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Delivering water neutrality: measures and funding strategies

Resource Efficiency science programme
Science report: SC080033/SR2

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Steve Killeen

Head of Science

Executive summary

The Environment Agency study *Towards water neutrality in the Thames Gateway* (2007) showed that it was technically feasible to achieve a state of water neutrality by offsetting a new development's demands for water in existing households and business properties. This study builds on technical work in the Thames Gateway to demonstrate strategies for the measures and funding required to deliver water neutrality in growth areas and eco-towns.

The refined definition of water neutrality is: "*for every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community*". This definition should be used to ensure a consistent understanding of the purpose of water neutrality.

Water neutrality cannot solely be delivered by the water companies and they cannot be seen as the "default" funders of the measures required for water neutrality. The delivery of water neutrality must be on the basis of concerted action in partnership with the local community, and involving the local authority, local water companies, the Environment Agency and developers.

Water neutrality must be established within the planning system if its delivery is to be effective. This will identify the need, bring partners together and provide the focus on community action and funding. Local authorities are at the centre of the planning process and can aim for water neutrality alongside energy efficiency and carbon reduction goals for existing housing stock. These need to be reflected in the development of Regional Strategies, and should be implemented as part of the Local Development Framework.

There needs to be an improvement in the way in which water efficiency measures are delivered, particularly through the mobilisation of a range of water efficiency measures, supported by adequate funding, into the specific water neutrality area. Water companies now have mandatory targets for a minimum level of water efficiency activity, which should count towards the offsetting of consumption in these areas. However, the final delivery of water neutrality will require additional interventions to be implemented.

Water cycle studies conducted by the Environment Agency, water companies and local authorities may be the best policy instrument to devise water neutrality strategies.

Delivering water neutrality will require technical and behavioural water efficiency interventions implemented in a co-ordinated and targeted way to maximise take-up rates and water savings. Delivery will require the right mix of: communication and education; water efficiency measures targeted at specific groups of domestic, commercial and public properties; metering and alternative tariffs; enforcement of water conservation standards and regulations; labelling, with retailers providing point of sale information on water conservation; and training of local plumbers to offer water conservation advice.

From the evidence and modelling of scenarios, metering the existing housing stock appears to offer the greatest water saving per household. Water neutrality areas should aspire to be fully metered to harness these savings and to allow the introduction of innovative tariffs to encourage further savings.

There is no over-arching funding mechanism to help meet water neutrality, unlike heat and energy efficiency. Funding sources should be harnessed, including:

- Funds that water companies receive to roll out metering programmes.
- Funds set aside by water companies for water efficiency activities (achievement of water efficiency targets in water neutrality areas should count towards the offsetting of consumption from new developments in these areas).
- Funds for heat and energy efficiency under CERT (CESP in the future) and all other retrofit programmes.
- Funds available under the New Growth Point schemes.
- Funds for the improvement of social housing through the Decent Homes schemes.
- Funds that may be available under the proposed Community Infrastructure Levy. Where measures contributing to water neutrality are identified as enabling the development to take place, it should be possible to establish funds (through infrastructure charging) for these intervention measures. This funding mechanism does not yet exist.

The Environment Agency should lobby Government to ensure that the Community Infrastructure Levy (CIL) makes more explicit reference to funding for water efficiency-related infrastructure. If implemented in this way the CIL could provide a sustainable funding mechanism for water neutrality, in addition to other environmental and amenity benefits.

Local Authorities are responsible for carbon reduction and report their progress on adaptation measures needed to meet the challenges of climate change. This potentially provides an incentive for local authorities to collaborate to deliver water neutrality alongside carbon reductions.

The current consultation on the Heat and Energy Saving Strategy should embrace water efficiency under the Community Energy Saving Programme (CESP) and reinforce an integrated energy and water-saving process. Government should move to integrate water efficiency and explicitly hot water savings within this strategy. Delivering the funding for water efficiency through or in partnership with energy efficiency schemes is one part of the funding for delivering water neutrality.

