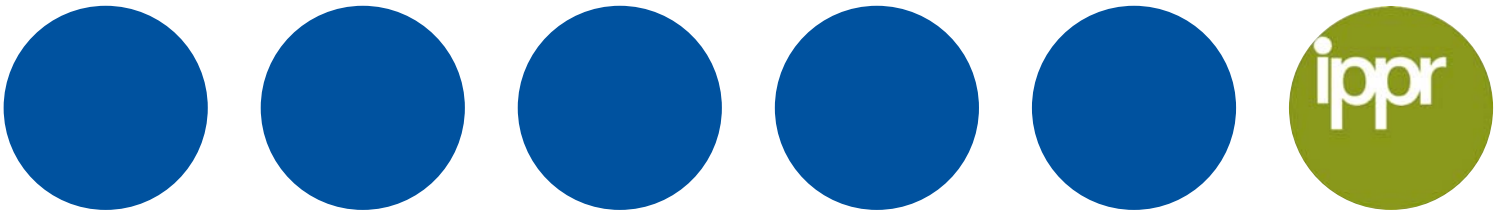
Commission on Sustainable Development in the South East



Managing Water Resources and Flood Risk in the South East

Louise Every and Julie Foley

WORKING PAPER **FOUR**

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The Commission on Sustainable Development in the South East

The Commission's goal is for the South East to maintain its economic success and its position as one of Europe's most prosperous regions, while at the same time enhancing its environment and improving the well-being and quality of life of all its citizens. The Commission shall take into account the position of the South East with regards to London as a world city and as the frontier to mainland Europe, as well as considering the UK's inter-regional disparities.

The Commission will have six research and policy challenges:

- The South East is a leading growth region. Should there be limits to growth and if so where do those limits lie?
- Do we give GDP too much priority when measuring success? Should we reconceptualise what we mean by human development and quality of life so that they are not solely reliant on narrow economic indicators of success?
- Can and should the South East absorb all the new homes the Government says are needed?
- Is the South East grinding to a halt? How should additional transport infrastructure and services be paid for and should policy makers be taking radical action to tackle congestion and pollution?
- How can the South East encourage more efficient and sustainable use of resources as well as mitigate the predicted effects of climate change?
- Should we see the Greater South East as one of the world's 'mega-city' regions? Does the South East's inter-relationship with London and the other counties that make up the Greater South East require new ways of working and in what policy areas?

The Commission members include:

- Cllr Sir Sandy Bruce-Lockhart OBE, Leader of Kent County Council and Chairman of the Local Government Association (Commission Chairman)
- Cllr Nick Skellett, Leader of Surrey County Council and Chair of South East England Regional Assembly
- Richard Shaw, Chief Executive of Surrey County Council
- Nick Pearce, Director of ippr
- Baroness Barbara Young, Chief Executive of Environment Agency
- Alistair Rose, Regional Chairman for the South East, PricewaterhouseCoopers LLP
- Robert Douglas, Deputy Chair of the South East England Development Agency
- Cllr Dame Jane Roberts, Leader of Camden
- Nicholas Boles, Director of Policy Exchange
- Dr Valerie Ellis, Member of the Sustainable Development Commission
- Sue Regan, Director of Policy, Shelter
- Chris Huhne, MEP for the South East region
- Nick Townsend, Group Legal Director of Wilson Bowden

The Commission will produce a final report of its findings in the summer of 2005. For more information on the Commission's work visit: www.ippr.org/research/index.php?current=44

This working paper does not necessarily represent the views of the Commissioners.

Acknowledgements

Thanks are extended to Cindy Warwick of Oxford University, Steve Cooke, Chris Hewett, Simon Hughes and Elliott Robertson (Environment Agency), Sebastian Catovsky (Association of British Insurers), David Payne (South East England Regional Assembly), Richard Lemon (Government Office of the South East), George Day (Ofwat), Sean Rendell (Woking Borough Council), Dr Elizabeth Wilson (Oxford Brookes University) and Graham Setterfield (South East Water Resources Forum).

Managing Water Resources and Flood Risk in the South East: Summary

Scope of the research

This working paper focuses on the impact that current and proposed housing developments in the South East will have on water resources, flood risk and flood management. It sets out to address two key questions:

- Is there enough water to meet the rising demand for new housing and domestic consumption in the South East?
- What impact will new housing developments have on flood risk in the South East growth areas?

Water resources in the South East

- The South East is currently water stressed both in terms of overall water resources and the public water supply.
- Climate change is expected to exacerbate water stress in the region. The impacts of climate change are uncertain but a precautionary approach is needed.
- Total industry leakage rates have risen over the last three years. In the South East, Thames Water and Three Valleys Water have failed to reach their leakage targets. Leakage rates may actually be higher than reported, as unmetered per capita consumption may be disguising significant levels of leakage.
- The South East has some of the highest rates of per capita consumption, and as population increases, household size decreases and climate change progresses, overall water demand is expected to rise significantly.
- There are a few areas in the South East where the physical ability of the environment to cope with increased effluent volumes could constrain development.

Managing demand for water

Reducing leakage

- The Office for Water Services (Ofwat) should more rigorously enforce leakage targets. It should work with water companies failing to meet leakage targets to develop action plans for reducing wastage, with clear penalties for failure.

Increasing water efficiency

- Water metering encourages a more efficient use of water.
- The Government, water companies and Ofwat should consider how to speed up the installation of meters in areas of low water availability.
- The Environment Agency should be given a stronger role to independently assess when supply zones should be declared as Water Scarce Areas so that higher levels of metering can be advocated.
- In conjunction with promoting water metering, the Government should work with water companies, Ofwat and local authorities to raise the profile of its assistance for low income and vulnerable householders who face difficulties paying their water bill.
- The Government should revise the Buildings Regulations to require that all new homes meet a minimum of a 20 per cent reduction in per capita consumption of water (compared to the national average) which could be achieved with affordable A-rated water saving household appliances.
- The voluntary Code for Sustainable Buildings should aim for water efficiency standards that go beyond the minimum required by Building Regulations. It could recommend a 20 to 30 per cent reduction in per capita consumption of water (compared to the national average) in new homes. Achieving higher water efficiency savings of above a 25 per cent reduction in per capita consumption will, however, require changes to the way people use water. Options such as grey water recycling

(re-using some household water for low-water-quality applications) will need public acceptance.

- The Government should consider introducing a water industry counterpart to the Energy Efficiency Commitment (EEC) for improving the water efficiency of new and existing homes. The Government should set each water company a water saving target which they could meet by encouraging householders to install water efficiency measures. The obligation should require a proportion of the target to be met in low income, larger households. Ofwat could take responsibility for co-ordinating the Water Efficiency Commitment with guidance from the Government. The Government would need to provide grants to help subsidise the costs of water saving measures for low income, larger families.
- The Water Efficiency Commitment would not have to be nationwide but could be focused on regions with water stressed areas. The South East should participate in a regional pilot giving water companies in the South East an opportunity to demonstrate their corporate commitment to water efficiency and a head start in implementing the scheme.
- The responsibilities of the Energy Saving Trust (EST) should be expanded to incorporate not only energy efficiency and transport fuel efficiency but also water efficiency. The EST could be renamed as the 'Resource Efficiency Trust' to reflect its expanded role.

Increasing water supply

Costing new water infrastructure

- The cost of providing new water infrastructure is borne by individual customers through their water bills.
- The extent to which the Water Price Review, for the period 2005–10, accounted for the additional water and sewerage infrastructure costs associated with new housing developments in the South East is unclear. If significant new infrastructure is needed this could further increase water bills over the medium to long term.
- But it should be noted that households in the UK currently pay less on average for their water use than some other European countries.

Co-ordinating water resource management and development planning

- Both the availability of water resources and impact on water quality, over the lifetime of the development, should be material considerations in development planning. Water scarcity and water quality may be grounds for refusal of planning permission in cases where further resources or improvements in water efficiency cannot be identified.
- Development plans should be elaborated in tandem with water resource plans, and both should consider long-term climate change impacts.
- Water companies should become statutory consultees for Regional Spatial Strategies and Local Development Frameworks to ensure that the cost and limits of water infrastructure requirements is fully understood.

Is there enough water to meet the rising demand for new housing and domestic consumption in the South East?

There is potentially enough water in the South East to meet the rising demand for new housing and domestic consumption. But only with the timely provision of new water resources and high water efficiency savings in existing and new homes. Relying on supply-side measures, such as new or enlarged reservoirs, to meet increasing demand would be a risky strategy. Even with these measures, there are some areas in the South East with severe water stress or fragile water quality where further significant development should be limited or avoided.

Flood risk in the South East

- By 2080 the number of people at risk from river and coastal flooding in the South East is expected to be higher than today, but still lower than those at risk in London and East Anglia. This is owing to climate change and other factors. But the expected damage to commercial and residential developments is likely to be higher in the South East compared to the other English regions and Wales.
- Across the UK, the number of properties at risk from surface water flooding is expected to increase substantially by 2080.
- Over 300,000 properties on exposed chalk aquifers in the South East are currently vulnerable to groundwater flooding.
- Despite planning policy guidance (PPG 25) directing development away from flood zones, inappropriate development is still occurring in the flood zone.
- In some cases the Government's target for 60 per cent of new build to be on brownfield land can conflict with its advice to direct new development away from the flood zone. It is unclear how much brownfield land is in the flood zone in the South East.

What impact will new housing developments have on flood risk in the South East growth areas?

- Across all the growth areas, 15 per cent of existing development is currently in the flood zone. Of the new development planned for 2016/21, 30 per cent of the sites will be in flood zone areas. According to the Association of British Insurers (ABI), the majority will be located in areas where the annual probability of flooding is either low (200:1 chance of flooding) or moderate (between a 75:1 to 200:1 chance of flooding) mostly due to existing flood defences.
- However, approximately 10 per cent of new development planned in Aylesbury and Kent Thameside by 2016/21 will be in areas where the annual probability of flooding is significant (greater than a 75:1 chance of flooding). This is the ABI standard beyond which affordable insurance is not guaranteed.
- In Milton Keynes and Ashford about a third of flood defences offer a low standard of protection (lower than the ABI 75 year standard of protection). But this is not necessarily a problem in Milton Keynes because many areas are naturally protected due to land elevations or have adjacent land with relatively low asset values such as open space or car parks. In Ashford, recent investment in defences mean the majority of defences are currently regarded as generally good.
- Of more concern is Aylesbury, where more than three quarters of the defences do not offer the 75 year standard of protection. Aylesbury's flood defences will need to improve, particularly for new homes built in the high risk flood zone.
- The South East parts of the Thames Gateway, such as North Kent and Kent Thameside, are currently less well protected than South Essex and East London which are defended by the Thames Barrier and other London barriers. The majority of defences in North Kent achieve the 75 year standard of protection, and their condition is largely unknown. Flood defences will need to be strengthened in North Kent and Kent Thameside in a timely fashion, to ensure a higher standard of protection for new housing in these growth areas.
- Most of the financial costs of fluvial and coastal flooding associated with new housing developments are expected to come from the Thames Gateway growth areas. The South East's share of these costs is relatively small.

Managing flood risk

- Regional Spatial Strategies and Local Development Frameworks should include a strategic flood risk assessment. This would help integrate flood risk management into strategic planning decisions.

- Local Planning Authorities (LPAs) and developers should give more consideration to the insurance implications of building in flood plain areas and behind existing flood defences.
- The Environment Agency should be made statutory consultees on all new developments in flood risk locations. LPAs should have a duty to re-consult the Environment Agency on developments permitted against its advice.
- The Government should have greater powers to ensure that no inappropriate development takes place in flood zone areas. The Secretary of State for the Office of the Deputy Prime Minister (ODPM) should review developments that are permitted against the sustained objection of the Environment Agency through a transparent and accountable review process.
- The risk of sewer flooding, and sewer and drainage capacity should be considered in Local Development Frameworks and become a material planning consideration.
- Sustainable Drainage Systems (SuDS) should be a mandatory consideration in all new developments, and if they are impracticable, effort should be made in the local catchment to compensate for extra surface water runoff.

Raising public awareness of flood risk

- The Home Information Pack should include information regarding the flood risk of the local area, and any resilience measures included in the building. Information on flood risk should also be required in tenancy agreements.

Scope of the research

This working paper sets out to address two key questions:

- **Is there enough water to meet the rising demand for new housing and domestic consumption in the South East?**
- **What impact will new housing developments have on flood risk in the South East growth areas?**

Many subjects could be covered under the theme 'Managing Water Resources and Flood Risk in the South East' and we necessarily have to limit what we can consider. This working paper focuses on the impact that current and proposed housing developments in the South East will have on water resources, flood risk and flood management.

We focus on household use of water and do not consider other demands for water from the agricultural, commercial or industrial sectors. Water quality/sewerage is not a strong focus, although it is considered as part of the research on water resources. In terms of flooding, we have focussed on the growth areas. In structuring this paper we have treated water resources and flooding separately. It is important, however, to stress their inter-relatedness. Measures to tackle flooding can contribute to improvements in water supply and quality, and some water efficiency measures can reduce the impact of development on flood risk.

This paper is structured into three sections. The first section sets out aspects of the current policy context, key actors and the drivers influencing water and flooding in the South East. The second section assesses water resources in the South East and the third section examines flood risk in the South East.

Key actors, policies and drivers of change

Actors

The *Department for Environment, Food and Rural Affairs* (DEFRA) is responsible for all aspects of water policy in England and Wales. DEFRA sets the framework of operation for the Environment Agency, the Office of Water Services (Ofwat) and the Drinking Water Inspectorate.

The *Environment Agency* is the environmental regulator of the water industry and has regulatory and operational responsibilities in other areas of water resources and environmental management. Specifically, the Environment Agency is responsible for water quality and water resources, including resource planning, the licensing and regulation of water abstractions and the issuing and regulation of discharge consents. It is also responsible, in whole or part, for pollution control, fisheries, navigation and flood defence as well as being responsible for managing the dissemination of flood warnings. The Environment Agency has a duty to conserve, augment, redistribute and secure the proper use of water resources and is responsible for long-term planning for water resources in England and Wales. The Environment Agency's regional boundaries are organised on the basis of river basin and water catchment geographies. The government office region of the South East falls into two Environment Agency regions – the Thames and Southern regions.

Water companies provide almost all of the Public Water Supply (PWS) in England and Wales. Water companies are responsible for: providing a clean and reliable supply of water; promoting the efficient use of water by their customers and on behalf of their customers; water resource plans; and drought plans. For those companies that provide sewerage they have the duty to provide, improve and extend the system of public sewers and to clean and maintain them to allow effective drainage. Table 1 shows there are seven water companies with a significant presence in the South East.

Table 1: Water companies operating in the South East

Company	Water/Sewerage	Water Supply Population*	Approximate Resource*
Folkestone and Dover Water	Water only	150,000	53 Ml/d
Mid Kent Water	Water only	580,000	165 Ml/d
Portsmouth Water	Water only	700,000	200 Ml/d
South East Water	Water only	1,400,000	440 Ml/d
Southern Water	Water/Sewerage	2,300,000	650 Ml/d
Sutton and East Surrey Water	Water only	650,000	175 Ml/d
Thames Water**	Water/Sewerage	8,000,000	3000 Ml/d

* Population and service area may not be entirely contained in the South East region
** includes supply to the city of London

The *Office for Water Services* (Ofwat) is the economic regulator of private water companies and has the duty of ensuring that the appointed companies are able to finance properly the carrying out of their functions. To fulfil this, Ofwat conducts a price review every five years to set a 'price-cap' limit on increases to water consumers. Ofwat also has duties to facilitate competition, promote efficiency on the part of the water utilities, and protect the interests of

consumers. *WaterVoice* is positioned within the customer services division of Ofwat to promote the interests of water and sewerage customers in respect of price, service and value for money.

Policies

European legislation
Two pieces of European legislation affect water management in the South East: the Habitats Directive (92/43/EEC) and the Water Framework Directive (WFD) (2000/60/EC). The Habitats Directive is concerned with biodiversity and the conservation of natural habitats and seeks to maintain or restore to a favourable conservation status those habitats and species that are of Community interest. The WFD requires Member States to produce statutory River Basin Management Plans (RBMP's) which will set out strategies for achieving 'good' water quality status in line with environmental quality objectives. The plans must be finalised by 2009 and environmental objectives met by 2015.

National policy
The 2004 Foresight report *Future Flooding*, produced by the Office of Science and Technology, has been a catalyst for national policy development on managing flood risk. DEFRA is currently conducting a review of flooding and coastal erosion and the Office of the Deputy Prime Minister (ODPM) is reviewing the Planning Policy Guidance note 25 (PPG 25) on development and flood risk for a new Planning Policy Statement. The 2004 periodic review of water company prices has recently set water price limits for the next five years.

Regional and local policy
The key regional planning process is the development of the Regional Spatial Strategy (RSS). The South East England Regional Assembly (SEERA) recently published the consultation draft of the South East Plan (SEERA, 2004) which sets out development proposals looking out to 2026, and considers sustainable water resources, river quality and flood risk management. The South East Plan will inform the Local Development Frameworks (LDFs) which local authorities have responsibility for.

Within the South East there is a South East Water Resources Forum which is a stakeholder group made up of water company, public sector and environmental representatives, and chaired by the South East England Development Agency (SEEDA). There is also a separate technical group – called the Water Resources in the South East (WRSE) Group – made up of water companies, DEFRA, SEERA, Ofwat, Watervoice, English Nature and chaired by the Environment Agency. The Environment Agency and other operating authorities produce flood risk policies through the Shoreline Management Plan and Catchment Flood Management Plan (CFMP) programme.

