

# Progress in Water Supply Planning

The Environment Agency's review of water company  
water resources plans

A submission to Government October 1998



ENVIRONMENT  
AGENCY



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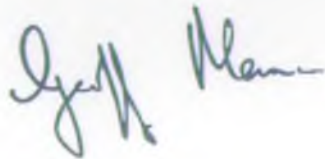
## Foreword by the Director of Water Management

Access to clean, reliable water supplies is part of modern life in this country. We use water for many purposes; some are essential for human life while others enhance its quality. How we use water in our homes, industry and agriculture has a direct impact on the amount of water available for rivers and the aquatic environment. We must balance our use of water to ensure security of supply while at the same time protecting the environment.

The Environment Agency has the central role in planning water resources at the national and regional level in England and Wales. We believe that a long term view of public water supply planning is essential. We have asked water companies to provide us with their plans for the next 25 years. This report describes our initial findings based on draft plans produced by water companies in June 1998.

I am pleased to record the progress made by many water companies in producing their draft plans for the next 25 years. This is a positive first step, but there is still some way to go. I am particularly concerned by the lack of consistency between water companies. The range of some of the predictions is frankly unbelievable. Some companies have worked much harder on these plans than others. All companies must meet the standards of the best, so that we can be sure that all are planning efficient use of water both for customers and for the environment. I challenge all water companies to make their plans more transparent and to place them in the public domain.

Over the next few months, we will work with water companies as they develop further drafts of these plans. By April 1999, I expect all companies to have produced plans with which the Agency can agree. I will expect companies to implement these and report on their progress. Together, we can all ensure that we plan for secure, environmentally sustainable water supplies.



Dr G Mance  
Director of Water Management  
The Environment Agency

# Executive summary

## The need for water resources plans

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In May 1997 the Deputy Prime Minister set out the Government's intention that, as we move forward into the 21st century, this country should have a world class, water-efficient, environmentally sustainable water industry. This report looks at the way that water companies are planning to maintain water supplies over the next 25 years.

The Environment Agency has a statutory duty to conserve, redistribute and augment water resources, and to secure their proper use. In *Water Resources and Supply: Agenda for Action* (Department of the Environment, 1996), the Agency was asked to:

- revise its national and regional water resources strategies in consultation with the water companies;
- be fully involved with water companies' new resource development plans.

As part of this work, the Agency asked water companies to prepare water resources plans. We have no powers to make companies provide us with these plans, but an understanding of the future needs of water customers is essential for effective planning. Good, clear and consistent water resources planning is essential both for preventing damage to the water environment and providing adequate water to water users.

## What the company plans say

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With the exception of Cambridge Water Company, all companies have submitted water resources plans that broadly comply with the Agency's requirements. However, some companies were late with their submissions and a few produced incomplete or barely complete work. We believe that some companies treated these draft water resources plans as a low priority.

Although there are areas of weakness, we believe that many companies have made good progress in producing these draft water resources plans. They are more consistent than any we have seen before, and provide a basis for initial comparison.

The key to these plans is the supply-demand balance. If supply is greater than demand, allowing for a security margin, the company should not need to develop new sources of water. If supply is less than demand, now or in future years, a solution will be needed. About one-third of companies tell us that the supply-demand balance is acceptable for the next 25 years. The other companies need to implement changes to ensure they can continue to supply water to customers over this period.

Most growth in demand comes from domestic water use. However, company projections vary greatly: for example, projected individual metered consumption in 2025 varies from less than 125 litres per person per day to more than 200 litres per person per day. Such a wide range seems hard to justify and is a cause for concern.

Company projections of meter penetration vary greatly. Six companies propose that more than 90 per cent of domestic properties will be metered by 2025, while two others plan only for four per cent metering by the same date. We note that companies are justifiably uncertain about metering, in view of the Government's consultation paper on water charging (*Water Charging in England and Wales – a new approach*, Department of the Environment, Transport and the Regions, March 1998). We understand that Ministers' proposals are due to be published in the next several weeks. We hope that this will limit or reduce this uncertainty for planning purposes.

Most companies have proposed further development of water supply to deal with shortfalls. This is a legitimate option, but it must be pursued alongside other measures to use water properly. We do not think that all companies have paid sufficient attention to water efficiency and leakage control. Further progress in justifying key assumptions on the demand side is essential to develop confidence comparable with that already achieved for the assessment of the availability of water.

It seems that some companies are following a traditional and safe approach that minimises risk to themselves, but at a potential cost to customers and to the environment. Companies must move away from the 'predict and build' approach to more imaginative, sustainable water resources management.

## Recommendations

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We recommend that Government should note the progress made by many companies. In considering the draft plans, the Agency has identified the following issues on which we seek and would welcome continuing support from Government:

- 1. Water companies must reduce the uncertainty associated with present unmeasured consumption.** Current estimates of unmeasured individual consumption vary greatly, from 136 to 180 litres per person per day. Few companies have explained the basis for their estimates or compared them with measured consumption and justified the differences. Estimates of unmeasured consumption have an enormous influence on estimates of leakage. Companies must justify their estimates, and improve their transparency.
- 2. Water companies must reduce the uncertainty in future estimates of consumption.** There is even more variation in future estimates of measured and unmeasured individual consumption. For example, the range of forecast measured individual consumption in 2025 varies from 125 to 200 litres per person per day. Most companies have provided little explanation of their future estimates, so we cannot identify which estimates are most likely. Companies must share data, models and methods, and must work with the regulators to establish best practice.
- 3. Water companies must consider the implications of tariff structures on consumption.** Very few companies have proposed sophisticated tariff structures that will help to enhance the distinction between water used for basic domestic purposes and water used for discretionary purposes, such as garden watering. Tariff structures should be a key element of water resources plans.
- 4. Water companies must set targets for the impacts of their water efficiency programmes, and report on progress against them.** Water companies have a statutory duty to promote the efficient use of water by their customers. However, most water resources plans do not reflect the benefits of water efficiency.
- 5. Water companies must continue to strive for reduced levels of leakage.** Many companies have not explained the basis of their projected leakage adequately. Very few assessments of the economic level of leakage are in the public domain: they must be published to allow informed debate. Some companies are predicting that they can allow leakage to rise to meet a calculated economic level. It is not acceptable to allow leakage to increase.



**6. Water companies must not rule out the use of hosepipe bans.** About one-third of companies have indicated that they plan never or practically never to use hosepipe bans, while many of the others are proposing to decrease their frequency. Hosepipe bans are an effective demand management measure in times of drought, affect only non-essential use, and avoid environmentally-damaging alternatives. Unless the company can demonstrate an alternative water saving measure for drought conditions, hosepipe bans should not be ruled out.

**7. Water companies must follow the 'twin track' approach enthusiastically, with active measures to manage demand incorporated in their plans and exposed clearly as targets.** Companies must show they are planning to achieve tough leakage targets and have in place rigorous demand management measures before a start on further development can be justified, although they should have plans at the ready. Future demand predictions should be based on positive management.

**8. Water companies must consider sharing supplies of water as one way to make best use of resources.** They must also be prepared to develop resources jointly where this is appropriate.

**9. Water companies must review and update their plans annually, and publish progress against targets.** Revised plans should be agreed with the Agency.

**10. Water companies must consult widely on their plans, and publish them.** Customers must be able to see how companies plan to manage resources.

Government has told the Agency that it expects us to agree water resources plans with water companies, and to use them as the base for our national and regional water resources strategies. To allow us to do this, companies' plans must be robust and complete. This will require companies to attain the ability to forecast demands to a standard comparable to that reached in the assessment of water availability. Until this is achieved, it is not possible to produce a fully satisfactory assessment of the balance between supply and demand.

This report deals only with public water supply. There are many other uses of water, including agriculture, industry and power generation. Water resources must be planned to balance these demands with the needs of the environment and others who use or value the water environment. This balance will be considered in the Agency's next regional and national water resources strategies. Consultation on these will take place during 1999, and they are due for publication in 2000.

# 1. Introduction

In May 1997 the Deputy Prime Minister set out the Government's intention that, as we move forward into the 21st century, this country should have a world class, water-efficient, environmentally sustainable water industry.

The Environment Agency has the central role for regional and national water resources planning in England and Wales. Its aim is to ensure that water resource development balances the needs of users and the environment.

This report looks at the way that water companies are planning to maintain water supplies over the next 25 years.

Water companies take water from rivers, lakes and underground sources to meet the needs of households and industry. Good, clean, reliable supplies of water are fundamental to public health and to our quality of life. People also value the environment, and want it to be protected not only now but also for their children and grandchildren. Water companies and the Agency must work together to ensure that future water supplies are secure, and that the water environment is protected or improved.

The Agency has a statutory duty to conserve, redistribute and augment water resources, and to secure their proper use. In *Water Resources and Supply: Agenda for Action* (Department of the Environment, 1996), the Agency was asked to:

- co-ordinate the fresh estimation of reliable yields of water resources systems (*Review of water company yields*, published in March 1998);
- lead the testing of these estimates against climate change scenarios (completed in January 1998);
- revise its national and regional water resources strategies in consultation with the water companies;
- be fully involved with water companies' new resource development plans.

Water companies were asked to:

- prepare fresh estimates of the reliable yields of water resource systems;
- establish further detailed measurements of household water use;
- conduct further studies of the implications of climate change on demand for water;
- extend the penetration of metering;
- develop more sophisticated tariff structures;
- increase efforts to promote water conservation;
- improve leakage measurement, control and reporting;
- enter into dialogue with customers about security of supply;
- draw up plans for timely development of new water resources where demand cannot be managed to remain within existing resource capacity.



At the Water Summit in May 1997 the Government set out its expectations for the water industry. This emphasised the need for companies to meet the needs of customers, and to be efficient and environmentally aware. The Deputy Prime Minister announced initiatives including reducing leakage from water mains, helping customers to repair their own supply pipes, and offering free water efficiency audits to domestic customers. He also emphasised the need to explore all of the opportunities for leakage reduction and water efficiency before seeking new abstraction rights, and announced the Government's intention to put the environment at the centre of the planning process where new resources are necessary.

To support these initiatives, the Agency has asked water companies to prepare water resources plans. We need to be sure that water companies are planning to make the best use of the water available to them. Plans must make good use of available information, and must consider the advantages and disadvantages of all available options, including the impact on people and the environment where they live. Water companies have produced draft 'Water Resources Plans' for the Agency, setting down their preliminary views on the way they want to manage water supplies over the next 25 years.

The Director General of the Office of Water Services (Ofwat) is reviewing the prices charged by water companies (a process known as the Periodic Review). It sets the limit on the amount the water companies of England and Wales can charge their customers. The strategies chosen will have a direct impact on customers' bills and also on the health of the water environment.

The water supply systems that belong to companies have been built up over many years. Most components predate the 1989 privatisation of the 10 water and sewage companies of England and Wales. This means that some parts do not reflect modern practice, and in some cases there are inherited problems: for example, some long-standing abstractions have an unacceptable impact on river flows or on Sites of Special Scientific Interest (SSSIs). The Agency, water companies, English Nature and the Countryside Council for Wales are working together to identify these sites and propose remedial measures. These issues are covered in the Agency's document *A Price Worth Paying* (May 1998), and the Government has recently given guidance to the Director General of Water Services on how these remedial schemes should be incorporated in his review of water prices for the period 2000 to 2005.

The purpose of this document is to show, in broad terms, how the water companies believe they need to manage water supplies over the next 25 years. We also make recommendations on areas that will need to be addressed by companies in revising their plans.

This report is the Agency's first response to the water companies' draft water resources plans. Water companies will need to refine their plans and produce progress milestones early in 1999. In 2000, the Agency will publish its regional and national water resources strategies, which will cover all aspects of water resource management, including public water supply. The Agency will be consulting on these during 1999.

## 2. The water resources planning process

### Background

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This part of the report looks at the way the Agency expects water companies to plan for future water supply. We will see how the Agency regulates the volume of water taken from the environment, and how controls are in place to minimise the damage this could cause. We will also see that planning future water supplies is important but complex, and look in some detail at the methods used and the options available to companies.

The Agency's main objectives for water resources support the Government's commitment to sustainable development. Water use supports economic development and prosperity, but we must balance this against the need to protect the environment and the rights of other water users.

### Managing water resources

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We manage water resources through a system of abstraction licensing. With a few exceptions, no-one may take water from rivers, lakes or underground without a licence from the Agency. The licence will specify how much water can be taken. It may also include conditions that stop the licence holder from using water if continued use might damage the environment. Such conditions would usually be designed to protect rivers or wetlands during periods of low rainfall.

When considering a new application for an abstraction licence, the Agency thinks about:

- the impact on the natural environment;
- the impact on other water users;
- the impact on other abstractors;
- whether this is a proper use of water.

These are considered for any proposed abstraction licence.

The Agency believes that water resources must be managed in a sustainable manner. This means that, as far as possible, any new resource development should not have an irreversible negative impact on the environment. Any new licences issued would normally be time-limited to allow the Agency to review the need for the scheme and its environmental impact at regular intervals.

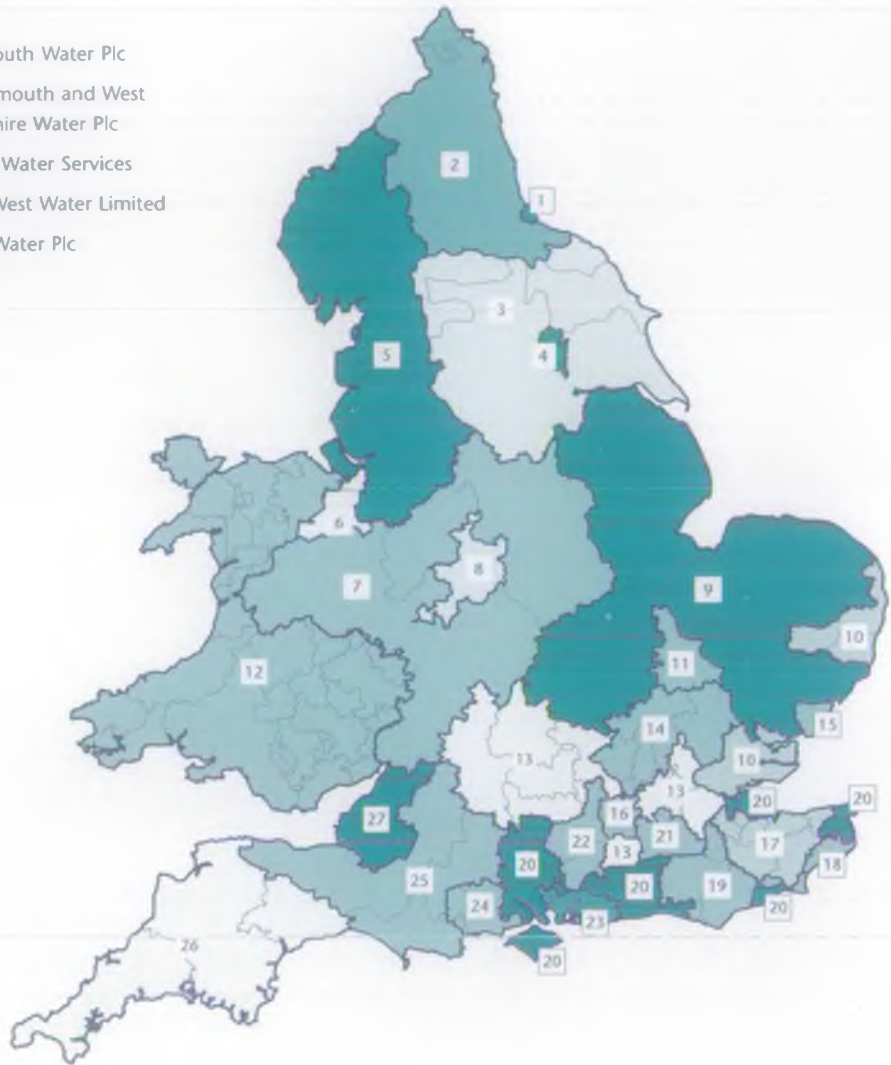
### Water companies

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Water companies supply water to households and industry across England and Wales. To do this, they abstract water from rivers, boreholes and reservoirs. Any change in the way their customers use water will affect the way that water companies manage their systems, which in turn affects the amount of water taken from the natural environment. The 27 water companies of England and Wales are shown in Figure 1.