In line with the increasing emphasis on local government delivery of climate change policies, innovative infrastructure tariffs are being developed by some local authorities. Where these include support for carbon reduction via energy efficiency programmes, a targeted and funded approach to include retrofitting of energy and hot water-saving devices would support the funding of water neutrality.

Policy makers should work closely with trade associations on the type of energy or water services discussed in the recent consultation on Heat and Energy Saving Strategy. Plumbing businesses are the main interface for most customers and could be the primary services for interventions that require retrofitting in existing properties. Given their relationships with householders, plumbing businesses also play an important role in providing advice and education.

Finally, it would be worth demonstrating that these conclusions and the delivery of water neutrality are feasible by undertaking an ”exemplar” project in a specific New Growth Point area.

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1 Introduction

1.1 Background

In November 2007, the Environment Agency published a report *Towards Water Neutrality in the Thames Gateway* (2007a) with the Department for Environment, Food and Rural Affairs (Defra) and Communities and Local Government (CLG) which looked at whether it was possible for the Thames Gateway development to be achieved without increasing the demand for water, that is, it could achieve water neutrality.

The concept of "water neutrality" looks at whether demand for water by new housing and commercial development could or should be offset in the existing community by making existing homes and buildings in the area more water efficient. In effect "water neutrality" is a more robust policy to emphasise demand management strategies.

This study aims to build on the Thames Gateway study (Environment Agency, 2007a) to carry out an exploration and analysis of the delivery options for water neutrality. This work is part of a series of studies (others being undertaken by Entec on the hydrological conditions for "water neutrality" and on the feasibility of "water neutrality" in the proposed eco-town areas), that together will develop a broader understanding of water neutrality so that it becomes a more useful concept for the Environment Agency and others to apply operationally (in areas outside of the Thames Gateway such as Eco-towns and Growth Points, as well as the Thames Gateway itself).

The aims and main tasks of this study are broken down into three areas:

- Work Package 1, to identify and assess options relating to the implementation and financing of water neutrality, particularly relating to 'off-setting' new water use by retrofitting existing homes, buildings and non-domestic water use.
- Work Package 2, to carry out a cost-benefit analysis of water neutrality (using the preferred scenario) as outlined in the Thames Gateway study. This work was undertaken by Metroeconomica and is available in a separate report.
- Work Package 3, to support the development of guidance to enable the Environment Agency and others to estimate the feasibility of reaching water neutrality in significant new developments (such as eco-towns and growth areas).This is presented in an accompanying report

This report covers Work Package 1.

1.2 Policy context of water neutrality

1.2.1 Policy on carbon reduction and climate change

Water neutrality sits within the Government's wider policies on mitigating and adapting to climate change. The manner in which regulators, water service providers, planners, developers and local community organisations approach water neutrality is a contributory part of the climate change action programme that has now been given

legal force through the November 2008 Climate Change Act[1]. This context is described in a speech by Margaret Beckett, the Minister for Housing in November 2008:

"*...attention has focused on the zero-carbon target for new housing - making our homes vastly more energy efficient to cut carbon emissions. But a sustainable home isn't just a zero carbon home. It's also one which reduces waste, which cuts energy consumption - and clearly, which helps reduce water usage. Our planning policies are already laying the foundations for more sustainable building - emphasising the need for all new development to respond to the threat of climate change...*"

Achieving carbon reductions is not just a matter of improving standards in new housing, but requires significant retrofitting in existing homes. The Minister for Housing calls this her *Green Changing Rooms* strategy[2]. Retrofitting of existing properties is a major issue for achieving the delivery of water neutrality and the commonality with energy efficiency strategies is another important policy context for understanding both the delivery strategies and future funding possibilities of water neutrality.

Making a particular area water neutral, and implementing wider water efficiency programmes, is not just the domain and responsibility of water supply companies. Water neutrality sits alongside energy efficiency and carbon reductions as policy that will involve many local community based organisations to deliver.

