

# FUTURE WATER RESOURCES IN THE THAMES REGION

## A STRATEGY FOR SUSTAINABLE MANAGEMENT

SUMMARY DOCUMENT  
JUNE 1994

*NRA Thames 139*



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# NRA

*National Rivers Authority  
Thames Region*



## INTRODUCTION

Water is so often taken for granted, yet it is probably our most valuable natural resource. Most of the time, we have enough water to meet all needs in England and Wales. The challenge in managing water resources for the south-east of England is to satisfy the reasonable demands of a large population, when the annual rainfall is below the national average. This is particularly the case in the Thames Region, which serves almost a fifth of the nation's population.

In meeting these demands, increasing and often conflicting requirements are made on the water environment. It is the NRA's duty to manage water resources to achieve and maintain the sustainable balance between the needs of the water environment and the demands for water.

We cannot afford to take this precious resource for granted. Against a background of increasing demands for water over the last 30 years and the prospect of increasing demand in the future, we must plan ahead to ensure that water resources are managed effectively and protected for generations to come.

*Future Water Resources In The Thames Region* sets out a strategy for the future planning and sustainable management of water resources to meet the reasonable needs of public water supplies, industry and agriculture in the region. The strategy aims to:

- **sustain the natural resource for future use;**
- **provide a flexible framework for water resources management and development in the region;**
- **secure proper safeguards for the water environment;**
- **identify opportunities to enhance the water environment, particularly in association with new schemes but also to address existing problems such as low flow rivers;**
- **respond to the reasonable expectations of social and economic development.**

## A NATIONAL STRATEGY

In March 1994, the NRA published *Water: Nature's Precious Resource* addressing the future management and development of water resources in England and Wales. A number of key policies and issues were identified:

**SUSTAINABLE DEVELOPMENT** The NRA's main concern is for environmental sustainability. This implies that there should be no long-term systematic deterioration of the water environment owing to water resources development or water use. New water resource schemes should benefit and protect the water environment for the use of future generations.

**PRECAUTIONARY PRINCIPLE** Where significant environmental change may occur, but our understanding of the issues is incomplete, any decisions made and measures implemented to control or mitigate change should err on the side of caution.

**MANAGING DEMAND** Demand on water resources can be managed by measures to minimise losses, for example through leakage from distribution systems, and by improved efficiency in water use. These measures together can offset the need for large-scale water resource developments over the next 20 years or so.

**NEW SCHEMES** Where practicable, the redistribution of water resources rather than the development of new sources should be sought. New schemes should lead to improvements in the water environment and meet the needs of a wide range of interests, while protecting and improving the quality of water resources. The early planning of major new schemes is necessary because of the uncertainties in forecasting future demand for water, to provide more time to assess their potential environmental impacts and make sure their design is the best possible.

The Thames Region was seen as central to the development of a national strategy for water resources having by far the greatest potential need for new water resources in the future. A key issue for the Region, therefore, is to establish a firm position on the choice between the leading scheme options whilst fully exploring the scope for minimising overall demand increases.



*The water environment: The River Kennet*

## FOCUS ON THAMES REGION

The Thames is one of the most intensively managed catchments in the world, supporting a population of 11.5 million and satisfying the pressures on water resources for public supplies, industry, agriculture, navigation and recreation. These pressures must be balanced against the need to maintain and improve the water environment.

We face a host of challenges unique in the UK, if sustainable development is to be achieved:

**MEETING DEMANDS** In supporting a fifth of the nation's population, each day approximately 4700 Ml (million litres) are abstracted from the region's rivers and groundwaters for use in the home, in industry and agriculture. We use more of the rain which goes to fill our rivers and groundwaters than any other region in the country. Water resources are sustained by a significant amount of re-use of water, taking advantage of the return to rivers of highly treated effluent from several hundred sewage treatment works and the natural purification capacity of our rivers.

**ALLEVIATION OF LOW RIVER FLOWS** Of the twenty low flow rivers which have been nationally identified as top priority, five are within the Thames Region and another, the River Darent, is closely linked with the London supply system. Work on the design and implementation of schemes to improve the flow and ecology of these rivers is progressing in co-operation with the relevant water companies. Concerns about a number of other rivers across the region are also being investigated.