Drivers of change

Population and housing growth
Future population and housing growth will have an impact on the availability of water resources, water quality and the management of flood risk in the South East. Between 1991 and 2003, all the English regions except the North East and North West, have experienced population growth. This population growth has been particularly strong in the southern regions. Between 1991 and 2003, the South East's population grew by 5.9 per cent (compared to the average for England of 4.1 per cent) owing to a number of factors including natural change (births and deaths) and net migration (ONS, 2003).

Long term future population trends are difficult to forecast and subject to many uncertainties. For instance, it is very difficult to account for the effects of international migration patterns on long term population trends. However, it has been projected that between 2003 and 2028, the South East's population is forecast to grow by 14.1 per cent which is higher than the predicted population growth for England which averages 11.1 per cent (ONS, 2003). The modelling undertaken for the second Commission working paper – 'The Problems of Success:

Reconciling Economic Growth and Quality of Life in the South East' – revealed that population growth is a more important factor than economic growth influencing household water consumption (Foley, 2004).

The Sustainable Communities Plan (ODPM, 2003) outlines plans to build 200,000 additional new homes in the growth areas of the Greater South East. The principal growth areas in the South East are Ashford, Milton Keynes and Aylesbury as well as the South East parts of the Thames Gateway growth areas. The level of future house building is a politically contentious issue. The Consultation Draft of the South East Plan (SEERA, 2004) proposes a range of future housing growth rates:

- 25,500 (build fewer homes each year to match the average the South East achieved over the past five years);
- 28,000 (build new homes at approximately the same level the South East achieved last year);
- 32,000 (build more new homes to meet the level that some experts say the South East will need in the future).[1]

The Commission will produce its fifth working paper on housing in the South East in Spring 2005. Although the numbers matter, the impact of housing on the environment is determined in large part by location and design and these are examined with regard to water resources and flood risk later in this working paper.

Climate change

The effects of climate change are already being felt, with the Earth's average surface temperature having risen by 0.60°C during the 20th Century and by 0.50°C in the South East. Since 1990, overall precipitation has been steady but summer rainfall has decreased and winter rainfall has increased, making the British climate pattern more akin to the Mediterranean (Foresight, 2004). The UK Climate Impacts Programme projects that we are committed to further climate change for the next 30–40 years as a result of past greenhouse gas emissions and inertia in the climate system (UKCIP, 2002). The South East could be facing winters that are warmer, wetter and more variable, while summers could be hotter and drier with up to a 60 per cent decrease in precipitation and temperatures of 50°C or warmer (UKCIP, 2002). Depending on emission levels, sea level in the South East will rise between 26cm and 86cm above the current level. Coastal erosion is likely to increase substantially, and it is unlikely that present levels of expenditure on coastal defences will keep pace with coastal erosion (Foresight, 2004).

A recent report for SEEDA examined the effects climate change could have on different economic sectors in the South East (Arkell *et al.*, 2004). It predicts that climate change will affect resource availability, with less water available in the summer. The increased incidence of droughts could have implications for the supply of water, the maintenance of river flows, and the ability of receiving waters to dilute treated effluent. Pipe systems are likely to be more prone to cracking, and additional infrastructure will be required for transferring water. Changing rainfall patterns and rising sea level are likely to increase the risk of flooding, not only along rivers and coasts but also in urban areas where high intensity rains can quickly overwhelm inadequate drainage systems. This will carry health risks and have significant environmental impacts on water quality and fisheries. The potential of development sites in coastal and fluvial areas could be reduced. The elderly and other vulnerable groups, many of whom live along the coast, will be at a higher risk. Drier summers could also lead to

[1] The brackets describing the housing growth rates proposed by the Consultation Draft of the South East Plan were set out in a public questionnaire: www.southeast-ra.gov.uk/southeastplan/consultation/questionnaire.php

increased incidences of subsidence, with implications for homeowners and insurance companies.

Public Attitudes

The second Commission working paper on quality of life issues found that South Eastern people's awareness of future environmental risks in the South East, such as water shortages and flooding, is limited (Foley, 2004). There is relatively little information on people's attitudes to water and its relation to their quality of life, particularly at a regional level. A national survey of water customers carried out for the 2004 review of water price limits (MORI, 2002) found that despite a relatively low awareness and concern for water and sewerage services, over a third (36 per cent) considered the water environment to be the aspect in most urgent need of attention, second only to 'litter and household waste' (53 per cent).

In 1999, it was reported that there had been a hardening of public attitudes since the privatisation of the water industry with the public expecting unlimited supplies at all times regardless of the circumstances. Hosepipe bans and similar restrictions on use were regarded as unacceptable and an infringement upon consumer choice (RGS, 1999). Yet, more recent research suggests that housebuyers are increasingly willing to spend more on sustainable homes, including measures to reduce water use (Mulholland, 2004), which contrasts with what many developers say.

In terms of attitudes towards flooding, it is generally known that people living in areas which have not flooded within living memory tend to underestimate both the probability and the consequences of flooding. In contrast, those who have experienced flooding tend to overestimate its impacts and can live in continual fear of being flooded again. Research on attitudes towards flooding indicates that people have unrealistic expectations of the role and capacity of the Government and other public agencies to deal with hazards. A widely held view among members of the public is that floods can be eradicated completely or that defences should be erected on all floodplains, regardless of the costs and benefits (Brown and Damery, 2002).

The Government and other public agencies need to raise public awareness of the longer-term risks of flooding so that people can make informed choices about the extent they are willing to accept these future risks. It is unclear whether people would put more pressure on public agencies to alter their approaches to development and/or strengthen flood defences and flood warning mechanisms if they had a better awareness of these longer-term risks (Foley, 2004).

Water resources in the South East

When the Sustainable Communities plan was first launched by the ODPM, it appeared to pay little attention to the water stress that currently exists in the region, or what the plan's impact would be on the supply–demand balance for public water supply. The Barker Review paid little or no attention to the environmental sustainability of housing growth.

In this section we address the question: Is there enough water to meet the rising demand for new housing and domestic consumption in the South East? To do this we first assess the current state of water resources in the South East including a look at how water is used now and in the future. A scenarios report on the supply–demand balance produced for the Consultation Draft of the South East Plan (SEERA, 2004) forms the basis of a discussion on whether there is enough water to cope with significant housing growth. The rest of the section explores some of the policy options that could help deliver a more sustainable supply of water to the South East.

Current and future water resources in the South East

The South East is a water stressed region. The Environment Agency's Water Resources Strategies show that during a dry year, current levels of abstraction from the water supply are having damaging impacts on rivers, so much so, that in several areas there is a presumption against issuing new licenses for summer water abstractions. Public Water Supply (PWS) refers to treated water supplied by water companies. The PWS is the most significant abstractor of water, accounting for 47 per cent of all abstractions in the Southern Region and 87 per cent in the Thames Region (EA, 2001). Climate change is expected to exacerbate water stress in the region, and while the impacts of climate change are uncertain a precautionary approach is needed.

The South East is thought of as having a more complex but less integrated water supply infrastructure than much of the rest of the country and is largely ground water dependant. In the Environment Agency's Southern Region, approximately 60 per cent of PWS abstraction is taken from chalk aquifers, with a further 20 per cent from other aquifers, 10 per cent from six reservoirs and 10 per cent from direct river abstraction (EA, 2001). In the Thames Region, PWS is serviced by a variety of groundwater, in river and reservoir abstractions, with the majority of groundwater aquifers in the region being chalk (EA, 2001).

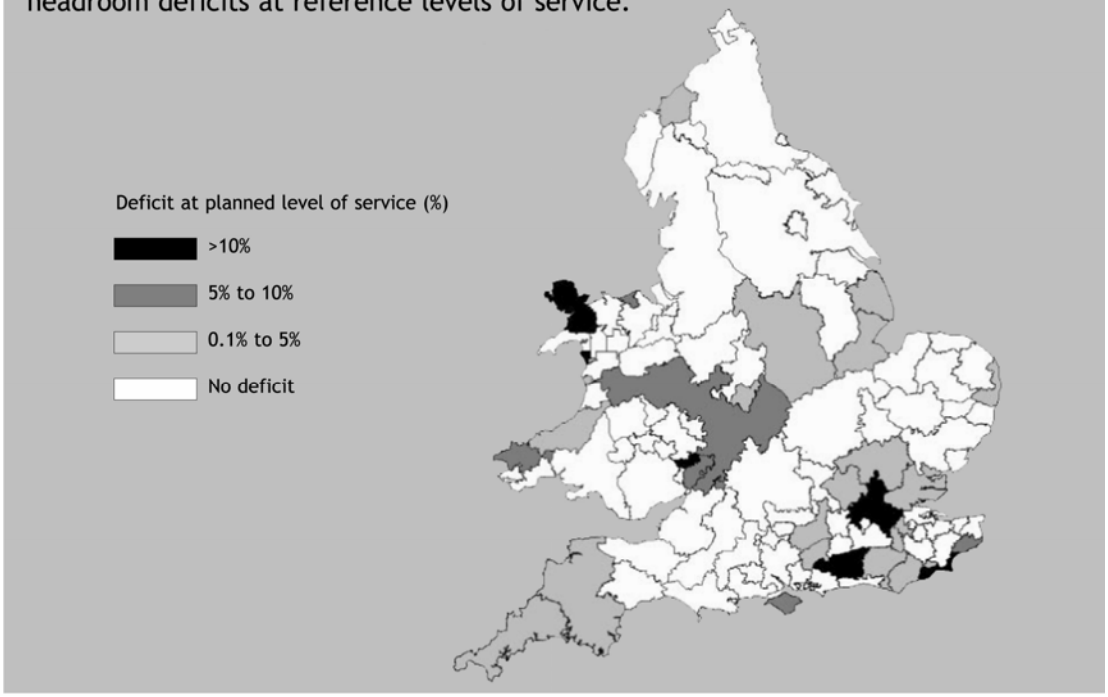
Stress in PWS management occurs when there are problems meeting the supply–demand balance, and this can relate to average demand or peak demand. Peak demand[2] usually occurs in the summer, when households and agriculture most demand water and when there is the lowest supply owing to dry weather and the need to protect low flows. To give an idea of how different water companies perform in terms of security of supply, Ofwat produces a security of supply index, banded from A to D. Only two water companies in the South East (Portsmouth and Sutton and East Surrey) currently achieve an 'A' rating indicating no deficit against target headroom[3] in any zone. However three companies: Southern, Folkestone and Dover and Thames have 'D' ratings, indicating 'large deficits against target headroom (Ofwat, 2004b)'. This does not mean customers can expect immediate supply problems, but that the company is operating with a greater than planned likelihood of needing to apply restrictions (such as hose pipe bans) during a dry year.

[2] In the Environment Agency Southern Region four out of five water companies regard planning and investing for peak period to be at least as necessary as for the annual average supply-demand. Peaks are estimated to be an important determinant in up to 90% of a water undertakers new capital expenditures and responsible for much of the forecast growth of public water supply in England and Wales (Herrington, 1998).

[3] In water company planning, supply is planned to meet forecast demand plus 'headroom'. Headroom is used to allow for uncertainties in supply and demand levels and 'target headroom' is the minimum amount of headroom that a company should be incorporating into their plans. This has typically been in the range of 5-10% of available supplies over demand (EA, 2001) but varies between resource zones reflecting different levels of uncertainty.

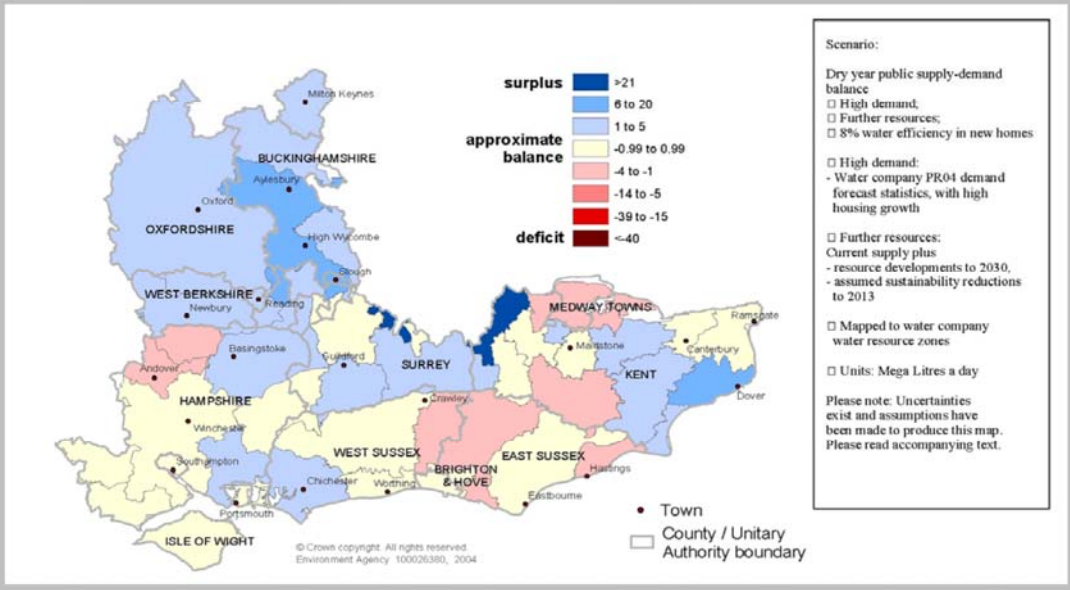
Figures 1 and 2 show the South East both has a cluster of resource zones with deficits, and some of the largest deficits compared to other parts of the country. The water companies have drought plans agreed with the Environment Agency detailing demand management and supply augmentation measures that could be employed during an extreme event. However, following the 1995 drought, water companies are hesitant to apply customer water use restrictions (Thames Water Utilities, 2004) and the Government has not encouraged the use of Drought Orders or Drought Permits that impact the environment (DETR and Welsh Office, 1999).

Figure 1: Distribution of resource zones with target headroom deficits at reference levels of service.



Source: Ofwat, 2004a

Figure 2: Current water resources surplus - deficit forecast (2005)

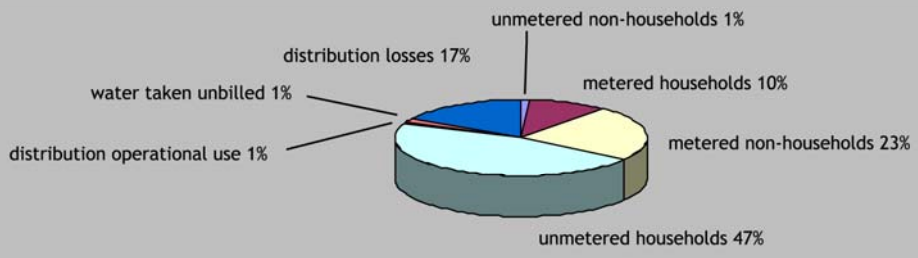


Source: WRSE Group, 2004

Household water use

Figure 3 shows that households account for the majority of demand for PWS – 57 per cent in England and Wales – about the same proportion for the South East. Distribution losses accounted for 17 per cent, but when leakage from supply pipes are included, total leakage accounts for 23 per cent of water distributed. The dominant non-household users are industry, commerce, agriculture and power generation. But most non-household users of the PWS are metered and have financial incentives to reduce waste. The focus of this research is on household water use.

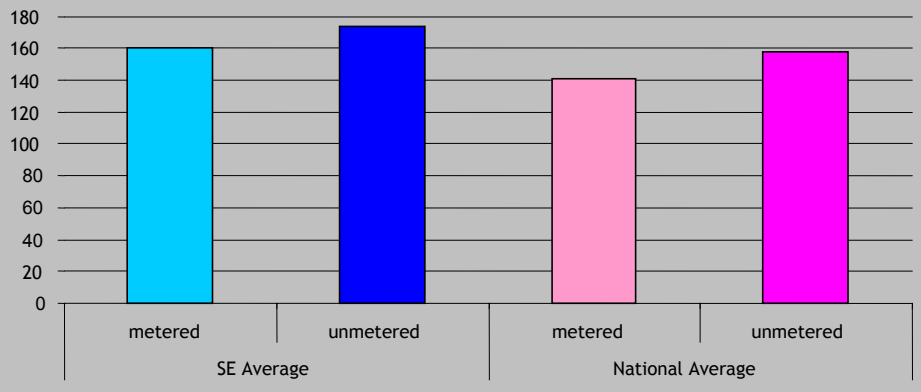
Figure 3: Components of Public Water Supply in England and Wales 2003-04



Source: Ofwat, 2004a

Per capita consumption (pcc) for both unmetered and metered households has shown a steady increase over time. However different water companies report different figures for pcc, and there has been recent concern that some of the higher pcc figures may be disguising higher rates of leakage which are being underestimated by the companies (Ofwat, 2004a; ENDS Report, 2004). Figure 4 shows that pcc for the South East (for both metered and unmetered households) is significantly higher than the average for Great Britain (Ofwat, 2004a). Leaving aside concern over the under-reporting of leakage, just why water consumption continues to grow generally or indeed why it so high in the South East is poorly understood.

Figure 4: Per Capita Consumption (pcc) (l/head/d) of water for households: average for the South East and the Great Britain, 2004



Source: Ofwat, 2004a. The South East figures are an aggregate of Southern, Thames, Folkestone and Dover, Mid-Kent, Portsmouth, South East, Sutton and Surrey and Three Valleys. Metered households tend to consume less water per head due to a combination of two factors – 1. low water use households tend to opt for metering; 2. metered households tend to be more efficient.

