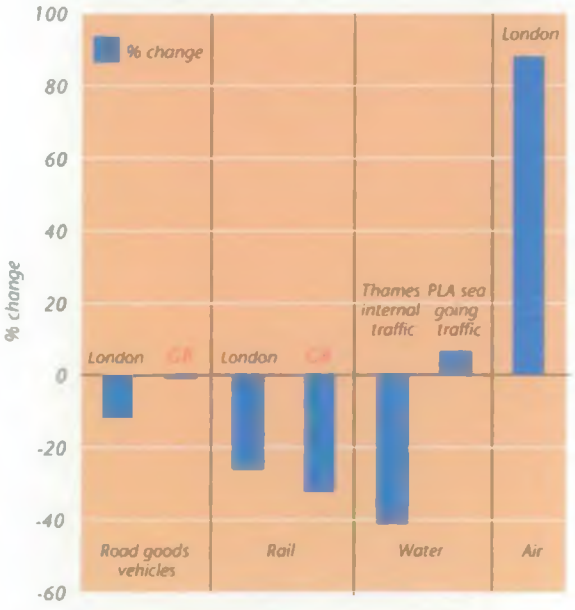
Source: PLA

During the period for which data is available, between 1986 and 1994, the fall in rail freight delivered in London was 26 per cent compared with 36 per cent in Great Britain as a whole. Air freight at London-area airports almost doubled between 1988 and 1998 to 1.7 million tonnes. Three quarters of this was handled at Heathrow Airport alone.

Trend

Latest trends in the quantity of cargo being handled within the Port of London seem to suggest that there will be an increase in the use of the river for commercial traffic.

Freight traffic in London, 1988-1998

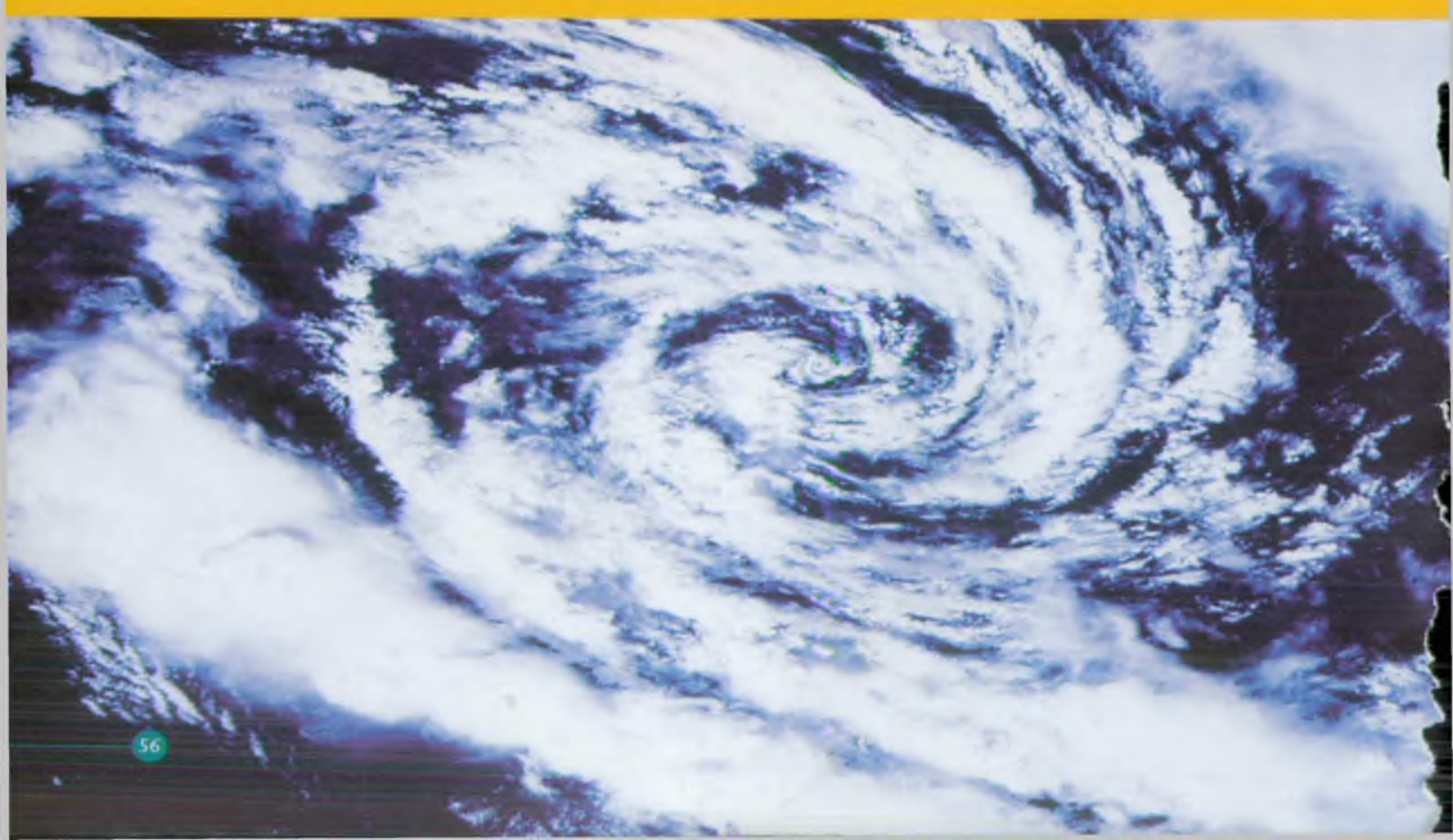


Source: DETR

Climate change

Key messages

- The people and the economy of London will have to adapt to the effects of climate change and reduce greenhouse gas emissions.
- Climate change will have a direct effect on the frequency of flooding which will need to be managed.
- Biodiversity will also be affected with coastal salt marsh being threatened by sea level rises.
- London is well placed to set an example to the rest of the country of how local action to reduce greenhouse gases can contribute to the UK's commitments on the Kyoto agreement and the need to reduce emissions much further in the longer term.



