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Leakage targets - your views on the way ahead

On 5 March, the long awaited report from the study ***Future Approaches to Leakage Target Setting for Water Companies in England and Wales****, otherwise known as the Tripartite study, landed on desks up and down the country. Those who expected definitive answers will be disappointed.

Rather than mapping out the way forward, the report presents a number of options and, as a result, acts as a consultation document. The report is in two parts, the first of which sets out some best practice principles in the calculation of an economic level of leakage (ELL).

However, it also considers whether the ELL is the most appropriate target setting methodology and whether alternative approaches could provide a better basis. For the calculation of ELL, some of the key principles are as follows:

* policy minimum leakage (a new term to replace base or background levels of leakage) estimates should be based on company specific District Meter Area (DMA) data, and is the level achieved following '*intensive active leakage control*'
* the form of the leakage/cost relationship (curve or equation) is less important than the use of reliable input data
* the cost per repair should be assumed to be independent of the level of leakage unless evidence can be provided to the contrary
* in calculating ELL, interactions of different policies and target level of leakage must be taken into account to avoid double counting and a 5-10 year analysis is recommended
* ELL should be calculated using a least cost planning approach that minimises the '*net present value*' of costs of managing the supply-demand balance over a 25-30 year planning horizon
* ELL should be developed using company costs (capital and operating) but should then be reviewed to consider including environmental and social costs.

The report includes a best practice framework for including social and environmental costs and benefits and a desk-based study is included to illustrate the process.

Table 1 **Leakage performance indicators**

Status	LPIs
Primary	Leaks found per property surveyed (by type) Leaks found per inspector (by type) Repair time (by type)
Secondary	Flow data age Burst reaction period Prioritisation factor Inspector number (peak week to average) Proportion of dry holes Proportion of repeat repairs
Leakage Management System Descriptors	Number of DMAs in the company Number of '*waste and combined metering*' areas in the company Number of PRVs in the company Average Zone Night Pressure(AZNP) target divided by AZNP

ELL alternatives

A range of alternatives to ELL are presented and discussed. These include targets set:

* on system characteristics
* on some multiplying factor of policy minimum
* by trading in leakage permits/credits
* on abstraction rather than leakage levels
* alternatively by the adoption of a deregulatory approach.

The range of possibilities emphasises the need for consultation.

The second section of the report covers leakage performance indicators (LPIs). The concept is that targets set by ELL or by other means do not allow independent assessment of efficiency of leakage management processes and operational conditions. An initial list of LPIs was tested out at a number of water companies and refined to produce the final set shown in Table 1. The LPIs are intended to measure the effectiveness of the selected policy, where the policy itself has been selected on an economic basis.

The tripartite group of DEFRA, Ofwat and the Agency are now considering how the themes in the report should be taken forward. In the consultation, views are particularly sought on:

* the principles for ELL calculation set out in the report
* the range of leakage performance indicators developed and how these might be used including the feasibility of incorporating them into leakage management
* the alternative approaches to target setting
* the feasibility of moving to the leakage best practice approach.

*** The report can be obtained from Ofwat (£25) or downloaded, free, from www.ofwat.gov.uk. The consultation closes on 5 June 2002.**

OFWAT introduces OPA

Ofwat have introduced a new acronym into our consciousness, the Overall Performance Assessment (OPA). Following a public consultation exercise, the report ***Linking Service Levels to Prices*** puts forward OFWAT's conclusions on each individual measure of performance and their overall weighting in the OPA.

So how do the demand management elements fare? A new measure covering the security of the supply of water is to be further developed in consultation with the water companies and the Environment Agency. The hosepipe ban measure has been modified to a rolling five year period. The leakage measure has been modified to deal with companies that intro-

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Where water conservation and profit coincide

Agriculture and horticulture was featured for the first time in the Water Efficiency Awards 2001 and, judging by the number of short-listed and commended projects, it was well worth the wait. A summary of the water conservation approaches appeared in the Awards booklet, but a visit to two of the farms, **CA Strawson Farming** (winner) and **Osberton Grange Farms** (commendation) revealed an even more impressive picture. It also brought home the simple message that, in a highly competitive sector, only when both the economic and environmental factors are favourable will sustainable investment take place.

Tony Strawson has developed a modern farming concern covering 8,000 acres on mainly sandy soils in Nottinghamshire and employing more than 100 people. Conserving water is only one part of a sustainable approach to farming.

All the fields, mainly used for growing carrots, leeks and potatoes, have two and six metre fallow perimeter margins as wildlife corridors. Through the *Countryside Stewardship* scheme, trees have been planted as a buffer to run-off pollution from fields used for pig rearing. All the hedgerows have been replenished and new hedgerows planted. The recently acquired county estate has been restored to pasture with proper public access. The old country house and stables are being renovated for business use. A willow plantation, grown naturally using water recycled from crop washing, provides fuel for local power plants.

All this reveals a desire to farm sustainably, but it is taking place because of financial and business incentives. However an underlying empathy for sustainable farming means that whenever business decisions are taken, the sustainability options are automatically considered. Thus, over the last ten years, the farm has introduced a host of irrigation and recycling measures that have reduced the water use by 40 per cent.

CA Strawson Farming has found that commercial pressures have meant the onus for water use has shifted towards the food grower, putting even more pressure on them to use water efficiently. The supermarkets nowadays require a high quality product and this means that vegetable crops regular irrigation.

Potatoes used to be supplied unwashed to the crisp factory. Now the factory expects clean potatoes of the highest quality and the burden of water use falls on the farm. However, this has been turned into a positive aspect: wash water from the potatoes is recycled and used in particular for irrigating the willow crop, thus reusing water that would have been simple discharged from the crisp factory.

High-Tech business

Modern farming is high-tech business. CA Strawson, in conjunction with other local farms, have weather stations on their property that are part of an irrigation scheduling service for each of the crops. Tony Strawson's son, Mark, Managing Director, enthuses that this provides a systematic approach to irrigation that can be fine tuned on a daily basis. Modern irrigation can be automatically scheduled and targeted so that a high quality product is obtained.