In the UK, one of the most significant factors in determining individual water consumption is household size. Work by Thames Water found that average pcc varies from 124 litres/person/day to 201 litres/person/day as household size decreases from 6 people to 1 person per household (Thames Water Utilities, 2004). Other factors found to impact significantly pcc were the socio-economic factors such as income and type of area. Research using the ACORN[4] classification, found that the highest pcc (180 litres/person/day) tends to be found in category A (agricultural villages) and J (affluent suburban houses) whilst the lowest pcc (less than 140 litres/head/day) tends to be found in category F (council housing). The relationships between pcc and household income and pcc and council tax band showed similar patterns (Edwards and Martin, 1995).

Figure 5 shows that personal washing and toilet use accounts for over half of household water demand. Household demand is a function of the ownership, volume and frequency of use of water using appliances and activities. For instance, the amount of water used for basic needs like personal washing and toilet use could be greatly reduced through the fitting of more efficient devices such as spray taps and low-flow toilets.

Figure 5: Micro-components of household demand, 1997-98

Source: Environment Agency, 2001

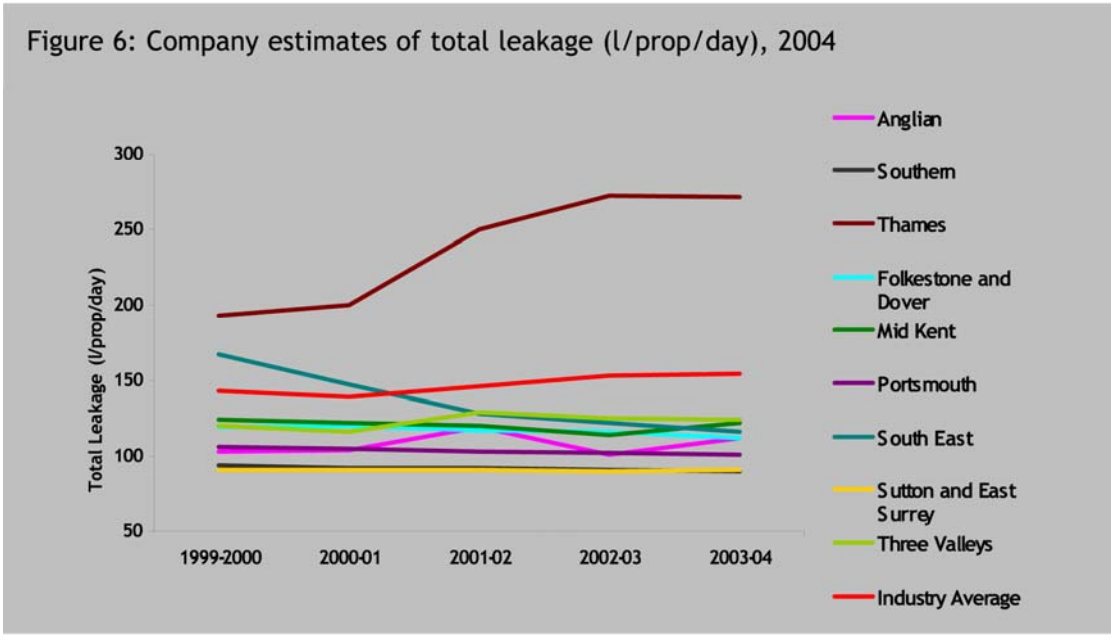
Leakage

Total industry leakage rates have increased over the last three years following a period of reduction from a peak in 1995 (Ofwat, 2004a). Ofwat reported that 2003–04 was considered a difficult year for leakage control due to the long hot, dry summer leading to ground movement and subsequently increased burst rates. Figure 6 shows that Thames Water has the worst absolute leakage record. In 2003-04, its leakage levels stabilised after a rise in 2002–03, but they were still much higher than any other company whether measured on an absolute or per property basis (Ofwat, 2004a).

Ofwat sets mandatory target levels for leakage based on the Economic Level of Leakage (ELL).[5] The current leakage targets are for 2005–10. Unsurprisingly, Thames Water has the biggest leakage reductions to make (20 per cent on current levels). In the South East, Thames Water and Three Valleys Water have failed to reach their leakage targets.

[4] The ACORN classification is a means of classifying areas according to various Census characteristics. There are six major ACORN categories – Category A: Affluent suburban and rural areas; Category B: Affluent family areas; Category C: Affluent urban areas; Category D: Mature home owning areas; Category E: New home owning areas; and Category F: Council estates and low income areas.

[5] This is the level at which it would cost more to make further reductions than to produce the water from another source, and operating at the ELL helps ensure best value for customers.



Source: Ofwat, 2004a

Water quality – sewage treatment

After significant improvements over the last decade, there has been a recent decline in the chemical and biological quality of South East rivers. Increased development combined with unregulated diffuse pollution sources threaten continued improvements to water quality, with a major obstacle to greater regulatory control being the difficulty in quantifying the contribution of diffuse pollution to the deterioration of river quality.

The presumption in Planning and Development Control has been that pollution problems can be solved by the installation of appropriate treatment facilities or technologies, and therefore should not impede development. However, with the expected increases in development in the South East, future protection of the water environment cannot be secured on this basis and proactive planning will be essential to secure the necessary water infrastructure.

Some sewage treatment works (STWs) in the South East have reached, or are approaching the point, where conventional technology is not adequate to secure the effluent quality needed to maintain environmental water quality. In addition, some STWs have limited capacity to accommodate additional housing growth – above the current Regional Planning Guidance 9 (RPG 9) – without the need for excessive expenditure. The phasing of new housing developments will be critical, and some locations may not be able to accommodate further development in the short term due to the lead times associated with delivery of the necessary infrastructure, and a few sites may not be able to accept new development at all due to the fragility of the water environment. The Environment Agency is currently working closely with SEERA, Southern Water and Thames Water to identify other sensitive sites and work out the appropriate phasing and funding of infrastructure needed to accommodate new housing growth. It is important that this work is progressed in time to feed into the South East Plan and Local Development Frameworks.

Water Resources in the South East (WRSE) Group Report

To guide the preparation of the Consultation Draft of the South East Plan (SEERA, 2004) the WRSE Group produced a report to explore the impact of various housing growth scenarios on the public water supply balance (WRSE Group, 2004). The key message of this report was that "increased demand from new development in the South East can only be accommodated through a combination of demand and supply side activities". However, the report did not

consider the impacts of housing growth from London, the South West, the Midlands and East Anglia, and neither did it consider water quality and the ability of sewerage treatment works and drains to support extra growth. Consequently, further assessment is necessary to take these issues into account before the South East Plan is finalised with regard to the impact of alternative housing growth scenarios on the public water supply balance. It is unclear how much of London's water demand is met from water resources in the South East. Proposed new housing developments in growth areas like the Thames Gateway, which is already considered to be water stressed, could influence future demand placed on water resources in the South East.

The report was based on a number of assumptions, some of which are optimistic. If they do not materialise, very different outcomes could be reached. The report assumes:

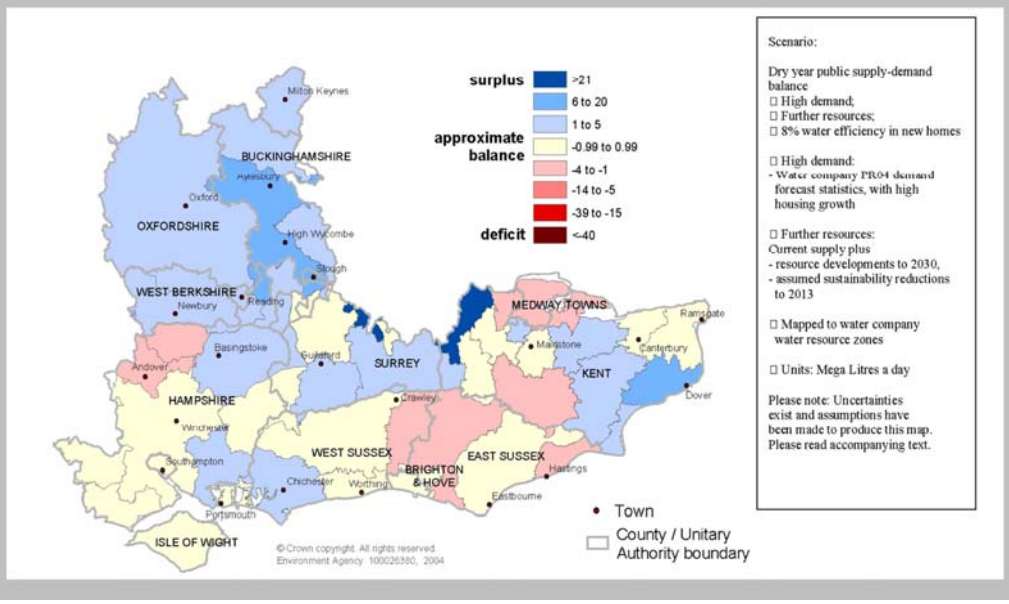
- Appropriate planning permissions and abstraction licenses for supply side options are delivered in a timely way. But abstraction licenses need to be approved by the Environment Agency and reservoirs can take years to plan and are often opposed by local communities.
- Enabling mechanisms to encourage greater demand management (e.g. water efficiency fittings in new homes). But take up of water efficiency measures will be low unless there are regulations or financial incentives to encourage them.
- Over 55 per cent of the households of the SEERA region will be metered by 2020. But this is an optimistic assumption as most South East water companies are failing to meet their metering targets.
- The impacts of climate change are no greater than allowed for in the modelling. But there are still uncertainties surrounding future predictions of the impact of climate change particularly at the regional level.
- Adequate funding will be provided to implement water resource plans. But long term funding for water infrastructure is not necessarily certain.

The WRSE Group modelled the effects of two housing growth rates and water efficiency projections to assess the future water supply-demand balance in the South East (WRSE Group, 2004). The two housing growth scenarios were: 'medium housing growth' – a growth rate of 29,500 which refers to RPG 9 plus the additional new housing added under the Sustainable Communities plan by SEERA; and a 'high housing growth' – a growth rate of at least 36,000. It should be noted that the high housing growth rate considered in this study was rejected by the South East Assembly. The highest housing growth rate proposed in the consultation draft of the South East Plan was 32,000.

The two water efficiency scenarios were: an 8 per cent reduction in pcc in new homes which was considered conservative and assumed to be possible through basic water efficiency fittings such as low flush toilets; and a 21 per cent reduction in pcc in new homes which was considered achievable with affordable A-rated water saving household appliances. For all the scenarios examined, the modelling assumes a greater reliance on supply side rather than demand side measures for addressing future water deficits. It assumes that three quarters of the projected deficit is met from new supplies, such as reservoirs, whilst a quarter is met from demand management measures such as water efficiency improvements.

Figure 7 shows what the water resources surplus-deficit forecast could look like in 2025 if there is high housing growth, provision of new water resources and an 8 per cent reduction in pcc in new homes. Under this scenario, the region's water surplus-deficit is broadly in balance.

Figure 7: Projected water resources surplus-deficit forecast, 2025:
High housing growth, further resources, 8 per cent reduction in pcc in new homes



Source: WRSE Group, 2004

However, other scenarios paint a very different picture. Figure 8 shows the 'worse case' scenario of 2025 where there is high housing growth, no new resources and no improvement in water efficiency. The South East would be heavily in deficit, with Oxfordshire and parts of Hampshire most in deficit. This would result in a very fragile water balance heavily susceptible to dry years, with hosepipe bans and other measures becoming a frequent occurrence. The picture is not that much better for medium housing growth accompanied by no new supplies or demand management shown in figure 9. If this were to occur it would present a significant water resource problem for areas within Oxfordshire and particularly for Hampshire that are expected to receive new housing developments.

Figure 8: Projected water resources surplus-deficit forecast, 2025:
High housing growth, no new resources, no improvement in water efficiency

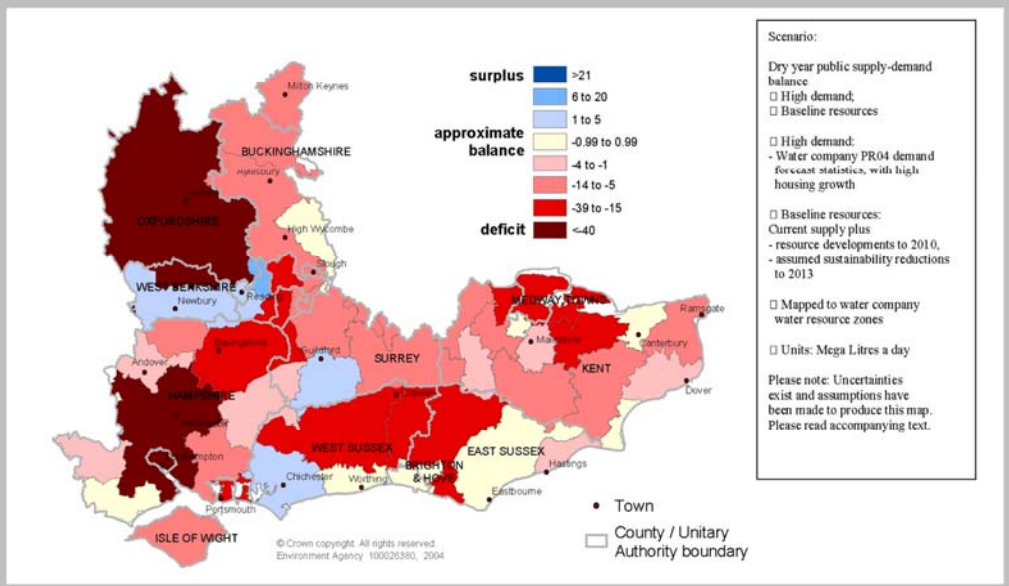
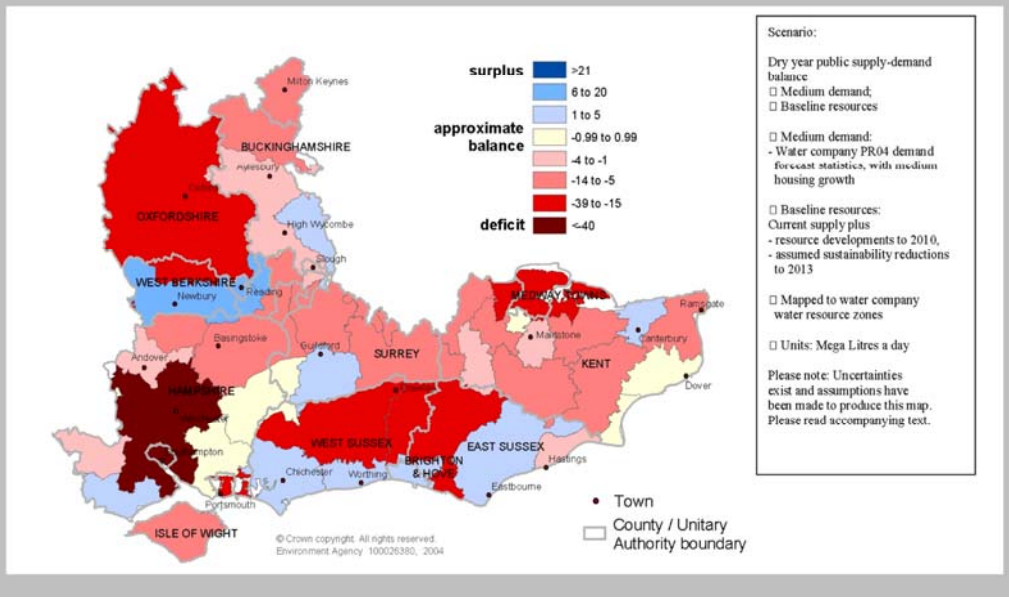
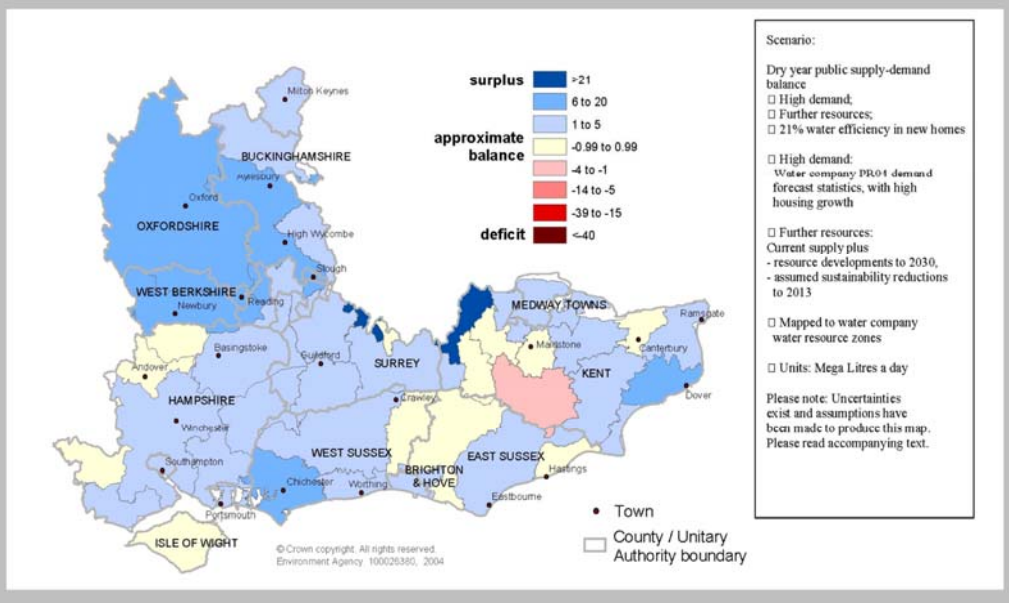


Figure 9: Projected water resources surplus-deficit forecast, 2025:
Medium housing growth, no new resources, no improvement in water efficiency



However, figure 10 shows that high housing growth if accompanied by further resources and a 21 per cent reduction in pcc in new homes would result in healthy water surpluses across the region by 2025, except a slight deficit in mid-Kent.