*Water Supply, London*

**MANAGING DROUGHT** Droughts are a natural phenomenon resulting from long periods of low rainfall. In most of the region, water resource systems have been developed to maintain water supplies during all but the most severe droughts. Planning to meet all water use throughout the worst conceivable drought would be unrealistic; there is a balance between maintaining environmental requirements, maintaining essential supplies and the imposition of restrictions on some uses. Many people in the region were affected by supply restrictions of varying severity as a result of the drought between 1989 and 1992.

**ECONOMIC DEVELOPMENT** The region has seen continuing growth in housing and commercial development and mineral extraction increasing pressure on land use, water resources and the water environment generally. The provision of new water resources can have a critical impact on the timing and viability of local authority plans for development.

*Future Water Resources In The Thames Region* provides a regional focus on the issues raised by the national review, reflecting current views of water resources in the region and providing a strategy for the sustainable management of the region's resources to meet future demands.



*Alleviation of low river flows The River Pang*

## TRENDS IN WATER USE

The vast majority of water abstracted in the Region is used for public water supply (78.7%), the remainder being used for industry and power generation and agriculture, including spray irrigation as shown in Figure 1. Almost 60% of the water for public supplies comes from surface water resources, mainly from the Rivers Thames and Lee in association with the major surface storage reservoirs around London.

The key factors which have influenced water demand are:

- the use of water in the home and in the garden;
- losses through leakage from distribution systems and consumers' plumbing;
- population growth and household size;
- development pressures and economic activity.

The trend in growth in demand has been significantly reduced over recent years. Improvements by the water companies in controlling losses, a decline in economic activity within the region and the lasting effects of publicity and awareness of water use issues following the recent drought have all led to a dramatic decline in demand since 1989. Water company forecasts of demand now indicate a trend of less than 0.3% growth in demand each year.

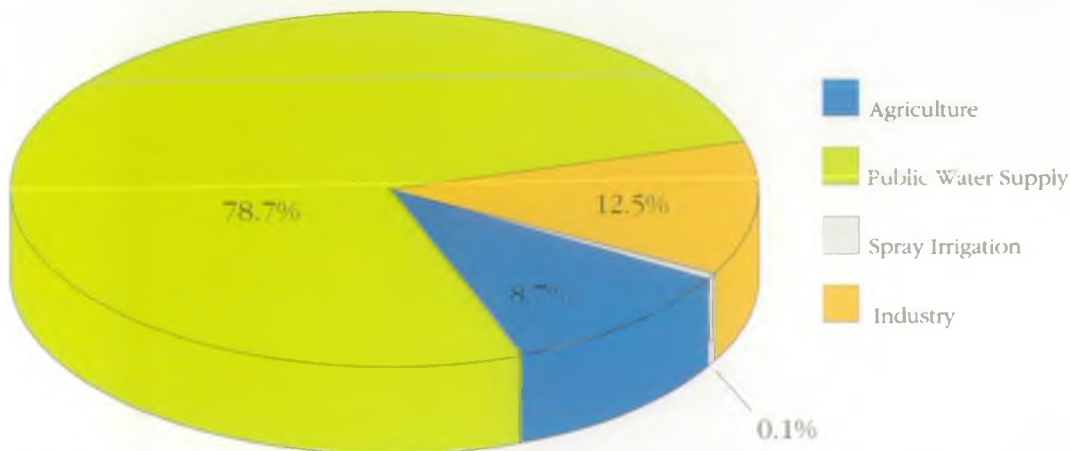


Figure 1. Water use in the Thames Region

Currently, we use an average of 150 litres each per day in the home, the majority of which is used to flush toilets, take baths and showers and use the washing machine (Figure 2). Only a small proportion of our water use annually is used for garden watering, although in the summer, especially under hot dry conditions, this can have a significant effect on the daily demand. Water use in the home accounts for 45% of the total public water supply demand. A further 27% of the public water supply demand is used by industry and commerce. The remainder, 28% across the region, is lost mainly through leakage from distribution and trunk mains systems, and supply pipes on customer premises.

Over the last twenty years or so, demand for public water supplies has increased by approximately 1.7% each year and until recently that trend was expected to continue.



## MANAGING FUTURE DEMANDS

If we can successfully 'manage' future demands for water, it will be possible to delay the need for major new strategic water resource schemes and perhaps avoid them altogether for the foreseeable future.

Managing the growth in demand will require a combination of methods which will involve us all.