Community-based collaboration is essential alongside an increasing role for regional and local Government to act on climate change. The UK's Heat and Energy Saving Strategy calls for a significant increase in energy saving and energy generation in and by communities. Devolved and local government entities and Government agencies are seen as having a critical role in helping individuals and communities to save energy and reduce their carbon emissions. Regional Development Agencies (RDAs) and local authorities are to play a key role in devising energy plans for their areas. New integrated regional strategies will be developed by the RDAs and local authorities should include specific plans for carbon reduction and renewable energy. These, alongside other features in the planning system, should provide local authorities with the tools to implement carbon reduction and renewable and low carbon energy generation in their area. This combination of the importance of local action, local responsibility and local delivery are themes of importance in the delivery of water neutrality, together with mix of the policy driver on carbon reduction.

A *Retrofit for the Future* competition has been launched by Government, to encourage companies to bid for a share of £10 million in funding to develop solutions to improve the environmental sustainability of existing buildings and reduce costs. Government is also reviewing the Local Government (Miscellaneous Provisions) Act 1976, as amended by the Energy Act 1989, which includes a provision preventing local authorities from selling electricity produced "otherwise than in association with heat". Government is reviewing this in order to support local authorities play a full role in action to develop renewable heat and electricity. The question this raises in the provision of water services is whether new retail water service providers involving local authorities might be encouraged within a new competition regime for water and wastewater.

1.2.2 Thames Gateway and national housing development plans

The Thames Gateway Interim Plan identified the capacity to provide around 165,000 new homes and 180,000 new jobs in the Gateway between 2001 and 2016 (CLG

[1] The Climate Change Bill became law on 26 November 2008.
[2] Speech to the Royal Society of Arts on 24 February 2009 - A sustainable makeover for every home in the country.

2006). In the context of the drought of 2004-06 the House of Commons Environmental Audit Committee of 2006 expressed concerns that levels of housing growth proposed for the Gateway may not be sustainable because of the water resource situation in the area. This concern for the sustainability of water resources in the context of housing growth and increasing demand has wider significance for other areas where housing growth will take place.

The large scale of development in the Thames Gateway was seen as an opportunity to make the area a show-case for best practice to achieve sustainable development – not just in water use, but also for renewable energy and reduced levels of carbon emissions. The Thames Gateway study was undertaken in conjunction with water supply companies, regulators, developers and housebuilders and residents in the Thames Gateway.

Major new housing growth is planned between now and 2020 and some of this will be in areas where water resources are already stretched or may become so as a result of development. The Government's plans to increase the number of new houses by three million before 2020 will place a significant burden on existing water resources[3]. In some areas, this extra demand could be met by new resources (such as reservoirs or transfers), but in other areas, options for meeting new demand may be more limited.

This increase in the national stock of housing is a high priority for Government, and the Government wishes to see this essential growth in the number of homes achieved in as sustainable a way as possible. The fact that the growth is focussed and planned rather than piecemeal provides opportunities to implement sustainability policies to a high standard and (cost) effectively. Government has plans for 1.6 million homes through regional plans and current growth areas (including the Thames Gateway, Ashford and Milton Keynes-South Midlands). In October 2006, it announced 29 current New Growth Points (NGPs) that will result in 100,000 extra homes by 2016. The Housing Green Paper commits to another round of New Growth Points (NGPs), see Figure 1.1. This programme will result in 50,000 extra homes. There will also be four eco-towns under construction by 2016 and a further six eco-towns by 2020.

[3] Statement by Minister of State for Housing to House of Commons on 23 July 2007