Figure 10: Projected water resources surplus-deficit forecast, 2025:
High housing growth, further resources, 21 per cent reduction in pcc in new homes



Although not mapped, if no new resources were forthcoming beyond those already planned by 2010, but a 25 per cent efficiency in new homes was achieved, in a dry year the region would have significant areas in deficit by 2025. This would be the case for both the medium and high rate of housing growth.

These scenarios indicate that whatever level of housing growth is decided upon, it will only be possible to accommodate significant new housing if there are new resources and, at the very least, an 8 per cent reduction in pcc in new homes. The WRSE Group's modelling

assumes that new resources will be added in a timely fashion before housing demand outstrips supply. But proceeding with new house building, at a medium or high rate, on the assumption that new resources, such as new reservoirs, will be delivered to meet new demand is a risky strategy. Reservoirs are not 'quick fixes' and can take 15 to 20 years to implement with at about three years for planning permission, about six years for building and approximately three years for filling (EFRAC, 2004). It is also not guaranteed that they will get planning permission as there is often a lot of local public opposition to new reservoir developments.

The assumptions underlying the WRSE Group's approach to assessing the future water supply-deficit needs to be reviewed to be more cautious about supply side solutions to meeting future water needs in the South East. It would be advisable to aim for higher savings from water efficiency from new homes to ensure that the rate of house build will not outstrip supply in the South East. It is also important that the location of strategic developments avoids areas that are water stressed.

Summary of findings

- **The South East is currently water stressed both in terms of overall water resources and the public water supply.**
- **Climate change is expected to exacerbate water stress in the region. The impacts of climate change are uncertain but a precautionary approach is needed.**
- **Several water companies are operating within their target headroom, putting security of supply and the environment at risk in a dry year.**
- **Total industry leakage rates have risen over the last three years, and in the South East Thames Water and Three Valleys Water have failed to reach their leakage targets. Leakage rates may actually be higher than reported, as unmetered per capita consumption may be disguising significant levels of leakage.**
- **Future household demand is expected to play the largest role in determining future water need in the region, ahead of industry and agriculture.**
- **The South East has some of the highest rates of per capita consumption and as population increases, household size decreases and climate change progresses, overall water demand is expected to rise significantly.**
- **There are a few areas in the South East where the physical ability of the environment to cope with increased effluent volumes could constrain development.**

Managing water resources in the South East

The Government advocates a twin-track approach to managing water supplies, where new resource developments are selected as an option only where a demand management approach is clearly insufficient or unjustified in terms of cost. However, the plans produced by the water companies for the current periodic review were criticised by the Environment Agency for being dominated by resource development rather than demand management, and that plans for new supplies were on somewhat ambitious timescales, while metering rates could be improved (EA, 2004).

As identified in the second working paper of the Commission – 'The Problems of Success: Reconciling Economic Growth and Quality of Life in the South East' – it will become increasingly difficult for the region to offer its citizens a high quality of life without offsetting policy measures for changing the behaviour of individuals and firms (Foley, 2004). But one reason given for the unbalance between new supplies and demand management is that demand management is perceived as more uncertain than supply augmentation. Changing individual behaviour to encourage greater water efficiency will rely on the co-operation of householders and it is therefore difficult to predict the savings that could be achieved. Furthermore, it has been suggested that there are greater financial incentives to acquiring more assets than there are in managing demand, and that no funding is allocated for managing demand.

The following section considers a balanced way of managing water resources in the South East based on a combination of two approaches: firstly, managing demand for water; and secondly, increasing water supply. But to readdress the balance between supply side and demand side measures, this section particularly focuses on options for extending water metering in the South East.

Managing demand for water

Reducing leakage
As noted above, a number of water companies in the South East have not met their leakage targets. The most obvious way to improve the efficiency of existing water use is to reduce the amount of leakage that occurs. But it is not clear what steps Ofwat requires water companies with a poor leakage record to meet if they fail to meet leakage targets. There is a clear need for Ofwat to enforce leakage targets more rigorously to reduce wastage and introduce penalties for failure.

Leakage targets are set on the basis of the Economic Level of Leakage (ELL). As part of the recent price review, Ofwat asked all water companies to update their ELL appraisals. There is an on-going debate about how environmental and social considerations should be incorporated within ELL.

Progressing water metering
Water usage in most households in the UK is not currently measured. As a consequence, water companies generally have very poor data on how much water is being used by households in different areas and what factors influence their use. This is in contrast to other utilities, such as gas and electricity, where their use is measured on a unit basis. Traditionally, the water bill has been divided into a standing charge, the same for each household, and an additional charge based on the rateable value of the home6.

[6] These charges vary throughout England and Wales as some water companies make the standing charge the main element of the bill whilst other makes the rateable value the main element. Rateable values were last assessed in 1973 and so they currently bear little relation to present property values.

A survey for SEERA found that 84 per cent of residents said they would be willing to use less water (MORI, 2004). As with other utilities, people are likely to use less when they pay for it on a per unit basis. Water company research has estimated that voluntary water metering could achieve a reduction in consumption of between 2 and 14 per cent per annum, with an average of 9 per cent per annum (EA, 2004). Logic suggests that this would be higher for compulsory metering and if tariffs were designed to penalise excessive use. Metering is particularly effective at reducing peak demand for water.

Ofwat has estimated that the cost of a voluntary or optional meter is about £194 and £237 for compulsory metering and metering on change of occupancy. The costs of metering are higher in the South East – £226 for optional metering and £251 for compulsory metering – owing to a combination of high labour costs in the South East and more 'complex' fits such as flats or properties with shared supply pipes (Ofwat, 2005). There are cheaper ways of saving water through the use of water conservation measures like low flush toilets or water saving taps and shower heads. But it is not clear why people would be persuaded to install such appliances if they have no incentive to do so. Water metering would not only enable people to save money by using less water, it would also show people the benefits of using water efficient appliances in their homes.

The Water Industry Act 1998–99 forbids compulsory metering except in designated water scarce areas, and for customers with high water using facilities (including power showers and sprinkers) (HoC, 1998). Water companies can put meters into all new homes and can install them in properties when there is a change of occupancy. The Act also introduced the right to free metered installation for households, which has encouraged more households to install meters. These measures have seen all water companies in the South East increase metering rates since 1997–98 (EA, 2004b) with 21 per cent of households in England and Wales as a whole metered in 2003–04, (Ofwat, 2004a). The table below shows there is considerable variation in the current and projected metering rates of water companies. The water companies that serve the largest populations in the South East are Three Valleys, Mid Kent, Southern, Thames and South East Water.

Anglian Water[7] achieved a near 50 per cent metering rate in 2003 demonstrating that significant penetration is already possible. Table 2 shows that the main companies supplying water in the South East are lagging behind. For instance, Three Valleys Water, Southern Water and Mid Kent Water are not expected to achieve similar levels of metering to Anglian Water until 2010. Portsmouth and Sutton and East Surrey are forecast to only achieve metering rates of 39 per cent and 44 per cent respectively by 2030.

The Environment Agency has called on all companies supplying water in the South East to increase their rate of metering to help reduce the amount of water consumed by each person (EA, 2004). According to water company plans over 55 per cent of households in the South East region will be metered by 2020 (WRSE Group, 2004). However, as demonstrated, most water companies supplying the South East are not on track to meet their targets. Without water companies taking a positive attitude to increasing water metering in the region, it is unlikely that they will reach their forecasted metering rates (EA, 2004). Ofwat must play a more prominent role in encouraging water companies to increase their metering rates.

Currently water companies can formally seek the designation of supply zones as 'Water Scarce Areas'. This designation would enable water companies to move more quickly towards higher rates of metering where need is most urgent. To date the water companies have been reluctant to seek the designation of Water Scarce Area, with Folkstone and Dover the only water company currently considering applying for water scarcity status. The Environment Agency has advised that other parts of Kent, East Sussex and perhaps West Sussex may also need to declare water scarcity status in the coming years (Environment Agency, 2001). As the regulatory body responsible for water abstractions and environmental

[7] Anglian Water mainly supplies water to the East of England although it also provides water to a small area of the South East.

protection, the Environment Agency should be given a stronger role in independently assessing when areas should be declared as Water Scarce so that higher levels of metering can be advocated.

Table 2: Water company household metering penetration 2003, 2010 and 2030

	Meter penetration (%)		
Water Company	**2003 (actual)**	**2010 (target)**	**2030 (target)**
Anglian	49	64	90
Bournemouth and West Hampshire	27	54	86
Bristol	18	29	46
Cambridge	49	61	84
Choderton and Distruict	13	22	No forecast supplied
Dee Valley	27	43	69
Welsh	14	31	61
Essex and Suffolk	30	46	69
Folkestone & Dover	34	65	91
Mid Kent	27	44	74
Northumbrian	8	20	43
Portsmouth	3	12	39
Severn Trent	21	31	66
South East	25	37	63
South Staffordshire	12	21	35
South West	36	64	90
Southern	23	42	71
Sutton and East Surrey	16	25	44
Tendring Hundred	54	66	85
Thames	19	27	59
Three Valleys	18	43	81
United Utilities	12	26	56
Wessex	28	44	73
Yorkshire	22	34	60

Source: Environment Agency (2004b) Meter penetration numbers can vary depending on whether household voids have been included in the calculation. The main water companies supplying the South East have been bolded.

Water metering and fairness

The traditional method of charging householders for water in England and Wales is inefficient. This is because a large proportion of water bills consist of the standing charge which is the same across all households in the water company's area. Only a proportion of the bill is based on the rateable value. As a consequence, two neighbouring homes will end up paying similar bills regardless of whether one household uses more or less water than the other.

A concern with the current system of voluntary or optional metering is that it is regressive – the people who tend to take it up are more likely to be small households in larger properties who are generally on higher incomes. To encourage people to switch to metering, the additional administrative costs of metering and bills are not borne by those who are metered, but shared amongst all customers so that those who are un-metered are effectively subsidising those who are. Since those who tend to opt for voluntary metering tend to be better off living in high rateable value homes, this tends to mean that poorer consumers end up subsidising richer consumers (NCC, 2002). However, the current system by which rateable value charges are based is littered with questionable cross subsidies. For instance, households in rural areas tend to pay less and so are heavily subsidised by households in urban areas. Policies for encouraging more lower to middle income households to switch to metering

would help to ensure that the administrative costs of metering are more equitably spread across different household income groups.

Paul Ekins and Simon Dresner of the Policy Studies Institute recently published a report for the Joseph Rowntree Foundation that examined the distributional effects of various universal water metering and charging options (Ekins and Dresner, 2004). The study used data supplied by Anglian Water which showed that the first adult in a household tends to use 50 m^3 water per year, the second adult uses 35 m^3 per year and a child uses 20 m^3 per year. The analysis focused on whether, on average, households in the lower income bands (less than £10,000 and between £10,000 and £20,000) would be better of worse off with the introduction of metering.

A concern is that water metering could potentially result in poorer households sacrificing hygiene to save money. The study therefore incorporated some metering options that combined an allowance of water that would have a fixed cost to cover essential water uses. Some of the metering options explored differentiate between households on the basis of Council Tax bands. The way in which council tax is paid bears little relation to current property values. For instance, a Band H property is worth at least eight times as much as a Band A property but the Council Tax paid is only three times as much. In the study, Council Tax bands were therefore stretched so that the amount paid was roughly proportional to the value of the property in 1991. Three of the main options are presented in table 3.

Table 3: Metering options based on the Anglian Water tariff

	Household income < £10,000		Household incomes of £10,000-£20,000		Household incomes > £40,000	
Metering options	**Average loss or gain (£ per week)**	**Proportion losing more than £1 per week (%)**	**Average loss or gain (£ per week)**	**Proportion losing more than £1 per week (%)**	**Average loss or gain (£ per week)**	**Proportion losing more than £1 per week (%)**
Option 1: Metering with the existing Anglian Water tariff (no effect on existing metered customers).	+0.34	8	-0.02	15	-0.09	17
Option 2: Metering with the volumetric rate varying according to stretched Council Tax bands.	+1.09	6	+0.81	12	-0.36	37
Option 3: Metering with a fixed allowance of 20m3 per capita for the first adult and each child and increased price per litre of water.	+0.31	12	+0.01	15	-0.17	25

Source: Ekins and Dresner, JRF (2004)

Table 3 shows that all the metering options investigated are progressive from the point of view of the lowest income households and all but one (option 1) are progressive for the next income group (£10,000 to £20,000). Option 2 leaves fewest households in the two lowest income groups worst off by over £1 per week. Option 3 leaves more low income households with extra bills in excess of £1 per week (12 per cent as opposed to 6 per cent for option 2). Table 3 shows that all the metering options are unattractive from the point of view of the

richest household income group (£40,000 and above). While option 2 leaves the fewest households in the two lowest income groups worst off, it leaves the highest proportion of households (37 per cent) worst off in the £40,000 and above income group.

The charges for different water companies are structured in different ways. Ekins and Dresner therefore also tested their metering options with Severn Trent which is unique among water companies because customers pay no standing charge. Similar results were obtained using the Severn Trent tariff structure which shows that the findings were not a function of the structure of the Anglian tariff. Even though the study did not examine water companies supplying the South East, the results are likely to be representative of the effects metering could have on water customers in the South East. The study therefore supports the view that water metering would be progressive from the point of view of low income households in the South East.

Tackling water affordability

The Government has a scheme for vulnerable and low income groups which caps the bills of those identified as having high essential water use. The assistance was introduced as part of the Water Industry (Charges) Vulnerable Groups Regulations which came into force in April 2000. To qualify for assistance a household must be in receipt of an income related benefit, and contain a large family (three or more children under the age of 16 years), or a person who has special water needs because of a medical condition.

However, a recent Select Committee on Water Pricing criticised the low take up of the scheme – only a 1.4 per cent take up among eligible customers in 2001–02. It highlighted that the scheme had been less than effective because it does not reflect the fact there are large regional variations in water charges. The amount of means tested benefit householders receive is fixed but water charges are not uniform. As a consequence the current assistance has largely been ineffective at tackling water affordability issues (HoC, Environment, Food and Rural Affairs Committee, 2003).

Improving the water efficiency standard of new homes

In a survey in which people were asked how important different features would be in a new home, water efficiency ranked fourth with 48 per cent of people saying it was important (Mulholland, 2004). When the Sustainable Communities plan was launched, the Deputy Prime Minister stated that water efficiency savings of between 20 and 30 per cent were crucial for new homes (Sustainable Buildings Task Group, 2004). There is currently no explicit requirement that Building Regulations should consider water efficiency although they are currently under review.

The WRSE Group report (2004) found that a 21 per cent reduction in pcc in new homes could be achieved with affordable A-rated water saving household appliances. The Government should require that all new homes achieve a minimum of at least a 20 per cent reduction in pcc (based on national pcc) as part of the Buildings Regulations. This would ensure that new homes built in the South East, and elsewhere, achieve a minimum water efficiency standard.

The Government is currently working with industry to develop a voluntary Code for Sustainable Buildings. The Code should contain explicit requirements for water efficiency that go beyond the minimum required in Building Regulations. The Code could recommend a 20 to 30 per cent reduction in pcc in new homes (based against average national pcc). Water efficiency savings of up to 25 per cent could be achievable without changes to the way people use water, i.e. it could be achieved through water efficient fixtures, fixings and new appliances.

Higher water savings of above a 25 per cent reduction in pcc would, however, require changes to the way people use water and may also require changes in public attitudes. For instance, rainwater harvesting requires people to water their gardens or wash their cars not

from the tap, but from a water butt, which would probably be acceptable to many people. However, grey water recycling which requires the re-use of some household water for low-water-quality applications, such as toilet flushing, before it is discharged to sewerage, is not currently popular. Encouraging grey water recycling at the household and community level will not only require overcoming the psychological hurdle of re-using water, but will also require the fitting of reuse plumbing schemes which will have a cost implication. As water reuse becomes more acceptable over time it would be sensible to design new buildings to enable the incorporation of water reuse schemes.

A Water Efficiency Commitment for all homes

Whilst Ofwat sets water companies targets for reducing leakage, they do not have any obligations to ensure they improve the efficiency of water use especially in homes. Ofwat could play a stronger role in encouraging water efficiency through the introduction of a Water Industry counterpart to the Energy Efficiency Commitment (EEC) for domestic suppliers – an idea proposed by the Sustainable Buildings Task Group (2004).

The EEC is a levy on top of energy bills which runs until 2005. The EEC required legislation when it was first introduced in 2002. Each supplier has an energy saving target which they can meet by encouraging householders to install energy saving measures, for example, by subsidising the cost of installing a condensing boiler or energy efficient lighting. At least half the target must be met in households whose occupants are either on a low income or disabled. The EEC has been successful at reducing energy use and the Government's Energy White Paper committed to extending the scheme to 2010. The Office of Gas and Electricity Markets (OFGEM), the equivalent of Ofwat in the energy sector, has co-ordinated the implementation of the EEC with guidance from the Government.

There are a lot of lessons the water industry could learn from the implementation of the EEC. An equivalent Water Efficiency Commitment could help to improve the water efficiency of both new and existing homes. Similarly, each water company could be set a water efficiency target with a requirement that a proportion of their target is met in low income and vulnerable households.

