Geo Factsheet

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WATER DEVELOPMENT OPTIONS IN OXFORDSHIRE

In 1996 the Chairman of Ofwat stated

'Water is a renewable resource but is also a diminishing resource, in that additional resources are disproportionately costly in financial and environmental terms. Demand needs to be managed, or else it may outstrip supply. Reductions in average household size, rising living standards and the increasing trend towards garden watering and the use of water for recreational purposes, have contributed to the increased water consumption by households. On the other hand, water-using appliances are becoming more efficient, and industrial water use has fallen.'

Over the last ten years the demand for water has increased while the supply of water has become less reliable. How then is the need for more water being addressed in Oxfordshire?

The national scene

In the UK there is a surplus or over-supply of water in the north and west of the country and a shortage of water in the south and east. This is especially true in the Thames Region which serves almost a fifth of the nation's population. This pattern is likely to intensify as a result of climatic change *(Fig. 1)*. It will become increasingly important to maintain a balance between the demands for water and the supply and development of new water resources. For example, in May 2007, the Environment Agency reported that south-east and eastern England had received no more than 2mm of rain in April, about 5% of the average. River flows and reservoir levels had also started to decline earlier than expected. Some stream support systems have been turned on earlier than normal.

Fig. 1 Future climate in the south-east.

By 2050 London's climate will be similar to that of Bordeaux today. The south and east of the UK will become hotter and drier whereas the north and west of the country will become wetter with more frequent flooding. Average UK temperatures will rise from 9°C to 10.6°C, and global sea-levels will rise by about 35cm. This will cause problems in low lying coastal areas as well as for groundwater in coastal areas.

There are a number of implications of these changes:

- *tourism and recreation will increase*
- *farming in upland areas will become more profitable*
- *farming in lowland areas will be subjected to more soil erosion and decreased yields*
- *climatic zones will move northwards by approximately 300km*
- *increased drought will, lead to increased building subsidence*
- *there will be more storms and flooding*

Any strategy for water resources needs should include the following issues:

- ***Sustainable development*** - there should be no long-term systematic deterioration of the water environment owing to water resources development or water use.
- ***Precautionary principle*** - where significant environmental change may occur, but understanding of the issues is incomplete, decisions made or measures implemented should err on the side of caution
- ***Managing demand*** - demand on water resources can be managed by measures to minimise leaks and losses and by improved efficiency in water use.

In the Thames Region the strategy for planning and sustainable management of water resources *(Fig. 2)* by the Environment Agency (EA) aims to:

- sustain the natural resource for future use
- 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 reasonable expectations of social and economic development.

Fig. 2 Guidance for development plans.

Where development would lead to a risk of water resources further allocations of land should normally be resisted until adequate resources can be made available.

Current sustainability principles for water resources:

i) There should be no long term deterioration of the water environment resulting from water use or water resources for future use

ii) Reasonable demands for water from both existing and new social and economic development should be satisfied

iii) Priority should be given to the management of water demand, and to ensure the best use is being made of existing resources. Only if additional water resources are still required will new water resource development be considered

iv) In managing water resources, opportunities to enhance the water environment should be identified

Water resources in the Thames Region

The succession of hot summers in the 1990s and early 2000s heightened the awareness of water resources in the UK. The hosepipe ban from 2006-07 was the first since 1976 and there were very low water levels in many of the region's reservoirs. in 2006, Bewl water was operating at less than 50% capacity for much of the year. Nevertheless, there should be sufficient water to meet the planned level of growth in most areas across the region in the near future. However, there remain a number of uncertainties in forecasting demand over the next 20-30 years.

The Thames Region comprises the main drainage basins of the Thames and its tributaries. It is the most developed part of the UK, with a population of about 12 million. It covers an area of over 13,000 km^2. Planning is not made easy by the fourteen counties, 58 district councils and 33 local planning authorities that make up the region. The Region comprises the main drainage basin of the River Thames and its tributaries such as the Colne, Lee, Kennet, Wey and Loddon. Much of the region, particularly in the west is rural in character, where the dominant land use is farming. The River Thames and its tributaries are a vital feature of the physical and human landscape: they are important commercial channels, water supply systems, recreation facilities and supports high levels of ecological diversity.