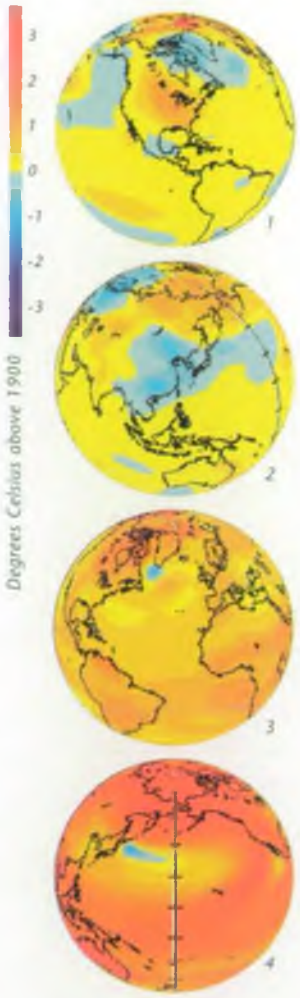
Background

The growth of greenhouse gases in the atmosphere is predicted to lead to serious consequences for the world climate unless action is taken to stabilise their levels. The recent report, *Energy – the Changing Climate*, by the Royal Commission on Environmental Pollution has stressed the need for effective action on a global basis. Whilst it may be possible for London to adapt to a limited degree of climate change, it is in London's as well as the rest of the UK's interests to support national and international efforts on mitigation.

Prediction models used to anticipate the likely impacts of climate change on the UK have generated scenarios which vary in certainty, but most agree that sea levels will rise, seasonal temperatures will be altered (by up to 2°C in winter and up to 1.8°C in summer) and current weather patterns will change.

London, as part of the south east, will be subject to many diverse and significant effects, particularly to the water environment, as a result of climate change. Winters will be wetter, causing more frequent flooding, and there will be an increase in the number and frequency of heavy local storms in summer causing flash flooding. The Thames Barrier currently protects property in central London worth in excess of £30 billion pounds, however sea level rises due to climate change will threaten its effectiveness. In contrast, increased temperatures could lead to more frequent drying-up of rivers and problems for water supply companies. Climate change threatens natural habitats such as wetlands, coastal mudflats and salt marshes that will be affected by droughts and permanent coastal flooding. Finally, the frequency of still hot days in summer causing particularly poor air quality in London will increase given current climate change predictions.

Modelled global temperature change, 1900-2050



1. *Temperature at 1.5m from 1/9/1890 to 1/9/1900 Increase = 0.121°C*
2. *Temperature at 1.5m from 1/9/1940 to 1/9/1950 Increase = 0.145°C*
3. *Temperature at 1.5m from 1/9/1990 to 1/9/2000 Increase = 0.685°C*
4. *Temperature at 1.5m from 1/9/2040 to 1/9/2050 Increase = 1.763°C*

(Source of data: Hadley Centre, Bracknell)

The Agency's role

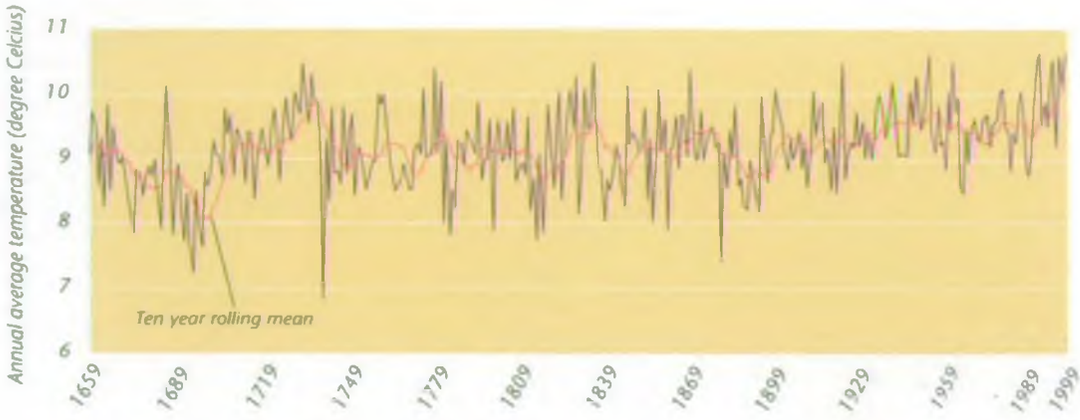
The Agency will need to adapt to the effects of climate change, as will London as a whole. We are helping to lead this process through a partnership as part of the UK Climate Impacts Programme (UKCIP), and as part of a similar partnership we have produced a report on the effects of climate change on the wider south east. We have an important role to play in planning to cope with rising sea levels, which will affect the Barrier and the tidal defences. In addition, we will need to plan to adapt to the increase in flooding both in winter and summer; in working with water companies to plan for effects on water demand and supply; and assessing likely effects on water quality and fisheries and ecology.

We have a direct role to play both in regulating emissions and in energy efficiency aspects of major industrial emissions under the PPC legislation. Wider than this, as guardians of the environment, we have climate change as one of the main themes of our Environmental Vision. We share with the Royal Commission on Environmental Pollution the aspiration of stabilising global atmospheric levels of greenhouse gases at a sustainable level. We would encourage London to take a lead on the issue and are keen to support and contribute to the GLA's Energy Strategy. We also support the initiative being taken by five London Boroughs as part of the Councils for Climate Protection programme.

Long-term change in temperature

The climate is a fundamental natural pressure on the state of the environment. For the purpose of this report we have used the long-term records for central England. We had hoped to utilise the long-term data record for Kew, but unfortunately this was closed due to the artificial effect that London was having on the temperature records.

Central England temperature record, 1659-1999



Average temperatures for the past two years have continued to rise. In 1999, the average was +1.16°C above the 1961–90 average, the warmest year recorded in 341 years. The 1990s were the warmest decade on record to date. The warmest two years globally were 1997 and 1998, with the latter the warmest at 0.57°C above the 1961–90 mean. The six warmest years globally have now occurred in the 1990s. They are in descending order 1998, 1997, 1995, 1990, 1999 and 1991.