The EEC has added just over one per cent to energy bills. The average energy bill is about £300 per year and the EEC levy has added about £3.60 per year (DEFRA, 2004). Any increases to utility bills tends to be publicly unpopular. Ofwat recently announced that water bills will increase on average by 18 per cent (in nominal terms) over the next five years largely to pay for improvements in sewage treatment with some of the highest increases in the Southern regions (Ofwat, 2004b). Unsurprisingly, this was met with criticism by WaterVoice – the water consumer group (WaterVoice, 2004). But if a Water Efficiency Commitment were to lead to about a one per cent addition to water bills this would have little effect on householders who take up the offers for water saving measures. A low-flush toilet could save about £10 per year[8] (Thames Water Utilities, 2005). The issue is that the one per cent additional charge would affect all customers and not all customers would take up the offers for water efficiency saving measures and so some households could lose out.

To limit any regressive impacts, the Government would need to provide grants to low income, larger families to help subsidise the costs of water saving measures. Alongside the EEC, the Government spends on average £150 million per year on the Warm Front Scheme which provides grants for heating and insulation to improve the energy efficiency of households. The scheme is central to the UK Fuel Poverty Strategy which has a target to eliminate fuel poverty in vulnerable groups by 2010 (DTI and DEFRA, 2001). In conjunction

[8] A water saving toilet saves about 3 pence per flush in a metered household (Thames Water Utilities, 2005). The average household size is about 2.4 individuals in the South East. To take a hypothetical example, if each person flushes the toilet 25 times in a week, then a water saving toilet could potentially save £9.36 per year. The savings will vary according to the average number of flushes per person.

with any Water Efficiency Commitment, the Government would need to provide grants to encourage low income, larger householders to adopt water efficiency measures.

The Water Efficiency Commitment would not have to be nation-wide but could be focused on regions with water stressed areas. Before the Government introduced the EEC for all domestic energy suppliers, a number of energy companies took part in a voluntary scheme. Given the South East has some of the highest levels of household water use in the UK, the Government should encourage some of the water companies in the South East to participate in a regional pilot of the Water Efficiency Commitment. The pilot would give water companies in the South East an opportunity to demonstrate their corporate commitment to water efficiency improvements and a head start in implementing the scheme. Ofwat could co-ordinate the implementation of the pilot.

Water efficiency advice for householders

The Energy Saving Trust[9] (EST) was created in 1992 to provide advice to householders about how they can improve the energy efficiency of their homes. It raises public awareness of the cost savings of energy efficiency and provides information about government grants for energy efficient appliances and measures. EST also has responsibility for encouraging the use of energy efficient vehicles through its 'TransportEnergy' programme.

A number of environmental organisations have proposed creating a Water Saving Trust that could serve many of the equivalent functions to the EST – it could raise public awareness of water efficiency appliances, promote water metering and provide advice to low income and vulnerable households eligible for government assistance to help pay their water bills. The Environment Agency has recently commissioned a study to explore the case for and against creating a Water Saving Trust.

It is questionable whether it would be practical and a prudent use of public money to create a new organisation for promoting household water efficiency. There is already a complex structure of organisations responsible for water regulation, planning and policy advice. It is unclear whether creating a Water Saving Trust would merely make that structure even more complicated. It is perhaps more helpful to explore how the roles of existing organisations could be expanded to incorporate water efficiency.

The responsibilities of the EST could be extended to incorporate not only energy efficiency and transport fuel efficiency but also water efficiency. EST could integrate water efficiency advice into its well established marketing and information programmes aimed at householders. The EST could be renamed as the 'Resource Efficiency Trust' to reflect its expanded role. It would need additional government funding to support a campaign programme for raising public awareness of household water efficiency options.

Policy recommendations

- **Ofwat should more rigorously enforce leakage targets. It should work with water companies failing to meet leakage targets to develop action plans for reducing wastage, with clear penalties for failure.**
- **The Government, water companies and Ofwat should consider how to speed up the installation of meters in areas of low water availability.**
- **The Environment Agency should be given a stronger role to independently assess when supply zones should be declared as Water Scarce Areas so that higher levels of metering can be advocated.**
- **In conjunction with promoting water metering, the Government should work in partnership with water companies, Ofwat and local authorities to raise the profile**

[9] The EST was originally created as an England wide organisation although in recent years it has extended it operations UK wide to include Wales, Scotland and Northern Ireland.

of its assistance for low income and vulnerable householders who face difficulties paying their water bill.

- **The Government should revise the Buildings Regulations to require that all new homes meet a minimum of a 20 per cent reduction in per capita consumption of water (compared to the national average) which could be achieved with affordable A-rated water saving household appliances. This would ensure that all new homes built in the South East, and other parts of the country, achieve a minimum standard of water efficiency.**
- **The voluntary Code for Sustainable Buildings should aim for water efficiency standards that go beyond the minimum required by Building Regulations. It could recommend a 20 to 30 per cent reduction in per capita consumption of water (compared to the national average) in new homes. Achieving higher water efficiency savings of above a 25 per cent reduction in per capita consumption will, however, require changes to the way people use water. Options, such as grey water recycling (re-using some household water for low-water-quality applications) will need public acceptance.**
- **The Government should consider introducing a Water Industry counterpart to the Energy Efficiency Commitment (EEC) for improving the water efficiency of new and existing homes. The Government should set each water company a water saving target which they could meet by encouraging householders to install water efficiency measures. The obligation should require a proportion of the target to be met in low income, larger households. Ofwat could take responsibility for co-ordinating the Water Efficiency Commitment with guidance from the Government. The Government would need to provide grants to help subsidise the costs of water saving measures for low income, larger families.**
- **The Water Efficiency Commitment would not have to be nation-wide but could be focused on regions with water stressed areas. The South East should participate in a regional pilot giving water companies in the South East an opportunity to demonstrate their corporate commitment to water efficiency and a head start in implementing the scheme.**
- **The responsibilities of the Energy Saving Trust (EST) should be expanded to incorporate not only energy efficiency and transport fuel efficiency but also water efficiency. The EST could be renamed as the 'Resource Efficiency Trust' to reflect its expanded role.**

Increasing water supply

Despite Government guidance that "only where a demand management approach is clearly insufficient or unjustified in terms of cost should companies look to the development of new resources" (DETR and Welsh Office, 1999), recent water company plans have been criticised by the Environment Agency for being dominated by development options without full consideration of demand management (EA, 2004). As noted above, it is important that planners do not heavily rely on supply-side options for meeting future water needs in the South East and that higher levels of water efficiency are needed in both existing and new homes. But some additional water resources will still be needed.

The modelling undertaken by the WRSE Group (2004) revealed that even with a 21 per cent reduction in pcc in new homes, this alone would not be sufficient to accommodate future water needs under both the medium housing growth scenario (29,500) and high housing growth scenario (at least 36,000). The provision of further water resources would also be needed (see figure 10 for the high housing growth scenario). Although not mapped, research by the WRSE Group suggests that the provision of further water resources would also be needed for a higher reduction in pcc of 25 per cent for new homes.

There are several ways of increasing water supply: reservoir development, desalination plants and transfers between resource zones, and also groundwater recharge and water reuse (see appendix 1). This section will not recommend particular supply options but consider the

costs of new water infrastructure and options for better co-ordinating water resource planning with development planning.

Costing new water infrastructure

The Sustainable Communities plan (ODPM, 2003) has been criticised for appearing to give little thought as to whether additional infrastructure will be able to keep pace with the rate of new housing and who would pay for this infrastructure. The third working paper from the Commission – 'Keeping the South East Moving' – found that there was a lack of official information about the additional transport infrastructure costs associated with new housing developments in the South East. Whilst the 2004 Spending Review provided a £200 million Community Infrastructure Fund for helping to pay for additional transport infrastructure in the growth areas, it was highlighted that this is unlikely to be sufficient (Foley, Sansom and Grayling, 2005).

The case for water is different as the costs of providing new infrastructure will be borne by individual customers through their water bills. The government is therefore not expected to identify the funding necessary to meet additional water infrastructure costs. There will, however, be ramifications for water bills in the South East. Water infrastructure provision include making the connection, laying new sewer or water mains if there is none already and upgrading the local distribution network or sewerage network, including local service reservoirs or pumping stations. Water companies can recover some of these costs from the developer. If water resources are already fully committed or if the capacity of sewage treatment plants needs to be increased there will be additional costs paid by the customer base.

Table 4 shows the additional costs for water and sewerage services over the Water Price Review period from 2005–10. Ofwat expects that 291,000 new connections for the water service will be needed in the South East between 2005 and 2010. These figures include a consideration of the impact of the Sustainable Communities Plan (Ofwat, 2004b). Ofwat's assessment is that on average water companies in the South East will need to invest an extra £382 more per new property in the water service and an extra £84 more per property in the sewerage service compared to the rest of England and Wales (Ofwat, 2005).

Table 4: The additional costs for water and sewerage services over the period from 2005 and 2010

Water service	Total costs (£ million)	Cost per property (£)
South East	£288	£992
Rest of England and Wales	£397	£610
Sewerage service		
South East	£119	£429
Rest of England and Wales	£216	£345

Source: Information Ofwat, 2005

Table 5 shows how these costs will be passed onto household water bills over the period from 2005–2010. The range of bill impacts for maintaining security of water supplies to all customers in the South East range from £2 to £22 (plus sewerage costs). Spread over the five year period, this increase is likely to have a limited impact on customers.

Table 5: Additional cost to household water bills in the South East over the period from 2005 to 2010

	Water	Sewerage
Southern Water	£10	£2
Thames Water	£22	£7
Folkestone and Dover Water	£18	n/a
Mid Kent Water	£16	n/a
Portsmouth Water	£2	n/a
South East Water	£9	n/a
Sutton and East Surrey Water	£5	n/a
Three Valleys Water	£8	n/a

Source: Ofwat, 2005

It is unclear, however, what these additional costs include with regard to the provision of new water resources,[10] and if that provided for is enough to maintain security of supply and water quality, particularly over the medium to long-term. If significant new water or sewerage infrastructure is needed to accommodate higher housing growth rates in the South East, then Ofwat and the water companies may need to revise their calculations and water bills could be increased further.

Ofwat has recognised that as water resources are stretched in the South East, it is likely that over the medium term one off investments may be required in large scale assets such as reservoirs, which could also increase water bills. While rising water bills are always unpopular it should be noted that water customers in the UK pay on average less for their water use than those in the Netherlands and France (see appendix 2) (European Environment Agency, 2003).

Summary of findings

- **The cost of providing new water infrastructure is borne by individual customers through their water bills.**
- **The extent to which the Water Price Review, for the period 2005-10, accounted for the additional water and sewerage infrastructure costs associated with new housing developments in the South East is unclear. If significant new infrastructure is needed this could further increase water bills over the medium to long term.**
- **But it should be noted that households in the UK currently pay on average less for their water use than some other European countries.**

Co-ordinating water resource management and development planning

Currently there is no clear mechanism for integrating water resource management and development planning. The government needs to provide clearer direction to planners on how, or if, water resources should be considered as a planning constraint – currently it is not.

If development planning is to take water resources issues into account, greater co-ordination is needed between planners and water managers. Simple improvements could be made through the adoption of shared planning horizons and planning periods. For instance, if development is not to be constrained by water stress or water quality, then water management plans must be developed after development plans have set out the levels of

[10] But it is known that the price determinations did allow studies to begin on two reservoirs in the South East and for further development of desalination plants at Beckton and Newhaven (Ofwat, 2004).

future demand to be serviced. Conversely, if water stress and quality are to be considered in development planning, development plans must follow, or be developed in tandem with, water resources plans. Currently, PWS management is conducted on a rigid 5-yearly cycle that does not match planning periods.

Water companies are currently not statutory consultees for either regional spatial strategies or local development frameworks. Despite this, SEERA has taken the proactive step of working with water companies and the regulators through the WRSE Group. This has helped to co-ordinate the development of the South East Plan with water resource planning.

Involving water companies in development planning would be a major step towards a more integrated land use and water planning system. A further step would be new planning guidance on development and water issues. This could be in the form of a new Planning Policy Statement (PPS) on water resources, or alternatives could include broadening PPS 23 on planning and pollution control, or a PPS on environmental hazards which would include flooding and other hazards such as contaminated land (Rydin, 2004).

Policy recommendations

These are general recommendations for better co-ordinating water resource management and development planning not only within the South East but also in other regions.

- **Both the availability of water resources and impact on water quality, over the lifetime of the development, should be material considerations in development planning. Water scarcity and water quality may be grounds for refusal of planning permission in cases where further resources or improvements in water efficiency cannot be identified.**
- **Development plans should be developed in tandem with water resource plans, and both should consider long-term climate change impacts.**
- **Water companies should become statutory consultees for Regional Spatial Strategies and Local Development Frameworks to ensure that the cost and limits of water infrastructure requirements is fully understood.**

Is there enough water to meet the rising demand for new housing and domestic consumption in the South East?

There is potentially enough water in the South East to meet the rising demand for new housing and domestic consumption. But only with the timely provision of new water resources and high water efficiency savings in existing and new homes. Relying on supply-side measures, such as new or enlarged reservoirs, to meet increasing demand would be a risky strategy. Even with these measures, there are some areas in the South East with severe water stress or fragile water quality where further significant development should be limited or avoided.

Flood risk in the South East

As with water resources, the Sustainable Communities plan has been accused of understating the risk of flooding associated with new housing developments. However, recent and recurring experience of flooding in different areas of the country have led to questioning, most notably by the insurance industry, of the compatibility of the plan with policies to better manage and reduce flood risk. The 2004 Foresight report *Future Flooding* looked at the longer term influence of climate change on flood risk. It has been an impetus for 'Making Space for Water' the new Government strategy for flooding and coastal erosion to be published shortly by DEFRA. Alongside Making Space for Water, the Government is also reviewing PPG 25 on development and flood risk for a new Planning Policy Statement. Significant parts of the growth areas in the South East are in the flood plain, but rather than seeking to ban development in these areas, the debate has shifted to how increased risk and social vulnerability can be minimised through planning, building design, and flood alleviation measures.

In this section we assess the current and future extent of flood risk in the South East, including a discussion on economic and social impacts. Following a recent report by the Association of British Insurers (ABI, 2005) we focus particular attention on the growth areas where significant housing growth will be concentrated. We then use the ABI report plus the Future Flooding report to discuss the sustainability and cost-effectiveness of various ways to ameliorate flood risk before moving onto policy issues and recommendations.

Understanding flood risk

Flooding is a natural process, vital for the maintenance of coastal and inland habitats. Flooding cannot be eliminated, but can be managed to minimise the consequences. Flood risk is regarded as a combination of probability (how often an event is likely to occur) and consequences (the damage that would result from a flooding event). The Environment Agency produces flood maps that identify areas at risk of river and coastal flooding that take into account the presence and standard of existing flood defences and the potential future impacts of climate change. There are three flood zones, and PPG 25 identifies the appropriate planning response to each flood zone:

- **Flood zone 1** is where the annual probability of flooding from rivers or the sea is less than 0.1 per cent (less than a 1000:1 chance of flooding). This is regarded as little or no risk and presents no constraint to planning.
- **Flood zone 2** is where the annual probability of flooding from rivers is between 0.1 to 1.0 per cent (between a 1000:1 and 100:1 chance of flooding) or where the annual probability of flooding from the sea is between a 0.1 to 0.5 per cent (between a 1000:1 and 200:1 chance of flooding). This is regarded as low to moderate risk by PPG 25 and is suitable for most development, but not for essential civil infrastructure such as hospitals.
- **Flood zone 3** is where the annual probability of flooding from rivers is greater than 1.0 per cent (greater than a 100:1 chance of flooding) or where the annual probability of flooding from the sea is greater than 0.5 per cent (greater than a 200:1 chance of flooding). This is regarded as high risk by PPG 25, and for developed areas suggests that development is possible as long as there are adequate defences over the lefetime of the development.

As well as the Environment Agency's flood zone classifications, the ABI identifies an additional classification – an annual probability of flooding from rivers or the sea of 1.3 per cent (75:1 chance of flooding each year). Developments located in areas where the annual probability of flooding is greater than 1.3 per cent are not guaranteed affordable insurance cover. In this report we refer to the ABI's 75 year classification as a baseline standard. In so doing we recognise that the Government has no statutory duty to protect land or property

against flooding, with the primary responsibility for safeguarding land and other property against flooding remaining with the owner.