Figure 1 The 27 water companies of England and Wales

- |  |   |
|--|---|
| 1. Hartlepool Water Plc                            | 23. Portsmouth Water Plc                        |
| 2. Northumbrian Water Plc                          | 24. Bournemouth and West<br>Hampshire Water Plc |
| 3. Yorkshire Water Plc                             | 25. Wessex Water Services                       |
| 4. York Waterworks Plc                             | 26. South West Water Limited                    |
| 5. North West Water                                | 27. Bristol Water Plc                           |
| 6. Dee Valley Water                                |   |
| 7. Severn Trent Water Ltd                          |   |
| 8. South Staffordshire Water Plc                   |   |
| 9. Anglian Water Services                          |   |
| 10. Essex & Suffolk Water                          |   |
| 11. Cambridge Water Company                        |   |
| 12. Dŵr Cymru Welsh Water                          |   |
| 13. Thames Water Plc                               |   |
| 14. Three Valleys Water                            |   |
| 15. Tendring Hundred Water<br>Services             |   |
| 16. North Surrey Water Limited                     |   |
| 17. Mid Kent Water Plc                             |   |
| 18. Folkestone and Dover Water<br>Services Limited |   |
| 19. South East Water Limited                       |   |
| 20. Southern Water                                 |   |
| 21. Sutton & East Surrey Plc                       |   |
| 22. Mid Southern Water Plc                         |   |



Public water supply is an extremely important use of water in England and Wales. There are many pressures on water companies to increase the volume of water supplied to customers. These include:

- additional new houses and the number of people who will live in them;
- new uses of water (for example, power showers);
- garden watering;
- new commercial ventures.

Set against these, there are measures that can be taken to maximise the use of existing sources of water. These include:

- sensible use of water in the home, industry and business (known as 'water efficiency');
- reducing leakage, both in water company mains and in customers' pipes;
- operation of water treatment works to minimise losses (usually known as 'process water');
- making best use of existing abstractions.



As well as the volume of water required by water companies, we must also think about where it should come from. Some river catchments can support no more abstraction; if more water is needed in these areas, it must be brought from elsewhere. Other catchments are known to be affected by too much abstraction. For these, we need to find solutions that involve reducing the load on the environment. These are explored further in the Agency's recent publication *A Price Worth Paying*.

## Planning future water supply

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Planning future water supply is a complicated task. We need to decide how much water is reliably available to the water company (supply) and how much water will be needed by customers (demand). If supply is less than demand, measures must be taken to either increase available water or reduce demand. We also need to consider how supply and demand will vary between wet and dry years, and how these patterns may change in the years ahead.

To provide a framework for companies to plan future water supply, the Agency developed a set of guidelines and tables. The approach taken in the guidelines was the subject of consultation with water companies, Ofwat and the Department of Environment, Transport and the Regions (DETR), and where possible drew on research carried out jointly between the Agency and water companies. These were issued to water companies in August 1997, with some revisions in February 1998. Draft plans were due to be submitted on 30 June 1998. Water resources plans look more than 25 years into the future.

Looking so far ahead will always be uncertain, and the plans submitted will need to be reviewed at regular intervals. These plans do provide a consistent basis for comparison between companies and raise many important issues.

The next part of this chapter looks in more detail at how the Agency expects water companies to plan water supply.

## Water company plans

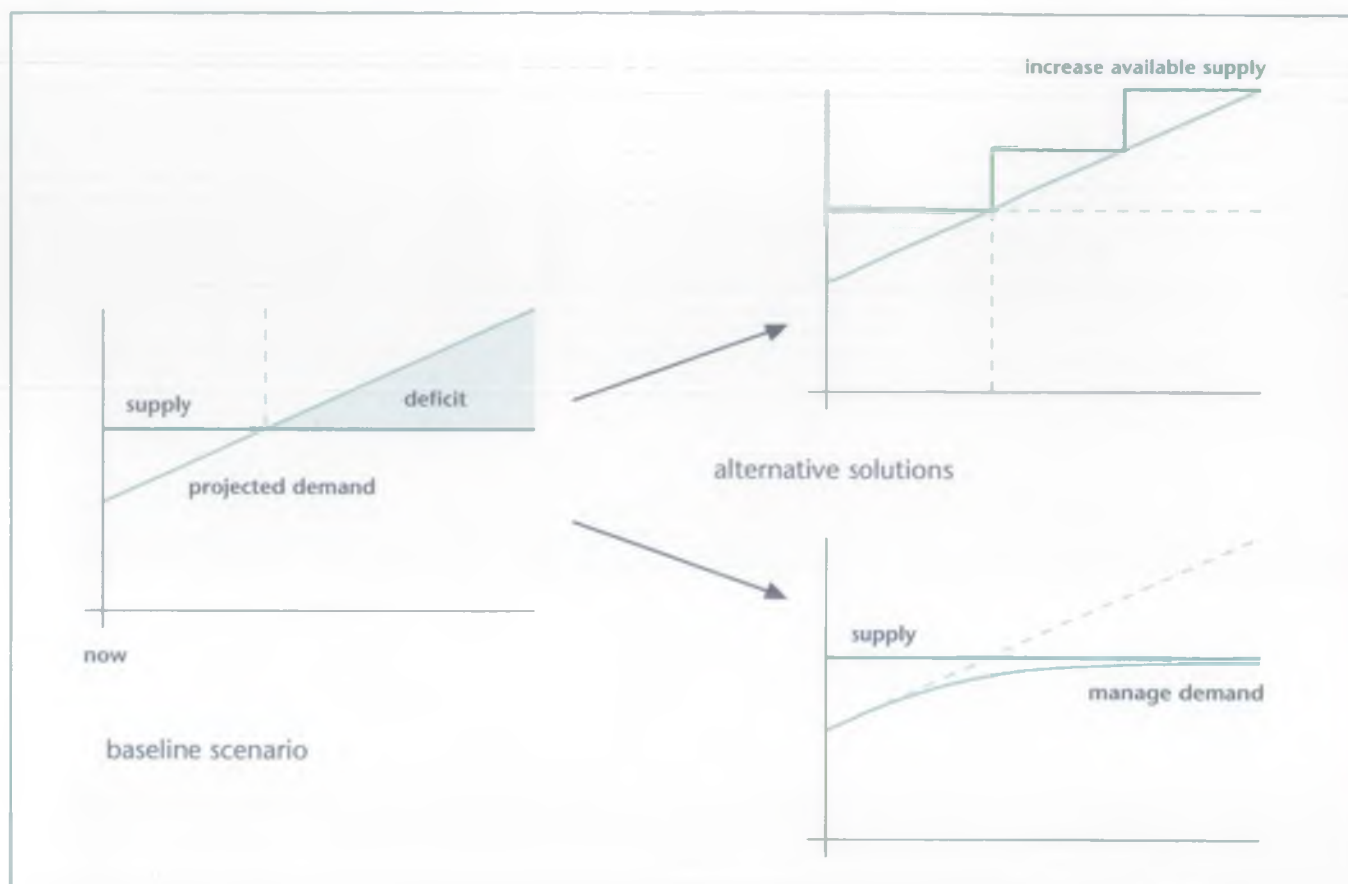
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The key to water company plans is the 'supply-demand balance'. This is the term used to describe the difference between available water and customer water requirements. If supply is greater than demand, the company should not need to develop new sources of water. If supply is less than demand, now or in future years, a solution will be needed (Figure 2).

Available water is calculated by considering how well the water resource system would have coped with past droughts. Some systems are sensitive to short, intense droughts, while others can survive one hot dry summer but will have more difficulty during an extended dry period of a year or more. Notable droughts covering all or parts of England and Wales include the summer of 1921, the dry period in 1933 and 1934, another dry period in the mid 1940s and the very dry summers of 1976 and 1995. Water companies usually plan their resource systems to cope with all of these droughts, although some companies may apply hosepipe bans or other restrictions during the worst periods.

There are several methods for calculating future domestic and industrial demand for water. The method most commonly used is to break current demand into its component parts. For household water use, these include washing, toilet flushing, drinking and garden watering. Similar methods can be used for commerce and industry. By looking at historic trends and making assumptions about future economic and social trends, a forecast of future demand can be created. Companies also need to look at other aspects of water use, including leakage, and project them into the future to establish an estimate of the total volume of water needed.

Figure 2 Managing the supply-demand balance



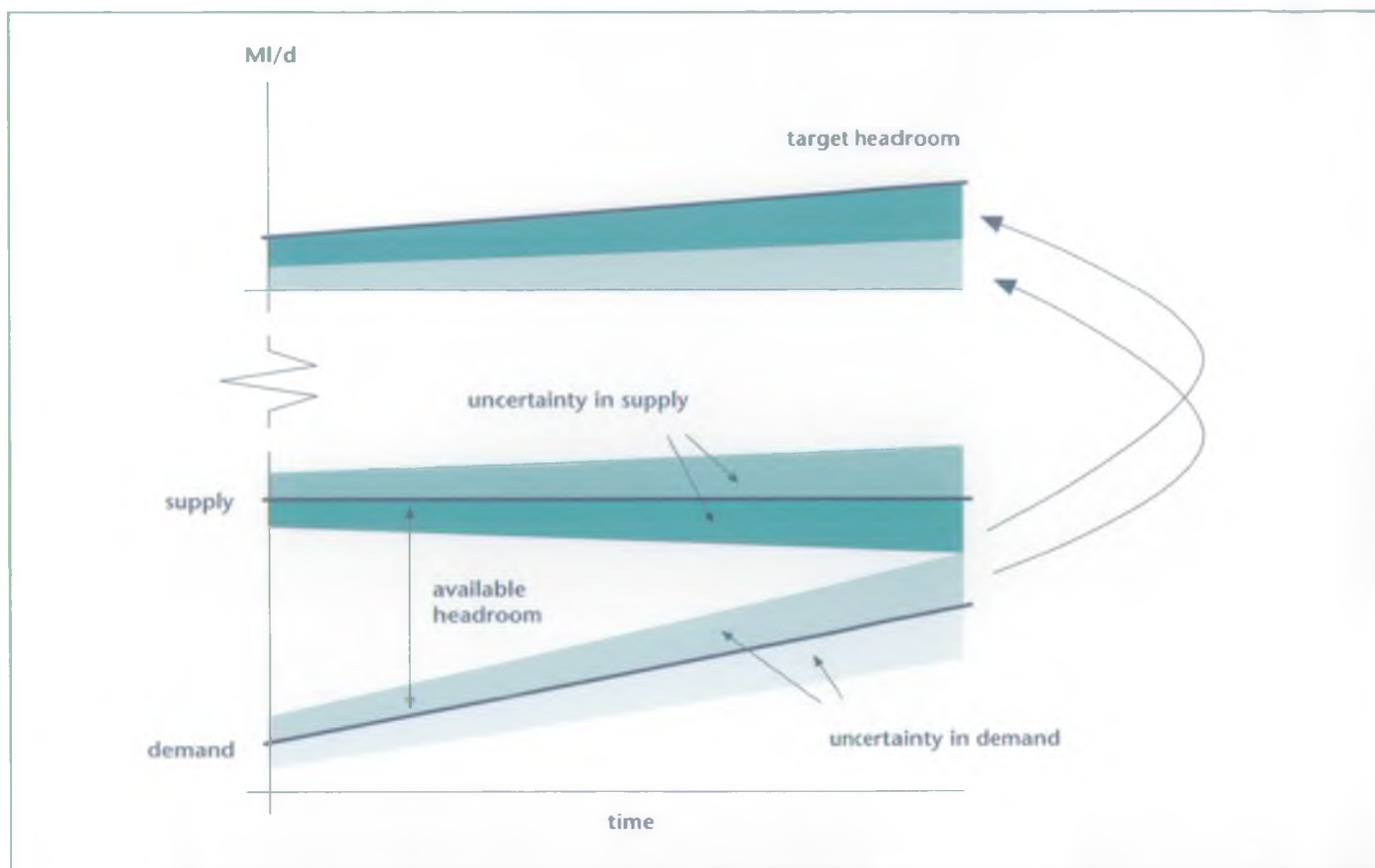
There is uncertainty associated with both the calculation of available water and demand. No two droughts are the same, which means that no future drought will be exactly like those used to calculate available water. This means that the water availability in future droughts is not known exactly. Projecting demand into the future is perhaps more difficult, as it requires many assumptions about human behaviour and socio-economic trends.

To deal with the uncertainties in the calculation of available water and future demand, the UK water industry has introduced the concept of 'headroom'. If resources were planned so that demand was exactly equal to supply, any slight error in the calculations could lead a company to run out of water during a dry but not exceptional year. Headroom is a margin of safety that allows for this (Figure 3). If the surplus of supply over demand is less than calculated headroom, the company will need to find a solution or run the risk of not meeting demand and having to take emergency measures to keep supplying water.

If a water company needs to make more water available to its customers it has several options, including:

- using water efficiently at sources and at water treatment works;
- managing losses in the water distribution system, for example by pressure reduction and repair of leaks;
- modifying customers' demand for water, for example by promoting low water use appliances in the home or simple devices that reduce toilet flush volumes, as well as education programmes;
- developing new water resources; for example building new reservoirs or drilling new boreholes.

Figure 3 Headroom



A successful water resources plan would consider a variety of options under each heading, and assess them according to cost and environmental impact. A solution that is cheap to build may have a severe negative impact on the water environment. By assessing its true cost, including environmental and social costs, a true least-cost option can be identified.

Some options will take many years to achieve. If a new reservoir was considered necessary, it could take 10 years or more before it could provide water. Similarly, schemes like meter penetration or retro-fitting of bathrooms with water-saving appliances may take many years. This is why water company plans need to look so far into the future, despite the uncertainties.

### Summary

In this chapter we have seen that it is necessary to manage our use of water to minimise the changes of permanent damage to the environment. However, water is essential for health and for economic development and prosperity. Water resources planning is intended to ensure that water is available when it is needed and in the right quantities. By planning ahead, we can also plan to protect the environment.

In the next chapter, we explore the draft plans presented by the water companies.



### 3. Water company supply-demand balance predictions

This section of the report looks at the supply-demand balances submitted by the water companies to the Agency in June 1998. Reports and tables produced by the companies contain much detailed information. This report concentrates on some of the more general information and looks in a broad way at how companies believe they need to plan for the next 25 years.

There are 27 water companies in England and Wales. Ten of these also provide sewage services, while the other 17 deal only with water supply. Each company has divided its supply area into resource zones. A resource zone is an integrated area of water supply. Within it, all customers will receive the same level of service: for example, a hosepipe ban would usually apply across a complete resource zone. Resource zones vary in size. Where there are highly developed water treatment and supply pipe networks, zones may be complete water company areas.

Where such integration is difficult or unnecessary, zones can be very small. In this report tables are presented at the company level, but resource zone information is shown in some maps.

This chapter of the report follows a simple structure. It looks first at what would happen if companies continued with existing policies and resources, and then examines the reasons for any predicted imbalance between supply and demand.