Trend

Whilst there is still uncertainty over the causes, the trend identified by current data indicates an increase in the overall background temperature in central England.

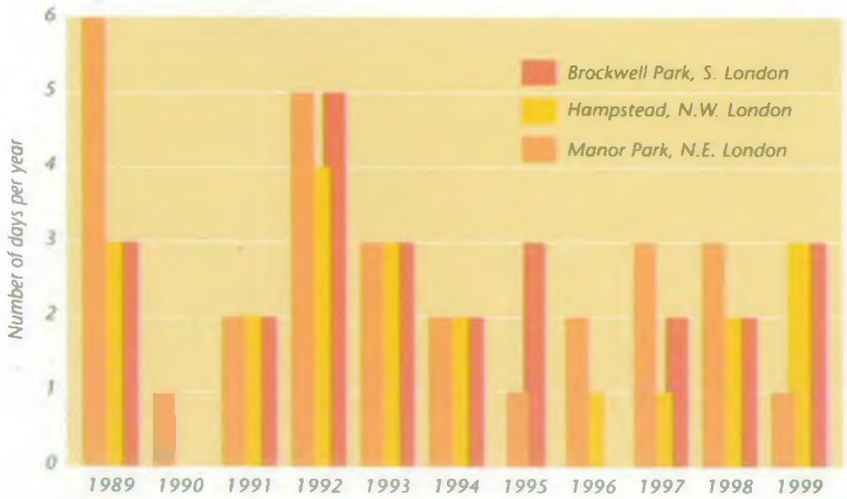
Source: University of East Anglia, Norwich and the Hadley Centre

Number of heavy rainfall events

The frequency and intensity of rainfall have a direct effect on flooding. The graph shows the number of heavy rainfall events (over 20 mm in a day) in three locations across London (Manor Park, Hampstead and Brockwell Park). As we can see from the current data there is no consistent trend for these locations as yet.

The degree of flooding caused by these storms will depend on the permeability of the ground and river levels at the time of the rainfall and therefore may not be directly associated with specific flooding events. We need to look at long-term trends and patterns of rainfall, which may create new challenges for the management of flood risk across the capital.

Number of days per year with rainfall above 20 mm, 1989-1999



Trend

Instances of heavy rainfall are likely to continue to be erratic. This indicator should provide a useful long-term reference to monitor the potential impact of climate change, which in turn will be used to influence our future management of flood defences.

Source: Environment Agency and Meteorological Office

Change in sea levels

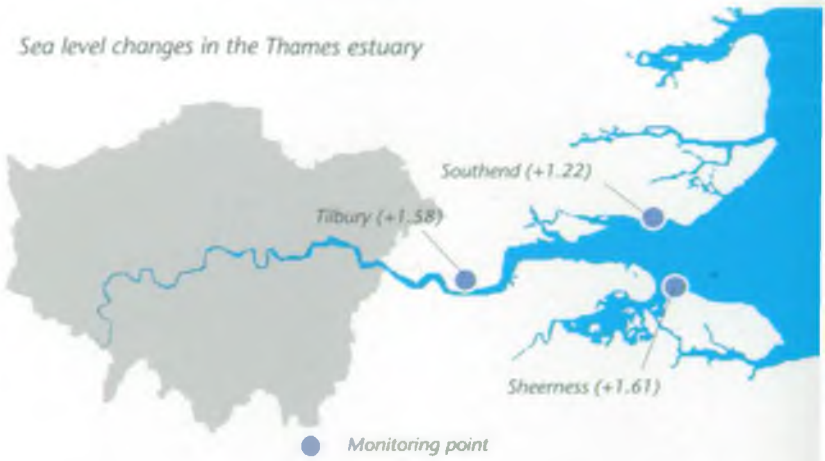
The coastline of the south east and its estuaries is under threat. Rising sea levels combined with increased storminess and changes in wave direction and energy will lead to more frequent breaches of coastal defences, and changes in the pattern of coastal erosion and deposition.

Since the 1953 floods that devastated the east coast of England, coastal defences in the south east have been strengthened, raised and extended in order to protect agricultural land and settlements. For London this saw the construction of the Thames Barrier and the tidal flood defences that extend downstream from this point.

To help assess the changes taking place data has been utilised from the Permanent Service for Mean Sea Levels (PSMSL) to monitor sea level changes at three locations along the Thames estuary. These are Southend, Sheerness and Tilbury. This data has been monitored over various timescales, but for Sheerness it has taken place since 1834.

Currently the trend for all of the sites is for sea levels to continue to rise on average by 1.44 mm per year. This in itself may seem insignificant, but when looked at on a longer timescale sea level rises of up to 25–50 cm by the year 2050 have been predicted.

Sea level changes in the Thames estuary



Trend

Levels continue to rise as a result of global warming and the geological sinking of south east England.

Source: Permanent Service for Mean Sea Levels (PSMSL)

Land quality

Key messages

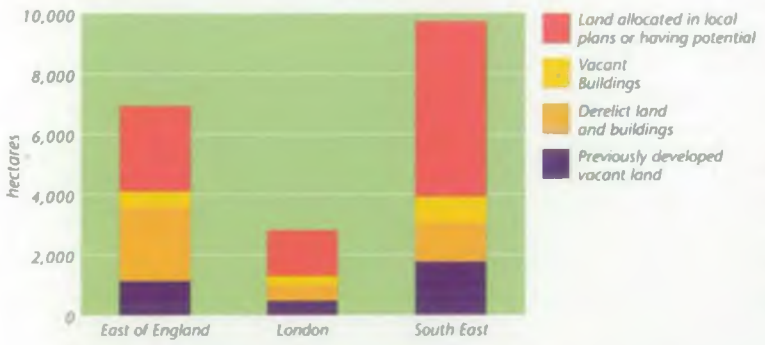
- The reuse of contaminated land is likely to become an increasing priority in London.
- Remediation of contaminated sites will require appropriate pollution prevention measures.
- Brownfield sites can provide a valuable habitat and this should be considered as part of any development proposals.