Mark saw the attitude of the supermarkets to sustainable farming as vital (see article on page 3). He had been encouraged by a recent presentation by Tesco's technical manager, David Collins, on good agricultural practice. Tesco's customer surveys have indicated that the environment was a significant and growing concern amongst customers.

The Water Efficiency Award as such had "*not opened doors, more re-enforced their position*", but what it had done was act as a "*trigger for new ideas and thinking*".

Pot-in-pot

Although **Simon Murch** runs a very different business, growing rhododendrons and azaleas, there are similarities in approach. Investment in water application has been made for economic reasons. Water is applied at root level and programmed to minimise wastage whilst producing the highest quality product. There is a willingness to seek out, trial and apply good ideas.

Osberton Grange Farm's 'pot-in-pot' system was based on a Belgian system. As with many good ideas, it appears very simple in retrospect. Traditionally the plants are grown above ground in black plastic pots that are the cheapest option. Unsurprisingly they readily dry out in high summer, meaning more water use and the risk of a poor quality product. By digging holes in the ground and inserting an outer pot, another pot containing the plant can be dropped into place. Water applied to the roots is better targeted and results in a better quality crop.

Although simple in concept it required a series of trials and finding a machine to economically dig the holes. Fortunately the farm has plenty of land as the system requires adequate spacing, not always available to similar growers.

Simon Murch is quite sanguine about whether his water efficiency efforts are rewarded by increased sales at garden centres. The vast majority of the public are still driven by price rather than any sustainable-use tag.

It's Your Choice !

It's Your Choice! Helping to Make Sustainability a Reality was the title of a *'high level'* workshop staged this February by United Nations Environment and Development (UNED) and Imperial College.

The workshop was part of the UK preparations for the Johannesburg World Summit on Sustainable Development (Earth Summit 2002). It brought together people from all sectors of UK society to discuss and agree practical actions on sustainable production and consumption patterns as part of a participatory process begun in March 2001.

In his introduction **Andrew Blaza,** Imperial College and UNED UK, stated that, since the Earth Summit in Rio in 1992, there had been progress on the production side of the sustainability equation. The '*greening of industry*' was a good example, but companies were becoming reluctant to do more without stakeholder agreement.

There had been much less progress on the consumption side because of the need to change lifestyles. Exhortations to make sacrifices fell on deaf ears, he said and the message had to be '*consume differently, rather than consume less*' and the challenge was now to turn the rhetoric into practical actions.

Short presentations from Unilever, Marks and Spencer, the Advisory Committee on Consumer Products and the Environment (ACCPE, the replacement for the Ecolabelling Board) and Race to the Top (see page 3) summarised the different perspectives to sustainable production and consumption.

The areas identified to date and discussed at the workshop were food, non-food domestic goods, transport, energy and water. A multi-stakeholder debate was held for each topic and consensus reached on key actions. The reporting back session identified where common issues were found to apply to the different sectors (e.g. need for clear vision, using market and policy mechanisms, better planning policy).

Andrew Blaza closed by reminding the audience that the process was not over. The dialogue would continue when the workshop groups convening in six months time, followed, in turn, by another '*high level*' workshop in twelve months time.

Details can be found on www.unedforum.org, or from contacting Stephen Horrax on email: stephen.horrax@ic.ac.uk.

Seawater greenhouse

An item on the **Seawater Greenhouse** by Fred Pearce in the 26 January 2002 edition of **New Scientist** caught our eye. It uses simple technologies to use the contrast in temperature between the sea and air temperatures in hot arid climates to condense vast quantities of water. The seawater also keeps the greenhouses relatively cool and humid thus significantly reducing the plants requirement for water. It is estimated that a hectare of seawater greenhouses could produce 350,000 lettuces a year and still have 80 per cent of its water left over for other purposes. A plant has recently been built near Abu Dhabi in the Persian Gulf and more are planned.

Water Sources 2002 in Las Vegas

This year the American Water Works Association combined its three separate tri-annual conferences covering water conservation, water resources and water re-use into the inaugural **Water Sources** conference.

This new structure encourages networking across the different but complementary disciplines. The individual subjects still retained their identity through having separate 'tracks', but with up to eight sessions (2 or 3 per track) running concurrently, some hard choices had to be made on what to attend.

At a pre-conference Sunday workshops, moderated by Bill Maddaus, the new AWWA Water ***Resources Planning Manual*** (M50) was introduced. This comprehensive manual includes chapters on demand forecasting, water rights and policy issues, alternative sources (including water conservation), water quality, hydrological modelling, watershed management, economic feasibility and integrated resource planning. The discussion demonstrated the different emphases to water resources planning in the UK and the USA. In the UK the main focus of would be on demand forecasting and economic analysis, whereas in the US the emphasis is on stakeholder dialogue and public participation.

This had been taken to extremes in the case of the Lower Colorado River where the desire of a wealthy elite to maintain reservoir levels in the vicinity of their real estate had been taken into account, despite the fact that the reservoir had been designed for flood alleviation and had to be drawn down in the summer months.

The case of the Southern Nevada Water Authority, presented by Mary Kincaid-Chauncey and Patricia Mulroy, provided considerable food for thought in how to tackle water scarcity. In 1990, water-use was increasing at a greater rate than had been predicted, such that existing resources were not expected to last beyond 2025. In response to this situation the five water agencies who had been competing on a first-come first-served basis for a dwindling resource decided to opt for a shared future by choosing to co-operate through the formation of the Southern Nevada Water Authority. A plan, based on mutual understanding and respect, provided an environment where water conservation could thrive, a plan that recognised environmental stewardship responsibilities and the need to educate young people.

Individualised tariffs

There is a growing interest in '*individualised rates*'. These are defined as block rates where the block is defined using one or more customer characteristics, for example number of persons per household or evapotranspiration requirements of a customer's landscape.

Tom Chesnutt of A&N Technical Services explained that, in order to implement an individualised rate structure, there are significant resource implications. Customer specific data is required in order to define the rate structure, additional staff time to design and validate the rate structure and the additional burden of communicating it to customers. However he explained that, following implementation in several areas, these rates have largely viewed as being successful, principally because they are regarded as fair and equitable.