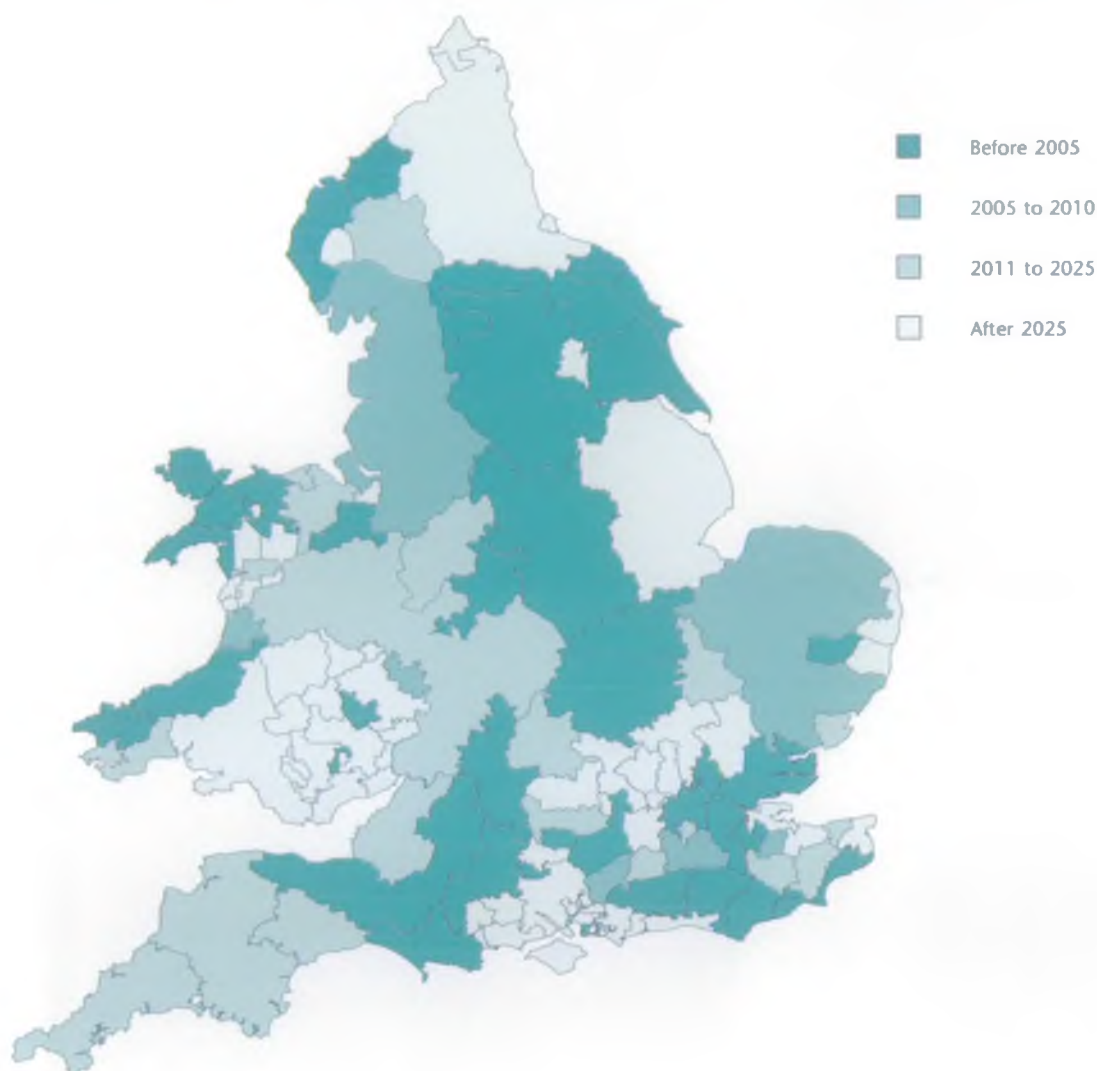
For most of the water companies of England and Wales, water resources planning is driven by the need to meet average demand. If these companies have sufficient water in total, they can manage to meet summer peaks in demand. Other companies find supplying summer peaks more difficult, and are proposing solutions to this problem. All companies have produced results for the annual average demand and these are discussed in much of this chapter. Peaks are considered separately.

All of the data used in this report come from water company plans. We have noted some inconsistencies in the information supplied and do not endorse the values presented. However, they do show the companies' initial, unchallenged views of how they need to manage resources now and into the future.

Table 1 First date when company wide available headroom is less than target headroom (note: some companies have deficits in individual resource zones before the dates shown)

Before 2005	2005 – 2010	After 2010
Essex & Suffolk	Severn Trent	Anglian
South Staffordshire		Cambridge
Yorkshire		Tendring Hundred
North West		Northumbrian
Folkestone & Dover		Hartlepool
South East		York
Wessex		Southern
Thames		Mid Kent
Mid Southern		Portsmouth
Dee Valley		South West
		Bristol
		Bournemouth & West Hampshire
		Three Valleys
		North Surrey
		Sutton & East Surrey
		Dŵr Cymru

Figure 4 First date when resource zone available headroom is less than target headroom for average conditions



### Baseline supply-demand balance

'Baseline' is the term used to refer to the supply-demand balance if existing policies (for example, on demand management and leakage) and resources are projected into the future. Dry year conditions are considered: during dry years demand for water is usually greatest and water availability is lowest.

There are marked differences between different water companies. About a third of companies have sufficient margin between average supply and demand to continue with current policies for the next 25 years. Some of these companies may need to make allowances for peak demand or may have local issues that require solution.

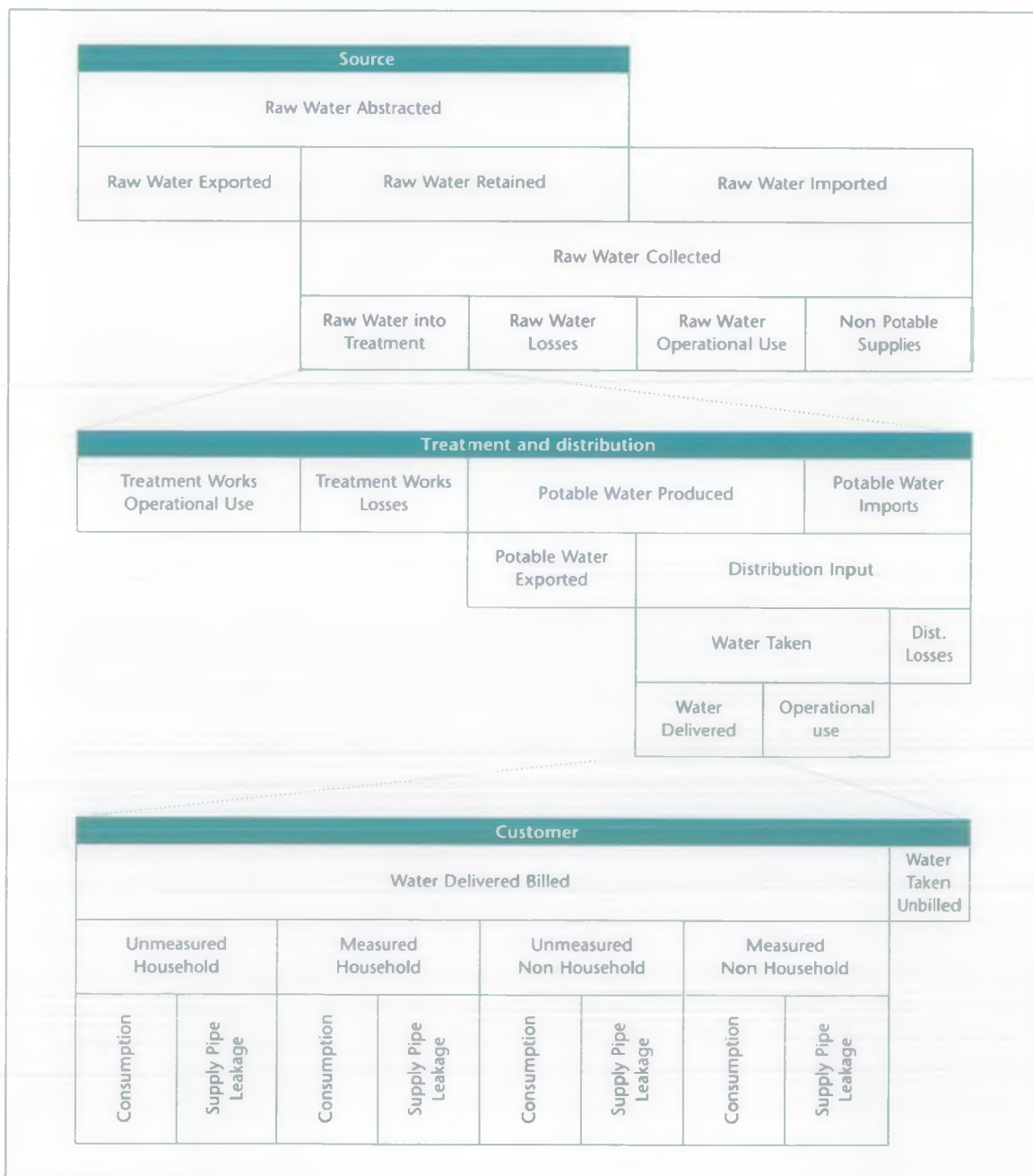
Around a third of companies could have water supply problems before 2005 if solutions are not identified and implemented. These problems are not necessarily across the whole company area, but the scale of the imbalance is such that the company does not have enough water available in total to meet its whole demand. These companies are listed in Table 1. This date is important because it is the period covered by the periodic review of water company prices currently being carried out by Ofwat. These companies will need to work quickly to clarify any inconsistencies in their plans, refine their calculations and, if necessary, plan, agree with the Agency, and implement short and long-term solutions. Other companies, although having sufficient water overall, may also need to carry out actions to deal with local problems: resource zone deficits are shown in Figure 4. Where problems occur in one zone only, the company may have a greater choice of options as it may be possible to redeploy resources from other zones.

There is little discernable geographical pattern to the baseline supply-demand balance. Companies in need of solutions now tend to be in the south of the country, but there are also companies in the south that should have no problems in the next 25 years. Of course, even companies with no predicted problems over the next 25 years may need to modify their practices to reflect either peak or local difficulties.

## Components of the supply-demand balance

Each company has calculated the volume of water available to it in a dry year. However, not all of this water can reach customers (Figure 5). Of the raw water collected some is lost before it reaches the treatment works (for example by leakage) and some has to be used during the process to flush away solids left during filtration. The potable water produced enters the distribution network. Some of this water is lost (mainly through leakage but also by evaporation or overflows from service reservoirs). Some is used in the operation of the system:

Figure 5 Water supply – where the water goes





for example pipes sometimes need to be flushed to maintain water quality. The remaining water is delivered to customers or taken unbilled from the system, either legally (for example by fire fighters) or illegally (this is usually only a very small volume of water).

Water that is delivered to customers goes either to households or non-households (mainly shops, industry and agriculture). Within the customers' houses or premises there may be further leakage. The water that is left is used by the customer. The different components of the supply-demand balance all provide opportunities for the management of public water supply.

For their baseline forecasts, most companies predict little change in the volume of water available from surface and groundwater sources over the next 25 years (Table 2). Some predict small reductions of up to six per cent because of the expiry of existing licences or because of planned schemes aimed at relieving particular environmental problems. Others predict small increases in available water; again, these are mostly due to schemes that are already in hand, such as enhancements to existing treatment works.

This means that any predicted deficits over the next 25 years are mostly the results of changes in demand for water. The principal components of water demand are distribution losses (leakage) and water delivered to customers' premises.

Table 2 Baseline water available for use (values provided by water companies) (MI/d)

Baseline water available for use (MI/d)				
	2000	2005	2010	2025
Anglian	1427.0	1420.0	1413.0	1413.0
Cambridge				
Essex & Suffolk	523.0	506.7	506.7	506.7
Tendring Hundred	38.0	38.0	38.0	38.0
Severn Trent	2072.9	2037.9	2009.4	1962.3
South Staffordshire	378.7	379.7	379.7	379.7
Yorkshire	1381.0	1348.0	1338.0	1335.0
Northumbrian	964.0	964.0	964.0	964.0
Hartlepool	45.7	45.7	45.7	45.7
York	70.0	70.0	70.0	70.0
North West	2117.9	2117.9	2117.9	2117.9
Folkestone & Dover	42.9	42.9	42.9	42.9
Southern	767.5	783.3	817.1	823.1
Mid Kent	161.9	161.9	161.9	161.9
South East	169.9	169.9	169.9	169.9
Portsmouth	257.7	257.7	257.7	257.7
South West	484.2	491.5	491.5	545.2
Wessex	408.5	430.5	430.5	430.5
Bristol	329.5	329.5	329.5	329.5
Bournemouth & West Hampshire	217.9	220.2	220.2	223.7
Thames	3407.9	3344.8	3326.2	3303.7
Three Valleys	778.7	778.7	778.7	778.7
Mid Southern	158.7	156.2	156.2	156.2
North Surrey	171.3	171.3	171.3	171.3
Sutton & East Surrey	204.1	204.1	204.1	204.1
Dŵr Cymru	1503.6	1503.6	1503.6	1503.6
Dee Valley	73.6	74.0	74.1	74.6
<b>Total</b>	<b>18156.0</b>	<b>18048.0</b>	<b>18018.0</b>	<b>18009.0</b>

## Distribution losses

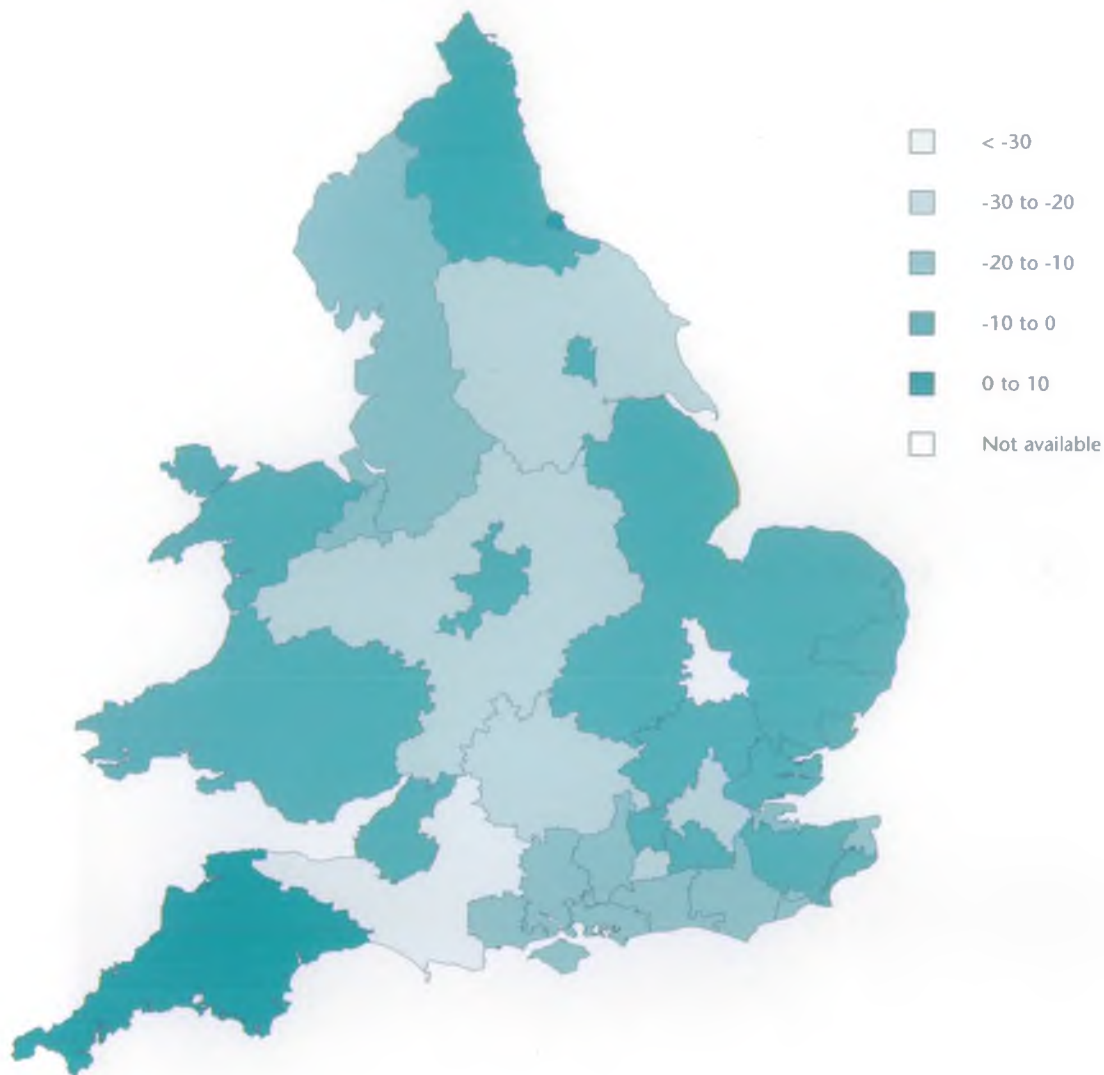
Baseline forecasts represent existing policies projected into the future. Only South West Water predicts that current policies would lead to an increase in company-wide distribution losses over the next 25 years. This partly reflects the growth in supply that the company is predicting; the proportion lost hardly changes. Some other companies have resource zones where they predict a rise in distribution losses over the same period. On a company-wide level, all of the other companies are predicting either almost no change (five companies) or quite significant changes (up to 40 per cent reduction) (Table 3 and Figure 6).