Background

The publication of Lord Rogers' Urban Task Force report *Towards an Urban Renaissance* (1999) signalled a significant change in the approach to dealing with derelict urban sites. Following Urban Renaissance, the Government has recently published a white paper which promotes the reuse of derelict and previously developed sites of derelict land within urban areas.

The Government is promoting the idea that as part of the sequential approach to future housing development, 60 per cent of this development should be on previously developed land. Some of this land may be contaminated as a result of its previous use. The Government objective for contaminated land is to identify and remove unacceptable risks to human health and the environment. Derelict or previously developed land identified as contaminated will be remediated back into beneficial use. The costs of this remediation to the private sector or public purse will be proportionate, manageable and economically sustainable.

Previously developed land, 1998



Source: National Land Use Database

The Mayor has taken over responsibility for strategic planning in London from the Secretary of State. Amongst his responsibilities will be to produce a Spatial Development Strategy (SDS) for the capital, a new form of planning instrument with statutory force within the planning system. It will take into account European, national and regional planning policies, and will include the Mayor's general policies for the development and use of land in London that are to be reflected in the Boroughs' unitary development plans (UDPs).

The SDS is expected to address the spatial aspects of issues of strategic importance to the capital. These include sustainable development, transport, housing, the built environment, the natural environment, waste and the River Thames.

Effects of urbanisation

The predicted future level of urban development, particularly house building, could have local, national and even global environmental effects, which are of continual concern to us. These include:

- increased demand for public water supply;
- increased loss of floodplain;
- increased rates of surface water runoff;
- threat to floodplain habitats and biodiversity;
- fragmentation of river corridors;
- increased demand for aggregates;
- increased waste production;
- threat to the integrity of the landscape;
- deterioration in local air quality;
- contribution to global warming;
- pollution threat to land and water.

With particular reference to land quality, a critical issue is the identification of contaminated land sites and their remediation. The Agency will take a lead in controlling the threat of pollution arising from the remediation of such sites under the Contaminated Land Regulations 2000 or their redevelopment under the planning system.

Urban regeneration across London

Nationally the trend for reclaiming derelict sites has fluctuated. In 1974 there were 43,000 hectares of derelict land in England. By 1982 this had increased to 46,000 hectares but subsequently, with reclamation, this figure declined to 40,000 hectares in 1988 and 1993.

The most recent figures appear in the DETR Circular 02/2000 that accompanies the Contaminated Land (England) Regulations 2000. This estimates that the amount of potentially contaminated land across the UK could be between 100,000 and 200,000 hectares. Currently it is estimated that there are 2,820 hectares of previously developed land within London.

The Agency's role

Future action on the legacy of land contamination will be led primarily under Part IIA of the Environmental Protection Act 1990, which was enacted by the Contaminated Land (England) Regulations 2000. The powers in the Regulations are only enacted where current regimes cannot be used.

We are currently providing information to the London Boroughs to help them prepare their inspection strategies, which in turn will be used by the Boroughs to identify contaminated land. We will also provide assistance and advice to the Boroughs on the remediation of these contaminated sites, and in those sites subsequently designated as special sites, we will be the enforcing authority with powers to ensure the sites are remediated.

We are responsible for preparing and publishing a national report on the state of contaminated land in England and Wales by 2002. The report will provide, for the first time, an authoritative source of information on the state of contaminated land at national level.

Future indicators

Currently there are no accurate data sources that allow detailed comparisons of land use and contamination across London. It is hoped that over the next few years we will be able to provide information on the following indicators:

- Number of contaminated sites identified under recent government legislation;
- Number of contaminated sites with an Agency agreed remediation strategy;
- Percentage of contaminated sites redeveloped.

Mill Lane, Carshalton

The redevelopment of this site involved the construction of 121 residential units. Part of the proposals allowed the River Wandle to be restored to a more natural state, enhancing the quality of the new residential development and the environment. The site was contaminated by heavy metals and volatile organic compounds (VOCs), which required extensive remedial works to be undertaken before the scheme could begin.

To safeguard against any future river pollution problems, the Wandle was diverted away from the contaminated area. The creation of a new semi-natural channel also incorporated:

- sufficient flood capacity;
- a staged channel design;
- riffles and pools and a rough bed in the low flow channel;
- creation of gently sloping, more natural banks;
- increased sinuosity; and
- creation of habitats with appropriate planting.

A buffer zone was provided along each bank and a riverside walkway was incorporated.

Tidal Thames case study

The tidal Thames extends from its upstream tidal limit at Teddington, through central London to the estuary and finally into the North Sea. The estuary is an important environmental and social asset. The continuity of the Thames through London, with the freshwater flows coming from upstream and the estuary and sea downstream, is fundamental to its character and continued environmental improvement. Ecologically, for example, it relies on the daily ebb and flow of the tide to support its varied range of habitat and species. The tidal Thames is also important economically and socially and it is estimated that it generates over £2.7 billion in income per year and employs over 37,000 people.

The following case study provides an overview of the current state of the tidal Thames, the pressures acting upon it and the responses of the variety of organisations involved in managing it. This illustrates the need for co-ordinated and integrated action and how the Thames within London cannot be considered in isolation, but must be thought of as part of a much larger system.

The state of the Tidal Thames

Water quality

Water quality standards

The tidal Thames is divided into three reaches: freshwater, brackish and marine. Each of these reaches has a different salinity range and supports a variety of biological communities. However, these reaches are not static and their boundaries fluctuate with the tide and changes in freshwater flow. Water quality objectives are applied to the tidal Thames which reflect its potential ecological and amenity value. Appropriate chemical and biological standards have been set in order to achieve the overall objectives. These standards incorporate regional targets for dissolved oxygen and temperature along with statutory limits imposed by EC Directives for various dangerous and polluting substances.