Tom Ash of Irvine Ranch Water District gave an example from his utility where the base rate was determined from the number of persons per household (an 'allowance' of 72 US gallons per day) and lot (garden) size. 'Reasonable' irrigation requirements were determined using the evapotranspiration rate measured at local weather stations. A five-block rate structure had then been designed where each block was a multiple of the base rate. Considerable customer co-operation had been required in building up the database and customer surveys had showed that 85 per cent thought the system fair and 95 per cent understood it.

Water/energy link

Tony Gregg, Water Conservation Manager from the City of Austin in Texas, when talking about *legislative and regulatory developments in Conservation*, covered the Department of Energy standards for residential clothes washers. Standards set in 2001 would be superseded by higher standards in 2004 and again in 2007. With tax breaks likely to be available for manufacturers who increase production prior to the standards coming into effect, the energy savings are likely to deliver considerable water savings.

Looking beyond the end-use effects, Robert Wilkinson (Rocky Mountain Institute) and Lisa Maddaus (Californian Urban Water Conservation Council) had considered the energy required to supply, treat and distribute water in California. Although the energy savings from, say, an efficient clothes washer, are principally due to less energy being used to heat a lesser volume of water, the energy savings from not having to supply, treat and distribute that water were worthy of consideration. This would obviously vary from system to system

The lesson to be drawn from this exploration of water/energy synergy must surely be that there are economies of scale in promotion and to ensure that all benefits of a program are considered when assembling the financial justification.

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Water efficiency aids Welsh career skills

NFU Cymru Wales President, **Huw Richards**, presented certificates to local school pupils who were participating in a trail blazing water saving initiative, co-ordinated and supported by Environment Agency Wales, Dwr Cymru Welsh Water and Careers Wales West.

A special water saving workshop, which is part of a wider campaign in the River Teifi catchment to increase awareness of the current and future demand for water in the area, was held in January. Introducing the importance of responsible water management and investigating opportunities to use water more efficiently were key aspects of the workshop. The environmental and economic benefits of saving water were also highlighted.

Also present at the workshop to receive a special award, after gaining a commendation in the Water UK & Environment Agency Water Efficiency Awards 2001 were local farmers, **J R & M Weekes & Sons** from Boncath near Newcastle Emlyn. J R & M Weekes & Sons were commended for introducing a range of water saving initiatives on their family run farm. These included:

* putting valves on each leg of the pipe network so that each can be individually controlled
* recycling water used in the milk cooler and regular inspection of all pipes to prevent leaks.

Bob Vaughan, the Environment Agency Wales Water Resources Manager, found the event particularly rewarding. *"It brought together young people from a wide area to address the challenges of our future water environment"*.

Supermarkets race to the top

The International Institute for Environment and Development (IIED) is managing **Race to the Top** which aims to track the social, environmental and ethical performance of UK supermarkets, and catalyse changes within the UK agri-food sector and beyond. An alliance of farming, conservation, labour, animal welfare and sustainable development organisations has developed several indicators of supermarket performance.

The supermarkets Asda, The Cooperative, Iceland, Sainsbury's, Marks & Spencer, Safeway, Somerfield, Tesco and William Morrison are already working with **Race to the Top**. They will provide comparative data to track progress towards fairer and greener food over the next five years. By identifying and promoting best practice by supermarkets, the project will point to key issues for public policy, consumers, investors, retailers and campaigners. It will also provide objective data and analysis. An advisory group of independent experts provides advice and quality control.

The final indicator framework, including sustainability management and reporting, is now being developed. Water use is likely to be included in the second round of indicators. Data collection has commenced and the first year's results will be published during this spring and summer. **Visit www.racetothetop.org for further details.**

'Making leakage management into a science'

Allan Lambert, who has been at the forefront of developing international leakage management concepts and performance indicators since the early 1990s, has decided to retire from active consultancy work. The concepts and methods he has promoted, to turn leakage management into a science, rather than a process of 'guesstimation', are now being applied and advanced in many countries. Allan discusses with Philip Turton how leakage management has become a success story in England and Wales, looks at some international issues, and peers into the future on how it might, or perhaps, should develop.

PT: Why did leakage stall after the burst of activity in 1980 and what revived it?

AL: ***Leakage Control and Practice (Report 26),*** published in 1980, stimulated the initial burst of activity. However, when privatisation occurred in 1989, there was no national methodology for calculating leakage and no standards or targets. The ***Leakage Control Initiative***, set up in 1991, ensured that a foundation for good leakage management – the ***Managing Leakage Reports*** - was in place in 1994. This was just in time to ensure extra efforts and financing made available during the 1995/96 drought could be well-targeted and cost-effective. Then came mandatory targets that have kept up the momentum.

PT: What are the burning issues in the UK?

AL: Experience gained from extensive working outside the UK helps to put some of the issues in the UK into a wider perspective. By any standards, the reductions in leakage that have been achieved in England and Wales during the last seven years are impressive. The burning issue seems, to me, to be 'how low can you go, economically'? But the research and analysis seems to be concentrating on matters of detail, not using all the tools available and, unfortunately, it misses some of the big issues which have been identified internationally, and which could help clarify thinking at national level in the UK.

PT: Can you give any examples?

AL: A prime example relates to measurement. We know from the International Water Association (IWA) Task Force that, for 'Best Practice' basic performance comparisons, choice of '*per service connection*' or '*per km of mains*' depends on whether the density of connections is greater or less than 20 per km of mains. So, for England and Wales company data, with connection densities 45 to 100 per km mains, the correct choice is 'litres/service connection/day'.

For a media-friendly indicator, you can turn this into a number of '*tap-minutes per person per day*' – for example, distribution losses of 80 litres/service connection/day means that the company leakage is around three tap minutes/head/day, compared to water delivered of around 16 tap-minutes/head/day. Performance data presented in this user-friendly form can be used to promote broader demand management issues.

However, for proper technical comparisons, you then must take into account average pressure – ranging from around 25 to 55 metres for England and Wales Company data. The latest UK and international research confirms that the relationship between average annual leakage rate and pressure for large systems is approximately linear. Until Ofwat publishes leakage performance data for the companies in litres/connection/day/metre of pressure, major mis-interpretation of true leakage performance - between higher pressure companies and lower pressure companies – will continue. But Ofwat does not ask companies for their average operating pressures, and seems to have no intention of doing so.