**LEAKAGE CONTROL** It is essential that water companies do all they can to reduce the level of water lost in the region through leaks in their distribution systems.

**METERING** The use of domestic metering, with an appropriate tariff, in areas where resources are under pressure may encourage greater water efficiency and aid the control of leakage, particularly from consumers plumbing. However, even selective metering can be



expensive and long term savings in demand cannot be guaranteed although growth in demand may be reduced. Water companies will be required to provide an assessment of the economics and benefits of metering (including those to the water environment) against major new resource development prior to the consideration of any new abstraction licence.

**WATER EFFICIENCY** Large quantities of water can be used unnecessarily in the home, for example by taps left running or by the unnecessary use of hosepipes and sprinklers. Improved awareness of, and attention to, water use efficiency in the home and at work will lead to many savings. Many water efficient appliances are now available such as low water use washing machines, low flush toilet cisterns and water-wise gardening products.

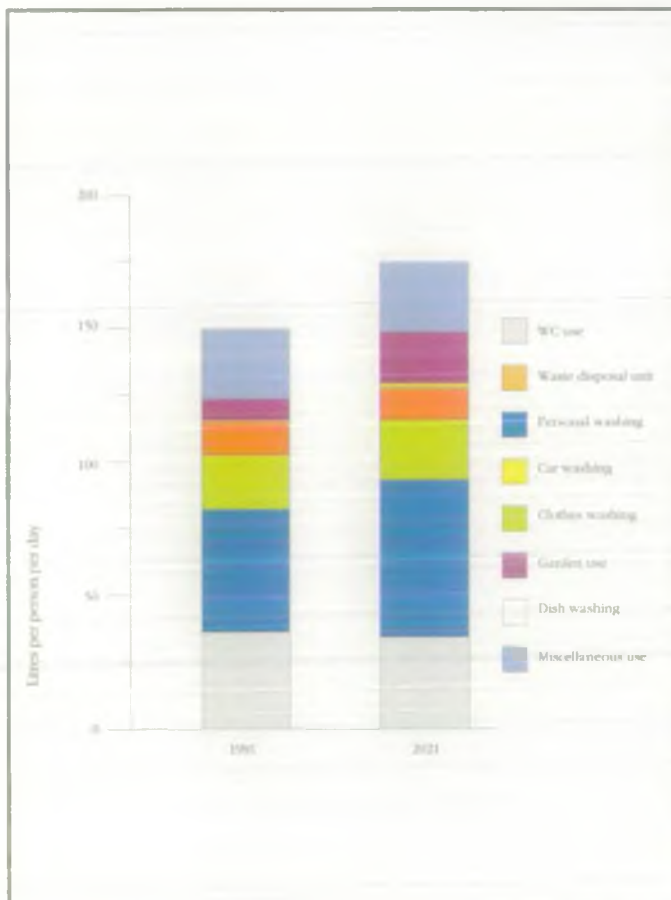


Figure 2. Water use in the home.