Achievement of water quality standards

Compliance with these standards is assessed over a quarterly period. Since 1996, the tideway has achieved compliance with its dissolved oxygen standards in 6 out of 8 quarters in the upper reaches and 5 out of 8 in the middle reaches. Failures in 1997,1999 and 2000 resulted from the impact of major storms. Deployment of the Thames Bubbler and Vitality (boats equipped with oxgenating equipment), and other oxygenation techniques reduced the impact of these storms but did not prevent significant fish mortalities during late summer 1999 and 2000.

Dissolved oxygen profile

Following rainfall, discharges from London's combined drainage system can produce rapid decrease in dissolved oxygen (DO) levels. The severity of the resulting DO 'sag curve' depends on such factors as rain intensity, duration, river temperature and freshwater flow at Teddington. The worst case scenarios result from summer thunderstorms when river temperatures are high and flows low.

Bathing waters

There are three EC designated bathing waters in the Southend area. The bathing water season runs from May to the end of September, and sampling begins two weeks before the start of the season. A minimum of 20 samples are taken at regular intervals to monitor quality at each of the designated sites. All samples are taken at predetermined points off the beach where the average density of bathers has traditionally been highest. In 2000, all of the sites passed the required minimum standards.

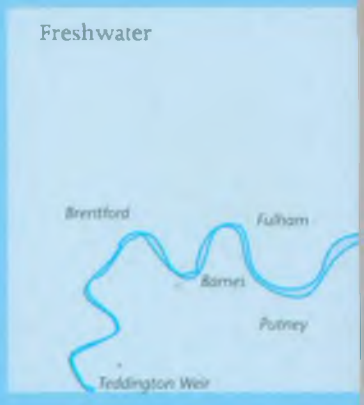
The Agency also monitors five other bathing waters in the outer estuary to provide additional background water quality data and to support an application to the DETR for extra designations at four of these sites. This is deemed necessary given the extensive recreational use of beaches in the area. Since 1995, these ancillary beaches have achieved the mandatory coliform standards and generally their water quality is compatible with the designated waters.

Wildlife and conservation

The tidal Thames is a unique wildlife corridor, running through the middle of the country's biggest and busiest conurbation. The corridor provides a wide range of habitats from shingle and mudflats to grazing marshes. It also provides continuity, linking the different habitats with one another and thereby maintaining a wide variety of animal life. Much of the original foreshore, especially the upper foreshore, has been lost through development.

Fish

The tidal Thames supports important recreational and commercial fisheries, including one of the largest UK estuarine commercial eel fisheries. A total of 118 species have been recorded, including salmon, dace, smelt, sole, bass, sole, sand-smelt and shad. It is one of the most important nursery areas for young marine fish in the southern North Sea. Indeed it is the premier UK nursery for Dover sole. Smelt, now a rare species in Europe, has returned in strength. A salmon recovery plan has been underway since 1978. The Thames Salmon Rehabilitation Scheme involves regular stocking in the headwaters and the building of fish passes.



Birds

Birds are a good visual indicator of water quality and the abundance of fish and invertebrates in the river. Nearly 300,000 water birds overwinter in the greater Thames area making it the most important estuarine complex for birds in the UK. The number of wildfowl and waders is of international and national importance, as the Thames is part of their migratory routes. The designation of the South Thames Estuary and Marshes as a Special Protection Area (SPA) and Ramsar site reflects this. At least four species, including the cormorant and lesser black-backed gull, are present in nationally significant numbers, representing more than 1 per cent of the British wintering population. There are also regionally significant numbers of species such as shelduck and dunlin, and 15 species have full 'Red Data Book' status.

Invertebrates

Macroinvertebrate communities form an important part of the tidal Thames ecosystem and are vital for the maintenance of both bird and fish populations. We currently sample the tideway at six subtidal and five intertidal sites as part of the Thames Benthnic Programme. Of the 350 freshwater, estuarine and marine macroinvertebrate species recorded, the mean number of species present at any one site

shows a marked change along the tidal Thames. This is largely due to changes in salinity, tidal flow, sediment type, habitat diversity and water quality.

Archaeology

The Thames foreshore is London's most extensive archaeological site. We can trace the development of the river and its hinterland from the time of the earliest human settlement into one of Europe's busiest waterways. Archaeological remains are fragile and are constantly degraded by the tides. Any further disturbance of the foreshore may damage or destroy these valuable remains forever.

Landscape

The tidal Thames has a unique identity, forming a unifying element through very different parts of the city. The river landscape has far from a consistent character and changes daily with the ebb and flow of the tide. Along its length it forms a transition between the narrower, more verdant upstream reaches and the expansive downstream landscapes of the estuary.

Pressures on the Tidal Thames

Pressures on water quality

An estuary is a complex system of interacting processes. The most important factor of water quality control in the tidal Thames is dissolved oxygen. This and other aspects of water quality, are caused by:

- insufficient flows of freshwater over Teddington Weir, as a result of abstraction upstream for drinking water supplies, drought etc., particularly in the summer. This results in low dilution and longer retention times of pollutants, before they are flushed out to sea;
- combined sewer overflows which discharge untreated sewage and urban runoff following heavy rain at any time of the year but particularly during the summer months;
- effluent discharges from the various sewage treatment works serving London;
- water temperature which is influenced by climate and industrial discharges and affects the speed of chemical reactions, ecology, fish migration, microbiological activity and the solubility of gases;
- suspended solids which enter via rivers, sewage and industrial discharges and from the sea.

Other pressures

Encroachment of riverside development
Encroachment of riverside development onto the bed of the river and the foreshore results in damage to or loss of valuable habitats and archaeological remains. It also compromises people's use of the riverside, intensifies the use of the river corridor, speeds up river flow thus increasing erosion and increases flood levels and the tidal range by narrowing the river. Encroachment also produces environmental stress for flora and fauna, which may impede the effective migration of species throughout the system.