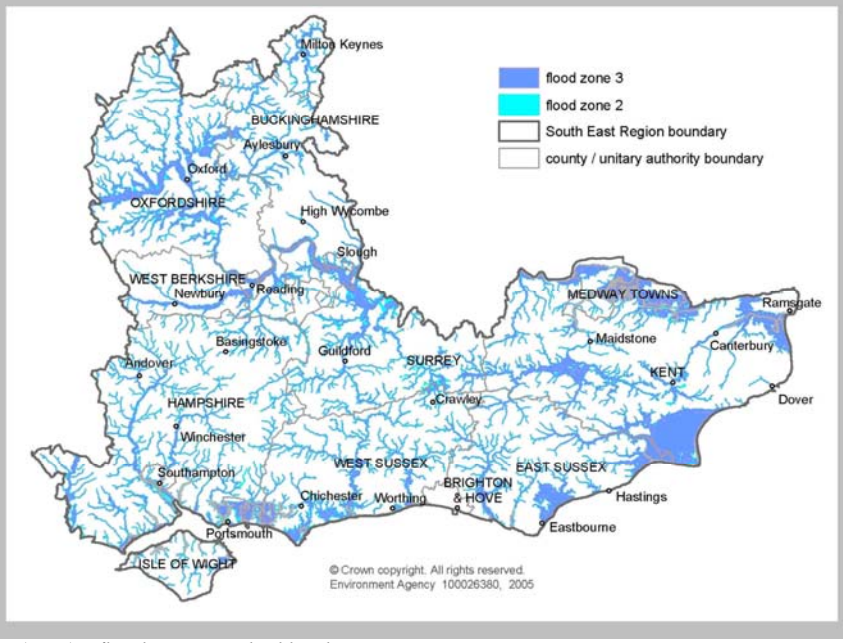
When assessing flood risk, attention is placed on the probability of flooding, leading to the potential consequences of flooding not being adequately considered. This can lead to the mistaken belief that building behind existing defences does not increase risk, when the opposite is true, as risk will increase because the potential scale of damage increases. A major concern for the insurance industry is the increase in aggregate flood risk due to this practice of building behind existing flood defences as it presents problems in re-insurance. Although PPG 25 advises local authorities to consider consulting insurers at an early stage, it does not specifically mention the problem of aggregated risk.

Current and future flood risk

The most common forms of flooding are from rivers and coasts, with nearly 2 million properties and 5 million people in the UK (roughly 10 per cent) potentially at risk from either of these forms of flooding (DEFRA, 2004). Figure 11 shows the Environment Agency's flood zone map for the South East where there are over 208,000 properties located in the higher risk zone 3. If an extreme flood event were to occur, many more properties and people would be affected.

The flood zone map does not include intra-urban or groundwater flooding. A further 80,000 properties are at risk in towns and cities across the UK from flooding caused by intense downpours that can quickly overwhelm urban drains and sewers (intra-urban flooding) (Foresight, 2004). Groundwater flooding is when groundwater levels exceed the capacity of aquifers and water surfaces above ground. Chalk areas are particularly vulnerable to groundwater flooding. As many as 380,000 properties on the exposed chalk aquifers of Southern England may be vulnerable because of widely fluctuating groundwater levels (DEFRA, 2004).

Figure 11: Flood zone map for the South East



Source: SEERA (2004) – flood map supplied by the Environment Agency

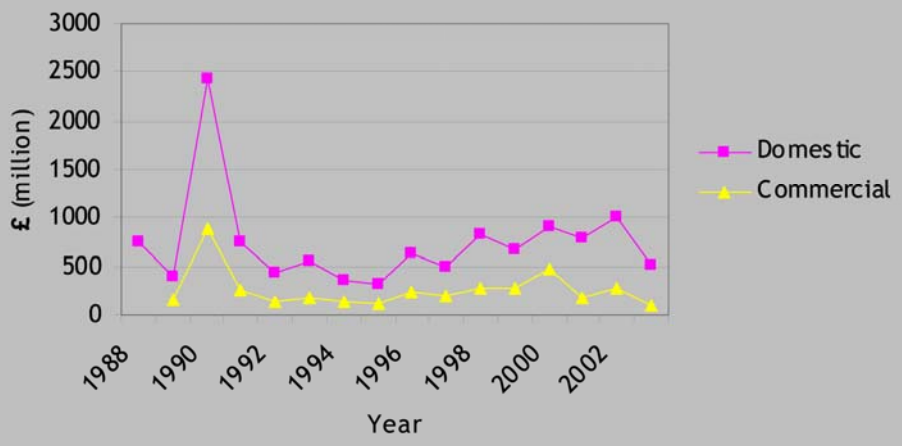
Economic impact of flooding

The economic impact of flooding can be split into financial losses from flood events, met through insurance and individual loss, and the economic costs of flood defences. The UK is

unusual in having flood insurance as part of standard buildings insurance. In most other industrialised countries coverage for natural hazards, including flooding, involves some form of state support. Whether this arrangement can continue as the impacts of climate change become more obvious is very uncertain, and is dependant on government providing and maintaining adequate defences.

In 2003–04 the total cost of flooding and managing flood risk in the UK was around £2.3 billion (Foresight, 2004). This equates to £800 million per annum spending on flood and coastal defences, split between £464m for river and coastal defences and £320m for intra-urban flooding. Even with these flood defences, annual flood damage costs average £1.4 billion (Foresight, 2004). In the South East the value of assets at risk of flooding exceeds £50 billion, with the biggest threat coming from the sea and tidal waters (Environment Agency, 2004a). Figure 12 shows how the financial costs of flooding have escalated since 1987. Over the past five years in the UK, storm and flood losses have totalled £5 billion – more than 60 per cent up on previous years (ABI, 2004).

Figure 12: Gross weather damage insurance claims (£ million) in the UK, 1987-2003.



Source: ABI, 2004. Claims are adjusted for 2003 prices, and include flood, storm, and burst pipes.

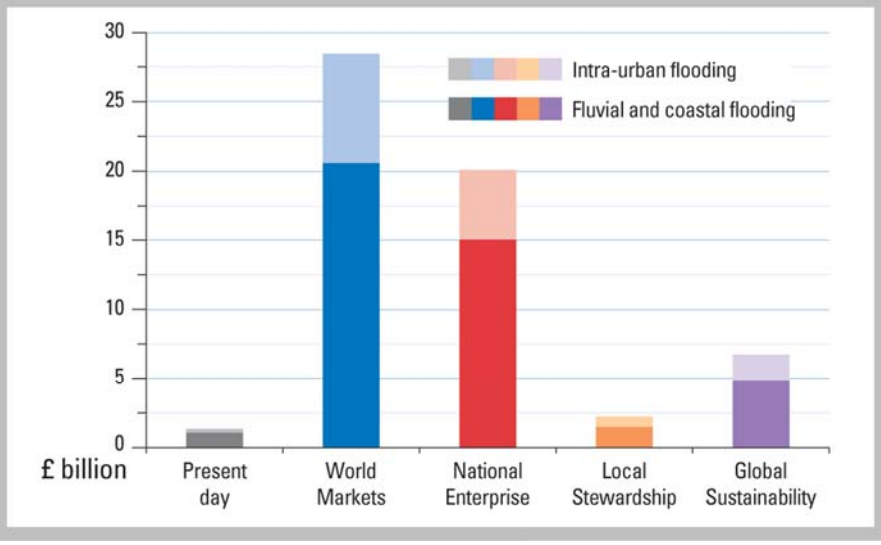
Climate change, urbanisation and other risk factors are going to have a significant impact on the incidence and costs of flooding. Urbanisation (combined with climate change) will increase the risk of intra-urban flooding in particular. The Foresight report (2004) stated that there is virtually a linear relationship between the increase in the area of impermeable surfaces and increases in run-off, with some 30–50 per cent of rainfall appearing as runoff from a paved area. Such increases are not only due to new developments on greenfield and brownfield land but also through urban creep – such as house extensions, paved patios and the surfacing of front gardens for parking, which is largely uncontrolled.

The Foresight report (2004) examined the effects of different greenhouse gas emissions scenarios on future flood risk. Figure 13 shows that if flood management policies and expenditure remained unchanged, annual losses would increase under every scenario by the 2080s. But the variation in the costs are very wide ranging. It could be less than £1 billion under the Local Stewardship scenario (low–medium emissions) to around £27 billion under World Markets (high emissions). These differences result from varying amounts of climate change, different increases in the value of assets, the degree of new development in flood-prone areas, and the fact that there are many uncertainties associated with very long term forecasts looking out to 2080.

Figure 14 shows that for all the Foresight Report (2004) emissions scenarios, the South East would experience the highest annual damage to residential and commercial developments compared to the other English regions and Wales. This is partly because the effects of climate

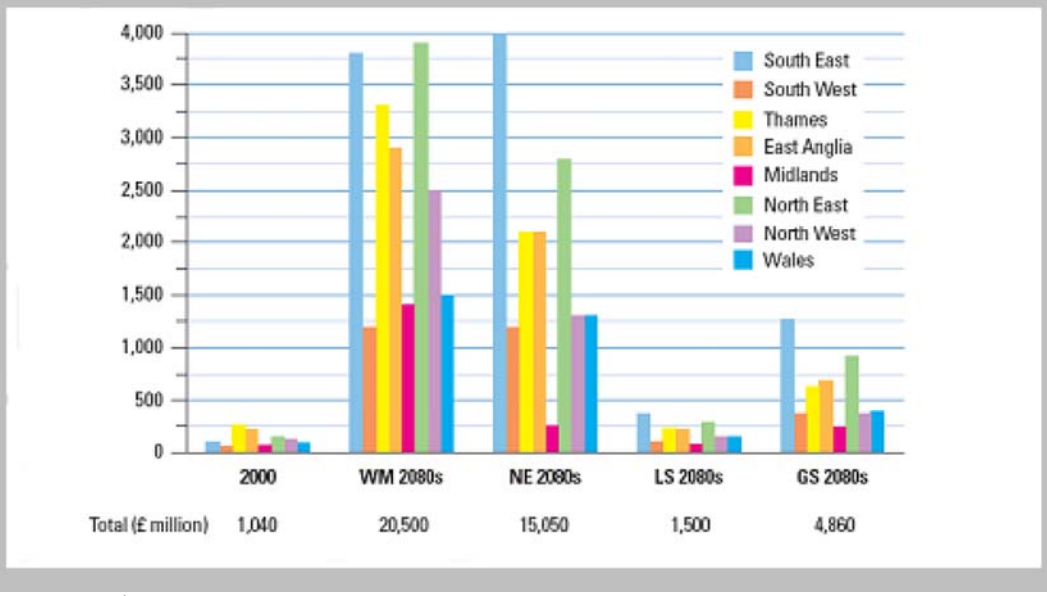
change are expected to be the worst in the South East compared to the other parts of the country (UKCIP, 2002).

Figure 13: Average annual damage for the UK (£ billion) (Assuming flood management approach and expenditure remain unchanged - present day and 2080's).



Source: Foresight, 2004.

Figure 14: Expected annual damage to residential and commercial developments across the English regions and Wales (£ million), 2000 and 2080s. (Assuming flood management approach and expenditure remain unchanged - present day and 2080's).



Source: Foresight, 2004.

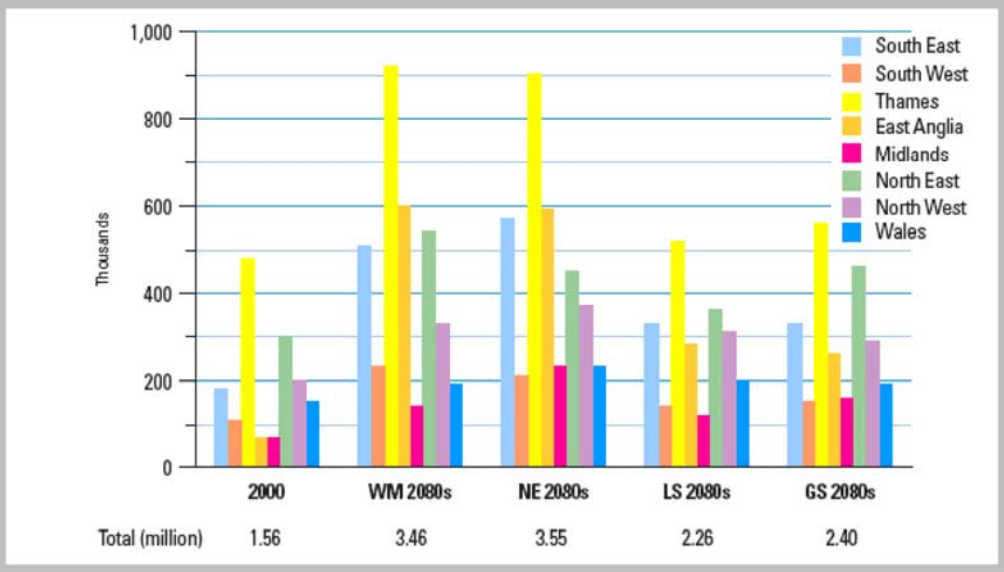
The Exchequer currently provides nearly all the funding for flood management, either directly or through government support for expenditure by Local Authorities. Although there is an established principle that where a development goes ahead in a flood risk area, the developer is responsible for fully funding the provision and future maintenance of any flood defences, it is unclear exactly how much developers have contributed to flood defences in the South East or in England and Wales. Government funding of the flood defence programme in England and Wales stands at a record £564m for 2005–06, which is £90 million more than in 2004-05, and nearly three times that spent in 1990–91 when it was just over £200 million

(Huber, 2004). The Government has stated that this high level is to be maintained during the three years of the Spending Review 2004 period to 2007–08 (HM Treasury, 2004).

Human impacts

Beyond the economic costs, flooding also has other human impacts. These include the loss of life, health hazards caused by floodwaters containing pollutants as well as the emotional distress caused by property damage. While statistics do a poor job of measuring such impacts, in terms of numbers, nearly 5 million people are currently at risk from river, coastal and intra-urban flooding in the UK. By 2080s the numbers at risk from both river and coastal flooding and intra-urban flooding will be substantially higher (Foresight, 2004). Figure 15 shows that those at risk from river and coastal flooding in the South East, while higher than today, is expected to be much lower than the number of people at risk in London and East Anglia.

Figure 15: Number of people at high risk from river and coastal flooding across the English regions, 2000 and 2080s. ('High' means a chance of flooding of greater than 1:75 in a given year).



Source: Foresight, 2004

It is debatable whether any particular section of the population has an increased likelihood of exposure to flooding. Research for the Environment Agency found that the relationship between income and the likelihood of flooding was complicated and not necessarily clear across England. It found that people in the lowest income deciles did not disproportionately reside within the flood zone of rivers in England. But there did appear to be some correlation between those people living in the most deprived wards and proximity to tidal flood zones (Walker *et al.*, 2003). This study did not, however, consider specific localities in detail.

What is certain is that some groups will be more vulnerable to flood events than others. Vulnerability can be considered as exposure to a given risk and the ability to cope (i.e. resilience). There is substantial evidence that the elderly, disabled and less affluent are particularly vulnerable to flood impacts because they find it difficult to cope and recover after a flood event (Walker *et al.*, 2003). In addition, poorer people are less likely to be insured and therefore less likely to be able to recover all their lost assets or rebuild their damaged homes with the consequent physical and psychological stress involved (Enarson and Fordham, 2001). Our understanding of who is most vulnerable to flooding is still fairly limited. While certain groups, such as old people, can be targeted in media campaigns, it has been difficult to map vulnerability and this is a current focus of attention by the Environment Agency.

Flood risk in the growth areas of the South East

A recent report for the Association of British Insurers (ABI) assessed the costs of flooding in the growth areas and evaluated various different options to reduce flood risk (ABI, 2005). This section reports on some of its key findings with a particular focus on the South East growth areas as outlined in the Sustainable Communities plan (ODPM, 2003). It should be noted that this report only considered economic risks, and did not consider social impacts. While recognising the interests of the insurance industry on economic risk, it would be extremely helpful if the debate on flood risk in the growth areas considered the social consequences of building in flood risk areas.

As table 6 shows 15 per cent of development in all the growth areas is currently in the flood zone. Of the development planned for 2016/2021, 30 per cent has been allocated in flood zone areas where the annual probability of flooding is between 0.1 and 1.3 per cent (between a 1000:1 and 75:1 chance of flooding). This wide range incorporates the Environment Agency's zone 2 and part of zone 3.

There is considerable variation in the proportion of sites in the flood zone, with the South East parts of the Thames Gateway growth areas having higher percentages (65 per cent in North Kent and 45 per cent in Kent Thameside) of developments in flood zones compared to Ashford, Milton Keynes and Aylesbury. Of potentially more concern are the developments that are planned for flood zones where the annual probability of flooding is greater than 1.3 per cent (greater than a 75:1 chance of flooding) which is considered 'significant' by the ABI and at the boundary of guaranteed insurability. Between 2016 and 2021, Aylesbury and Kent Thameside are planning to put around 10 per cent of new development in the significant flood zone.