Colleagues in the UK also tell me that Ofwat regularly questions as to why there is such a large range between company estimates of background leakage, in litres/property/day. It is no mystery – we have known since the mid 1990s that background leakage varies with pressure approximately to the power 1.5. Bring this into the calculation, and much of the apparent diversity disappears.

PT: Is pressure still being underestimated as a factor?

AL: 'Practitioners know that pressure management is the simplest way of managing leakage; in Spain it is described as the method 'par excellence'.

Some say that including pressure in performance indicators excuses Companies that cannot bother to manage pressures - yet clearly all Companies cannot achieve the same pressure because of topography, and widely different standards of service for minimum pressure. The thrust of the ILI approach is to assess the '*infrastructure management*' components of Figure 2 at the current pressures, whilst also actively considering whether improvements in pressure management are both possible and economic.'

PT: What about international comparisons?

AL: The only reliable Performance Indicator (PI) for international comparisons or comparisons of any systems with diverse characteristics is the **Infrastructure Leakage Index** (ILI). This is a new IWA 'Best Practice' measure and the ratio of:

Current Annual Real Losses (CARL) /UARL

UARL stands for Unavoidable Annual Real Losses (a technical minimum value which is calculated using BABE methods on a system specific basis) which allows for density of connections, customer meter location, and average pressure. The ILI is being successfully used not only for International and National comparisons (e.g. Australia, Malta, South Africa, New Zealand, USA), but also for '*within company*' comparisons down to sectors of around 5,000 service connections, as demonstrated at a recent Environment Agency training workshop.

PT: Why it has been easier to sell some of the ideas abroad than in the UK?

AL: Probably because, since ***Managing Leakage,*** the UK research agenda has been substantially driven by the assumptions, objectives and views of the regulators. In other countries, individuals and small active groups in national organisations are interested to hear and question the options with an open mind, and decide whether to adopt them or not on their merits. Isn't there a saying about '*a prophet in his own country…*'?

PT: Why has the USA been slow in turning to leakage control?

AL: High consumption has meant that other aspects of demand management have taken priority. Also, the use of percentages associated with high consumption, and the method of accounting for '*discovered leaks and overflows*' has effectively hidden the true scale of the problem. However, the Leak Detection and Water Accountability Committee of the AWWA has now had a good long look at the IWA's '*best practice*' recommendations, including the ILI approach, and will be promoting these from now on. A major AWWARF contract has also recently been let on this topic to an international consortium lead by Bristol Water Services Ltd (see below). Leakage control in North America has been described as a '*sleeping giant*' – it seems it is now waking up in both the USA and Canada.

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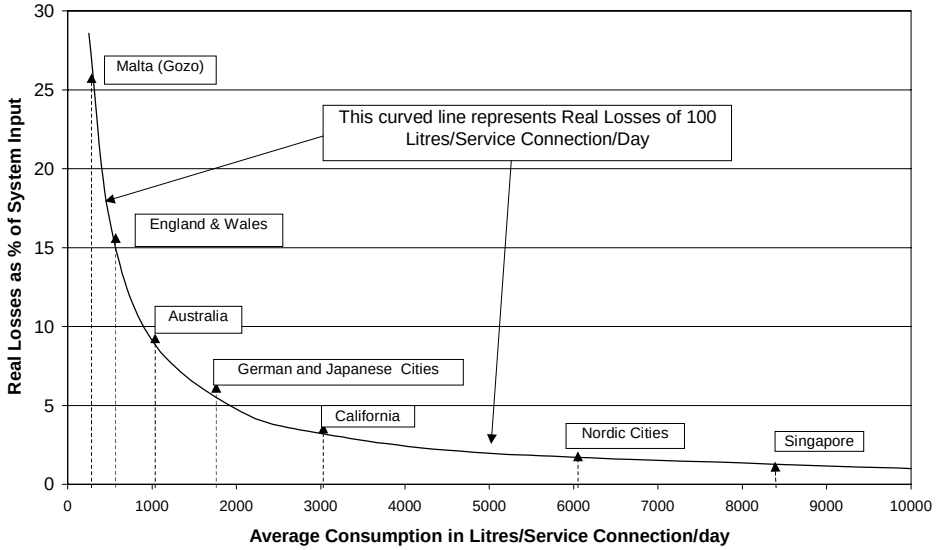
Figure 1: For Real Losses of 100 litres/service connection/day, the % Real Losses can vary between 26% (Gozo) and 1% (Singapore), depending upon consumption per service connection



Bristol Water carry on leakage legacy in USA

Bristol Water Services are applying their legacy of leakage control expertise, typified by the late Stan Bessey's work for the UK's ***Managing Leakage*** reports, to good effect. They have recently been appointed to lead an American Water Works Association Research Foundation project to produce a guidance document on ***Non-Revenue Water Reduction***.

This one-year project, led by Paul Fenner, will help North American Water Utilities to:

* select appropriate performance indicators
* prepare an accurate water audit and water balance
* determine the economic level of leakage
* plan and implement water loss reduction programmes.

Recently the company have been involved in a number of studies assessing the potential of loss reduction in the water distribution networks of Kazakhstan, Uzbekistan, Tajikistan in Central Asia. **Roland Liemberger**, Managing Director and his team have been applying the IWA ***Water Losses Management and Techniques*** and, in particular, the **Infrastructure Leakage Index** (ILI) in these countries.

The ILI values well exceed even the more pessimistic anticipations and the city of Dushanbe in Tajikistan "*has probably some of the highest water losses in the world*". It is therefore encouraging that World Bank funding is now incorporating strict contractural water loss reduction performance indicators.

Roland is impressed by the success of the company's flagship project in Selangor, Malaysia, the world's largest water loss project where network zoning, leak detection, repair and pressure management are carried out to reduce water losses and where "*challenging contractural targets have been substantially overachieved*".

For further information, you can contact Roland Liemberger on email: roland.liemberger@bws-austria.com.