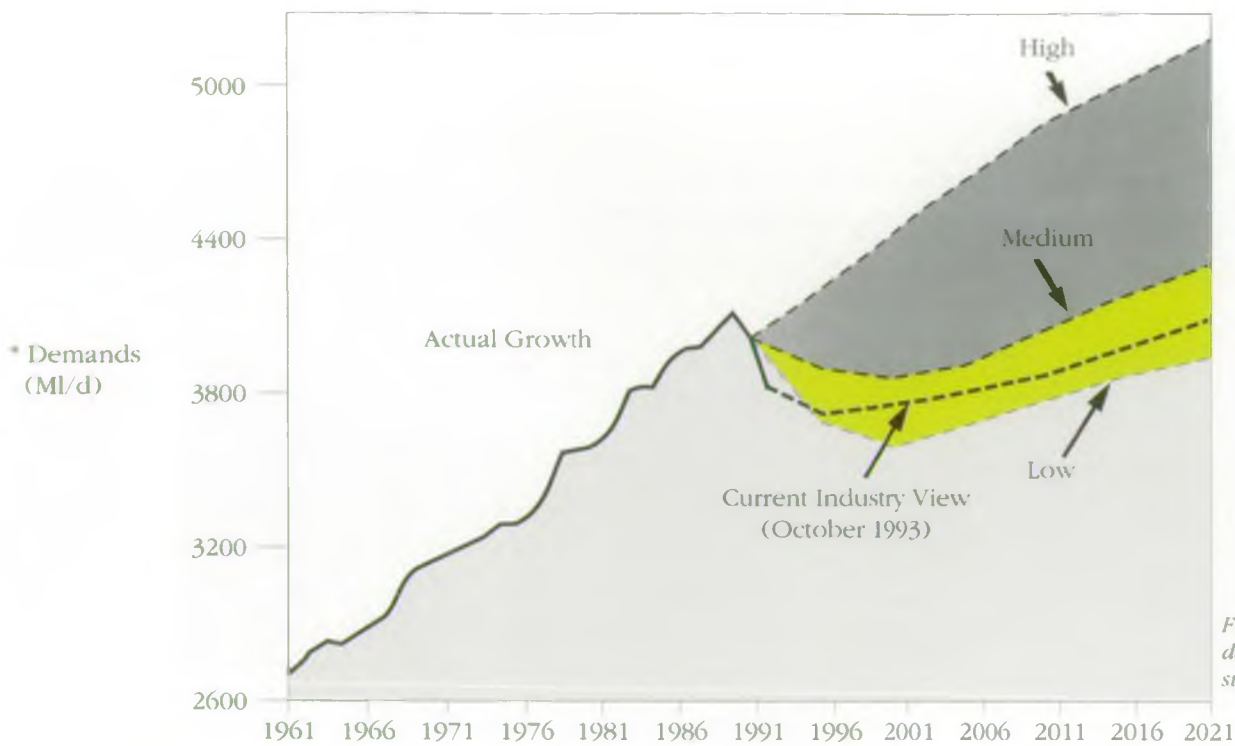


Figure 3. Supply and demand for public water supply 1961 - 2021

#### DEMAND SCENARIOS

In forming its strategy, the NRA has recognised the uncertainties of predicting how different trends in water use may influence demand in the longer term. The strategy also recognises the scope for managing growth in demand, for example through the effectiveness of leakage control.

In securing wise use of water resources, it is essential that all practical steps are taken to increase our efficiency in water use before major new water resource schemes are promoted. With this in mind, the NRA has consulted with the six water companies and others within the Thames Region to produce three scenarios of potential future growth in demand for public water supplies (Figure 3):

**HIGH** growth in demand assuming relatively high rates of growth in domestic and commercial/industrial consumption and no (or negligible) increase in current demand management activity.

**MEDIUM** growth in demand assuming a moderate growth in domestic and commercial/industrial consumption, limited domestic metering and reduced leakage.

**LOW** growth in demand assuming moderate growth in domestic consumption, no increase in commercial/industrial consumption, moderate domestic metering and further reduced leakage.

The range in demand over the next 30 years between these three scenarios illustrates how growth in demand can be limited, particularly through controlling losses through leakage. The water companies' own estimates fall between the NRA Low and Medium scenarios.

#### INDUSTRY, AGRICULTURE AND OTHER DEMANDS



Most industrial/commercial water use is already supplied by the public water supply companies. However, there is also a wide range of industrial use from private boreholes within the region, including sand and gravel washing, direct manufacturing industry and power generation. Growth in demand in these uses is expected to be limited or even to decline. This is because patterns of use are changing,

companies are becoming increasingly aware of water efficiency and opportunities for recycling, and the number of companies transferring to public water supplies continues to increase.

Future agricultural demand for water is expected to depend mainly on changes to agricultural policy. Recent research undertaken for the NRA indicates that for this region there are likely to be only minor increases in spray irrigation demands and that, in general, agricultural use is unlikely to increase significantly.

The restoration of disused canals may become a pressure on water resources. There are a number of restoration projects that are currently being progressed in the region which may benefit from the development of major new water resource schemes which are described below.



\* ML/d Meagalitres per day or millions of litres per day

**RESOURCE - DEMAND BALANCE**

Comparing the three demand scenarios (High, Medium, Low) with the yields of existing and planned resources provides an indication of the scale of future need for water resources within the region (Figure 4). This takes into account possible schemes which are currently being planned or which are likely to have an impact on the future availability of water resources, such as improvements to rivers with low flow problems; the potential resources from 'planned' local schemes; and, an allowance for the possible operational failure of sources.