Reductions in total distribution loss under current policies must be welcome; this implies that companies have long-term and far-reaching commitments to reducing total distribution loss. It may still be possible for companies to make further reductions beyond these baseline proposals. As almost all companies are predicting a reduction in distribution losses and little change in available water, any predicted deficits in the supply-demand balance are likely to be mainly the result of increased customer demand for water.

Table 3 Baseline distribution losses (MI/d) (values provided by water companies)

Distribution losses (MI/d)					
	1998	2000	2005	2010	2025
Anglian	181.0	181.0	181.0	180.0	180.0
Cambridge					
Essex & Suffolk	53.9	49.5	49.5	49.6	49.6
Tendring Hundred	4.7	4.5	4.5	4.5	4.5
Severn Trent	281.8	231.4	220.4	219.3	216.4
South Staffordshire	57.1	57.1	57.1	57.0	56.4
Yorkshire	283.1	250.3	228.3	224.7	224.7
Northumbrian	128.0	119.8	118.8	117.6	117.6
Hartlepool	3.2	3.2	3.2	3.2	3.2
York	5.9	5.9	5.9	5.9	5.8
North West	465.9	403.1	405.8	406.7	403.6
Folkestone & Dover	6.0	5.9	5.9	5.9	5.9
Southern	70.2	65.4	64.8	61.7	59.9
Mid Kent	23.4	19.8	19.9	20.3	21.3
South East	26.9	24.4	24.1	23.9	23.2
Portsmouth	23.7	21.8	21.6	21.3	20.9
South West	70.4	63.6	70.4	74.8	76.9
Wessex	89.6	62.9	51.8	52.7	51.4
Bristol	41.6	39.3	39.7	40.1	41.1
Bournemouth & West Hampshire	18.5	16.7	16.9	16.7	16.3
Thames	679.3	498.1	486.8	486.9	486.8
Three Valleys	100.2	88.0	90.0	94.9	99.5
Mid Southern	40.9	35.8	33.6	33.6	34.5
North Surrey	16.5	16.0	16.0	16.0	16.0
Sutton & East Surrey	15.9	15.3	15.5	15.6	15.8
Dŵr Cymru	267.4	235.0	216.7	224.5	248.6
Dee Valley	7.7	7.4	7.3	6.9	6.9
<b>Total</b>	<b>2961.9</b>	<b>2520.9</b>	<b>2455.4</b>	<b>2464.3</b>	<b>2486.7</b>

Figure 6 Baseline percentage change in distribution losses 1998 to 2025 (company data)



### Customer demand

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Customer demand for water comes from households and non-households.

### Non-household demand

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Non-household demand (commerce and industry) makes up between a fifth and a half of each company's current demand. Total non-household demand is predicted to fall by eight per cent (about 300 Ml/d) between 1998 and 2025, but this disguises significant differences between companies. Anglian Water predicts a 30 per cent drop in non-household demand by 2025, while South East Water predicts a 27 per cent increase. All companies say that supply pipe losses in non-households are very small (Table 4).

### Household demand

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Between half and four-fifths of water supplied goes to households (Figure 7). Some households have meters and therefore the water supplied to them is known as 'measured', while households without meters are 'unmeasured'.



Table 4 Non-household demand and non-household underground supply pipe leakage (USPL) (values provided by water companies)

	2000		2005		2010		2025	
	demand (Ml/d)	USPL (Ml/d)	demand (Ml/d)	USPL (Ml/d)	demand (Ml/d)	USPL (Ml/d)	demand (Ml/d)	USPL (Ml/d)
Anglian	263.0	0.0	250.0	0.0	235.0	0.0	201.0	0.0
Cambridge								
Essex & Suffolk	143.5	0.7	145.7	0.6	151.0	0.6	160.3	0.5
Tendring Hundred	5.8	0.0	5.7	0.0	5.8	0.0	6.1	0.0
Severn Trent	440.8	0.0	429.6	0.0	435.3	0.0	461.9	0.0
South Staffordshire	80.8	1.0	80.5	0.9	80.2	0.8	86.1	1.0
Yorkshire	311.7	2.8	293.7	2.7	272.9	2.8	230.9	3.1
Northumbrian	231.2	2.3	226.7	1.9	221.3	1.5	221.3	1.5
Hartlepool	16.0	0.0	15.6	0.0	13.0	0.0	12.9	0.0
York	12.1	0.1	11.9	0.1	12.3	0.1	14.3	0.1
North West	483.1	3.6	434.0	5.0	401.0	5.4	395.8	5.7
Folkestone & Dover	14.8	0.2	14.2	0.1	14.4	0.1	14.9	0.1
Southern	142.2	1.6	129.6	1.6	123.9	1.6	123.9	1.6
Mid Kent	40.3	0.5	40.7	0.5	41.3	0.5	40.7	0.5
South East	47.1	0.6	47.2	0.6	47.9	0.7	49.7	0.8
Portsmouth	47.0	0.1	46.0	0.1	45.2	0.2	43.9	0.5
South West	120.8	0.8	122.1	0.8	124.9	0.8	139.2	0.8
Wessex	136.5	0.7	137.3	0.8	141.2	0.8	144.0	0.9
Bristol	84.1	0.7	84.5	0.6	85.8	0.5	94.1	0.5
Bournemouth & West Hampshire	82.0	0.4	83.7	0.4	86.0	0.5	94.9	0.5
Thames	576.1	6.0	590.9	6.1	612.4	6.5	685.5	6.9
Three Valleys	126.7	1.4	120.1	1.3	116.2	1.3	107.1	1.3
Mid Southern	60.9	0.5	61.2	0.6	61.9	0.6	62.7	0.7
North Surrey	31.0	0.2	29.1	0.2	27.9	0.2	25.3	0.2
Sutton & East Surrey	29.0	0.4	29.0	0.4	29.0	0.4	29.0	0.4
Dŵr Cymru	223.9	1.0	216.1	0.8	210.6	0.9	201.6	1.0
Dee Valley	22.1	0.2	22.1	0.2	22.1	0.2	22.1	0.2
<b>Total</b>	<b>3772.3</b>	<b>25.7</b>	<b>3667.1</b>	<b>26.4</b>	<b>3618.2</b>	<b>26.9</b>	<b>3669.0</b>	<b>28.7</b>

All the companies are predicting an increase in the volume of water delivered to households, with seven companies predicting an increase of between 20 and 30 per cent by 2025 (Table 5 and Figure 8).

Some water delivered to households leaks from supply pipes owned by customers. Four companies predict that customer pipe leaks will increase by between 10 and 36 per cent by 2025, while another nine companies predict almost no change (Figure 9). This is despite the commitment from all companies to repair customer supply pipes at no charge. The other 13 companies predict significant falls in customer supply pipe leakage. Four of these predict a fall of around 50 per cent, while Wessex Water predicts almost 60 per cent and South West Water predicts more than 75 per cent.

It would be reasonable to expect companies with high customer supply pipe leakage to deliver the biggest savings, but this does not appear to be the case (Figure 10).

Some of the differences reflect how companies have interpreted their current policies: for example a company predicting a fall of more than 50 per cent must already have a robust service for detecting customer pipe leaks and helping with their repair. Some of the other companies may plan reductions to the volume lost from customers' pipes as part of any solution for the supply-demand balance.

Figure 7 Proportion of water supplied to households in 1998 (company data)

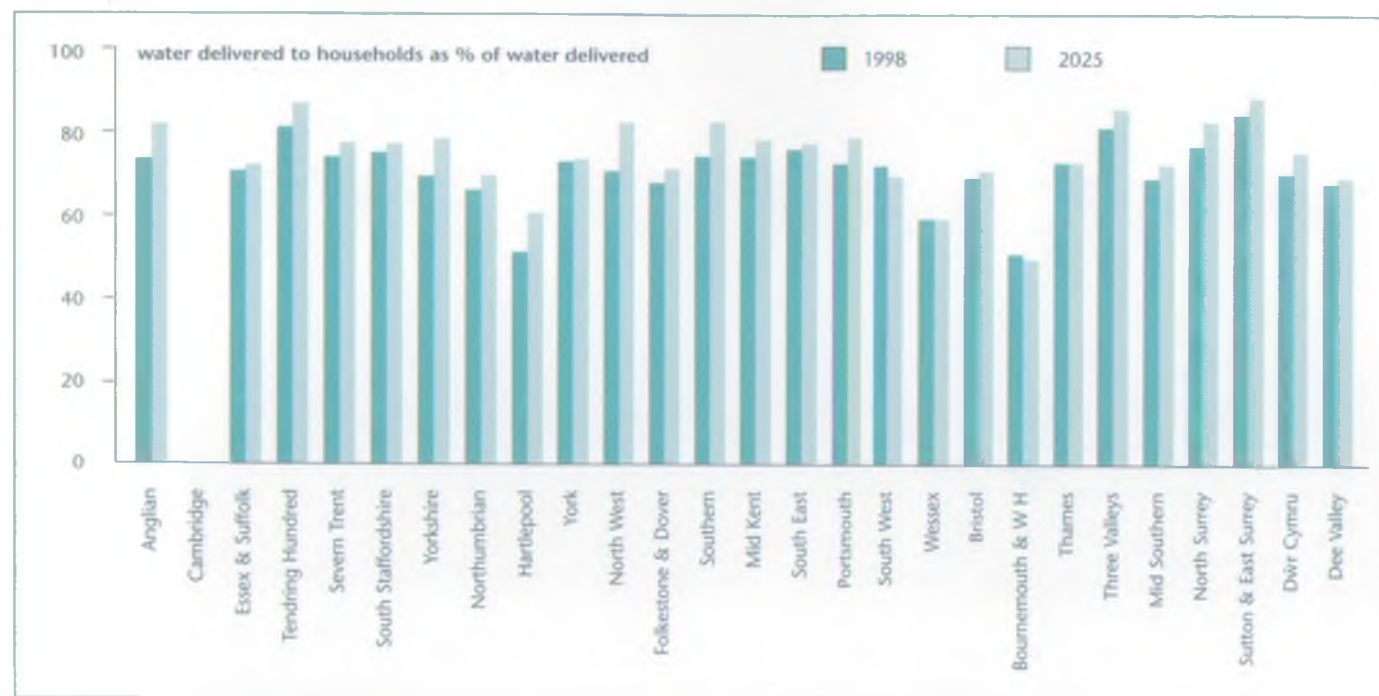


Table 5 Baseline household water delivered (MI/d) (values provided by water companies)

Baseline household water delivered (MI/d)				
	2000	2005	2010	2025
Anglian	666.0	672.0	681.0	713.0
Cambridge				
Essex & Suffolk	307.5	314.1	319.6	350.1
Tendring Hundred	22.7	23.4	24.9	28.9
Severn Trent	1193.6	1202.3	1219.6	1296.4
South Staffordshire	208.5	214.9	221.3	238.1
Yorkshire	648.5	653.7	662.0	681.7
Northumbrian	409.6	414.7	420.4	436.3
Hartlepool	15.7	16.2	16.7	17.6
York	28.6	29.4	30.3	33.6
North West	1136.7	1188.5	1252.5	1436.9
Folkestone & Dover	28.5	28.9	29.5	31.4
Southern	375.7	386.1	402.7	457.0
Mid Kent	102.8	104.4	107.9	119.8
South East	114.0	113.4	119.3	139.8
Portsmouth	112.3	116.0	120.4	132.8
South West	258.5	250.1	247.0	273.4
Wessex	182.9	185.0	183.6	186.1
Bristol	181.7	184.6	187.3	195.5
Bournemouth & West Hampshire	75.6	76.1	78.2	85.1
Thames	1355.0	1384.4	1420.1	1555.0
Three Valleys	467.1	465.3	465.4	479.9
Mid Southern	117.7	120.2	124.8	139.4
North Surrey	93.0	92.3	91.2	93.9
Sutton & East Surrey	126.7	130.8	136.2	154.8
Dŵr Cymru	456.3	448.7	463.2	510.9
Dee Valley	41.1	41.7	42.1	42.6
<b>Total</b>	<b>8726.3</b>	<b>8857.1</b>	<b>9067.1</b>	<b>9829.8</b>

Figure 8 Baseline percentage change in volume of water delivered to households 1998 to 2025 (company data)