Leakage publications

A couple of leakage publications are now available through **The Stationary Office - visit www.thestationeryoffice.com**.

Water Service Leakage Management and Water Efficiency: Northern Ireland Assembly Papers Session 1 (2000/2001), ISBN 033940017X, is priced at £14.95.

Leakage Management and Control - a Best Practice Training Manual by Malcolm Farley (ISBN 0119874466), £12.50 is published by the World Health Organisation.

Cranfield's groundbreaking study

Cranfield University and the developers of Elstow Garden Villages have entered into a groundbreaking partnership with the signing of an agreement to fund an MSc scholarship to research the water and wastewater management.

Elstow Garden Villages in Bedfordshire is a proposed mixed-use development of 4,500 new homes, businesses with shops, schools and leisure facilities.

The studies will consider which water and energy conservation and efficiency methods can be implemented from the very beginning of the new settlement. **Professor Tom Stephenson,** Head of Water Sciences at Cranfield, added "*we hope to run the study throughout the development of the new settlement, so that we can learn and improve on a continuous basis.*"

The site for the new settlement is centred on the Elstow Storage Depot, which was previously home to a munitions factory during the Second World War. **Visit www.cranfield.ac.uk/sims/water for further details of the project and a 'MSc by research' appointment to work on the project.**

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PI: Anything else interesting on the International scene?

AL: A strong tendency within the past year for 95 per cent confidence limits to be introduced for estimates of leakage and PI calculations. Increasing networking between the individuals who are using the improved methodologies around the world; several of these guys are co-ordinating an international study on assessing apparent losses for systems with roof tanks. A 'don't miss it' IWA Conference in Cyprus in November, at which experiences will be shared.

PI: And finally, what are you going to do once retired?

AL: Take it a lot easier; the last seven years have been very stimulating, but also very hectic. Continue to offer encouragement and occasional e-mail support to those who want to make leakage management become a science. Continue to travel, perhaps take up golf again, get fitter ....

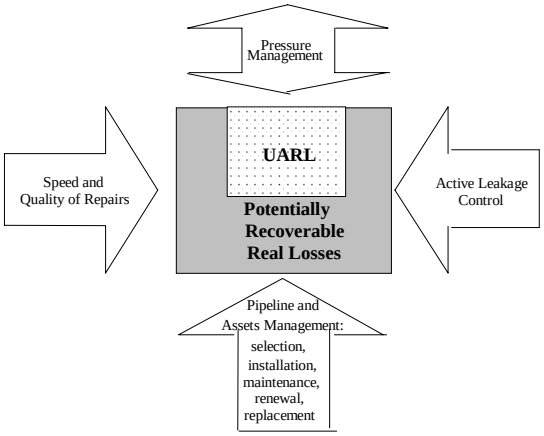
Allan Lambert was President of the British Hydrological Society in the early 1990s, and a consultant on Flood Forecasting for World Meteorological Organisation.

However, during the 1980s as Water Manager for Welsh Water/Dwr Cymru in North Wales, he had already started to apply his expertise in hydrology and modelling to research unresolved aspects of leakage measurement.

As Technical Secretary, together with the late **Stan Bessey** of Bristol Water, he guided the WSA/WCA National Leakage Control Initiative (NLCI) that produced the ***Managing Leakage*** Reports in 1994.

In 1995 he became a freelance consultant he became a specialist adviser to many UK and International Water Utilities. He was the specialist adviser on 1996 Water Resources and Leakage to the ***House of Commons Select Committee Inquiry into Water Conservation and Water Supply*** and leader of the International Water Services Association (IWSA, now IWA) Task Force on Water Losses in 1996 and was international Rapporteur for the Report on ***Water Losses Management and Techniques*** to the IWA Congress in Berlin in October 2001. He has recently been helping to apply the IWA methods in many countries around the world. **Allan can be contacted on email: allanolambert@cs.com**

Figure 2: The four components of a managing leakage policy



The large square represents the Current Annual real Losses volume
The small square represents the Unavoidable Annual Real Losses volume, calculated from an IWA formula
The ratio of the large square to the small square (CARL/UARL) is the Infrastructure Leakage Index

Water Sources 2002

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Leakage call-to-arms

The traditional home of leakage control is still not at this conference but at the annual AWWA Distribution Symposium. However, George Kunkel from the Philadelphia Water Department and chair of AWWA's Leak Detection and Water Accountability Committee has been working hard at promoting the issue in the USA.

The Committee has issued the following lively vision statement *"AWWA's Leak Detection and Water Accountability Committee will awaken the North American Water Industry to the often overlooked and fundamentally misunderstood impact of the large amount of water lost and not-accounted for by water utilities; and bring about a call-to-arms to start managing lost water to economically low levels with the same vigor that has made AWWA instrumental in promoting safe water throughout the world".*

Two conference sessions were held on '*Water Loss*'. This included an introduction to the AWWARF project ***Non-Revenue Water Reduction*** by Paul Fanner of Bristol Water, ***Water Loss Management in England and Wales*** by the Centre's David Howarth and ***Principles of Comprehensive Loss Management: Spain Experiences*** by Francisco Cubillo of Canal de Isabel. Time will tell whether "*water loss recovery is the USA's greatest untapped resource*", a question posed by George Kunkel in his opening address.

This is just a sample of the many interesting and thought-provoking presentations and discussions that took place at Water Sources 2002. **Individual papers can be downloaded from www.awwa.org.**

A strategy for rehabilitation

In Bulletin 49, Reflections concentrated on the issue of how mains rehabilitation could contribute to lower levels of leakage. Thus it is timely that two UKWIR reports have been published that improve our understanding of issues behind bursts and rehabilitation.

There have been many opinions behind the causes of mains deterioration and bursts but few hard facts. ***Understanding Burst Rate Patterns of Water Pipes*** owes much of its credibility to the efforts of the contractors, Pipeline Developments Ltd, and many of the water companies to create a national database of pipe burst information covering 55 per cent of the UK system.

There are now over 130,000 records of bursts of all types of material since 1995. Only with a large spread of information has it been possible to really get to grips with the effects of different soil types, pipeline materials and climate of the rate of bursts. Pipeline Developments also obtained information from Canada, Germany and Australia for comparison. The level of detail of records from the water-only companies turned out to be better than from the generally larger water-and-sewerage companies.