Focusing on the LOW and MEDIUM demand scenarios, the need for new resource development can be significantly delayed or avoided altogether by the successful implementation of demand management, especially leakage control. There is unlikely to be a need for major new water resource schemes under the LOW scenario, although some development to meet local needs may be required. The strategic development of major new schemes is likely towards the end of the planning period (2016 - 2021) under the MEDIUM scenario. In this instance, the key areas which may require the



development of new strategic schemes include the Upper Thames area and the London supply area.

The strategy recognises that there may be local 'pressure points', for example in the Kennet catchment, which can be masked in this regional analysis but which may require local or 'tactical' development of water resources. A number of potential schemes which require further investigations are described in the strategy.

Recent experience of the promotion of major new water resource schemes indicates that it can take up to 15 to 20 years from starting feasibility studies to full commissioning of a major new scheme. Should the trend in demand for water follow that envisaged under the MEDIUM (or HIGH) scenario, the planning of schemes required towards 2016 must begin now.

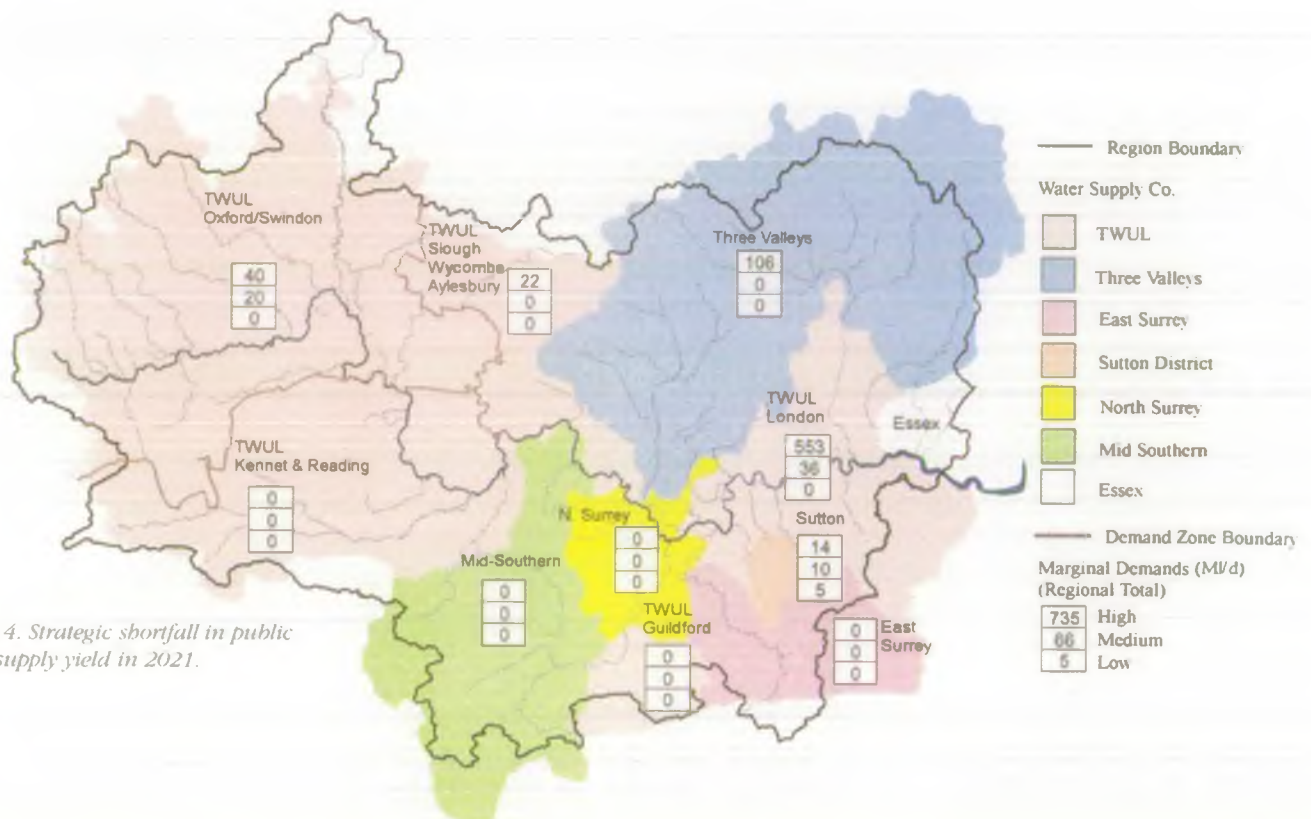


Figure 4. Strategic shortfall in public water supply yield in 2021.