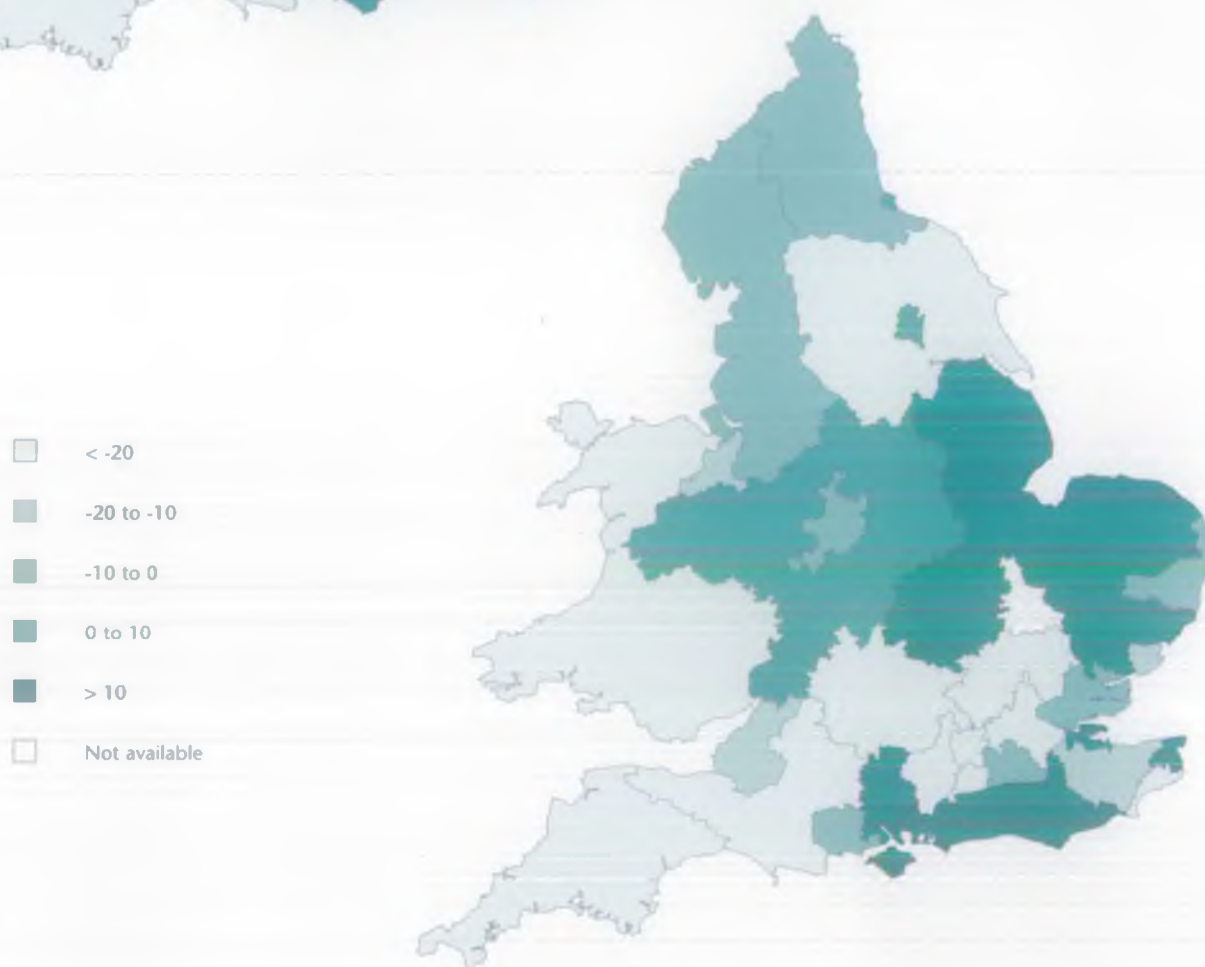
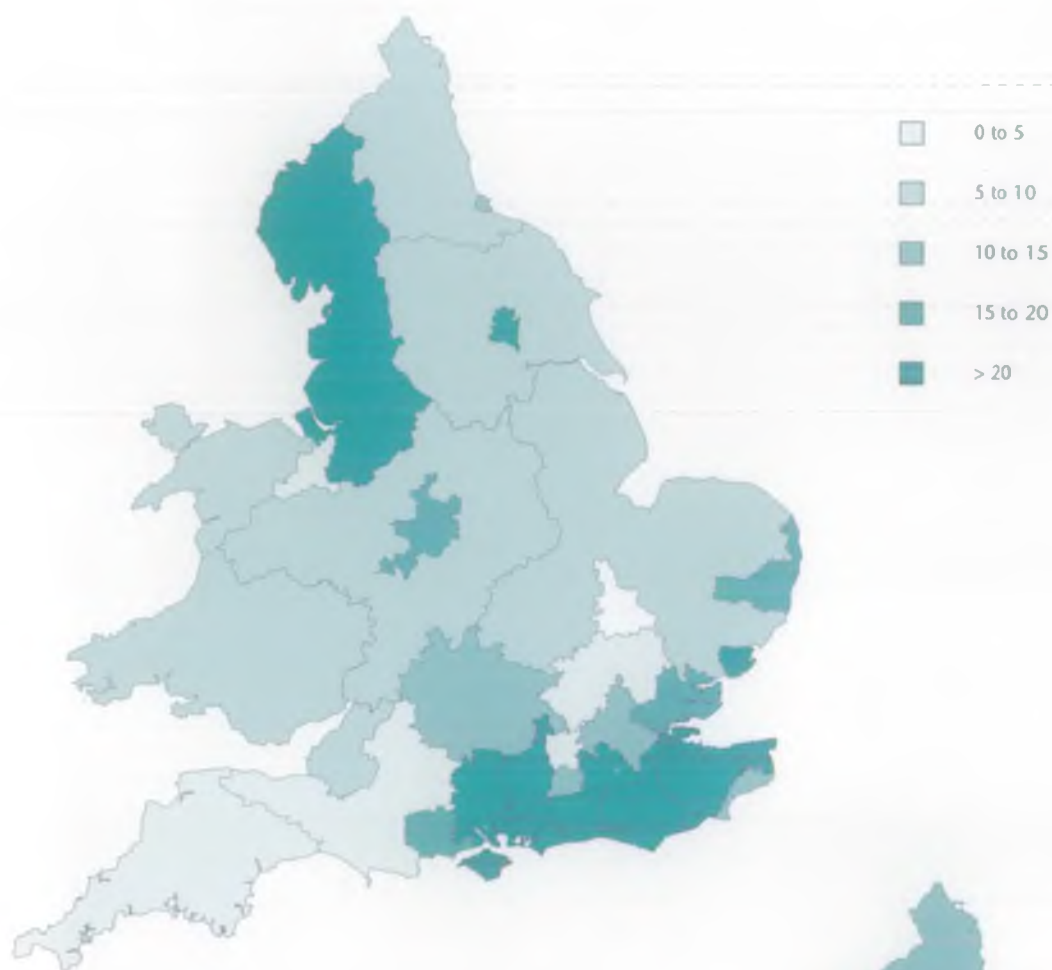


Figure 9 Baseline percentage change in customer supply pipe leakage 1998 to 2025 (company data)



Figure 10 Relationship between customer supply pipe leakage now and change expected by 2025

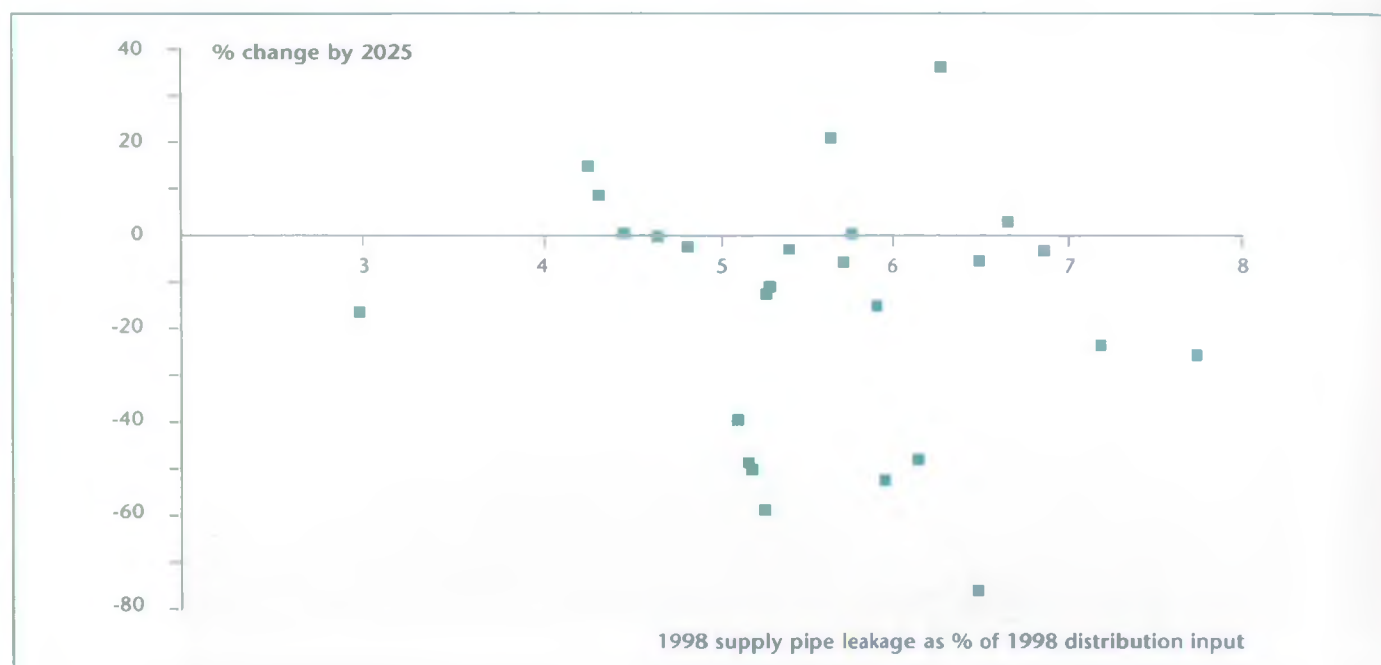


Table 6 Population (values provided by water companies)

	Population (000s)				
	1998	2000	2005	2010	2025
Anglian	4021	4060	4112	4177	4400
Cambridge					
Essex & Suffolk	1679	1684	1695	1709	1745
Tendring Hundred	143	147	151	156	172
Severn Trent	7306	7382	7465	7562	7811
South Staffordshire	1232	1237	1241	1244	1251
Yorkshire	4508	4547	4590	4634	4773
Northumbrian	2531	2540	2574	2532	2513
Hartlepool	91	92	93	93	91
York	174	176	179	182	191
North West	6866	6888	6931	6969	7083
Folkestone & Dover	158	161	165	168	171
Southern	2216	2252	2289	2311	2379
Mid Kent	560	569	581	594	606
South East	628	639	648	658	685
Portsmouth	648	655	663	668	669
South West	1503	1548	1608	1645	1781
Wessex	1162	1184	1212	1249	1345
Bristol	1044	1059	1075	1089	1127
Bournemouth & West Hampshire	429	432	436	439	450
Thames	7567	7663	7741	7798	7929
Three Valleys	2422	2450	2483	2519	2541
Mid Southern	731	756	777	786	809
North Surrey	477	486	493	501	508
Sutton & East Surrey	630	640	654	670	720
Dŵr Cymru	2822	2827	2839	2856	2908
Dee Valley	255	257	258	257	252
<b>Total</b>	<b>51802</b>	<b>52331</b>	<b>52950</b>	<b>53466</b>	<b>54910</b>

For all companies, customer supply pipe leakage is a small proportion of the water delivered to households. This means that the increase in the volume of water delivered to households must be due mainly to a predicted increase in customer demand.

Demand for water is calculated by multiplying individual consumption by the number of people supplied with water. This is a useful way to carry out predictions because it is separated into the simple components of population forecasts and consumption.

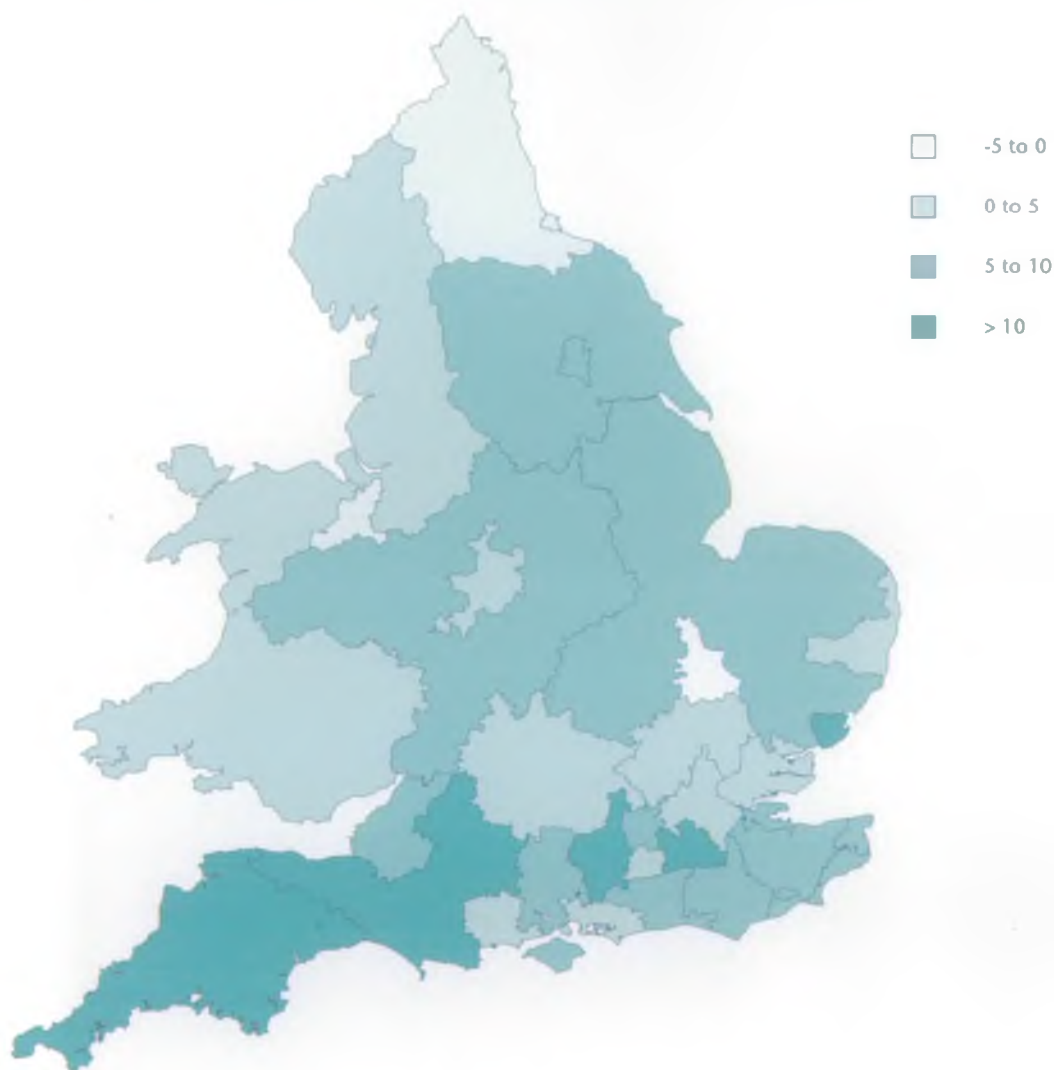
In total, water companies are predicting an increase in population of around three million between 1997/98 and 2024/25 (Table 6). This is broadly in line with Government projections. Companies are predicting an increase in the number of households by about four million in the same time (Table 7). This is also broadly in line with published projections, although there is uncertainty about where the new houses will be built. We do not know what assumptions companies have made about the water efficiency of new houses.

Only three companies (Hartlepool Water, Northumbrian Water and Dee Valley Water) predict a fall in population; all of the others predict a rise of up to 20 per cent, with the biggest increases predicted by Tendring Hundred Water, South West Water and Wessex Water (Figure 11). There are some noticeable differences between companies with adjacent supply areas.

Table 7 Number of households (values provided by water companies)

Number of households (000s)					
	1998	2000	2005	2010	2025
Anglian	1573	1617	1679	1757	1987
Cambridge					
Essex & Suffolk	661	676	696	722	798
Tendring Hundred	61	62	64	66	72
Severn Trent	2865	2925	3005	3115	3445
South Staffordshire	477	483	492	504	542
Yorkshire	1728	1770	1822	1887	2082
Northumbrian	996	1014	1040	1070	1145
Hartlepool	36	37	38	40	45
York	70	72	74	77	86
North West	2681	2729	2795	2890	3302
Folkestone & Dover	62	63	65	66	72
Southern	880	898	922	952	1042
Mid Kent	202	206	211	217	237
South East	254	261	266	277	308
Portsmouth	259	266	275	283	301
South West	597	616	641	656	714
Wessex	444	457	474	494	545
Bristol	417	428	440	453	496
Bournemouth & West Hampshire	165	168	173	178	194
Thames	3016	3098	3199	3321	3658
Three Valleys	923	942	961	984	1030
Mid Southern	264	278	291	304	338
North Surrey	180	185	189	194	205
Sutton & East Surrey	242	246	251	257	277
Dwr Cymru	1107	1130	1163	1200	1310
Dee Valley	99	102	105	107	114
<b>Total</b>	<b>20259</b>	<b>20730</b>	<b>21328</b>	<b>22072</b>	<b>24348</b>

Figure 11 Baseline percentage change in population 1998 to 2025 (company data)



## Consumption

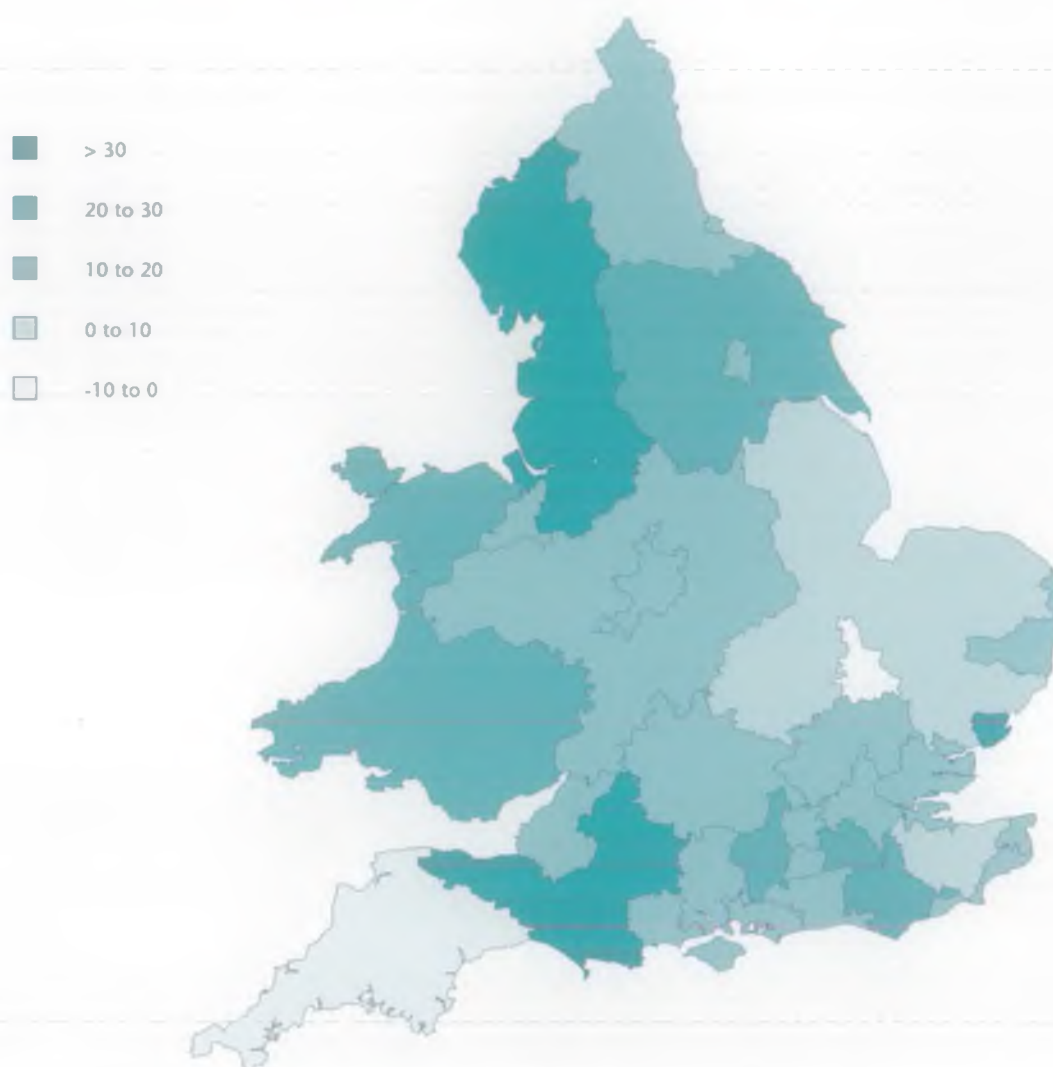
The other aspect of any change in household demand is a change in each person's consumption of water. We all use water for a variety of purposes, including drinking, cooking, washing, cleaning, garden watering and car washing. Predicting future individual water consumption is very difficult. Companies have to estimate how our behaviour may change; for example, will we want to water gardens more or will we plant them with drought-tolerant varieties? Technological innovation also makes it difficult to predict future water use. For example, when showers became common they certainly saved water over bathing with the same frequency, but now power showers can use as much water in five minutes as a bath.