There are considerable development pressures in the region, and these are likely to increase in the future *(Fig. 3)* Growth in housing and infrastructure creates additional pressures on the water environment and water resources. For example in the Thames Region there is a need for more new housing, for development of derelict sites, for mineral extraction, flood defences, a supply of safe drinking water and sustained agricultural yields. Geologically, the area contains much chalk, limestone, sand and gravel, which creates pressure for mineral extraction. In May 2007 the government announced that it was investigating the development of two nuclear power stations in Oxfordshire - one at Didcot to replace the existing coal-burning power station, and one at the Harwell Nuclear laboratories to the south of Oxford. Either of these developments would require large amounts of water for cooling purposes.

Fig. 3 The Thames Region factfile

- The Thames Region is one of the most **intensively managed** catchments in the world.
- **Meeting demand** - every day approximately 4700ML are abstracted from the region's rivers and groundwater.
- **Alleviation of low flow** - of the twenty low flow rivers which have nationally identified as top priority, five are within the Thames Region and another, the River Darent, is closely linked with the London supply system.
- **Economic development** - the region has seen continued growth in housing and commercial development and mineral extraction increasing pressure on land use, water resources and the water environment generally.
- **Water falling in the Cotswolds can be used up to eight times** before it reaches the Thames Estuary.

Trends in water use

The vast majority of water abstracted in the Thames Region is for drinking water supply. Almost 60% of the water for public supplies comes from surface water supplies, mainly from the Thames and the Lee in association with the major surface storage reservoirs around London.

Water use in the home accounts for 45% of the total public water supply demand. A further 27% of the public water supply is used by industry and commerce. The remainder, 28% across the region, is lost through leakage from distribution and trunk mains systems, and supply pipes on customer premises.

Over the last twenty years demand for public water supplies has increased by approximately 1.7% each year. The key factors which have influenced demand are:

- the use of water in the home and garden
- losses through leakage from distribution systems and consumers plumbing
- population growth and household size
- development pressure and economic activity
- changes in economic activity such as the decline of manufacturing industry and the growth of services *(Fig. 4)*.

The trend in growth of demand has been significantly reduced in recent years owing to improvements by water companies in controlling losses, a decline in economic activity within the region and increased awareness and publicity over drought related issues.

Fig. 4 Factors affecting water demand

The main areas of uncertainty regarding water demand and supply are:

- *land use planning*
- *resilience of water supply system*
- *climatic change*
- *environmental acceptability of any new water resource scheme*
- *changing patterns of development*
- *uptake of household appliances and levels of ownership*
- *gardening habits*
- *population growth and household size*
- *levels of economic activity*
- *the methods of charging for water and the price level adopted*
- *the effectiveness of demand management measures, particularly control of losses through leakage*
- *agricultural change*

Groundwater resources

The importance of groundwater in the Thames Region cannot be underestimated. There are hundreds of private, domestic and commercial boreholes and springs in daily use. The total volume of groundwater licensed for abstraction amounts to over 2305 million litres/day of which about 85% is used for potable supply. Water companies in the region operate over 300 public supply sources from groundwater. Groundwater also provides a considerable base flow component to many rivers, especially in the upper reaches of the catchment.

Approximately two-thirds of the catchment is permeable and thus subject to direct recharge from rainfall. Polluting discharges may also infiltrate into the ground in these areas. Rainfall varies from 850mm/year in western parts of the catchment to less than 650mm/year in eastern parts. Rates of recharge to groundwater vary considerably from 524mm/year in the north-west to 124mm/year in the east.

In much of the catchment a situation has been reached where there is no remaining capacity for abstraction because of the need to protect streamflows and the valley environment. In some areas over-abstraction has led to reduced flows and the drying up of some groundwater-fed rivers, particularly on the chalk aquifer. Abstraction in proximity to the Thames estuary has resulted in the intrusion of saline waters several kilometres inland. Therefore there is a need to create or find new sources of water for the region. A notable exception to the above trend is the chalk aquifer in the London Basin. The considerable reduction in abstractions since 1970 has resulted in rising groundwater levels.