## LOCAL OR 'TACTICAL' RESOURCE DEVELOPMENTS

In addition to managing growth in demand, the NRA need to be sure that the best use is being made of existing licensed resources. This might include re-allocating any spare capacity from existing sources or improving the flexibility with which different resources can be used, particularly during droughts. Nevertheless, some local water resource developments may still be required. The strategy identifies a number of potential local schemes throughout the area, together with the need for further investigations. These investigations include detailed environmental studies and impact assessments. In most cases, new abstraction would be limited by the requirements to protect river flows or groundwater levels. Where practicable, the NRA will try to ensure that water abstracted is used and returned as highly treated effluent to the river upstream of the point of abstraction in order to sustain and protect water resources.

Potential local developments include:

## LOWER AND MIDDLE KENNET Thames Water Utilities Ltd

- The "conjunctive use" of some existing licensed sources involves 'managing' abstractions from a group of sources to produce a larger overall resource than would be provided if each source was used individually. The two groups of sources supplying Newbury and Reading could potentially be operated in this way.
- Possible local use of the West Berkshire Groundwater Scheme to support river flows and allow increased abstraction from some existing sources serving Newbury and Reading.
- Development of emergency resource provision for the Reading area which currently relies on unsupported river abstractions from the River Kennet.
- In the longer-term, if required, possible artificial recharge of groundwater.

These four options could be combined in various ways.

## RIVERSIDE GROUNDWATER (Middle Thames) Thames Water Utilities Ltd

- New abstraction from the chalk aquifer close to the River Thames is possible at a number of locations. With appropriate licence constraints this would not result in undesirable environmental impacts. A number of possible sites are being investigated at Remenham, West Marlow, Harpsden and Reading. Increased abstraction at Medmenham will be used to compensate for reduced abstraction in the Misbourne catchment to alleviate low flows.



*Balancing demands on the environment*

## NORTH DOWNS East Surrey & Sutton District Water Companies

- The opportunities in this area are limited. With appropriate environmental protection measures, small increases in average and daily abstractions may be feasible at some sources supplying the East Surrey area and, potentially, at the margins of the London Basin to supply Sutton District Water. Additional new demands would otherwise have to be met through arrangements using the large reservoirs managed by Thames Water Utilities.

## MIDDLE & LOWER COLNE Three Valleys Water Services

- Limited groundwater development is currently being investigated in this area to replace other water company abstractions which have been identified as contributing to low flows on the River Misbourne.

## STRATEGIC SCHEMES TO MEET FUTURE NEEDS

Under the LOW demand scenario, the development of major new schemes would not be needed. Meeting future demands under the MEDIUM scenario, however, especially in the Greater London and Upper Thames areas, is likely to result in the development of some strategic schemes to meet demands towards 2021. Some strategic schemes are already being investigated within the region, for example Thames Water Utilities' proposed reservoir development in south-west Oxfordshire and a possible inter-regional transfer. Others are being developed or are currently under investigation, for example schemes to artificially recharge groundwater in the London Basin.

**A key issue for the Region is to establish a firm position on the choice between the leading strategic options.**

Each scheme will need to be judged against the key sustainability criteria (which include environmental, social and economic factors) in addition to further considerations of engineering feasibility.

There are a number of environmental concerns regarding each of the main options, principally related to the potential impacts of flow and water quality changes on the environmental quality of the Region's rivers. The Region has already begun studies to establish the current environmental conditions of the River Thames in those areas potentially affected by the development of these schemes and of the range of impacts, including benefits, that may result from their development and operation.





Figure 5. Resource development options

#### LONDON BASIN GROUNDWATER

During the early part of the century, water levels in the aquifer in North and Central London fell owing to over-abstraction leaving a large volume of empty aquifer. Since the 1940s, abstractions have decreased so that in most parts of London, but especially the central area, water levels are now rising. Methods to utilise these conditions to increase resources include the following:

- Schemes to replenish the aquifer artificially during times of surplus (typically during winter months) through a network of boreholes to increase the quantity of water available from the aquifer particularly during hot, dry summers. Schemes in North London are now almost complete. A similar scheme in South London is currently being investigated.
- The possible benefit to water resources of controlling rising groundwater levels under Central London. The practicabilities of utilising this resource require further investigation by the NRA and Thames Water Utilities.