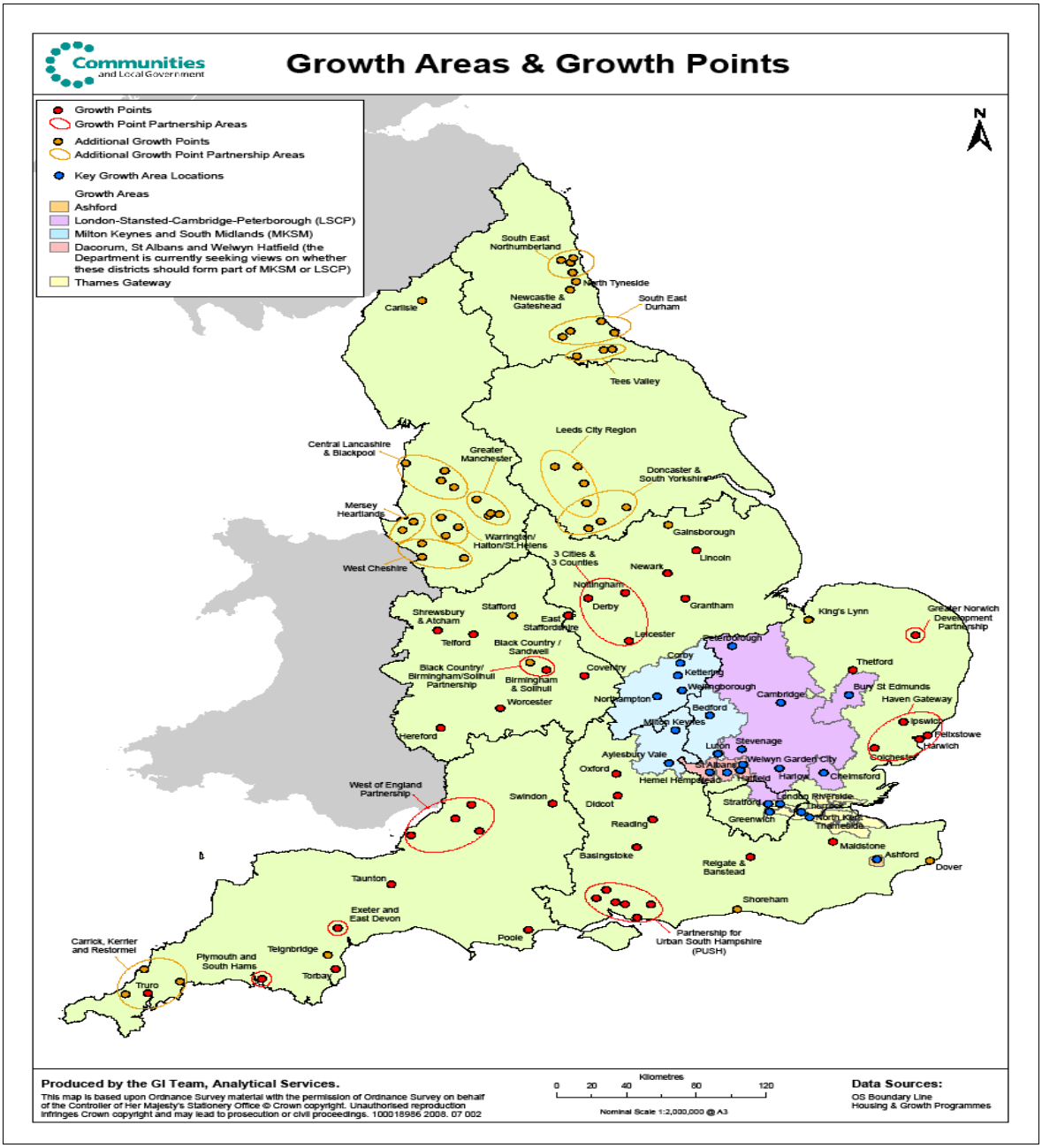

Figure 1.1 Projected new growth points (Source: Communities and Local Government website 2008).

1.2.3 Eco-towns

An eco-town is a new settlement of between 5,000 and 20,000 homes which will demonstrate the highest levels of sustainable development and should act as an exemplar for future developments. Eco-towns will be near to and well-connected to existing settlements, particularly major centres of employment, retail and leisure. The aim is to have settlements that enable households and individuals to live sustainably. The eco-towns Planning Policy Statement (PPS) states that eco-towns developments should be ambitious in terms of water efficiency across the whole town development, particularly in those areas of serious water stress. High standards of water efficiency are expected of eco-towns, with the water conservation hierarchy of reduce– re-use–recycle providing an appropriate model. As a minimum requirement, homes built before

2016 should achieve level 3 or 4 of the Code for Sustainable Homes (per capita internal consumption of 105 litres per person per day).