Contaminated riverside sites
Contaminated riverside sites also pose a potential threat of river pollution. The Contaminated Land (England) Regulations 2000 are aimed at dealing with the legacy of

Responses on the Tidal Thames

Managing water quality

In order to sustain the improvements in water quality that have been achieved, the pressures on the tideway are closely monitored and interactively managed. Crucial to the management of dissolved oxygen levels in the summer months, is an Operating Agreement between Thames Water and the Agency. This Operating Agreement covers:

- improved STW effluent standards;
- operation of the Thames Bubbler and Vitality to alleviate the effects of storm discharges;
- the suspension of abstraction above Teddington in order to provide extra flow in the tideway at critical times.

We also use two hydrogen peroxide dosing installations in partnership with Thames Water. These provide an additional source of oxygen for critical periods following major summer storms.

Monitoring water quality

We regularly sample the tidal Thames at a range of sites and for a large number of parameters. Nine automatic monitoring stations between Kew and Purfleet - the Automatic Quality Monitoring Stations (AQMS) network - ensure that immediate information is available on the essential water quality parameters, allowing us to take remedial action. We use rain radar and weather data, along with the AQMS data, to help us deploy the Thames Bubbler and Vitality effectively.

Nuisance marine algae

The Agency also undertakes a national microalgal monitoring programme to detect nuisance marine algae at coastal bathing beach sites. Nuisance species produce toxins that may be harmful to fish, animals and man and are therefore a potential public health risk. If a bloom is observed during sampling, a sample is collected and analysed. We have not detected nuisance marine algae at the Thames estuary bathing beach sites in recent years.

Tidal Thames encroachment policy

We have formulated a policy on tidal Thames encroachment, and promoted it to developers and planning authorities. The policy, which was adopted in 2000, is aimed at enabling development to proceed in a sustainable way without damaging the environment.

Thames archaeological survey

We have jointly funded the Thames Archaeological Survey with the Museum of London and English Heritage. This initiative aims to chart the whole of the tidal foreshore between Teddington and the Thames Barrier.

Riverbank design guidance and partnership in planning

We have produced the *Tidal Thames Landscape Assessment and Design Guidelines* which subdivides the Thames into 'character reaches' and summarises appropriate forms of riverside development. We have also produced a best riverside practice portfolio: *Partnership in Planning.*

land that is already contaminated. These Regulations and well-managed development under the planning process provide an opportunity to bring these sites back into productive use, whilst safeguarding the environment. However, brownfield sites are often biologically rich, so developments must include the maintenance of the significant biological resource contained within these sites.

Invasion of non-native species
Invasion of non-native animals and plants, such as Chinese Mitten Crab, Floating Pennywort and Japanese Knotweed, can cause native species to be crowded out and natural habitats to be destroyed. This in turn upsets the natural balance of the ecosystem.

Proposals for a barrage and the recreational closure of the Thames Barrier
Proposals for a barrage and the recreational closure of the Thames Barrier would have to be considered on their merits, but are likely to have significant negative impacts on the tidal Thames environment.

Poor perception
Poor perception of the tidal Thames as a dirty river with no wildlife results in people not taking care to protect it. The problem of litter is being effectively tackled through a joint initiative led by the Tidy Britain Group with the support of the PLA, Environment Agency, Thames Water and the London Borough of Richmond. This is known as Thames 21 (formerly Thames Clean).

Lack of co-ordinated management
Co-ordination of the numerous organisations which have an interest in the tidal Thames, makes its management a particular challenge. However, the Thames Estuary Partnership is now providing a focus for action.

Access and recreation
Access and recreation are important to utilise the tidal Thames as a valuable educational resource. However, any improvement in access must be done in a safe and sensitive way, to protect the environment and visitor alike.

Shipping and river traffic
Shipping and river traffic can provide for a healthy river economy, however, the environmental impacts of jetties and dredging etc. also have to be considered.

Mudlarking
Uncontrolled 'mudlarking', or scavenging in the river mud for objects of value, poses a threat to the archaeological and ecological value of the foreshore and can cause erosion.

Access policy for the Tidal Thames
We are developing an access policy for the tidal Thames that will identify where access to the foreshore should be maintained, promoted or restricted, based on environmental and safety considerations.

Vegetation and habitat mapping using 'CASI'
We are using an aerial photographic technique to map land cover and vegetation types along the tidal Thames.

Habitat and environmental improvements
We encourage developers to work in partnership with us to realise environmental enhancements. Examples of this approach include the former Bell Green Gas Works and the Millennium site in Greenwich. The Agency publication *Environmental Enhancement Studies in Thames Region* provides case studies of enhancements along the tideway.

Education initiatives
We raise awareness of the tidal Thames and promote its protection and enhancement with information leaflets, displays at key locations (e.g. Thames Barrier and the London Aquarium), school trips to the foreshore, boat trips, and river inspections and seminars.

Tidal Thames fisheries management action plan and sea fisheries action plan
Historically the Agency has regulated and managed recreational fishing for freshwater fish in the upper estuary and a commercial eel fishery below Tower Bridge. More recently we have acquired sea fisheries responsibilities to Mucking. The Management Action Plan lays out an integrated approach to fisheries management for salmon, eels, freshwater fish and sea fish. In partnership with other organisations on the estuary, we will be seeking to enhance the estuary's nursery status, while promoting and regulating sustainable recreational and commercial fishing. Draft sea fisheries byelaws are under development at present.

Managing flood risk
We operate and maintain defences, including raised river embankments and flood gates, at strategic points such as the Barking Barrier and the Thames Barrier. The Barrier will become even more critical to the defence of London with the ever increasing threat of climate change.

Management plans and the Thames Estuary Partnership
The *Tidal Thames Local Environment Agency Plan* (LEAP), and the *Thames Estuary Management Plan* which is being implemented by the Thames Estuary Partnership, are the mechanisms by which the Agency and its partners intend to develop integrated local action plans for the tidal Thames.

3. EMERGING ISSUES AND FUTURE MONITORING

Summary of the challenges for London

The environmental indicators highlighted within this report illustrate the current state of the environment for London and the pressures that are currently placed upon it. Balancing these pressures with social and economic needs is a major challenge for the GLA, the Mayor and the other organisations working in London.