A further complication in predicting individual water use comes from metering. Generally those of us with water meters are more careful about how much water we use, because we see the results directly in our bills. Therefore predicted future consumption will partly reflect companies' existing policies on water metering and pricing.

Household size is another important factor. Smaller households use more water for each person than large households. This is partly because small households tend to use domestic appliances as frequently as large households; for example washing machines and dishwashers may be run on part-loads.



Figure 12 Baseline percentage change in unmeasured per capita consumption 1998 to 2025 (company data)



All companies except South West Water believe that the water consumption of each person in households without meters will increase between now and 2025. Some companies are predicting a small increase of less than two per cent but others predict very large increases (Figure 12). The biggest is Wessex Water with an increase of almost 90 per cent. However, Wessex Water is predicting that fewer than one per cent of homes will be unmetered, so this represents a very small part of its water supply. Companies predict an increase at least partly because those customers without meters in 25 years will be customers who will not benefit financially from the change; in other words, these will be the high users in properties of low rateable value.

Some of the variability in predictions of both metered and unmetered households reflects present policies. Some companies tell the Agency that they will introduce programmes of demand management whatever happens, while others are proposing demand management only if it is required as part of the solution to a supply-demand balance problem. However, the variability in predicted unmetered consumption is remarkable.

In some ways, measured individual consumption is even more interesting. All customers with meters will be able to see how much water they use, and therefore are encouraged to save water. Metering also provides companies with the opportunity to identify customers' individual patterns of water use and to target high users with appropriate messages. Measured consumption varies now from 111 litres/person/day in Dee Valley's area to 207 litres/person/day in Hartlepool (Figure 13). Variability now reflects in part existing metering policies, the

Figure 13 Present measured per capita consumption (litres per head per day) (company data)

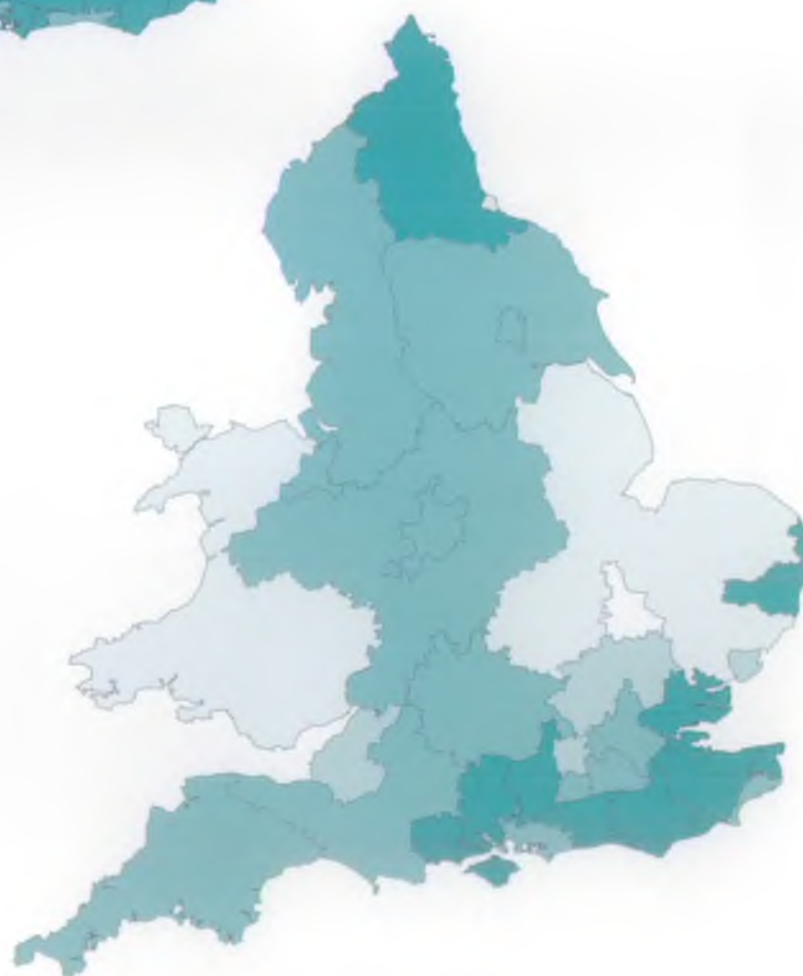
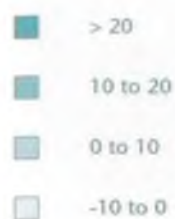
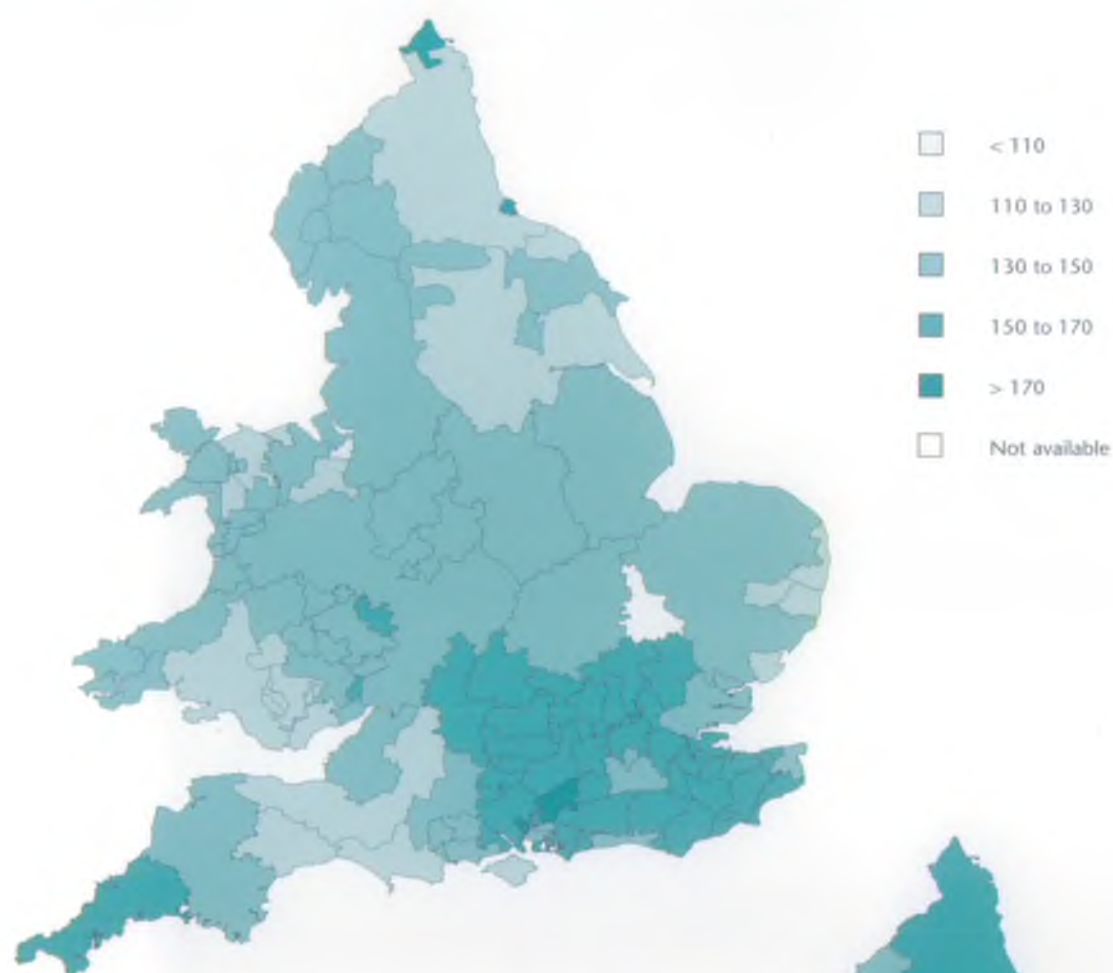


Figure 14 Baseline percentage change in measured per capita consumption 1998 to 2025 (company data)

price of water, and the social and economic conditions of the company's area. However, the variability of measured individual consumption is large, with the highest almost double the lowest. More explanation of this is essential, because this is the base for much future planning.

Only three companies say that with existing policies and practices, individual consumption will fall over the next quarter of a century (Figure 14). All of the other companies see metered consumption rising, by up to 25 per cent in the case of Mid-Southern Water. It is difficult to compare these values closely because some companies tell the Agency they have built demand management into their forecasts of individual consumption. However it is interesting that some companies are planning to deliver a fall in individual consumption over the next 25 years; if this is really possible, it must be an option for the other companies as well.

## Peak demands

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All water supply systems experience peak demands. Demand for water always rises in summer as people use more water for washing, car washing and garden watering. The size of this peak depends on weather conditions: hot, dry weekends always produce high demand for water.

Very cold winters often give a second peak, as pipes burst during periods of thaw. If cold weather and the associated thaw coincide with weekends or holidays, bursts can go unnoticed for several days.

Many supply systems are capable of dealing with peaks in demand, provided that, on average, sufficient water is available. Such systems usually have flexibility in their sources of supply and some storage in the system that allows them to buffer some of the extremes. Other systems are sensitive to peaks in demand, and companies have to plan on this basis. Zones sensitive to peak demands are shown in Figure 15.

Peak demands that cause problems may last as little as a week or as long as several months. In general, the shorter the period, the more extreme the peak is compared to the average.

If on average there is sufficient water, but peaks present a problem, there are several options for companies:

- add flexibility to the system to make it less sensitive to peaks in demand;
- develop new resources to meet peaks in demand;
- manage customer behaviour so that peak demands are reduced.

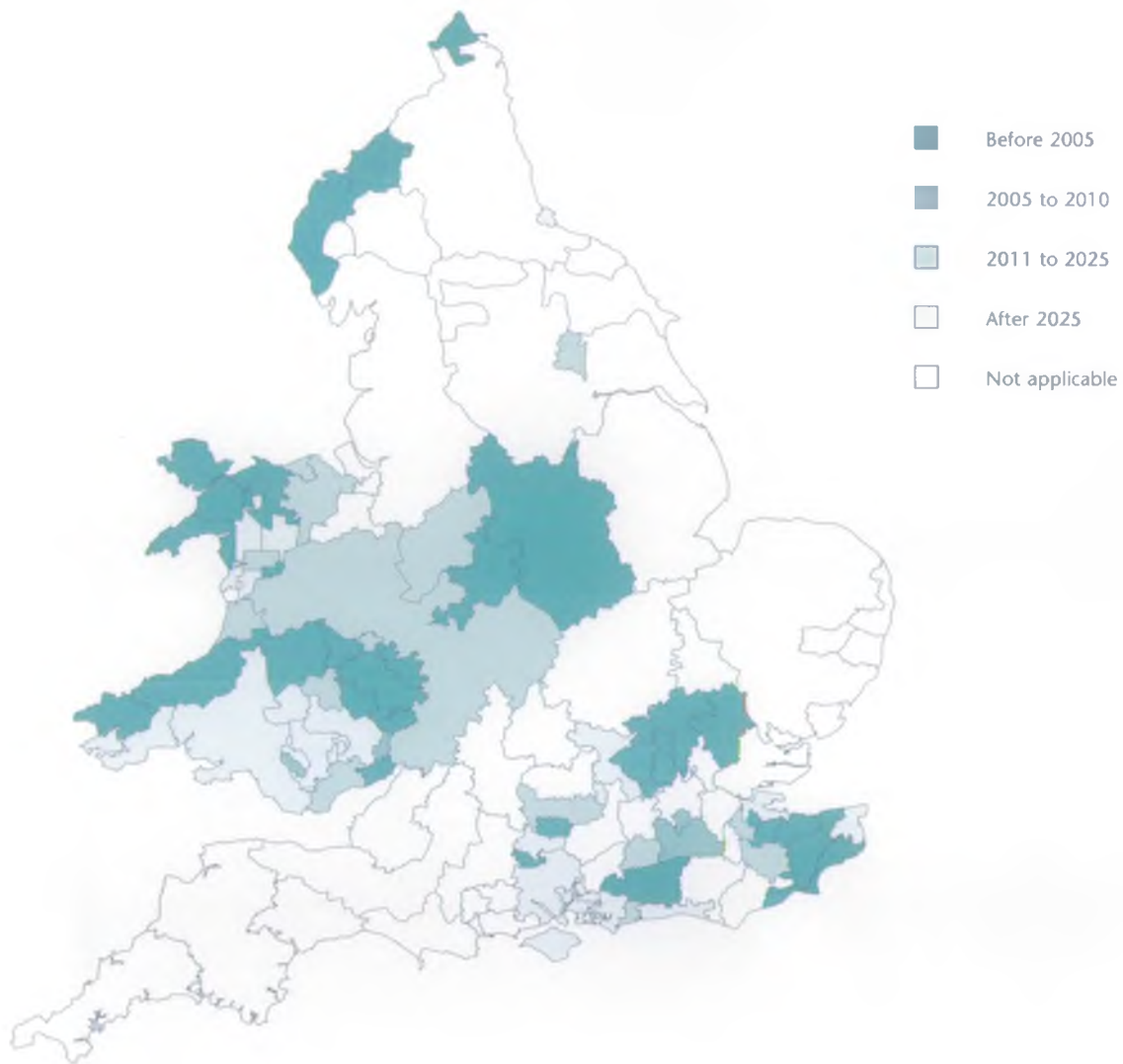
Choosing an appropriate strategy for dealing with peak demands may involve a combination of some of the above. Each will need to be costed and balanced against the impact on the environment and other users. In general, new resource development to deal only with peaks would need to be justified carefully, as this would have an impact on the environment at a time when flows are likely to be lowest. Although resources developed for the purpose of dealing with peak demands would usually be used only for short periods, the resources would not be available to other legitimate users throughout the rest of the year.

Companies have taken a varied approach to dealing with peak demands. Many are proposing resource developments, although some companies have suggested customer and distribution savings.

As long as there is sufficient water available on average, the Agency expects companies to demonstrate that they have explored fully options that involve demand management and enhancements to the distribution network.