The Town and Country Planning Association eco-towns water cycle worksheet (2008) says that for eco-towns built after 2016, homes must achieve Code Level 5 or 6 (80 litres per person per day), which usually requires some form of water reuse and long-term management and maintenance. For non-household buildings, developers should demonstrate how they have considered water efficiency and conservation in the design and maintenance of buildings. Where standards currently exist for a particular building type, developers should aim for the BRE Environmental Assessment Method (BREEAM) 'Very Good' or 'Excellent' standard, with a request that maximum points are scored on water.

Under the Supplement to Planning Policy Statement 1, Planning and Climate Change, local planning authorities can set higher standards of water efficiency for an eco-town (and other developments) where local circumstances warrant such action. The eco-town PPS states that such circumstances could include, for example, an eco-town located in an area of serious water stress and where this is the case, it is proposed that eco-towns should aspire to water neutrality.

From the eco-town prospectus:

Water neutrality is a demanding level of ambition which is only likely to be achieved through a combination of measures. A key component is to make the new development water efficient, through utilising the most water-efficient products and where appropriate looking at water reuse options. Other measures involve the existing building stock and would need to be explored in partnership with the water companies. These may include extending the extent of metering, introducing variable tariffs to encourage water efficiency, retrofitting existing buildings with water-efficient products and reducing demand from non-households.

1.3 The planning and development context for water supply

Water neutrality needs to be set in the context of the planning process for large new developments and the organisations involved; local authorities, developers, property owners and water companies and their regulators, all have important roles and responsibilities. Development of water supply infrastructure is currently managed by integrating the planning process of Regional Spatial Strategies with Local Area Frameworks and Local Area Action Plans, and that of the regulatory process for water companies. Water companies are private sector organisations with their own regulatory process detached from governance of the wider infrastructure planning in a region.

The Water Act 1989 recognised the impact of new development on the existing water supply and allowed companies to make an infrastructure charge on developers to cover the provision of extra capacity. These charges are designed to ensure that existing customers do not have to bear the full burden of investment in additional infrastructure for a new development. Infrastructure charges are raised when new premises are connected to the water supply or sewerage network for domestic drainage.

For large developments, water companies will be involved at an early stage in the planning process. This starts with an understanding of Planning Policy Statement 12 (see http://www.planningportal.gov.uk/ which sets out the Government's policy on local spatial planning, and which plays a central role in the overall task of "place shaping" and in the delivery of land uses and associated activities. A key sustainability objective for the preparation of a Local Development Framework is that the new development

needs to be coordinated with the infrastructure it demands and to take into account the capacity of existing infrastructure.

Paragraph 4.9 of the PPS12 2004 states that "*Local planning authorities...should ensure that delivery of housing and other strategic and regional requirements is not compromised by unrealistic expectations about the future availability of infrastructure, transportation and resources*". PPS12 also emphasises the need to take account of water supply and sewerage infrastructure in preparing Local Development Documents. Paragraph B3 states: "*The provision of infrastructure is important in all major new developments. The capacity of existing infrastructure and the need for additional facilities should be taken into account in the preparation of all local development documents. Infrastructure here includes water supply and sewers, waste facilities*".

To meet the test of "soundness" as set out in PPS 12, the Local Development Framework needs to consider water and sewerage infrastructure. In December 2005 The Planning Inspectorate published *Development Plans Examination – A Guide to the Process of Assessing the Soundness of Development Plan Documents (DPD)*. The guide sets out a series of 'key questions and evidence requirements' for DPDs.

For the water sector, the main question under the PPS12 Conformity Test iv(a) is: "*Has adequate account been taken of the relationship between the proposals in the DPD and other requirements, such as those of utility companies and agencies providing services in the area including their future plans or strategy and any requirements for land and premises, which should be prepared in parallel?*" A key source of evidence in answering this question is: "*Evidence - of particular significance, will be representations from bodies that consider that the DPD either does or does not have sufficient regard to other relevant strategies for which they are responsible*".