#### A RESERVOIR IN SOUTH-WEST OXFORDSHIRE

The proposed scheme would rely on water being abstracted from the River Thames during times of high flows. The scheme would be used directly to supply the Upper Thames area and indirectly to supply London via the release of water (augmentation) to the River Thames. More recently, this proposal has been deferred by Thames Water Utilities owing to the success of leakage control and demand management along with a significant downturn in commercial demand for water.

A scheme of the size originally proposed, to contain up to 150 million cubic metres of water, could clearly have adverse environmental impacts. There could also be a number of benefits. A clear attraction in water resource terms is the additional security of resources gained from the storage and use of normally available winter river flows from within the catchment. The key water environment issues for this scheme include:

- Impacts on-site:
  - potential pollution risks during construction;
  - effects of the development on land drainage and flood risk;

- the need to divert water courses;
- possible effects on groundwater and local catchments through leakage of stored water.

- Effects of operation:

The physical, chemical and ecological implications of abstraction and augmentation on the River Thames and its associated environment.

- establishing reservoir water quality and management practices to control the discharge of algae, oxygen-poor water or water of a different temperature into the river at times of low flow.

- establishing environmental limits to possible abstraction and augmentation management.

- The potential benefits which may be gained through flexible operation of the reservoir in association with existing water resources.

Many impacts could be mitigated through forward planning. Early planting to establish the overall landscaping character during initial construction should be considered. There may also be opportunities to enhance local watercourses and potentially, rehabilitate the Wilts-Berks canal.

## TRANSFERS FROM RIVER SEVERN

Schemes to transfer water from the lower River Severn to the Thames Region have been raised a number of times in the past. Options currently being considered include a transfer either directly from river to river or via reservoir storage. Transfer routes could make use of restored canals in addition to pipelines.

The NRA Thames Region has identified a number of investigations to establish the environmental and engineering feasibility of this scheme. These include investigations of the following:

- the physical, chemical and ecological implications of transferring and mixing water from the River Severn into the River Thames;
- the security of supply during periods of naturally low flows;
- the infrastructure and water treatment implications, costs and feasibility of an inter-basin transfer of different river water qualities;
- the potential need for additional reservoir storage in Wales, and regulation of the River Severn and the associated environmental impacts.

Because of these concerns the NRA will be undertaking investigations into possible transfers direct to supply or via reservoir storage within the Region.



## TRANSFERS FROM ANGLIAN REGION

Investigations into additional reservoir storage in the Anglian Region are currently being carried out. These schemes could, if appropriate, not only provide security to meet forecast demands in the Anglian Region but also support a transfer of water to the Thames Region. If feasible, this option might minimise the total reservoir development in the South-East of England. However, a full environmental, financial and engineering appraisal will need to be undertaken with the co-operation of those water companies concerned including the possible implications and benefits of river to river transfer into the Thames Region.

The provision of additional water resources in the Anglian Region may provide an opportunity to review existing exports of water from the Thames Region into the Anglian Region.

## RE-USE OF WATER

Indirect re-use of water is already widely practised within the Thames Region by virtue of the geography of the River Thames. Most surface water abstraction from the River Thames occurs near its downstream (freshwater) limit and relies to a large extent on the return to rivers of highly treated effluent upstream. Further opportunities for re-use may be feasible including:

- recycling by industry and power generation;
- possible 'grey water' use (water which may be recycled or treated to a lower level than drinking water). For example, use for toilet flushing or outside uses (car washes, parks, sports grounds and irrigation);
- the use of high grade treated effluent to supplement existing water resources available to London which would otherwise be discharged to tidal waters.

The feasibility of further re-use depends on a number of factors, principally the achievement of treatment standards to meet drinking water and public health requirements, and the provision of adequate environmental protection to rivers.



## PLANNING FOR UNCERTAINTY

The NRA recognises the need for flexibility in its strategy for water resource development in order to respond to the risks and uncertainty associated with changes in demand, available resources and environmental processes. The main areas of uncertainty are:

- the extent to which leakage control can offset growth in demand in the long-term;
- the effects of land use planning, development and economic activity on demand for water;
- the resilience of water supply systems during future drought events;
- the risk of pollution leading to reduced availability of water resources;
- the potential effects of climate change;
- the environmental acceptability of any new water resource schemes.