As might be expected, a number of illuminating conclusions emanate from the report.

The relationship between the age of mains and burst rates is not as simple as one might expect. Information from South Australia shows increased burst rates are only evident in mains laid more than 85 years ago. PVCu pipes were first laid in the UK in the mid-1960s and have a poor history of performance until tougher British Standards were introduced in the early 1980s and burst rates are shown to have fallen significantly. PE pipes have been used extensively since the 1980s and the report states that three bursts/100km/year is worryingly high for a material introduced so recently.

The main concern here is over the quality of the welded joints. The dramatic effect of laying mains under roads with heavy traffic as opposed to grass verges or paths is vividly illustrated.

There is an underlying seasonal pattern of burst pipes with levels rising in the autumn, related to soil movements as the soil moisture deficits reduce. Thus a warm dry summer is likely to exacerbate burst rates in the following autumn and winter. Superimposed on this are the more obvious effects of winter cold spells.

The recommendations for further investigation include more work to confirm the effects of temperature and soil moisture deficit on failure rates in different soil types. The report also makes the important point that such predictive advice would assist operational planning and would improve targeted investments.

Rehabilitation strategy

"In the last few years rehabilitation has been undertaken in response to regulatory pressures particularly to solve water quality problems only. This document advocates looking at all problems including water quality, structural conditions and hydraulic". This is a quote from the project brief of ***Rehabilitation Strategy*** and the new approach is encapsulated in "*In practice what is sought is a replacement rate which minimises problems for customers, whether they be water quality or supply interruptions, whilst minimising the cost of rehabilitation*".

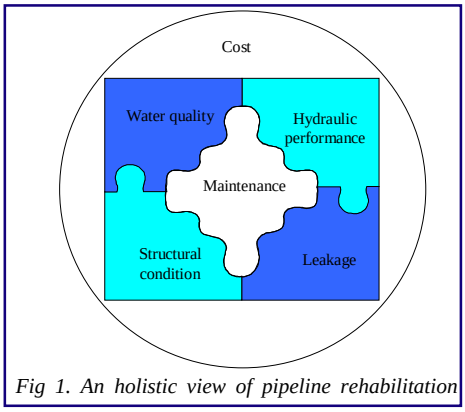

Fig 1. An holistic view of pipeline rehabilitation

There is a shopping list of policies from which a water company can choose to adopt to suit its own circumstances.

In future, whilst improvement in water quality is likely to be the main driver for main replacement or renewal, this framework brings leakage levels into the equation. Indeed, as the report suggests, data on leakage may well be indicative of the general state of the distribution system

***available from via the internet on www.ukwir.org or from Webree, PO Box 162, Portsmouth, PO1 2XL. *Understanding Burst Rate Patterns of Water Pipes* (01/WM/02/16), £100, ISBN 1 84057 242 6. *Rehabilitation Strategy* (01/WM/02/18), £100, ISBN 1 84057 244 2.**

Table 1 **International comparisons of burst rates per 100 km of pipe per year**

Material	All UK Average	Canada	West Germany	East Germany	Adelaide 85-95	Sydney 95-96	South Australia
AC	9.4	7.3	6.0	34.0	6.8	53.5	8.6
Cast iron	21.1	39.0	19.0	41.0	24.7	25.0	13.3
Ductile iron	4.2	9.7	2.0	-	-	1.6	-
PE	3.1	-	10.3	74.0	-	-	-
PVC all	8.7	1.2	6.0	14.0	-	9.0	-
Steel	11.1	-	21.0	74.0	-	9.8	-

For the lengths of mains used, please refer to the original report

Spain test Framework Directive

An early test of the sustainability credentials of the Framework Directive has come in the form of Spain's controversial National Hydrological Plan. In late February, over 100,000 people demonstrated in Barcelona against the plan.

The European Environmental Bureau, (EEB) the Worldwide Fund for Nature, BirdLife International, Friends of the Earth and Greenpeace sent a letter to European Commission President Romano Prodi. In it, they estimate that the plan could cost EU taxpayers up to seven billion euros and state that it contravenes EU environmental legislation. The five environmental NGOs also assert that the plan contravenes the EU's Sustainable Development Strategy, the Water Framework Directive, several articles of the EU Treaty and that it is likely to infringe the Birds and Habitats Directives.

An EEB spokesman added, "*this is a crucial test of the European Commission's commitment to sustainable development*". The EEB's position paper ***Making the EU Water Framework Directive Work*** includes a section on 'New Economic Transparency for Water Use'.

At the end of February the European Parliament, though not specifically mentioning the Spanish Plan, adopted a resolution that expressed concern about "*the precedent set by proposals for the development of unsustainable water management schemes across Europe*". The resolution was sent to the EU Summit held in mid-March in Barcelona.

WFD explained

For those who wish to have EC water legislation explained in an easy to read format, then ***The EU Water Framework Directive - an Introduction***, published by IWA, fits the bill. Written by **Peter Chave**, ex-NRA Head of Water Quality and now international consultant, it puts the Directive in the context of overall European policy. You can also find out how sustainable water-use, paying the true cost of water, and involving the public in decision making all fit into the legislation.

Visit www.eeb.org for further details on the issues and the position paper.

Hampshire action

Hampshire County Council has been at the forefront of sustainability and water conservation development (Bulletin 41, page 3). It has published its internal **Corporate Water Action Plan** on how to keep its own house in order. It has the aim "*to make Hampshire County Council a model for excellence in its stewardship of the water environment*".

Hampshire Water Strategy: Stakeholder Event took place last September and, as a consequence, watch out for the draft **Hampshire Water Strategy** that is expected at the end of April. Following a two month consultation period, a final version is expected to be launched by the end of the year.

Visit www.hants.gov.uk/environment/water/ to keep up-to-date on the evolving water strategy. Contact Mike Bridgeman on email:mike.bridgeman.hants.gov.uk for details on the strategy and the action plan.