The need to plan housing within existing or new infrastructure capacity, including water, is a clear message within PPS3, the main policy statement for housing. For example:

- Paragraph 36 requires that housing be developed in suitable locations which offer a range of community facilities and with good access to jobs, key services and infrastructure. This should be achieved by making effective use of land, existing infrastructure and so on.
- Paragraph 37: One of the criteria for identifying broad strategic locations for new housing developments is the availability and capacity of, and accessibility to, existing major strategic infrastructure, and/or feasibility of delivering the required level of new infrastructure to support the proposed development.
- Paragraph 38: Local Development Document criteria for site identification should take into account any physical, environmental, land ownership, land use constraints or risks associated with broad locations or specific site. This includes the need to protect natural resources such as water.

In addition, Paragraph 54 of PPS3 requires local planning authorities to identify suitable sites for housing in the first five years (of a 15-year period). Infrastructure capacity is an important criteria in terms of what is achievable. Lack of infrastructure capacity (or inability to build new capacity in time) is a key component of PPS3.

As part of their five-year business plan, water companies advise Ofwat on the funding required to accommodate growth in networks and at all treatment works. As a result, investment programmes are based on development plan allocations which form the clearest picture of the shape of the community (as mentioned in PPS12 paragraph B6). If any large engineering works are needed to upgrade infrastructure, the lead time could be up to five years and bringing in new technologies and the construction of new treatment works could take up to ten years.

For water companies, it is up to the developers to demonstrate that adequate capacity exists both on and off the site to serve the development and that it would not lead to problems for existing users. In some circumstances, developers may have to carry out studies to ascertain whether the proposed development will lead to overloading of existing water (and sewerage) infrastructure. Where there is a capacity problem and no improvements are planned by the water company, the developer needs to contact the water company to agree what improvements are required and how they will be funded prior to any occupation of the development. The introduction and use of water cycle studies (Environment Agency, 2009a) will provide a more consensus-based approach between local planning authorities, water companies and developers.

1.4 Recent policy on water efficiency

In the time since the Thames Gateway report was published a number of new or updated policy statements and actions on water efficiency have emerged which have a bearing on water neutrality implementation.

Recent policy interventions to promote water efficiency will also have an impact on the mitigation measures needed to meet water neutrality. For instance, changes to Building Regulations Part G, Water Supply And Fittings Regulations, Water Saving Group over-arching goals and Ofwat's Water Efficiency Targets are all aimed at reducing per capita consumption over the coming years. These are in line with Defra's vision to achieve an average per capita consumption (pcc) of 130 litre/head/day by 2030 (Defra 2008a). Policies act to encourage the development and installation of the most water-efficient fixtures and fittings and encourage changes in consumer behaviour. Over time, these policies should lower average pcc. This will need to be taken into account when determining the potential for offsetting water use in existing properties.

Some areas of the country will be approaching full metering by 2015. Options for using metering as a tool to offset water use will be limited, although the potential to encourage efficient use of water through alternative tariffs may be greater (depending on the type of metering installed).

Average pcc in an area and percentage meter penetration might be used to determine intervention options.

1.4.1 Building Regulations Part G

New requirements on water efficiency will be introduced into Building Regulations Part G, at the same time as changes to improve the safety of hot water systems and to update the supporting technical guidance. Government will amend the Building Regulations to include a requirement for a minimum standard of water efficiency in new homes, in the form of a calculated whole building performance standard set at 125 l/p/d (GLG 2007).

The new regulations will be implemented in April 2010. This will be a mandatory standard for new homes, and is broadly equivalent to the Code for Sustainable Homes Level 1 with an allowance of approximately four per cent for external use.

1.4.2 Water supply and fittings regulations

Defra has indicated that it will review the Water Supply (Water Fittings) Regulations 1999 during 2009. The review is likely to consider enforcement issues, advances in

technical standards and water conservation, and the case for setting new performance standards for water fittings.

This could have an impact on water efficiency in existing homes where water fittings are replaced or retrofitted, and potentially on non-household buildings. The extent to which this will affect water neutrality cannot be determined until the review has been carried out. The expected timescale is as follows:

- Consultation on amendments to regulations – summer 2009.
- Instructions for changes to legislation and notification – autumn 2009.
- Regulations made and laid – spring or autumn 2010.
- Regulations come into effect - autumn 2010 or spring 2011.