It is essential that investigations into the key features of the principal strategic options begin immediately, because of the long time it can take to promote and develop large water resource schemes. The results of these investigations will help to minimise work on schemes which might never be required and avoid unnecessary planning blight.

## THE WAY FORWARD

The provision of water resources to secure public water supplies and their efficient use are key issues facing this region. The successful implementation of demand management strategies and the promotion of water use efficiency are essential elements of the NRA strategy for the sustainable management of water resources. The extent to which leakage from mains can be controlled or growth in demand 'managed' is critical to the need and timing of any further major strategic water resource development.

The NRA Thames Region recognises these uncertainties, together with the time needed to promote major new schemes and the scale of potential environmental impacts. The region has identified investigations to establish a position on each of the key water resource development options and is committed to completing most of them over the next five years. During this time and in co-operation with others, we intend to:



- identify further opportunities for the sustainable management of water resources;
- monitor and review the extent to which demand management measures can curtail the need for new water resource developments for public water supply;
- continue challenging the water companies to improve the efficiency of their distribution systems within acceptable economic and practical limits;
- promote water efficiency and raise awareness of water resources and issues affecting the water environment of the Thames Region;
- monitor and review the need for additional water resources to meet non-public water supply demands;
- establish the environmental acceptability, benefits and risks associated with each of the strategic and local water resource development options;
- establish the Region's preferred strategy for long-term water resource scheme development should any new resources be required.

*This strategy will be reviewed and built upon as new information becomes available, in order to ensure the security of water supplies and a healthy, sustainable water environment for the Thames Region.*



*'Future Water Resources In The Thames Region' reflects current views of water resources in the Thames Region and will be reviewed in the light of future trends in demand and the outcome of resource investigations. It has been issued to major abstractors, organisations representing water users, planning authorities, regulatory and advisory agencies and others with legitimate interest in the water resources and the water environment of the Thames Region. Your views on the document and the key issues raised would be welcome and should be sent to:*

**Dr Brian Arkell, Principal Water Resources Planner, National Rivers Authority**  
Thames Region, Kings Meadow House  
Kings Meadow Road, Reading RG1 8DQ.

## DID YOU KNOW . . .

1. On average Thames Region gets 704mm of rainfall each year. However, two thirds evaporates back to the atmosphere or is used by plants.
2. On average, a person in the Thames Region uses seventeen times more water than a person in a developing country ; but only half that used in Switzerland.
3. About 4800 million litres of water is abstracted from rivers and ground water sources each day. Approximately 80% of this is used in public supply.

4. On average, only 4% of household water use is for gardening. However, during dry summer months it can be more than 30%.
5. A leaking tap which drips once every second wastes about 13 litres a day or 500 buckets full a year.

6. A garden sprinkler can use as much in one hour as a family of four uses in one day.
7. If you need to water your lawn during a dry summer, water it well, but infrequently, to encourage deeper rooting. Water gardens in the early morning or late evening when it is cool to reduce the amount of water lost through evaporation and prevent scorching of plants.
8. Only 3% of household consumption is for drinking use.



9. By turning off the tap when brushing your teeth you could save a minimum of 5 litres of water.

10. To brew one pint of beer takes eight pints of water.

11. It takes 30,000 litres of water to build the average car.

12. About 30% of water put into public supply is lost through leaks.

13. Water can be conserved by using a water butt to collect rain water off your house or shed roof. Many plants grow better when they are watered with rain water.

14. Most gulleys and roof drains connect to rivers and streams, so do not pour oil or chemicals down them.

15. One bath can use as much water as three showers.

16. On average, one third of all water used in the home is for flushing toilets. New water efficient models can save up to 6% of a typical households water.

17. Water efficient dishwashers, washing machines and WC cisterns are available. Look out for new 'eco-labels'

18. It takes about 36 litres of water to grow a tomato.



National Rivers Authority - Thames Region, Kings Meadow House,  
Kings Meadow Road, Reading RG1 8DQ Telephone: (0734) 535000 Fax: (0734) 500388

Water use facts gathered with the help of Thames Water, Water Aid and WSA Illustration by Lee Barrett