Table 6: Existing and proposed development in the flood zone – for all the growth areas and in the South East growth areas

	Development currently in flood zone (%)	New development in flood zone 2016-2021 (%)	New development in significant flood zone 2016-21 (>1.3% or 75:1) annual probability
All growth areas	15	30	10
Ashford	8	7	0
Aylesbury	8	19	11
Milton Keynes	2	2	0
Kent Thameside	7	45	8
North Kent	11	65	Unknown

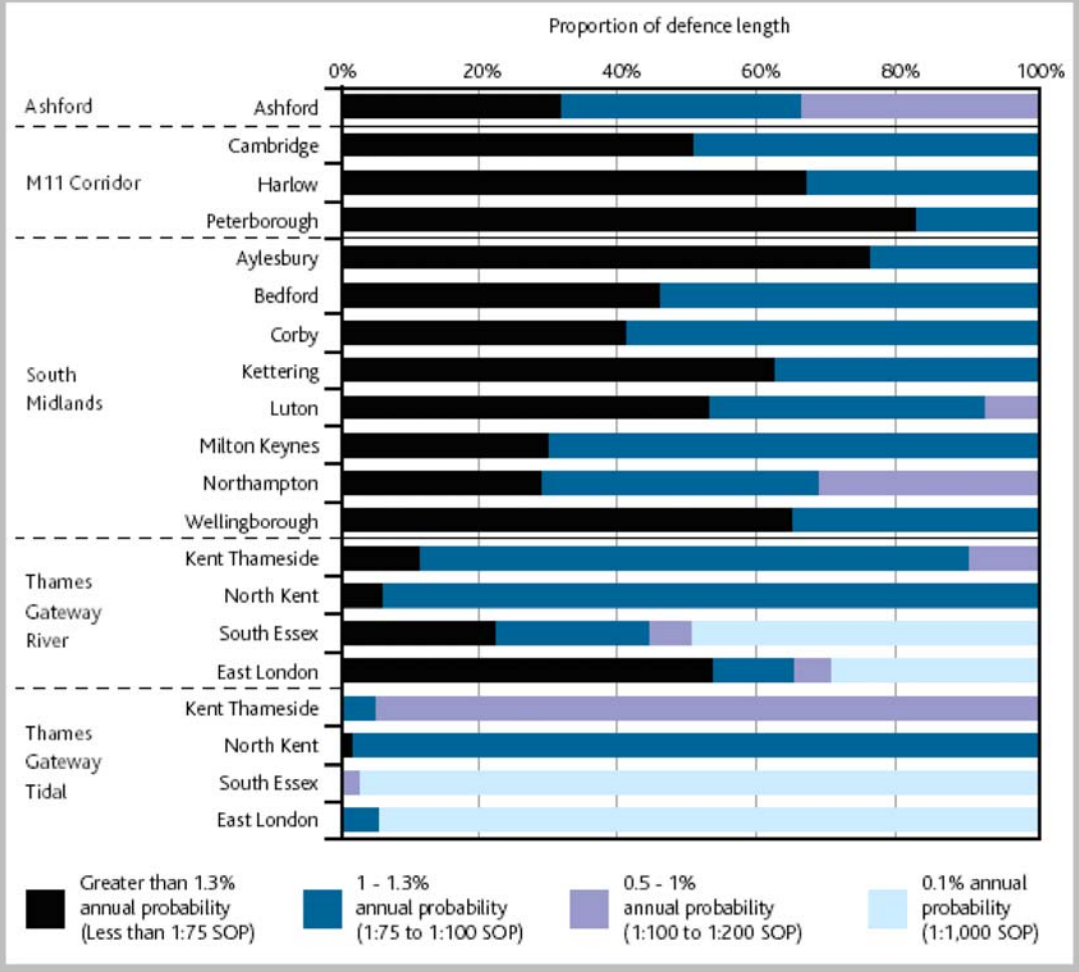
Source: Compiled from information in ABI, 2005

Figure 16 shows the present day standard of protection offered by flood defences across all the growth areas with the black areas denoting defences that do not meet the standard of 1.3 per cent (75 year standard of protection). What it does not show is the extent to which these growth areas are at risk from flooding, their condition, or how the standard of these defences are likely to change in future years.

In the two major growth areas in the South East – Milton Keynes and Ashford – 30 per cent of their flood defences do not currently meet the 1.3 per cent (75 year) standard of protection. However, many parts of Milton Keynes are naturally protected due to land elevations or have adjacent land with relatively low asset values such as open space or car parks. The proportion of defences where the standard is low in Milton Keynes will therefore not necessarily present a problem to new housing developments. Ashford is more susceptible to flooding. In those parts of Ashford that have experienced flooding in recent years there has been investment in

defences. Flood defences in Ashford are currently regarded as generally good (ABI, 2005), but it is recognised that present defences will require review. An assessment of the current situation and future priorities for flood risk and water management requirements in light of development proposals is being conducted as part of the 'Ashford's Future' work.

Figure 16: The standard of protection of flood defences in the growth areas, present day



Source: ABI, 2005
Note: less than 1.3% standard of protection (greater than a 75:1 chance of flooding); between 1-1.3% (between a 100:1 and 75:1 chance of flooding); between 0.5-1% (between a 200:1 and 100:1 chance of flooding); 0.1% (1000:1 chance of flooding).

In Aylesbury – one of the South East's smaller growth areas – more than three quarters of its defences do not offer the 1.3 per cent (75 year) standard of protection which is potentially of concern as there is a high risk of flooding in parts of Aylesbury. If Aylesbury is to accommodate new housing developments in the flood zone, then flood defences will need to be improved. The majority of defences in the M11 growth areas do not currently meet the 1.3 per cent (75 year) standard of protection. However, as with many parts of Milton Keynes, a high standard of protection is not currently necessary in all these areas.

The Thames Barrier is the major flood defence measure protecting the Thames Gateway growth areas. As a consequence areas such as East London and South Essex currently have high standards of protection of between 0.5 and 0.1 per cent (between a 200 year and 1000 year standard of protection). The current barrier is expected to provide a high standard of defence up until about 2030 allowing for sea level rises. 'Thames 2100' is the Environment Agency sub-group taking forward plans for constructing a new barrier for ensuring the

Thames Gateway growth areas and other parts of London are adequately protected from flooding beyond 2030.

Figure 16 shows that the South East parts of the Thames Gateway, such as North Kent and Kent Thameside, are currently less well protected than South Essex and East London. The majority of defences in North Kent achieve a standard of protection of between 1 and 1.3 per cent (between a 100 and 75 year standard of protection). If new housing developments are built in these areas, which are at risk of a major surge event, then there will need to be significant investment in flood defences in North Kent and Kent Thameside, to ensure a higher standard of protection.

If no steps are taken the ABI (2005) estimates that the proposed developments (in all growth areas not just the South East) between 2016 and 2021 could increase the financial costs of fluvial and coastal flooding by an average of £54.6 million per year – a 74 per cent increase in potential flood damages within the growth areas and an increase of 5 per cent in national flood risk. Consequential flood losses (infrastructure damage and business interruption costs) could add between £19 million and £27 million per year to this total. The losses from intra-urban flood sources could increase losses by another £14.6 million per year. The majority of this extra cost comes from new development in the Thames Gateway, accounting for £47.1 million a year, compared to £7.5 million for all the other growth areas combined. The South East's share of these costs would be relatively small.

Managing flood risk in the South East

There are pro-active steps that the Government, local authorities and developers can take to reduce the flood risk presented by the new developments. Table 7 shows some of the options for mitigating flood risk in the growth areas.

Table 7: Options for mitigating flood risk

Option	Comment (applicability to different growth areas)	Climate proofed
Moving property off the flood plain	Policy potentially very successful in Ashford, M11 and South Midlands growth areas but limited in Thames Gateway.	Yes
Moving property to lower risk sites	Policy potentially successful in all growth areas but could be limited in some areas by land supply.	No – as some lower risk sites could increase in risk with climate change
Reducing vulnerability – reduced ground floor living (residential property only)	Most suited to homes located in significant risk areas.	Yes, but flooding still inconvenient
Reducing vulnerability – flood resilience (residential property only)	Most suited to homes located in significant risk areas.	Yes, but flooding still inconvenient
Flood alleviation – defence improvements	Traditional approach to flood mitigation but important issues of long term maintenance costs and the implications of climate change.	No – climate change needs to be explicitly factored into defence design
Flood alleviation – land raising	Complete flood avoidance but could have negative effect upon nearby existing development.	No – elevation cannot be increased after initial development
Flood alleviation – flood storage	Successful in some areas but requires large land areas.	Yes
Flood alleviation – Sustainable Drainage systems (SuDS)	Should be adopted in all new development to mitigate intra-urban flood problems (see later section on SuDS)	Yes (potentially)

Source: ABI, 2005

In discussing what the nation's aims should be for future flood management, the Foresight report (2004) offered a blunt choice: should we accept increasing levels of flooding, seek to maintain existing risk-levels, or seek to reduce the risks of flooding? The first of the options would have undesirable social as well as economic consequences and goes against a trend in society that expects increasing standards of safety and risk reduction. This trend also suggests the second option may be undesirable, while the third option would require considerable additional investment in flood management. However the Foresight report (2004) suggests that the economic benefits of flood management would be significantly greater than the economic costs, with the cost-benefit greater in higher growth scenarios.

Risk reduction needs to be approached from a broader front than just looking at new development, for example through rural land use, and emergency responses. However, in this section we discuss how new development can proceed in a way that minimises flood risk by looking at four common approaches: mitigating climate change, avoiding building in the floodplain through land use planning; reducing the vulnerability of buildings through design; and alleviating floods through flood protection schemes.

Mitigating climate change

Reducing global greenhouse gas emissions would substantially help to manage future risks of flooding and also water shortages. The Foresight project estimated that in the absence of other responses, in a high growth scenario, if the world emitted low emissions rather than high emissions the risks of catchment and coastal flooding would fall from around £21 billion per year to around £15 billion per year in the 2080s. In the case of intra-urban flooding, mitigating climate change could make the difference between the existing system of drains and sewers coping, or reaching the limit of their capacity (Foresight, 2004).

However, action to reduce greenhouse gas emissions needs to be achieved at a global level. Under the Kyoto Protocol, the UK has committed to reducing greenhouse gas emissions by 12.5 per cent by 2010 and the Government's intention is to move towards a 60 per cent reduction in carbon emissions by 2050 (DTI/DEFRA, 2004). A positive step last year was when Russia became a signatory to the Kyoto Protocol allowing it to come into force in February 2005.

Avoiding building in the flood zone through land use planning

The planning system plays a key role in controlling the location, density and design of new development. Not building in the flood zone is an obvious way to reduce flood risk both to new development and to other properties whose risk may be increased through building on the flood plain (ABI, 2005). The Foresight report (2004) showed that effective land-use planning to manage flood risk could reduce the aggregate cost of flood defences from £52 billion to £22 billion until the 2080s. In the growth areas, if properties were moved off the flood zone and housing densities increased in non-flood zone locations, then flood risk could be reduced by 89 to 96 per cent for all growth areas except Thames Gateway (ABI, 2005). If development in Ashford were located first off the flood zone, and then concentrated on the least risky flood areas, flood risk could be reduced by 79 to 86 per cent (ABI, 2005).

Despite planning policy guidance (PPG 25) directing development away from the flood zone, and a high level target (HLT12) to prevent all new inappropriate development in flood zones by 2007, development is still occurring in the flood plain against Environment Agency advice. There was initial progress in 2001–02 when the number of planning applications approved against Environment Agency advice decreased from 37 per cent to 21 per cent in 2002-03, but there was a slight rise to 22.5 per cent in 2003 (Environment Agency, 2005).

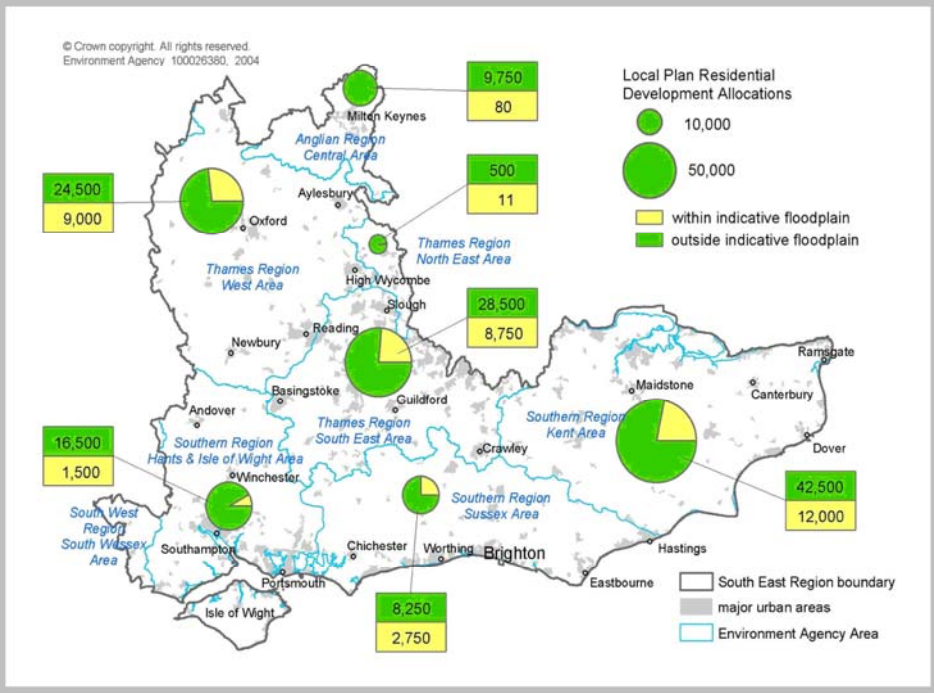
Local Planning Authorities (LPAs) do not have a statutory duty to consult the Environment Agency in relation to flood risk (except in limited circumstances), so these figures only tell part of the story. In some parts of England, the Agency's research suggests it may be consulted on just over half of applications in the flood plain. If a development is permitted

contrary to the Environment Agency's advice, PPG 25 requires the LPA to re-consult with the Agency, but very few LPAs do this – nearly 12 per cent in 2003-04 as a percentage of all permissions granted against Agency advice (Environment Agency, 2005). From the reported figures, a few LPAs appear to be flouting national guidelines on flood risk, with 51 per cent of sustained objections by the Agency resulting from to applications not being submitted with the required flood risk assessment. Of the 323 applications permitted against Agency advice in 2003/04 no reason was provided for granting approval in over half the cases, while less than 3 per cent stated reasons of social or economic need (Environment Agency, 2005).

Data from the National Land Use Database indicates that an average of 10 per cent of new dwellings were built within flood risk areas in the South East between 1999 and 2002, which is slightly below the England average of 11 per cent (ODPM, 2004).

Figure 17 indicates that a significant amount of development is planned in flood risk areas in the South East. However, brownfield land tends to also be located in flood zones.

Figure 17: Proposed residential dwellings within the indicative floodplain in the South East



Source: Environment Agency, 2004a

In some cases, the Government's target for 60 per cent of new build to be on brownfield land (in PPG 3) can conflict with its advice to direct new development away from flood zones (in PPG 25). The South East region is exceeding the brownfield target, having increased the percentage of new dwellings built on brownfield land from 54 per cent in 1997 to 62 per cent in 2003 (ODPM, 2005). However, there is no publicly available information on how much brownfield land is on or off the flood floodplain in the South East, or if brownfield land off the floodplain is reaching capacity. The problem is not helped by PPG 25 being unclear over the relative priority of each policy.

There is also a lack of strategic planning in relation to flood risk assessment, with no strategic flood risk assessment currently required for Regional Spatial Strategies (RSSs) or Local Development Frameworks (LDFs) leaving flood risk to be considered on a case-by-case basis. Similarly, sewerage and drainage capacity is not currently considered at a strategic level by local authorities. Although water companies and the Environment Agency are consulted on

planning applications, drainage issues can arise after initial planning permission is granted. It would make more sense to make drainage a material consideration that is considered at the start of the planning application process. Better incorporating (and acting upon) flood risk assessments and the consideration of sewerage and drainage capacity – and water resources – into the planning process would have implications for both local and regional planners. They may require additional training and supplemental planning guidance so that they can account for these issues when assessing planning applications and strategies.

Reducing the vulnerability of buildings through design

If development cannot be located off the floodplain, it can be made more resilient to flooding through design. Living space can be moved above the likely level of flooding by using high density apartment blocks, restricting ground floor areas to flood compatible uses, e.g. car-parking, and raising the ground-floor. Alternatively the ground floor can be kept as living space, but made more flood resilient through concrete floors and wiring electrics above the likely flood level. Such measures could be included in the Code for Sustainable Building. These measures are regarded as 'climate proof' by the ABI, with the costs of flooding reduced to secondary impacts such as loss of power and access. However, flood impacts will still be a nuisance and pose a risk to people. Reducing the vulnerability of building has cost implications. The ABI has calculated that constructing an extra storey typically increases building costs by 25–30 per cent (ABI, 2005). Making a property more flood resilient could increase costs by 12–15 per cent, but many flood resilient measures will pay for themselves in areas prone to frequent flooding (ABI, 2005).

Alleviating floods through flood protection schemes

Flood risk can be further reduced through flood alleviation measures. These include flood defences, land raising, flood storage and/or Sustainable Drainage Systems (SuDS). We do not discuss the advantages and disadvantages of the first three of these measures here, although see table 7 for how these options may or may not be suitable for the growth areas. The government is moving away from the provision of traditional flood defences towards a catchment approach that uses appropriate and cost effective measures that minimise flood risk while enhancing biodiversity and the landscape (Environment Agency, 2004a). This includes a greater emphasis on flood storage and SuDS, so that rather than constraining and directing water out of the catchment as quickly as possible, flood waters are recognised as a resource that need to feed back into the catchment and replenish water resources. This is of obvious importance in many areas of the South East that are already water stressed.

SuDS are designed to manage surface water runoff to both attenuate the run-off and provide varying degrees of water treatment through filtration etc. SuDS schemes may use one or more methods of drainage control such as lawns, filter strips and swales, permeable surfaces and ponds to limit damage from river and intra-urban flooding. Costs depend on the site size and the nature of runoff. However PPG 25 guidance outlined a basic installation cost of around £1,000 per home (for a 200-home site) with a further £500 cost for future maintenance (based on the typical time span of a system). The Environment Agency, DEFRA and the ODPM all advocate SuDS as the recommended approach to surface drainage, and PPG 25 encourages use of SuDS wherever possible in new developments.

Although there is widespread agreement on the importance of SuDS, some LPAs and developers are unwilling to incorporate SuDS because of uncertainties over responsibility for long-term costs and management. An Interim Code of Practice for SuDS (2004) established a set of core standards and agreements between organisations with statutory or regulatory responsibilities relating to SuDS. However, appropriate legislative and policy changes are needed to ensure their widespread use and proper management, and these are being considered in DEFRA's current 'Making Space for Water' review (DEFRA, 2004).