1.4.3 Water Saving Group

The Water Saving Group (WSG) was established in October 2005 to promote water efficiency in households. It brought together skills and experience from organisations such as Defra, the Department for Business Enterprise and Regulatory Reform, the Department for Communities and Local Government, Ofwat, Environment Agency, Consumer Council for Water, Water UK and Waterwise. Towards the end of 2008, a majority of the WSG's work was completed and the group disbanded. However, each member has identified a number of areas for future work according to their roles and responsibilities. The main achievements of the WSG and commitments of each of its members to future work are contained in a Defra paper on the WSG overarching goals. A summary of commitments from each organisation are included in Appendix A.

1.4.4 Work on standards

In January 2009, the British Standards Institute published a Code of Practice for Rainwater Harvesting. A similar code of practice is being developed for grey water systems.

1.4.5 Ofwat's water efficiency targets

In November 2008, Ofwat published its Water Supply and Demand Policy (Ofwat 2008). This policy covers water efficiency, leakage, metering and climate change. Of particular relevance to water neutrality are the water efficiency targets.

The water efficiency targets are a basis for measuring companies' performance on water efficiency activities, and to highlight their work in helping consumers to use water more wisely. Since 1996, each company has had a duty under Section 93A of the Water Industry Act 1991 (WIA91) to promote water efficiency to its customers. Since 2005, this duty has also applied to licensed water suppliers.

Ofwat have set targets in two parts. The first is a base service water efficiency (termed BSWE), and the second a sustainable economic level of water efficiency (or SELWE).

BSWE is the minimum level of activity that Ofwat expects all water companies to achieve under their duty to promote water efficiency.

The target is activity-based and Ofwat have set the target in terms of three key elements:

- An annual target to save an estimated one litre of water per property per day through water efficiency activity, during the period 2010-11 to 2014-15.
- A requirement to provide information to consumers on how to use water more wisely.
- A requirement that each company actively helps to improve the evidence base for water efficiency.

The target is halved (0.5 litres/property/day) for companies that report average pcc (over three years) below 130 litres/head/day. At the present time, only the Tendring Hundred water company qualifies for this.

Ofwat believes that BSWE represents the level of activity that companies should be achieving. Therefore, Ofwat does not propose additional funding to meet this target.

SELWE is not set in the same way as BSWE. SELWE requires companies to consider additional water efficiency as part of a sustainable, economic approach to balancing supply and demand, where there is a supply deficit. SELWE activities would normally be considered as demand-side options during the water resource planning process. As such, if they are included in the final water resource plan they may receive an allowance during the price-setting process.

1.4.6 Walker Review on charging and metering

Defra has initiated an independent review of water metering and charging. The review (known as the Walker Review) will cover both England and Wales. It is intended to:

- Examine the current system of charging households for water and sewerage services, and assess the effectiveness and fairness of current and alternative methods of charging.
- Consider social, economic and environmental concerns.
- Make recommendations on any actions to ensure that England and Wales has a sustainable and fair system of charging in place. This could include changes to current legislation and guidance.

The review covers a wider range of charging issues than metering, but is expected to draw conclusions on the role of metering in charging for water and may guide future policy on the rate of metering. An interim statement from the Walker Review was published in June 2009.

The current rate of household metering in England and Wales is driven by four main policies:

- All new households are metered (with exceptions where the cost is prohibitive).
- Any existing customer who is not on a meter can request a free meter and opt to be charged on a metered basis (known as the ‘Optant’ or ‘Free Meter Option’ policy). All companies must have this policy on place.
- Change of occupier metering (CoOM) can be carried out on a compulsory basis if it can be shown to be cost-effective. The cost-effectiveness case is generally easier to demonstrate if there is a supply-demand deficit.

- Compulsory metering can be carried out if the company is in an area of water stress and can demonstrate the cost-effectiveness.