Figure 15 Resource zones sensitive to peak demands: date of imbalance



## Summary

This section of the report has looked at companies' predictions of their supply-demand balances and explored the components of any predicted problems. For most companies, the largest component of increased demand is customer water consumption; in other words it is predicted that we will nearly all use more water in our homes in the next 25 years. In the next section of the report we will look at how water companies plan to deal with any shortfalls in supply that this brings.

## 4. Options and solutions

This part of the report looks at potential solutions to any supply-demand imbalance. At this stage solutions put forward by water companies indicate their current proposed way forward, rather than definite answers. These proposals have not been agreed by the Agency. The implementation of precise solutions may depend on external factors. For example, solutions that require infrastructure development may need Ofwat to agree funding. Solutions that involve resource development would need an abstraction licence from the Agency, and the detailed justification that this would involve.

### Options

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The Agency has asked companies to consider options under four headings:

- customer demand reduction;
- reduction of distribution losses;
- reduction of process losses;
- new or increased water resources.

Under each of these headings there are usually many potential options. Some will be more expensive than others, and some will have a greater impact on the environment.

Options that companies can consider include:

- payment-based options (for example metering, metering plus tariff management, introduction of special fees for garden sprinklers and other large uses);
- education and information options (for example advertising, awareness programmes aimed at specific groups, advice on leakage detection and fixing);
- promotion of water-saving devices (for example subsidised appliance exchange programmes, toilet cistern dams, self-closing taps);
- recycling and re-use of water (for example using bath water for toilet flushing);
- waste minimisation projects;
- repairing customers' supply pipes;
- supply network leakage reduction;
- supply network pressure management;
- increased distribution capacity;
- new resources;
- additional storage in the existing system;
- enhanced management of existing resources;
- transfers from other water suppliers;
- desalination and other technological solutions.

## Comparing different options

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We have asked companies to value each option according to the volume of water produced or saved and the cost of the option. This cost includes a preliminary method for assessing the costs to the environment of the option, which may be either negative or positive. For example, a reduction in the amount of water taken from a river will usually produce an environmental benefit. Methods for valuing the environment in this way are open to interpretation, and must be used sensibly. For example, we know that abstraction that would damage an SSSI is not acceptable, whatever the results of the calculations.

Comparing the solutions put forward by companies is difficult. Some have built customer demand management into their baseline forecasts, which makes it difficult to see the strengths of their approaches. Other companies say that reduction in distribution leakage is already set and therefore will have no further part to play in meeting a supply-demand imbalance. Without a proper baseline it is difficult to know whether these proposed reductions in leakage are the best that can be achieved or whether they are the most cost-effective and environmentally sensitive solutions.

## Proposed options

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Almost all companies are suggesting a solution based on the development of additional water resources. In some cases these additional resources are very large. For example, Severn Trent Water and Thames Water are suggesting that the construction of new reservoirs is the only option available to them to meet predicted deficits.

Some companies have separated leakage and customer-based options from their baseline forecasts. Notable further reductions in leakage come from Anglian Water, North West Water, Thames Water and Dee Valley Water, although it should be noted that some other companies are proposing significant reductions in leakage in their baseline forecasts.

Many companies have not presented sufficient detail for the Agency to be sure that all possible options have been considered. In some cases, it appears that only the preferred option has been presented. We do not have enough information to be sure that the option has been chosen because it presents the best combination of additional water and environmental impact. It also appears that some companies have not considered the possibility of a series of options adding up to the necessary total. Instead, they seem to have looked for an option that meets the total shortfall. We believe that many companies need to demonstrate more clearly why their chosen option represents the best combination of value for money and environmental impact.

## Summary

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Solutions to any supply-demand imbalance are very important. With a few exceptions companies have not provided the Agency with sufficient information to be sure that their preferred options have been selected rationally. In particular, in many cases we have not received a clear baseline against which we can compare other options. This is an area which will require more work from water companies and the Agency. We believe that companies must move away from their traditional 'predict and build' approach towards more imaginative sustainable water resources management.



## 5. Management of risk

Water resources management is very closely involved with the management of risk. There are many uncertainties associated with the supply-demand balance. These include:

- uncertainties in the estimation of yield;
- uncertainties in estimating demand;
- uncertainty associated with environmental change including climate change;
- uncertainty in the effectiveness of proposed solutions.

Risk arises both from external influences and from our difficulty in predicting the future. For example, national and even international economic cycles influence industrial demand for water. In some resource zones, this makes demand forecasts particularly uncertain.

This part of the report looks at the management of uncertainty in the supply-demand balance.

### Target headroom

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'Target headroom' is a term used in the water industry to mean the minimum buffer that a prudent water company should allow between supply and demand. Target headroom is intended to deal only with specified uncertainties. The UK water industry recently published a methodology which the Agency subsequently asked companies to follow for their water resources plans.

In broad terms, the uncertainties considered are those associated with supply, demand and climate change. The method is intended to produce an initial estimate of the target headroom required in each resource zone, rather than a definitive solution.

All companies have applied this methodology although some have subsequently adjusted it to produce a lower target than the initially calculated value.

The Agency supports the concept of target headroom: a planning margin to deal with uncertainty is appropriate, given the importance of maintaining public water supply. However, we believe that in the spirit of the headroom methodology, more work would be required to support licence applications aimed at increasing supply for the purpose of achieving a higher target headroom.

### Outage

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Outage refers to a temporary loss of water supply due to planned or unplanned events. Planned events include the maintenance of machinery and equipment while unplanned events are pollution and equipment failure, including power failure.

Outage is deducted from the yield of a resource to give the 'water available for use'. It is reasonable for companies to allow for outage: supply systems cannot be expected to work all the time without maintenance and some unplanned failures are inevitable.

Unfortunately companies have not adopted consistent methods for the calculation of outage. Most have based their figures on historical experience, although some have applied more complex risk analysis. Companies that have high outage figures should give some thought to making their systems more robust. We will be taking this up with individual companies.

## Climate change

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A significant risk for water resources is the problem of potential climate change. While it seems clear that global temperatures are rising, the impact on rainfall and evaporation in Britain is less clear. Some research suggests less rainfall in summer but more in winter, while other work suggests decreased rainfall throughout the year. It is certainly not clear what impact climate change will have on extreme weather events. It seems possible that droughts may be more frequent or more serious, but there is little evidence yet to suggest how these changes will show.

All water companies have done some work on the potential impact of climate change on their resource systems, but without further research on drought severity the results are inevitably of limited value. Some companies have suggested that the best way to deal with the potential impact of climate change is to develop new storage reservoirs. These would buffer the effects of more extreme droughts but potentially at a large cost to the environment.

Whatever the cause of a severe drought, companies must have plans to deal with it. It is clear that customers will no longer accept the possibility of rota cuts or standpipes and all companies are planning to prevent them. Many companies are also planning to have no hosepipe bans or to reduce their frequency. With such policies the only recourse for a company that finds itself in a difficult situation because of drought is an environmental drought order. The Agency is concerned that such orders should not be the only way in which companies manage the risk of extreme droughts. The Agency is also concerned that companies should not develop additional water resources simply to ensure that they can survive through extreme droughts when other measures may be possible.

## Summary

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In this section we have seen that managing uncertainty and risk is an important part of water resources management. Companies have looked at uncertainties and how they relate to the supply-demand balance, outage and potential climate change. The work carried out in all of these areas has been valuable and the Agency will continue to work with companies on these subjects.

## 6. Demand management and water efficiency

We have seen that the greatest change to the supply-demand balance for most water companies is a growth in individual demand. In this part of the report we look at how companies intend to influence customers to use less water.

### Metering

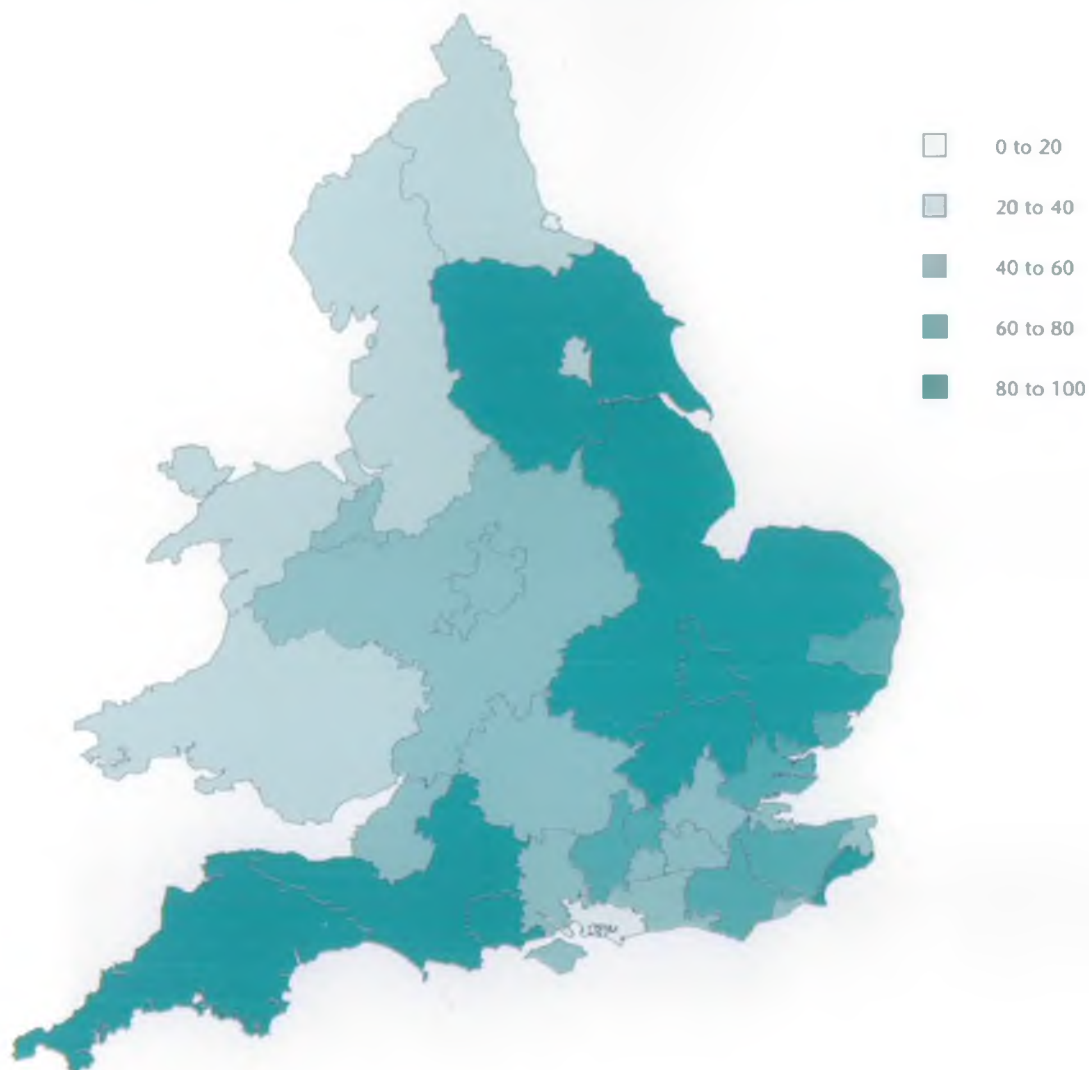
Metering is seen by most water companies as an important way to influence customers. Present levels of domestic metering range from less than one per cent for Portsmouth Water, York Waterworks and Hartlepool Water to more than 30 per cent for Anglian Water (Table 8). All companies are proposing an increase in domestic meter penetration over the next 25 years with Three Valleys Water, Bournemouth and West Hampshire Water, Anglian Water, Folkestone and Dover Water, South West Water and Wessex Water all proposing metering levels of more than 90 per cent by 2025 (Figure 16). Wessex Water plans to reach more than 99 per cent of domestic customers by 2025. In contrast, Portsmouth Water and Hartlepool Water plan to have meter penetration of only four per cent in 2025.

Table 8 Domestic meter penetration (per cent of households) (values provided by water companies)

	Households (%)				
	1998	2000	2005	2010	2025
Anglian	32.3	63.8	89.1	94.6	95.0
Cambridge	22.2	48.4	56.9	64.0	81.4
Essex & Suffolk	19.2	28.2	37.0	47.4	60.5
Tendring Hundred	19.9	41.4	61.9	68.2	73.2
Severn Trent	12.7	21.2	33.4	43.3	57.4
South Staffordshire	7.0	11.9	19.9	25.8	39.6
Yorkshire	12.1	24.3	41.8	62.3	88.7
Northumbrian	2.6	5.3	11.0	19.0	30.0
Hartlepool	0.6	1.8	2.9	3.2	4.2
York	0.9	4.5	8.4	13.1	24.6
North West	6.9	10.1	14.7	20.5	36.8
Folkestone & Dover	22.6	36.5	52.0	69.3	96.3
Southern	13.6	26.9	45.6	47.3	51.9
Mid Kent	10.9	20.3	39.4	54.7	72.8
South East	19.6	29.8	43.0	57.1	76.8
Portsmouth	0.4	0.8	1.4	2.0	3.9
South West	14.0	34.0	69.0	90.0	98.0
Wessex	14.2	27.1	46.1	68.0	99.7
Bristol	9.9	16.1	24.0	32.1	54.7
Bournemouth & West Hampshire	11.0	22.6	45.4	61.0	92.4
Thames	7.9	18.7	27.5	37.7	43.5
Three Valleys	7.8	20.7	44.0	67.1	90.1
Mid Southern	12.2	21.2	30.4	39.3	61.7
North Surrey	11.5	20.7	37.9	58.5	78.4
Sutton & East Surrey	5.9	9.4	16.1	24.0	40.2
Dŵr Cymru	4.9	10.7	24.1	27.5	32.2
Dee Valley	13.4	19.1	24.1	29.8	45.6



Figure 16 Meter penetration by 2025 (per cent of households) (company data)



We note that companies are justifiably uncertain about metering, in view of the Government's consultation paper on water charging (*Water charging in England and Wales – a new approach*, Department of the Environment, Transport and the Regions, March 1998). We understand that Ministers' proposals are due to be published in the next several weeks. We hope that this will limit or reduce this uncertainty for planning purposes.

Most companies have found that metered customers use less water than customers without meters. However, this is at least partly because many of those customers who have chosen to have meters do so because they can save money. It is not certain that the pattern will be so clear when a very high proportion of customers is metered; water is currently relatively cheap and some customers may not see the need to save water. Without tariffs that induce customers to use less water, it is not clear how much water meters will save. Most plans are silent on more progressive tariffs. The Agency believes these should form a basic part of any water resources plan.

Some companies are planning a significant capital investment in metering. We note that in some areas metering may not be the most cost-effective way to save water.

Metering alone may not deliver great savings in water use. However we believe that without metering many water efficiency measures will not be effective. Unless water users can see the savings they are making, they are unlikely to start or continue with efficiency programmes.

## Water efficiency

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Other than metering, we have seen little evidence that many companies are planning major water efficiency programmes. Many companies have already distributed toilet cistern devices and leaflets with bills, but we have seen little further innovation.

Some companies have told us they believe customer water efficiency programmes to be extremely uncertain. They are worried that customers will gradually return to previous patterns of water use, and therefore any savings delivered will be available only for short periods. This does not seem to be supported by the water efficiency projects that have been carried out, where customers have shown enthusiasm and willingness to be involved. By working with customers, companies also have an opportunity to improve customer relations. We believe that there are also further opportunities for some companies to promote water efficiency in commerce and industry, where customers already have meters. Water companies have a statutory duty to promote the efficient use of water by their customers.

## Summary

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Individual water consumption is the greatest component in growth for most water companies, but we have not seen many imaginative options for managing this. Some companies are proposing high levels of household metering, which should deliver some water savings, but these will only be truly effective if they are accompanied by other measures to help customers save water.

## 7. Resource development and sustainability

Most companies have said they will need to develop new water resources to meet supply shortfalls. This section of the report looks at the issues associated with the development of new water resources.

### The 'Twin Track' approach

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Government and the Agency have said that companies should follow a 'Twin Track' approach to managing their future water resources. This means that companies must think about managing customer demand now and in the future, but they must also bring forward timely proposals for resource development where this is appropriate.