Paying for protection

Many of the UK's flood defences need maintaining, upgrading, replacing or in some circumstances, abandoning. In addition, some developments in flood risk areas will require significant upfront expenditure on flood alleviation measures, which could add significantly to the cost of housing, and may require government subsidy. Further costs, this time to developers and homeowners, include those required to make new and existing buildings more resilient to flooding and for integrated drainage schemes. Although again, the Government may be called on to provide subsidy for this, particularly for affordable housing in the Gateway areas. In addition, water and sewerage companies currently spend around £320 million a year on intra-urban flooding (not including estimated annual damages of £270 million).

The Government currently provides nearly all the funding for flood management. It has recently been considering how additional funds could be raised for flood protection following the principle of polluter pays, i.e. those who increase the probability of flooding and/or those who develop in the floodplain. Although developers, in theory at least, already have to bear the cost of any flood mitigation arrangements needed, the proposed flood development charge (FDC) would be an additional payment paid by developers in recognition of the benefits that developments might get from existing flood risk management services such as flood warning, research, advice and any defences for the at risk area (DEFRA, 2004).

This could be viewed as acceptable when developers and households choose to build in a flood risk area, but it is questionable when development has been allocated in the flood plain by central government in the absence of a strategic flood risk assessment. The charge has also been criticised for only being applicable to new developments, ignoring the existing and largely unprotected stock of properties on the floodplain. Raising money through charges on developers is also a crowded market, as developer contributions are being sought through Section 106 agreements on a wide range of infrastructure costs, and there is also the possibility of introducing a means to capture land value. These charges may result in declining development rates, as fewer sites come forward for development.

If planning regulations do not guide enough development off the floodplain and/or funding for flood management is inadequate, there may be pressure for insurance to reflect more strongly the logic of the market to steer development away from the floodplain. However, if insurance premiums were substantially raised in flood risk areas to reflect flood risk better, insurance may become unaffordable to some households. While this would, from the perspective of the insurance industry, lead to a sorting out of high risk properties, it would put pressure on the government to become the 'insurer of last resort'. That is, should a flood event occur in an area where insurance is difficult to access, particularly if it is in a growth area designated by the Government, the Government (or local authority) may be seen as having liability and may be put under pressure to cover the costs of flooding. If this were to happen, and it is not an outcome currently given serious thought by the insurance industry, this would mean taxpayers paying for damages to the individual, when they currently assume that risk themselves. While this would be regarded as unacceptable, it is perhaps just as unacceptable to expect all homeowners to cover the costs of such an (expected) event through their insurance premiums. Clearly, it is imperative that planning regulations on development and flood risk are adhered to by all authorities and that the Government continues to fund flood management adequately.

Summary of findings

- **By 2080 those at risk from river and coastal flooding in the South East is expected to be higher than today, but still lower than those at risk in London and the East Anglia, due to climate change and other factors. But the expected damage to commercial and residential developments is likely to be higher in the South East compared to the other English regions and Wales.**

- **Across the UK, the number of properties at risk from surface water flooding is expected to increase substantially by 2080.**
- **Over 300,000 properties on exposed chalk aquifers in the South East are currently vulnerable to groundwater flooding.**
- **Despite planning policy guidance (PPG 25) directing development away from flood zones, inappropriate development is still occurring in the floodplain.**
- **In some cases the Government's target for 60 per cent of new build to be on brownfield land can conflict with its advice to direct new development away from the flood zone. It is unclear how much brownfield land is in the flood zone in the South East.**

What impact will new housing developments have on flood risk in the South East growth areas?

- **Across all the growth areas, 15 per cent of existing development is currently in the flood zone. Of the new development planned for 2016/21, 30 per cent of the sites will be in floodplain areas. According to the Association of British Insurers (ABI), the majority will be located in areas where the annual probability of flooding is either low (200:1 chance of flooding) or moderate (between a 75:1 to 200:1 chance of flooding) mostly due to existing flood defences.**
- **However, approximately 10 per cent of new development planned in Aylesbury and Kent Thameside by 2016/21 will be in areas where the annual probability of flooding is significant (greater than a 75:1 chance of flooding). This is the ABI standard beyond which affordable insurance is not guaranteed.**
- **In Milton Keynes and Ashford about a third of flood defences offer a low standard of protection (lower than the ABI 75 year standard of protection). But this is not necessarily a problem in Milton Keynes because many areas are naturally protected due to land elevations or have adjacent land with relatively low asset values such as open space or car parks. In Ashford, recent investment in defences mean the majority of defences are currently regarded as generally good.**
- **Of more concern is Aylesbury, where more than three quarters of its defences do not offer the 75 year standard of protection. Aylesbury's flood defences will need to improve particularly for new homes built in high risk floodplain areas.**
- **The South East parts of the Thames Gateway, such as North Kent and Kent Thameside, are currently less well protected than South Essex and East London which are defended by the Thames Barrier and other London barriers. The majority of defences in North Kent achieve the 75 year standard of protection, and their condition is largely unknown. Flood defences will need to be strengthened in North Kent and Kent Thameside in a timely fashion, to ensure a higher standard of protection for new housing in these growth areas.**
- **Most of the financial costs of fluvial and coastal flooding associated with new housing developments are expected to come from the Thames Gateway growth areas. The South East's share of these costs is relatively small.**

Policy recommendations

These are general recommendations for better co-ordinating flood management and development planning not only within the South East but also in other regions.

- **Regional Spatial Strategies and Local Development Frameworks should include a strategic flood risk assessment. This would help integrate flood risk management into strategic planning decisions.**
- **Local Planning Authorities (LPAs) and developers should give more consideration to the insurance implications of building in flood zone areas, and behind existing flood defences.**

- **The Environment Agency should be made statutory consultees on all new developments going ahead in flood risk locations. LPAs should have a duty to re-consult the Environment Agency on developments permitted against its advice.**
- **The Government should have greater powers to ensure that no inappropriate development takes place in flood zone areas. The Secretary of State for ODPM should review developments that are permitted against the sustained objection of the Environment Agency through a transparent and accountable review process.**
- **Sustainable Drainage Systems (SuDS) should be a mandatory consideration in all new developments, and if impracticable, effort should be made in the local catchment to compensate for the extra surface water run-off.**

Raising public awareness of flood risk

- **The Home Information Pack should include information regarding the flood risk of the local area, and any resilience measures included in the building. Information on flood risk should also be required in tenancy agreements.**

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Appendix 1: Options for increasing water supply

Reservoirs

There is tremendous scope for capturing and storing more water through reservoir development, particularly as winters become wetter. The WRSE report (2004) identified five proposed PWS reservoirs in the South East:

- An Upper Thames Reservoir by 2019/20
- Enlargement of Bewl Reservoir by 2014/15
- Broad Oak Reservoir by 2019/20
- Clay Hill Reservoir by 2014/15
- Havant Thicket Reservoir by 2020/21

The main issues in reservoir development are: lead-in times, public acceptance, land use and environmental impact. Reservoirs can take years to plan and build. They cost approximately £500 million each (EFRAC, 2004) although this is a one off cost. Reservoirs provide a relatively reliable water resource, although they are an irreversible option and therefore not very flexible as water demand changes over time. A major concern in reservoir planning is gaining the acceptance of local communities who can sometimes views reservoirs as a 'blight' on the landscape.

Desalination plants

Desalination is the process of removing salt from sea water or brackish water to make it suitable for use in the public water supply. The main issues with desalinisation plants include: their cost, energy use, the use of high-value coastal land, the disposal of wastes generated from the treatment process and the potential for pipe corrosion from increased salts in water (Sutherland and Fenn, 2000). The main benefit of desalination is that it is a relatively quick and reliable method of supply augmentation that won't be significantly impacted by climate change. It is particularly useful for 'topping up' supplies during peak periods. Currently there are six to eight proposals for desalination plants being discussed with the Environment Agency in England and Wales. These include proposals for a desalination plant at Beckton for 2007/08 (Thames), at Newhaven (South East Water) and Folkestone and Dover is also proposing a small desalination scheme in 2019.

Water Transfers

Water transfers include canal, river, or pipeline transfers. Canal and river transfers generally involve raw water while pipelines usually transfer treated water. Implementation times for canal and river transfers are 3-5 years while pipeline transfers can take 6-10 years. A major issue is where the water is transferred from. Moving water out of water stressed areas can be controversial, even if part of a wider strategic plan. For instance, the environmental impacts of a reservoir in one area may be geographically removed from the area(s) that benefit from the additional water resources it provides. Nonetheless, the Environment Agency supports inter-zonal water transfers as part of ensuring security of supply. Transfers are important in the South East because it has a relatively fractured water company base. The WRSE report (2004) bases its scenarios on transfer assumptions, largely moving water from the west to the east of the region to support additional housing growth.

Groundwater Recharge

Groundwater recharge involves pumping excess water into groundwater aquifers to be stored for eventual abstraction in drier periods, but its use depends on aquifer properties. Recharge can counter climate change impacts through the augmentation of summer flows and summer supply from winter storage. Compared to storage in surface reservoirs, groundwater recharge schemes have low implementation costs, shorter lead in times and reduced land impacts.

Effluent Reuse

Effluent reuse is considered to cover the reuse of wastewater, which may or may not involve treatment. While it can cover household and community reuse schemes (which will be discussed under water efficiency) here we are concerned with the situation whereby wastewater from sewage works is used to replenish flows in watercourses. Already Oxford's treated effluent is a London water source, albeit indirectly via the Thames and some days later (Binnie, 2001). The Environment Agency has suggested in their 2001 resource plans that effluent reuse schemes specifically engineered to enhance water resources could help bridge the gap between supply and demand, especially in the growth regions of the South East.

The Chartered Institute for Water and Environmental Management (CIWEM) states that the greatest potential for reuse may be in areas where effluents are discharged to the sea at present, as they could be diverted inland to support river flow and increased abstraction (CIWEM, 2002). There is support for such schemes from groups such as the CPRE, who have recommended that the Margate and Broadstairs wastewater treatment plant not dispose treated effluent to sea, but to the Stour, as a means of augmenting river baseflow, with the possibility, in due course, of re-abstracting a proportion for public supply (CPRE, 2004).

CIWEM (2002) identifies several issues to the uptake of effluent reuse. Although existing standards of water treatment are considered by the industry as sufficient to protect public health, others are concerned about the build up of toxins and other "exotics" such as endocrine disrupters through wastewater recycling. There are also perception issues. The general public does not generally like experiencing other peoples waste and could be concerned if they were aware of even current practices of indirect recycling. Treatment is energy intensive and needs to be considered and compared with more traditional methods of matching demand and supply.

Resource Development in the South East

The balance between different supply options to meet demand in the South East is not finalised. However, an appendix in the WRSE Group report indicates where new resources are expected to come from both in terms of resource type and geographical area. The data is presented in four tables (below) which indicate the amount of water (in Ml/d) derived from different resources in terms of the dry year annual average and the dry year critical period.

Table 5. Total resource development by area in the SEERA region*

East Area		Dry year annual average						Dry year critical period					
Resource description	**Units**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Reservoir	Ml/d	0	-1.56	30.67	66.67	70.67	70.67	0	-1.49	30.72	86.72	91.72	91.72
Groundwater development	Ml/d	3.53	13.23	14.73	16.33	17.83	17.83	12.54	29.73	35.73	38.63	41.03	42.03
Surface water development	Ml/d	5.6	5.6	9.22	9.22	9.22	9.22	0	0	3.62	3.62	3.62	3.62
Desalination	Ml/d	0	9.5	9.5	11.5	11.5	11.5	0	9.5	9.5	11.5	11.5	11.5
Effluent reuse	Ml/d	0	0	0	0	0	0	0	0	0	0	0	0
Treatment works improvement	Ml/d	0	0.72	0.72	0.72	0.72	0.72	0	10.43	10.43	15.41	15.41	15.41
Total	**Ml/d**	**9.13**	**27.49**	**64.84**	**104.44**	**109.94**	**109.94**	**12.54**	**48.17**	**90**	**155.88**	**163.28**	**164.28**

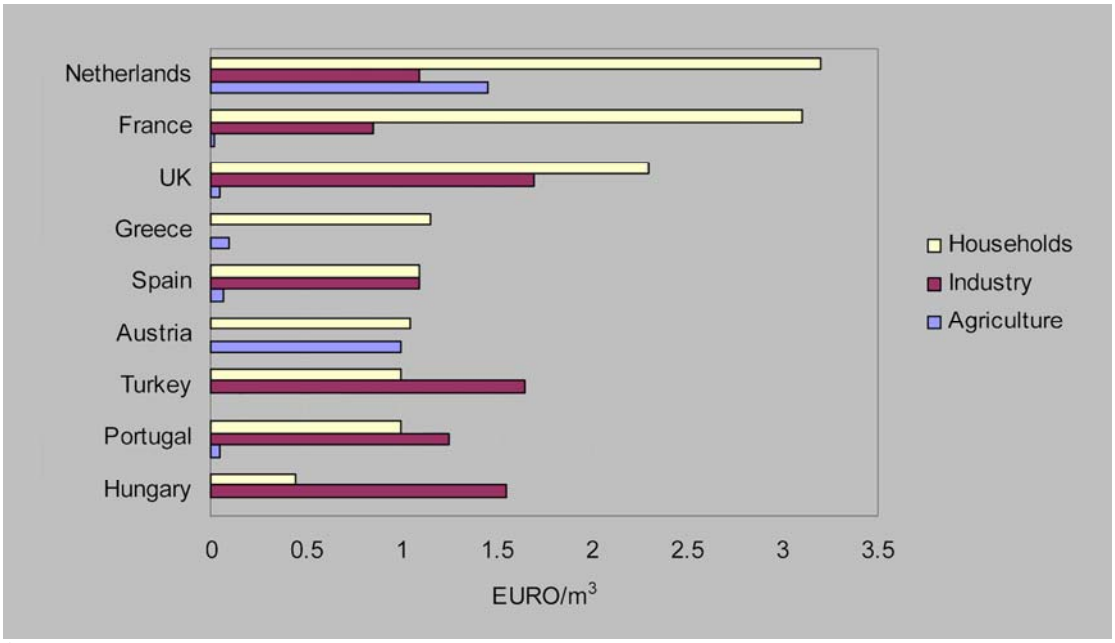
West Area		Dry year annual average						Dry year critical period					
Resource description	**Units**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Reservoir	Ml/d	0	0	0	0	23	23	0	0	0	0	30	30
Groundwater development	Ml/d	-5	23.37	23.37	33.59	33.59	35.9	0	50.28	65.24	80.56	80.56	87.17
Surface water development	Ml/d	14.52	38.11	43.11	48.16	48.16	72.1	1.03	3.6	13.6	13.65	37.59	39.14
Desalination	Ml/d	0	0	0	0	0	9.97	0	0	0	0	0	0
Effluent reuse	Ml/d	0	0	0	20	20	20	0	0	0	20	20	20
Treatment works improvement	Ml/d	3	7.69	7.69	7.69	7.69	9.81	2.3	55.14	55.14	55.14	55.14	63.92
Total	**Ml/d**	**12.52**	**69.17**	**74.17**	**109.44**	**132.44**	**170.78**	**3.33**	**109.03**	**133.99**	**169.36**	**223.29**	**240.23**

North Area		Dry year annual average						Dry year critical period					
Resource description	**Units**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Reservoir	Ml/d	0	0	0	62.36	62.36	62.36	0	0	0	62.36	65.32	65.32
Groundwater development	Ml/d	25.02	55.51	65.33	65.83	76.95	89.49	37.88	97.43	124.04	124.2	138.35	159.26
Surface water development	Ml/d	2.23	11.76	14.83	14.83	24.41	24.41	2.23	5.38	8.45	8.45	22.82	22.82
Desalination	Ml/d	0	0	0	1.67	1.67	1.67	0	0	0	1.67	1.67	1.67
Effluent reuse	Ml/d	0	2.88	2.88	2.88	2.88	2.88	0	0	0	0	0	0
Treatment works improvement	Ml/d	2.46	56.75	57.89	58.7	70.74	72.37	2.46	61.22	63.18	64.14	78.13	78.94
Total	**Ml/d**	**29.71**	**126.91**	**140.94**	**206.28**	**239.02**	**253.2**	**42.57**	**164.04**	**195.67**	**260.83**	**306.29**	**328.02**

SEERA Region		Dry year annual average						Dry year critical period					
Resource description	**Units**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Reservoir	Ml/d	0	-1.56	30.67	129.03	156.03	156.03	0	-1.49	30.72	149.08	187.03	187.03
Groundwater development	Ml/d	23.55	92.11	103.44	115.76	128.37	143.23	50.42	177.45	225.01	243.39	259.94	288.47
Surface water development	Ml/d	22.35	55.47	67.16	72.21	81.79	105.73	3.27	8.98	25.67	25.72	64.03	65.58
Desalination	Ml/d	0	9.5	9.5	13.17	13.17	23.14	0	9.5	9.5	13.17	13.17	13.17
Effluent reuse	Ml/d	0	2.88	2.88	22.88	22.88	22.88	0	0	0	20	20	20
Treatment works improvement	Ml/d	5.46	65.16	66.3	67.11	79.15	82.9	4.76	126.79	128.75	134.7	148.68	158.27
Total	**Ml/d**	**51.36**	**223.57**	**279.95**	**420.16**	**481.4**	**533.92**	**58.44**	**321.23**	**419.65**	**586.06**	**692.86**	**732.53**

Source: WRSE Group, 2004.
*__Annual average__ – the total demand in a year divided by the number of days __Critical Period__ – any period within a year during which the supply-demand balance may be more stressed (critical) than on a gross annual average basis.

Appendix 2: Agricultural, industrial and household water prices in the late 1990s for a selection of European countries.



Source: European Environment Agency, 2003

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