Calling water efficiency to account

Ofwat's 2001 report ***Efficient Use of Water – Current Progress and Future Plans***, states that "*…further work is now needed to clarify the costs and benefits of water efficiency measures, particularly over the longer term*". Common sense tells us that if we are to pursue water efficiency as part of a demand management programme, it should be done with regard to financial viability. As with the economic level of leakage (ELL), there is a trade-off between water savings achieved and expenditure. But how do we measure this? Anglian Water's **Andy Chivers** debates the issues.

The UKWIR/Environment Agency guidelines in ***Economics of Demand Management*** (now being updated and revised) had already engaged this question back in 1996. A major element of the proposed appraisal methodology, adopted by the UK water industry, is the calculation of average incremental social costs (AISC's).

Whilst cost benefit analysis (CBA) is now a well-established management accounting procedure used in government (HM Treasury's 'Green Book') and business, environmental evaluation is still a relatively undeveloped and at times vague science.

Yet, in carrying out a CBA of water efficiency schemes, it is only proper that any likely environmental effects, although not necessarily 'significant' and unlikely to require an environmental impact assessment (EIA), should not be ignored in weighing-up the costs and benefits.

This is a nettle that Anglian Water has attempted to grasp in drawing up a set of appraisal guidelines that apply to the analysis of water efficiency schemes. The term 'appraisal' is used here in its widest sense: a measure not just of expense, but also of the economic and environmental sustainability of a scheme.

A brief survey of the relevant literature indicates that contingent valuation (CV) appears to be the most appropriate method of environmental evaluation. CV is generally based on surveys of the public and their willingness to pay (WTP) to protect a resource or avoid restrictions in use, for instance. WTP rivals other methods of evaluation such as replacement cost, hedonic pricing, existence value, or travel-cost approaches, as a relatively easy to manage process.

However, this is not to say the WTP technique is thoroughly robust. The value that people choose will be influenced by factors such as affluence, wealth and an individual's social values or preferences. It is also difficult to place a price on a commodity that has no market value: how much are you willing to pay for a lung-full of clean, fresh, non-polluted air?

Many respondents will guess at a figure without carefully considering how that figure is derived. In addition, there is the dilemma faced by all methods of evaluation, of whether it is morally right to try and place a commodity price on the Earth and its natural resources.

A final point of debate among those concerned about the use of cost benefit analysis is the use of discount rates. This is defined in the ***Economics of Demand Management*** report as:

"*The rate at which future costs and benefits are adjusted downwards to reflect, for example, that current benefits are valued more highly than future costs*".

Discount rate crucial

The discount rate cuts straight to the heart of an appraisal, in returning the estimated long-term costs and benefits of a scheme. HM Treasury recommends a general discount rate of 6 per cent for Government projects. The greater level of risk associated with capital in the private sector generally results in a higher discount rate, perhaps 8 per cent.

Ofwat's 2001 *Interim Determination Table A – Materiality Test* recommended a rate of 4.2 per cent. All of these will deliver very different results as shown in table 1 below.

Table 1 Present values of £1m in 50 years

Discount rate	Present value	Difference in PV
4.2%	£127,824	£0
6.0%	£54,288	£73,536
8.0%	£21,321	£106,503

This demonstrates how sensitive a CBA's results are to the discount rate used in an appraisal. The lower the discount rate, the greater the present value (PV).

There are limitations to the appropriateness of CBA. Whilst the intention is to construct a rationale for policy decision-making, CBA is most effective where the objective is economic efficiency. Most capital projects or investments are intended to increase income or reduce costs. In either case, the ultimate aim is to increase profits. This aim does not necessarily pertain to water efficiency schemes. Economic efficiency in the context of water efficiency may be defined as the scheme that achieves the desired reduction in demand at the least cost to the business.

Using this principle, CBA is being applied by Anglian Water to a series of water efficiency schemes, which can then be ranked according to least cost, as per standard practice, for comparison with other capital projects.

Table 2 compares the economic efficiency of customer supply pipe repair and replacement schemes. It is assumed that the supply is unmeasured (thus there is a neutral revenue impact), short run marginal cost of water is 5p/m^3, the long run cost is 50p/m^3, repairs cost an average £300 with a ten year lifespan, replacements cost £487 with a fifty year lifespan, and the division of the total environmental evaluation by the distribution input equates to a cost of 4p/m^3.

The results in would appear to indicate that although £187 more expensive, the replacement scheme is most favourable, indeed, delivering a significant economic gain with benefits accruing over 50 years. However, this does not take account of the cost of capital, or the gradual deterioration over time of the water savings initially achieved in year one, or the AISC benefit achieved through reduced water demand.

Table 2 Supply pipe repair and replacement scheme costs.

Discount rate	Marginal cost	Repair scheme AIC £/m^3	Repair scheme AISC £/m^3	Replacement scheme AIC £/m^3	Replacement scheme AISC £/m^3
4.2%	long run	-1.59	-1.54	0.97	1.11
	short run	-2.15	-2.10	-0.55	-0.42
6.0%	long run	-1.52	-1.46	2.36	2.60
	short run	-2.15	-2.09	-0.41	-0.17
8.0%	long run	-1.43	-1.37	5.48	5.97
	short run	-2.14	-2.08	-0.10	0.40

Anglian Water's work on the CBA of water efficiency schemes is nearing completion and will be integrated into their demand management strategy process, helping to make best use out of both their water and financial resources.

For further details, you can contact Andy Chivers at Anglian Water, email: achivers@anglianwater.co.uk.

Overall Performance Assessment

continued from page 1

duce tighter leakage targets based on a revised economic level of leakage.

The OPA scores are as follows for the difference between the ELL target for the report year and the actual level of leakage recorded:

Table 3 (ELL - actual leakage) scores

<=0%	50	10.1% to 15.0%	35
0.1% to 5.0%	45	15.1% to 20.0%	30
5.1% to 10.0%	40	20.1% to 25.0%	25
		>25%	20

Supply pipe repair policy is one of the seven elements of '*Assessed Customer Service*' with three bands. '*Good*' is for free locate and repair service and free replacement service (with some restrictions). '*Average*' is as above, but with significant restrictions. '*Poor*' is where none of the above is offered. The '*Availability of Free Meter Option*' is included in the '*Information to Customers*' section.