The Agency is not opposed to the development of new water resources provided the need is justified and they are designed to have the least possible negative impact on the environment. Sensitive design and careful siting can help to reduce environmental impact, especially if the opportunity is taken to reduce existing abstractions at vulnerable locations.

At this early stage in the planning process, few companies have identified clear resource development options. This is legitimate as major developments need careful justification and investigation before any decisions can be made. In the case of large developments, public inquiries are likely.

### Sustainable water resources

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The Agency believes that water resources must be managed in a sustainable manner. This means that as far as possible any new resource development should cause no irreversible environmental damage. Of course we still need to balance the competing requirements of the environment and abstractors and others who use or value the water environment.

We adopt the following principles when considering how water resources should be managed:

- we will ensure adequate water remains for the environment;
- we will seek a sustainable balance between users' needs and those of the environment;
- we will ensure efficient use of water resources by promoting demand management;
- we will take a long-term view;
- we will take account of the need to maximise economic efficiency.

Any new water resources development must be planned carefully to ensure that it follows these principles. Future schemes must be shown to be necessary, which means the water must be needed and cannot be made available by other measures such as leakage control or demand management. They must be planned from the outset to take account of environmental concerns which would feature prominently in the planning process. Any new licences issued would normally be time-limited to allow the Agency to review the need for the scheme and its environmental impact at regular intervals.



## Summary

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This section has looked at the 'twin track' approach and the relevance of sustainable water resources management. Given the importance of minimising the impact of abstraction on the environment, it is essential that options for using existing water as effectively as possible are explored. At the same time companies may need to plan to develop new resources which must take account of the environmental concerns that would feature prominently in the planning process.

## 8. Issues

This report has shown, in general terms, the way that water companies are planning to manage resources over the next 25 years. It can be seen that planning water resources is a complicated matter, and the Agency will need to discuss many details with individual water companies. However, this report has helped to show some of the general issues that need to be resolved.

### Consistency

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With the exception of Cambridge Water Company, all companies have submitted water resources plans that broadly comply with the Agency's requirements. However, some companies were late with their submissions and others produced incomplete or barely complete work. We believe that some companies treated these water resources plans as a low priority.

The quality and standard of the submissions vary. We have found it particularly difficult to evaluate the impact of company policy on demand forecasts because in many cases a true baseline has not been submitted. Some companies have made great efforts to provide us with this type of information but others have been less forthcoming. All companies must work to reach the standard achieved by the best.

### Future demand for water

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Individual water consumption is one of the most important factors in the supply-demand balance. Current estimates of demand vary greatly even between adjacent companies. Unless we understand such differences, we cannot expect future predictions to be accurate.

Many water companies have carried out detailed studies of household water consumption. Some seem reluctant to share the information they have while others have collected little. Companies must share data with the Agency, Ofwat and each other by regular publication. Those companies with little available data must be encouraged to collect more.

### Household metering and tariffs

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We have seen that companies have vastly different proposals for household metering. Some companies tell us that high levels of metering are not economic, suggesting that meter installation and operation will cost more than the value of water saved.

The Agency welcomes increased levels of metering. Metering will lead to a better understanding of how customers use water and provides the opportunity for customers to understand their own water consumption. Metered charges provide incentives for consumers to economise and will help greatly in the delivery of any water efficiency programmes. These would probably need to be accompanied by imaginative tariffs that benefit customers who would not now be attracted by the option of having a meter. We have seen little evidence of proposals for such tariffs, but these would need to ensure that the issue of those on low incomes is addressed.

In some parts of England and Wales we do not believe that metering will deliver the greatest water savings for the amount of money spent. In some zones, leakage control and pressure management will be more

cost-effective. We would not wish to see companies concentrating effort on promoting metering to the exclusion of all other water-saving measures.

## Water efficiency

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Most companies are proposing very limited water efficiency measures for both households and non-households. We believe that many water efficiency measures can be more effective if metering is in place. If customers can see how much water they are saving, they are likely to continue to do so. Companies also have the opportunity to target high users.

Some companies are planning to promote water efficiency but tell us the savings will be negligible. Pilot water efficiency studies have shown that customers are enthusiastic about water efficiency as long as they are involved. We believe that more water conservation and demand management can be cost-effective for both domestic and industrial customers and that more attention must be paid to this area. Water companies have a statutory duty to promote the efficient use of water by their customers.

## Leakage

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All companies are making progress with leakage control. Comparing companies' leakage totals is difficult and some measures are quite misleading.

The 'economic level of leakage' has attracted much attention. This is the level of leakage where the cost of finding and repairing leaks to save a given volume of water is the same as the cost of supplying that water. This can in principle include environmental and social costs. The value calculated is highly sensitive to assumptions that are not always transparent, such as the cost and success of detailed leakage control policies and the value of water in the environment. Most company assessments of their economic level of leakage are not in the public domain; this stifles debate. Leakage is an important issue that should be discussed widely.

Society expects water companies to continue to reduce leakage. We believe that a long-term view must be taken, and that this must include the value of saving the development of new water resources. It is important for companies to have clear leakage targets and to report on how well these are achieved. We are concerned that some companies with old water mains are replacing them very slowly. We believe that these companies should pursue an active programme of mains replacement in order to reduce the risk of major failure in the longer term.

## Levels of service

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'Levels of service' is the term used to refer to water companies' proposed frequency of restrictions on water supply. It is clear that customers believe rota cuts and standpipes are unacceptable. The Agency agrees with water companies that they should not plan to introduce rota cuts or standpipes even in a repeat of the worst droughts historically experienced.

Around a third of companies tell us they are planning never or almost never to introduce hosepipe bans. We believe this is not acceptable. In the sort of drought that occurs every 10 years or so, hosepipe bans are a successful and effective way of reducing demand for water and therefore reducing stress on the environment.



For a company that has traditionally planned to have hosepipe bans in dry years, achieving the target of 'no hosepipe bans' may mean that extra resource development is sought. This may have a significant environmental impact. We are also concerned that companies may seek environmental drought orders to maintain enhanced levels of customer supply. It is not acceptable to damage the environment to allow garden watering.

Different companies are proposing different frequencies of restrictions. While there are good reasons for some regional differences, we believe that companies competing for or utilising the same resource should offer similar levels of service.

## **Choice of options**

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There are many options to manage the supply-demand balance. Some companies have explored these carefully and presented the results in a useful way. However, many companies have either not presented their analysis or have considered very few options.

Some companies have concentrated mainly on options involving the development of new resources. The Agency believes that new resource development is a legitimate and valuable option, but it must be pursued alongside other measures to use water properly. It seems that some companies are following a traditional and safe approach which minimises risk to the company, but at a potential cost to customers and the environment.

Balancing the cost of options against their impact on the environment is difficult. Intuitively, it is easy to see that an option which damages the environment is less satisfactory than a slightly more expensive option that does less damage. The Agency adopts a precautionary approach and will ensure there is no potentially irreversible environmental damage.

## **Target headroom**

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'Target headroom' is the term given to the margin of resource allowed to take account of uncertainty in the supply - demand balance calculations. The Agency believes that public water supply is important enough to warrant such a margin of safety. However, there are limitations in the existing method and we believe it is only suitable for indicating in general terms the size of an appropriate margin. Other work would be necessary to support licence applications aimed solely at supporting a margin of safety.

## **Bulk supplies**

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Many companies supply water to or receive water from other companies. Such bulk transfers are sometimes a source of concern, with receiving companies fearing donor companies could reduce supply in times when water is scarce. We have seen many examples of companies co-operating well on inter-company transfers, and believe that such concerns are largely unfounded.

Few companies have suggested that bulk supplies should form part of a solution to supply-demand balance problems. The Agency believes that more consideration must be given to bulk supplies as a solution to shortages of water. Companies must work together to look for solutions. They may need to involve Ofwat and the Agency if it is necessary to find mechanisms to reassure companies about security of supply and vulnerability to competition.

## **New households**

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Government forecasts suggests that 4.4 million new households will be required between 1991 and 2016. Water companies are planning for about four million from now to 2025, which is broadly in line with this prediction. Regional and local allocation of housing stock remains contentious and water companies need to work with the Agency and local planning authorities to avoid double-counting between adjacent companies. This is important for proper water resources management.

## **Abstraction that causes environmental damage**

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The Agency is working with English Nature, the Countryside Council for Wales and others to identify sites where legal abstraction causes environmental damage. It is essential that companies plan to protect such sites. It appears that water company plans already incorporate the costs of dealing with the over-abstractions that are affecting the most important sites. We will continue to work to ensure that sites damaged by over-abstraction are restored and protected.

Ongoing investigations may identify other sites where companies will need to reduce abstractions. These may have an impact on future assessment of the supply-demand balance, which reinforces the need for future revisions of plans.

## **Dealing with climate change**

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All companies have carried out some preliminary work on the potential impact of climate change, using work sponsored jointly by water companies and the Agency. This work dealt with possible trends in average summer and winter rainfall in different parts of the country, but did not deal with the possibility of more frequent or more severe droughts. As more research becomes available, we may have a better picture of how to deal with climate change. However, it seems that at present the best response is to ensure resource systems are robust to different events. Companies will need imaginative drought contingency plans to help with this.

Climate change may increase demand for household water use for bathing and garden watering. Companies that have a good understanding of demand will be in a better position to deal with such changes.

## **Critical periods**

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Most water resource systems are designed to deal with short-term peaks in demand from either garden watering or winter bursts as long as there is enough water on average. However, there are some companies or resource zones that find short-term peaks particularly difficult. We understand these problems but urge companies to work to either manage peak demands or, where possible, develop their distribution systems to be robust enough to have longer, less peaked critical periods. This could reduce potential environmental impact in dry periods and will reduce the risk of supply problems in intense droughts.

## Outcome of the Periodic Review by Ofwat

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Some of the proposals put forward by companies appear to depend on Ofwat agreeing that they can be funded. These include metering proposals and many water conservation measures, including proposals for significant leakage control. The rate at which companies embrace water conservation measures is influenced by Ofwat's funding regime and the way this reflects Government policy. If companies are not encouraged in their efforts to use water wisely, we may see proposals for more controversial water resources developments. Ofwat must fully acknowledge the statutory duty of water companies to promote water efficiency.

Some water conservation methods have been built into water company baseline forecasts. The Agency understands this to mean that these measures will be achieved under any funding regime, and we will expect companies to report regularly on progress.

## Publication and openness

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In the *Water Resources Planning Guideline*, we told companies that we expect them to publish their plans or appropriate summaries. We believe that increased transparency and openness in the planning process will result in an improved understanding of the issues by the public and by non-Governmental organisations. We will urge companies to publish their water resources plans and help to inform the debate on these issues. However, the Agency currently has no powers to require this publication.

## Revisions to plans

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Water companies will need to review their plans and revise them as necessary. As time passes, it will be possible to assess the accuracy of predictions: for example, is leakage being reduced at the proposed rate?

The Agency believes that companies should report on progress annually, with new plans being produced every five years, or if there are major changes.

We have not agreed these water resources plans with companies, although we have started to discuss issues with them. After discussions between companies and the Agency and Ofwat, and any ensuing modifications, we expect companies to have agreed plans in place by April 1999. Subsequently, companies will be expected to notify the Agency of any intended significant changes to the main assumptions and framework of the plans.

## Revisions to the Agency's Water Resources Planning Guideline

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The planning guideline issued in August 1997 has been successful in helping water companies produce plans that are more consistent than ever before. However, there remain areas of the planning guideline that could be improved. The Agency intends to produce a revised version of the Guideline in mid-1999 for use in subsequent planning rounds (we do not intend to modify our instructions before this planning round is completed in March 1999). We would welcome ideas and suggestions for improvement and items for inclusion in the planning guideline from Government, Ofwat, water companies and others.



## 9. Conclusions and recommendations

The Agency is pleased to record the significant progress made by companies in producing their draft water resources plans. Many water companies have put much effort into this work, with the result that we have a set of plans more consistent than any ever seen before. Despite this, when we examine the plans as a whole there is a disappointing lack of consistency in some areas. These will need to be addressed before the Agency can agree plans with the companies.

Most companies have proposed further development of water supply to deal with shortfalls. This is a legitimate option but it must be pursued alongside other measures to use water properly. We do not think that all companies have paid sufficient attention to water efficiency and leakage control. In particular, further progress in justifying key assumptions on the demand side is essential to develop confidence comparable with that already achieved for the assessment of the availability of water.

It seems that some companies are following a traditional and safe approach that minimises risk to themselves, but at a potential cost to customers and to the environment. Companies must move away from the 'predict and build' approach to more imaginative, sustainable water resources management.

We recommend that Government should note the progress made by many companies. In considering the draft plans, the Agency has identified the following issues on which we seek and would welcome continuing support from Government:

**1. Water companies must reduce the uncertainty associated with present unmeasured consumption.**

Current estimates of unmeasured individual consumption vary greatly, from 136 to 180 litres per person per day. Few companies have explained the basis for their estimates or compared them with measured consumption and justified the differences. Estimates of unmeasured consumption have an enormous influence on estimates of leakage. Companies must justify their estimates, and improve their transparency.

**2. Water companies must reduce the uncertainty in future estimates of consumption.** There is even more variation in future estimates of measured and unmeasured individual consumption. For example, the range of forecast measured individual consumption in 2025 varies from 125 to 200 litres per person per day. Most companies have provided little explanation of their future estimates, so we cannot identify which estimates are most likely. Companies must share data, models and methods, and must work with the regulators to establish best practice.

**3. Water companies must consider the implications of tariff structures on consumption.** Very few companies have proposed sophisticated tariff structures that will help to enhance the distinction between water used for basic domestic purposes and water used for discretionary purposes, such as garden watering. Tariff structures should be a key element of water resources plans.

**4. Water companies must set targets for the impacts of their water efficiency programmes, and report on progress against them.** Water companies have a statutory duty to promote the efficient use of water by their customers. However, most water resources plans do not reflect the benefits of water efficiency.

**5. Water companies must continue to strive for reduced levels of leakage.** Many companies have not explained the basis of their projected leakage adequately. Very few assessments of the economic level of leakage are in the public domain: they must be published to allow informed debate. Some companies are predicting that they can allow leakage to rise to meet a calculated economic level. It is not acceptable to allow leakage to increase.

**6. Water companies must not rule out the use of hosepipe bans.** About one-third of companies have indicated that they plan never or practically never to use hosepipe bans, while many of the others are proposing to decrease their frequency. Hosepipe bans are an effective demand management measure in times of drought, affect only non-essential use, and avoid environmentally-damaging alternatives. Unless the company can demonstrate an alternative water saving measure for drought conditions, hosepipe bans should not be ruled out.

**7. Water companies must follow the 'twin track' approach enthusiastically, with active measures to manage demand incorporated in their plans and exposed clearly as targets.** Companies must show they are planning to achieve tough leakage targets and have in place rigorous demand management measures before a start on further development can be justified, although they should have plans at the ready. Future demand predictions should be based on positive management.

**8. Water companies must consider sharing supplies of water as one way to make best use of resources.** They must also be prepared to develop resources jointly where this is appropriate.

**9. Water companies must review and update their plans annually, and publish progress against targets.** Revised plans should be agreed with the Agency.

**10. Water companies must consult widely on their plans, and publish them.** Customers must be able to see how companies plan to manage resources.

Government has told the Agency that it expects us to agree water resources plans with water companies, and to use them as the base for our national and regional water resources strategies. To allow us to do this, companies' plans must be robust and complete. This will require companies to attain the ability to forecast demands to a standard comparable to that reached in the assessment of water availability. Until this is achieved, it is not possible to produce a fully satisfactory assessment of the balance between supply and demand.

In our turn, we will seek ways to improve the resource planning framework. We will work with companies to refine, improve and agree the existing plans. We look forward to working with water companies on improved plans in the future.



## MANAGEMENT AND CONTACTS:

The Environment Agency delivers a service to its customers, with the emphasis on authority and accountability at the most local level possible. It aims to be cost-effective and efficient and to offer the best service and value for money.

Head Office is responsible for overall policy and relationships with national bodies including Government.

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