Managing future demands

Managing the growth in demand will require a combination of methods such as leakage control, selective metering, improvements in water efficiency and creating new sources of water in the region. Many water efficient appliances are now available such as low water use washing machines, low flush toilet cisterns and water-wise gardening products. There is also likely to be a change in the demand for water. Demand for manufacturing industry is likely to decline since the patterns of manufacturing are changing but companies are becoming more efficient at using water. Future agricultural demands depend mainly on changes in agricultural policy. The growth in tourism and recreation will increase the demand for water, e.g. the restoration of disused canals may become a pressure on water resources. There are a number of restoration projects currently being considered in the region.

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 commissioning for a new scheme. The planning of schemes required by the year 2027 should begin in 2007.

Water resource development options in the Thames Region

A number of water development options have been considered *(Fig. 5)* including:

- use of gravel workings for storage
- redevelopment of existing resources
- freshwater storage in the tidal Thames Estuary
- inter-regional transfers from Wales, Northumbria (Kielder Water) and Scotland

These have been rejected for the present on environmental and/or financial costs.

A number of other options have also been considered and given the green light for further investigation.

These include:

- artificial recharge of the London Basin groundwater supply;
- inter-regional transfer form the River Severn and the Anglian Region;
- groundwater development opportunities in riverside areas (riparian zones);
- desalinisation of salt-water in the Thames Estuary;
- re-use of effluents presently discharged into the tidal Thames Estuary, and
- reservoir storage in south west Oxfordshire.

However, there are costs and benefits of each of the schemes *(Fig. 6)*.

Key selected information on some of the remaining options

London Basin groundwater

The confined chalk aquifer of the London Basin provides an extensive natural storage body which has very limited connection with the river systems. 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. Artificial recharge during times of surplus, largely in winter, are almost complete in North London. However, rising groundwater levels may pose a threat to foundations and tunnels constructed while levels were depressed.

Transfers from the River Severn and Anglian water

While it is possible to transfer water from the Severn to the Thames there are a number of issues. For example, what would be:

- the physical, chemical and ecological implication of transferring and mixing water from the River Severn into the River Thames?
- the security of supplies 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 implications?

Development in conjunction with the restoration of the Thames and Severn canal has been ruled out on engineering feasibility and cost grounds.

Fig. 5 Water development options in the Thames region.