The key environmental challenges and priorities faced by London from an Environment Agency perspective are summarised below.

Transport and air quality – London needs to tackle its transport and resulting air quality problems. To reduce vehicle emissions alternative modes of transportation to the car will need to be improved and developed, as well as emission reducing technologies. On a positive note, the impact of emissions from major industrial processes have a minimal impact on air quality in London and are predicted to continue to decline.

Waste management – Currently London exports over 60 per cent of the waste it generates out of the city for disposal mainly to landfill sites. This is unsustainable and practical alternatives will need to be promoted. London needs to increase the current rates of recycling and waste minimisation.

Land quality – The increased use of previously developed land is a priority for the capital, however this brings with it the challenge of dealing with contaminated sites. The Mayor will need to work closely with the Agency and London Boroughs in addressing public concerns over health issues arising from the reuse of such sites. Identification of these sites and the risk they pose must be a priority.

Climate change and flooding – It is not possible to definitively predict the future impact of climate change. However, it is likely to have a significant impact on the environment. Perhaps the most critical issue facing Londoners will be the ability of the current flood defences to adequately protect the capital. We need to plan for the future as climate change will affect a variety of issues, not least flood risk, but also water resources, water quality and biodiversity. We also need to protect floodplains from inappropriate development;

Water resources – Whilst London currently has enough water resources, potential future supplies of water cannot be so certain. We need to manage demand for water, continue to tackle leakage and promote water efficiency. Future water resource management is an issue that needs to be addressed on a scale wider than London and will impact across the whole of the south east of England. We also need to continue to manage rising groundwater in London and utilise the available resource.

Riverside development – the Thames, and other rivers in London, are an important ecological, visual, recreational and archaeological resource. They need to be protected from encroachment and opportunities to achieve environmental enhancements realised.

Water quality – London's drainage problems, particularly combined sewer overflows, will require considerable investment and co-operation between a number of organisations to produce a long-term sustainable solution;

Biodiversity – valuable species and habitats need to be protected and conserved and opportunities for enhancement realised.

Mechanisms for action and partnership

This report presents a snapshot of the state of London's environment, against which future change can be measured. It concentrates on the aspects of the environment in which we have a particular interest. However, responsibilities are split between numerous organisations. Partnership is therefore essential in working towards the common goal of a healthy environment for Londoners. We are looking forward to working with others in delivering this goal.

The State of the Environment Report has been produced by the Environment Protection department under the direction of a Steering Group chaired by Tim Reeder, Regional Environmental Surveillance Manager.

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If you would like to find out more about the Agency's work in London please contact the GLA Liaison Team on 020 8305 4022.

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GLOSSARY AND ABBREVIATIONS

Glossary

Above Ordnance Datum (AOD) – land levels are measured relative to the average sea level at Newlyn in Cornwall. This average level is referred to as 'Ordnance Datum'. Contours on Ordnance Survey maps of the UK show heights in metres above Ordnance Datum.

abstraction – removal of water from surface or groundwater.

abstraction licence – licence issued by the Environment Agency under s.38 of the Water Resources Act 1991 to permit removal of water from a source of supply. It can limit the quantity of water taken daily.

Agency – Environment Agency.

ammonia – a chemical found in water often as the result of discharge of sewage effluents. High levels of ammonia affect fisheries and abstractions for potable water supply.

aquifer – layer of porous rock able to hold or transmit water.

Asset Management Plan 3 (AMP3) – the third Asset Management Plan produced by the Water Companies for the Office of Water Services (OFWAT). It sets out the water industry investment programme for the period 2000 to 2010.

Best Practicable Environmental Option (BPEO) – can be applied to any aspect of pollution control. Used to indicate the waste disposal choice having the least impact on the environment. It does not refer to cost; the BPEO may be the most expensive.

biodiversity – the variability among living organisms. This includes diversity within species, between species and between ecosystems.

brownfield site – land that has previously been used for built development.

Bye Report – report commissioned by the Agency to look at the emergency response to the 1998 Easter floods.

catchment – the total area from which a single river collects surface runoff.

civic amenity site – facility provided by a Local Authority for householders to take bulky household waste, garden wastes and other household wastes which are not normally taken by vehicles on domestic waste collection rounds.

Combined Sewer Overflow (CSO) – an overflow structure, which permits a discharge from the sewerage system during wet weather.

consent (discharge) – a statutory document issued by the Environment Agency under Schedule 10 of the Water Resources Act 1991 as amended by the Environment Act 1995 to indicate any limits and conditions on the discharge of an effluent to a controlled water.

controlled waste – defined by the Control of Pollution Act 1974, Part 1 Section 30. It includes household, industrial and commercial waste.

culverts – piped watercourse, drain or covered channel carrying water across or under a road, canal, embankment etc.

de-oxygenised – process by which oxygen is extracted from a substance. In this case from water.

diffuse pollution – pollution without a single point source e.g. acid rain, pesticides, urban runoff etc.

dissolved oxygen (DO) – the amount of oxygen dissolved in water. Oxygen is vital for life so this measurement is an important, but highly variable, indicator of 'health' of a water. It is used to classify waters.

ecosystem – a functioning, interacting system composed of one or more living organisms and their effective environment, in a biological, chemical and physical sense.

effective rainfall – the amount of rainfall reaching surface and groundwater after the losses to the air by evaporation.

estuarine – relating to reaches of a tidal river.

eutrophication – the enrichment of water by nutrients, such as compounds of nitrogen or phosphorus. It causes an accelerated growth of algae and higher forms of plant life.

floodplain – parts of river valleys or coastal plains, which are inundated during floods. It includes areas protected by flood defences.

GARDIT – General Aquifer Research, Development and Investigation Team. A team of interested organisations co-ordinated by Thames Water looking at the issue of reducing groundwater levels within London.