***Linking Service Levels to Prices* is available from OFWAT via www.ofwat.gov.uk or tel: 0121 625 1300.**

US EPA promotion

The Water Saver Home web page has been developed by the California Urban Water Conservation Council under a cooperative agreement with the US Environmental Protection Agency at **www.h2ouse.net.** This impressive site gives you the information you require to save water as you take a trip through the rooms of the house.

R&D Fact Sheets

Finding the basic details of demand management related research can be a daunting task, especially when the exact title and date do not readily come to mind. To make life easier, the Centre has issued a set of ***R&D Fact Sheets*** that cover completed projects that the Agency has conducted, either alone or in partnership with stakeholders.

Many of the projects have been carried out in collaboration with the water companies through UKWIR. These include those on demand forecast methodology and components as well as on the economic and environmental effects of demand management.

Also prominent is the BSRIA study on water conservation in buildings that led onto the popular and recently updated ***Fact Cards***. The ***Fact Sheets*** will also help unravel the Agencies research into the optimum use of water and industry as it has moved through its different phases.

For copies of the *Fact Sheets*, please contact the Help Desk.

METRON

Just arrived at the Centre is ***Water for the City - Critical Issues and the Challenge of Sustainability*** (ISBN 960-86789-2-7) by G Kallis and H Coccossis. This is the final publication of the METRON project. This and the summary report ***Metropolitan Areas and Sustainable Use of Water*** (ISBN 960-86789-4-3) will be reviewed in the next Bulletin and can be downloaded from **www.aegean.gr/enpl/newpage119.htm.**

Good progress on plans, but ...

In the ***Second Annual Review of Water Company Water Resources Plans**** the Environment Agency acknowledges that most companies are making good progress on their water resources plans. The system of thoroughly analysing the information each year means that significant issues can be identified that need further attention.

Those identified for the period covering April 2000 to March 2001 were:

* South East Water progress in achieving an appropriate supply-demand balance seems slow. The company risks a supply deficit if a dry year occurs
* Dwr Cymru Welsh Water is making little progress resolving resource balances in zones that were predicted to have a deficit before 2010. The Agency also seeks further clarification to understand some of the values provided by the company, including per capita consumption (pcc), leakage, population, property numbers and occupancy rates
* Essex & Suffolk Water has proposed a change to its resource development plan which will identify inadequate headroom from 2002 to 2008
* the high volume of water put into the distribution system by Thames Water is of continued concern to both the Agency and Ofwat
* credible per capita consumption and occupancy rate values are sought from Yorkshire Water.

*** ISBN 1-85-705772-4, pp20, available from the Agency, tel: 01454 624400.**

DIARY

CIWEM is holding a national one day conference **Planning & Managing Drought in the UK** on 16 May in London. **Contact Erica Hammond on tel: 01787 249290, email: erica@lavenhamgroup.co.uk or visit www.ciwem.com for details.**

This year's **Water Conservation and Demand Management Professional Development Course**, to be held in the week beginning 10 June at the University of Newcastle, has a number of new presenters this year. **Diana Maslin** from Envirowise, **Terry Bates**, the Education Manager for United Utilities (and the project manager for waterintheschool.co.uk) and BSRIA's **Reg Brown**, responsible for the Buildings that Save Water project will give practical examples of how water conservation is progressing. **Visit www.ncl.ac.uk/hydroinformatics/ for details.**

The School of Water Science at Cranfield University are hosting **Industrial Wastewater Recovery and Reuse** on 17 July 2002. Included are presentations from the Netherlands, Belgium and the USA **Visit www.cranfield.ac.uk/sims/water/iwrr.htm for details.**

UNEP and Global Water Partnership are organising a **Forum on Water Demand Management** as part of the 'Plan Bleu' programme in the Mediterranean Region. This will report on progress on the Case Study on Integrated Resource Management (IWRM) and Water Demand Management (WDM). **Visit www.planbleu.org for details.**

REFLECTIONS

You will have noticed that much of this edition is once again concerned with leakage. We make no apologies as there is no doubt that the reduction of leakage, over the last five years, has been a success story for both the water companies and for the regulators. The debate is now centred upon just how much further leakage can be reduced and this is where the *Tripartite Study* is intended to act as guide.

While it might not be true that the water companies have *enjoyed* reducing leakage, it is in their c*omfort zone* as it is something directly within their sphere of influence that they can simply get on with. But now, with the gains diminishing, water companies will need to look elsewhere if demand management is to remain part of the 'twin-track' approach to balancing supply and demand. Most of the other options require dialogue and some degree of 'buy-in' from customers.

Consume differently

Andrew Blaza of UNED UK stated at the *It's Your Choice workshop* (see page 2) that the message had to be '*consume differently, not consume less'*. Herein lies the subtlety of the marketing strategy: we want people to consume less, but we ask them to consume differently.

The lack of a demand by consumers for water efficient goods should not be used as an excuse for inaction. In this issue we report on Race to the Top (see page 3). Instead of waiting for their customers to set the environmental agenda, the supermarkets themselves are now involved in developing their own indicators to track their own social, environmental and ethical performance.

Developers stating that they won't put water efficient fixtures in new homes because there is no demand is a 'cop-out'. They can also demonstrate their own environmental responsibility by helping create the demand.

Was the electric toothbrush or mobile phone invented because there was a huge demand for these goods? No, companies reached the decision that there was plenty of profit to be made from these goods once the marketing strategy had convinced people that there lives would be incomplete without them.

A marketing strategy begins with understanding how people value water. With this in mind, in our next edition we will be reviewing ***Evaluating Water - Cultural Beliefs and Values about Water Quality, Use and Conservation*** written by Veronica Strang from the University of London.

David Howarth

HELP DESK

If you require more information on articles or publications referred to in this Bulletin, please contact Paula Wood by email: **paula.wood@environment-agency.gov.uk** or by telephone: **01903 832073.** Your comments and suggestions will be most welcome.

Bulletin articles are posted on the Environment Agency's website and are text searchable.
Visit **www.environment-agency.gov.uk/savewater** for more information.

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