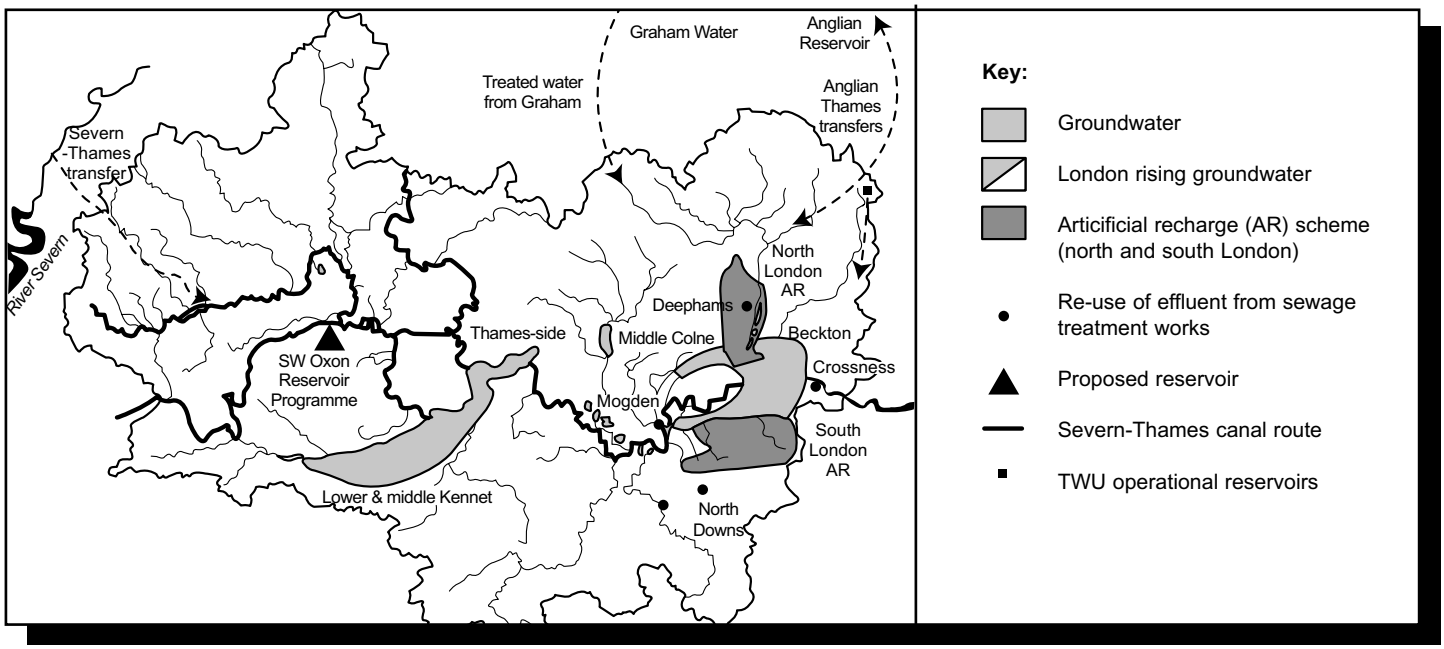


Fig. 6 Environmental impacts: the main options.

Engineering Options	Sensitivity to change								Potential environmental risks: Construction							Potential environmental risks: Operation							Environmental opportunities							
	Aquatic ecology	Terrestrial ecology	Water quality	Recreation & navigation	Agriculture	Community impacts	Archaeology & heritage	Planning & general landscape	Aquatic ecology	Terrestrial ecology	Water quality	Recreation & navigation	Agriculture	Community impacts	Archaeology & heritage	Aquatic ecology	Terrestrial ecology	Water quality	Recreation & navigation	Agriculture	Community impacts	Archaeology & heritage	Planning & general landscape	Aquatic ecology	Terrestrial ecology	Water quality	Recreation & navigation	Agriculture	Community impacts	Archaeology & heritage	Planning & general landscape
LONDON BASIN GROUNDWATER:																														
North London Artificial Recharge			•										•					•						•	•					•
South London Artificial Recharge			•										•			/	/	•						•	•					•
Rising groundwater			•															•												
EFFLUENT REUSE	•	•	●	•								•	•			•	•	•								•				
SW OXFORDSHIRE RESERVOIR PROPOSAL (SWORP):																														
On-site	●	●	●	•	•	●	•	•	●	/	/	●	•	●	●	●	•	●	•	•	●	•	/	●	●	●	●	•	●	•	●
River Thames & River Corridor	●	•	●	●	•	•	•	•	/	/	/	•				●	/	●	•					•	•	•	•	•			
SEVERN-THAMES TRANSFER	●	●	●	•	•	•	•	•	/	/	/	/	•	•	•	●	•	●	•	•	•	•	•	●			•		•	•
ANGLIAN THAMES TRANSFER	●	●	●	•	•	•	•	•	●	/	•	•	•	•	•	●	•	●	•	•	•	•	•							

Key: Aquatic ecology; Terrestrial ecology; Water quality; Recreation & navigation; Agriculture; Community impacts; Archaeology & heritage; Planning & general landscape

• Low ● Medium ● High / Impact can be mitigated

Desalinisation is currently extremely costly and makes high demands on energy.

Re-use of water - a number of possibilities exist:

- recycling by industry and power generation
- possible 'grey-water' uses (water which may be recycled or treated to a lower level than drinking water), e.g. use for flushing toilets or outside uses (car washes, gardens, 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 upon a number of factors, principally the achievement standards to meet drinking water and public health requirements, and the provision of adequate environmental protection to rivers.

A new reservoir in south-west Oxfordshire?

The Environment Agency proposed a new reservoir for South West Oxfordshire *(Fig. 7)*. The plan is for the reservoir to store water from the Thames during high flows and supply the Upper Thames area and the Thames during low flow. It could also help supply water to the proposed nuclear power stations in Oxfordshire, if either of these materialise. However, there are a number of potential impacts to consider. These include on-site and operational impacts as listed below:

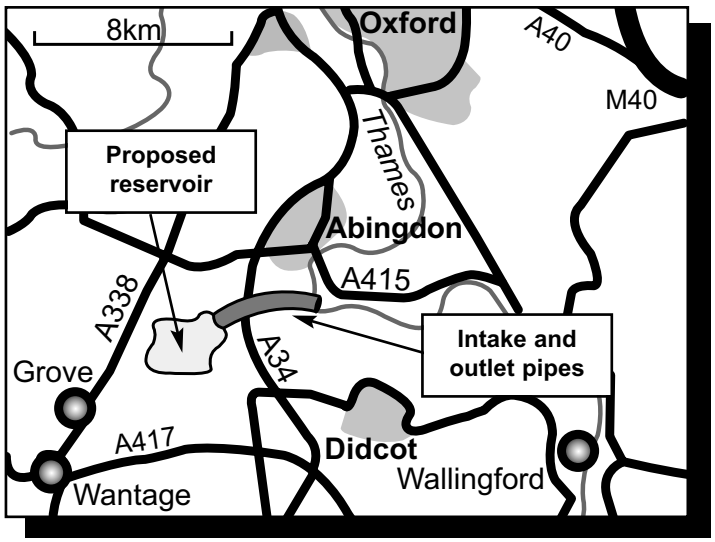
i On-site

- pollution risks during construction
- effect of the reservoir on flood risk and drainage
- diversion of water courses
- effect on groundwater levels (leakage from reservoir)

ii Operational impacts

- the physical, chemical and ecological implications of abstraction from the Thames
- maintaining reservoir water quality in terms of oxygen, algal and temperature characteristics

Fig. 7 The proposed reservoir for south-west Oxfordshire.



Nevertheless, there are a number of potential benefits of the scheme. The main one is the security of water resources in the region. The proposed reservoir is impressive. As big as 2,500 football pitches, or half the size of Windemere, it will form the largest stretch of open water in southern England. Critics claim that while the reservoir will hold 33 billion gallons of water, that is less than half the 70 billion gallons Thames Water loses every year through leaks. They also claim that 'Lake Oxford' will swamp a vast area of precious English countryside near Abingdon, destroying wild animals and plants.

The statistics are equally impressive. Instead of simply digging as hole, contractors will construct an embankment around the site between 15m and 25m high - 10m higher than the tower of the nearby historic church in Steventon. Inside, the reservoir will be up to 33m deep - equivalent to around 15 single-decker buses placed on top of one another. The perimeter distance will be approximately 9km. Its 33 billion gallon capacity would be enough to support the annual needs of 2.74 million people, or a city the size of Greater Dublin. It would meet the water needs of London for almost 5 months. It will be filled with water from the Thames during the winter. This will be pumped back during the summer and taken out lower down, treated and put into the mains in the London area.

The £1 billion cost will fall on Thames Water customers, who face paying higher bills in future to fund the work and loans. Construction is likely to start in 2010 and finish in 2020 and involve a massive fleet of lorries and even a new train line to bring materials and people to the site. At the same time, vast new pipelines will also be built to link it to the Thames and there will also be a new water treatment and pumping centre. There will also be a boat park, water sports club house, beach, jetty, pier and slipway.

Critics argue that we should save water rather than waste it. Every householder should think about how to use less water and Thames water should deliver on better management of existing supplies before it pushes ahead with such a major scheme.

Thames is promoting the reservoir as an alternative to proposals to transfer water to the South east from Wales via the Severn and the Thames. The company also plan to spend millions of pounds on a desalinisation scheme that will convert salty water from the Thames Estuary to drinkable water.

Conclusion

The proposed reservoir for south-west Oxfordshire is a major engineering project. It is also very costly. It is required due to an increasing demand for water in the region, while at the same time increasingly unreliable supplies. As a result of climate change water supplies are likely to become even less reliable in the future. To improve water supplies, a number of options have been considered. Many have been rejected on financial or environmental grounds. The likely impacts of the reservoir on the area are far reaching - in terms of social, economic and environmental impacts but it is still the least worst option. Yet, according to critics, if Thames water were to conserve water (and fix leaking pipes) there would be no need for such as reservoir. What do you think?

Questions

1. Suggest contrasting reasons for the increased demand for water in the Thames region.
2. What are the social, economic and environmental advantages of large reservoirs, such as the proposed SW Oxfordshire reservoir?
3. Outline the disadvantages of large engineering schemes such as the SW Oxfordshire reservoir.
4. Briefly describe alternative ways in which water in the South east of England could be managed.
5. Using as much evidence as possible, outline a case for the development of water resources in the Thames Region. You may choose up to three of the options mentioned above to form an integrated approach to sustainable development. You must reject at least one of the options.

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