General Quality Assessment (GQA) – a scheme for assessing and reporting environmental water quality. The chemical grades for rivers introduced in 1994 use BOD, ammonia and dissolved oxygen. Other grades for estuarine and coastal waters are being developed and aesthetic components will be measured and graded by a system under trial now.

greenfield site – land which has never been used for development.

groundwater – water contained in the void spaces in pervious rocks and also within the soil.

habitat – natural home of plant or animal.

hydrogen peroxide – chemical used for increasing oxygen levels within river water.

Integrated Pollution Control (IPC) – an approach to pollution control in the UK, which takes account of potential effects upon all environmental media. Applies to prescribed processes and uses the principles of BATNEEC and BPEO.

intertidal zone – the area between the low and high tide limits.

invertebrates – animals without a backbone e.g. insects, worms and spiders.

invasive alien species – plant or animal not native to the country concerned.

landfill site – site used for waste disposal into/onto land.

Local Environment Agency Plan (LEAP) – a LEAP is a non-statutory document which looks to establish a five-year plan for managing and improving the environment.

Main River – designated under the Water Resources Act 1991 by the Ministry of Agriculture, Fisheries and Food. In broad terms Main River includes all watercourses which contribute significantly to a catchment's drainage. Formal consent is required for all activities that interfere with the bed or banks of the river or obstruct the flow.

Mayoral strategies – The Mayor of London and the GLA have to produce a number of strategies covering a variety of issues by 2004.

megalitres – millions of litres.

Natura 2000 – the European network of sites designated under the Birds and Habitats Directives and comprising Special Protection Areas and Special Areas for Conservation.

Ordinary Watercourse – every natural river or stream which is not a Main River (see above) and is covered under the Land Drainage Act 1991. Sometimes referred to as non-Main River. Responsibility for maintenance lies with the landowner.

RAMSAR site – Wetland sites of international importance designated under the RAMSAR convention.

runoff – water leaving a river catchment. Normally regarded as rainfall minus evapotranspiration (evaporation and loss of water by plants) but commonly used to mean rainwater flowing across the land (also known as overland flow).

sewage – liquid waste from cities, towns and villages which is normally collected and conveyed in sewers for treatment and/or discharge to the environment.

sewerage – a system of underground pipes designed to carry sewage to sewage treatment works.

Site of Special Scientific Interest (SSSI) – sites of national importance designated under the Wildlife and Countryside Act 1981 by English Nature in England. Sites may be designated to protect wildlife, geology or land forms.

source control – a collective term used to describe the management of runoff at or near the point of impact of rainfall and before it reaches the piped drainage and sewerage systems of urban areas. It includes balancing ponds, permeable pavements and underground water butts.

Special Protection Areas (SPAs) – sites identified by UK government under the EC Directive on the Conservation of Wild Birds (79/409/EC).

Special Area of Conservation (SAC) – areas designated under the EC Habitats Directive.

Statutory Water Quality Objective (SWQO) – Water Quality Objectives set by the Secretary of State in relation to controlled waters.

surface water – general term used to describe all the water features such as rivers, streams, springs, ponds and lakes.

sustainable development – development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable Urban Drainage Systems (SUDS) – a collective term used to describe the management of runoff at or near the point of impact of rainfall and before it reaches the piped drainage and sewerage systems of urban areas. They include balancing ponds, permeable pavements and underground water butts.

watercourse – a stream, river, canal or channel along which water flows.

water table – level below which the soil/rock is permanently saturated.

Abbreviations

AMP3	Asset Management Plan – Phase 3
AOD	Above Ordnance Datum
APRIL	Air Pollution Research In London
AQAPs	Air Quality Action Plans
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
BAP	Biodiversity Action Plan
BATNEEC	Best Available Techniques Not Entailing Excessive Costs
BPEO	Best Practicable Environmental Option
CAMS	Catchment Management Strategies
CSOs	Combined Sewer Overflows
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DO	Dissolved Oxygen
DETR	Department of the Environment, Transport and the Regions
EC	European Council
GARDIT	General Aquifer Research, Development and Investigation Team
GDP	Gross Domestic Product
GLA	Greater London Authority
GOL	Government Office for London
GQA	General Quality Assessment
HAPs	Habitat Action Plans
HBRC	Hertfordshire Biological Records Centre
IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention Control
ITE	Institute of Terrestrial Ecology
LA	Local Authority
LAQN	London Air Quality Network
LEAP	Local Environment Agency Plan
LMG	London Mammal Group
LRC	London Research Centre
LWP	London's Waterways Partnership
MAFF	Ministry of Agriculture, Fisheries and Food
NOx	Nitrogen Oxides
NO_2	Nitrogen Dioxide
OFWAT	Office of Water Services
ONS	Office for National Statistics
PPC	Pollution Prevention Control
PPG	Planning Policy Guidance
PLA	Port of London Authority
PSMSL	Permanent Service for Mean Sea Levels
PWS	Public Water Supply
SAC	Special Area of Conservation
SEIPH	South East Institute for Public Health
SO_2	Sulphur Dioxide
SAPs	Species Action Plans
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
SUDS	Sustainable Urban Drainage System
SWMA	Strategic Waste Management Assessment
SWT	Surrey Wildlife Trust
TEP	Thames Estuary Partnership
TWUL	Thames Water Utilities Limited
UKCIP	UK Climate Impacts Programme
WDAs	Waste Disposal Authorities
WFD	Water Framework Directive

Units

°C	degrees Celsius
cm	centimetres
d	day
ha	hectare
km	kilometre
km^2	square kilometre
l	litre
l/h/d	litres per head per day
l/p/d	litres per property per day
m^3	cubic metres
m^3/s or cumecs	cubic metres per second
mg	milligrams
Ml	megalitre
Ml/day	megalitres per day
mm	millimetre
mph	miles per hour
ppb	parts per billion (parts per 1000 million)
µg/l	micro-grams per litre
$µg/m^3$	micrograms per cubic metre
%	per cent

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— Area Administrative Boundaries

— Regional Boundary

● Area Office

▲ Regional Headquarters

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