In the current round of PR09 planning (Business Plans and Water Resource Management Plans), some companies are proposing to increase the rate of meter penetration over and above rates in the current AMP4 (Asset Management Planning) period. Some areas will thus have much greater metering over the next five years. For example Southern Water, Anglian Water and South West Water all expect to achieve a meter penetration above 80 per cent by the end of AMP5 (2015). Areas such as Northumbrian, South Staffs, Portsmouth and United Utilities are expected to be below 40 per cent. Therefore, some areas might be limited in their options for using metering as an intervention for water neutrality. On the other hand, aiming for water neutrality could encourage companies with low meter penetration to boost their metering.

2 Definition of water neutrality

2.1 Defining water neutrality

There is no universally accepted definition of water neutrality, and the term probably has its origins in the equivalent term ‘carbon neutral’. “Water neutrality” is used in manufacturing (by companies such as Coca Cola) and in water resource management (Thames Gateway).

For the purposes of this study, we will start with the definition used in the Thames Gateway water neutrality study (Environment Agency, 2007a). This definition needs to be modified to make it more generally useable in other areas. The definition also needs to be clarified to enable clear guidance to be given. The Thames Gateway report identified potential alternative definitions and some of these are being considered in parallel work.

The starting point for the definition is:

For every new development, total water use in the region after the development must be equal to or less than total water use in the region before the new development.

The terms in the definition need clarification for further guidance on how to achieve water neutrality. Taking the key terms in order:

New development. This could be a single property through to a major new community (such as the Thames Gateway), and will include developments such as eco-towns.

For the purpose of this guidance, we propose that the term “significant new development” is used. The guidance would then need to explain how to define the “significance of the development”, and how this is dealt with for developments which are phased, where the overall development might be significant.

Total water use. In the Thames Gateway study, this term refers to total demand by all licensed abstractors, for all sectors, including the public water supply (domestic and non-domestic sectors and leakage), industrial abstractors and agriculture.

Guidance will need to be given on how this value should be derived for the ‘before’ and ‘after’ comparison. This guidance will need to take account of variations in total water use that would take place even with no development (such as leakage, manufacturing or agriculture changes which may increase or decrease total water use). One option would be to consider changing the wording to talk about offsetting the ‘increase in predicted total water use due to the new development’.

Region. In the Thames Gateway study, this was defined as the area covered by the Thames Gateway Plan. However, to make the definition more flexible and applicable to other regions, the definition of the term ‘region’ needs strengthening.

The definition of water neutrality should be consistent with sustainable water management, which requires water companies to maintain the balance between demand and supply. The main policy tool for this is the Water Resource Management Plan, and the base unit area used in this plan is the Water Resource Zone (WRZ). The definition of a WRZ is “*the largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers will experience the same risk of supply failure from a resource shortfall*.” The WRZ is one suitable definition of the region. In certain circumstances the development may span more than one WRZ; in this situation, specific guidance will be given. One problem

with this definition is that the WRZ may be a purely infrastructure-defined area, not based on hydrological characteristics like a catchment, with no link to the "community".

Alternative definitions of the spatial area for the region include local authority boundaries, river catchment boundaries or river abstraction management areas. Similar issues surround the definition of the spatial area to be covered by water cycle studies (Environment Agency, 2009a). The final definition of the region should be agreed between the local groups based on local requirements, including the need to consider the range of development sites, water catchment and abstraction issues, water supply issues, and political boundaries. The definition of the region may cross several boundaries, as was the case for the Thames Gateway (Environment Agency 2007a).

Other considerations

This definition of water neutrality entails meeting the needs of new demand through more efficient use of existing water resources. Water resources in England and Wales should be managed by following the 'twin track' approach (Environment Agency 2007b). This requires the costs and benefits of different supply and demand management options for maintaining the supply-demand balance to be assessed and selected on the basis of cost-effectiveness. This should be carried out in accordance with the 'economics of balancing supply and demand'. However, achieving water neutrality may give preferential treatment to demand management options over the potential contribution of new resources, such as reservoirs or additional abstraction and transfers from other catchments (and could be viewed as a 'single track' approach).

The definition should be consistent with the water resource management planning process, where issues of cost and availability of supply-side options may mean less ambitious goals are more desirable. The definition could be further modified to say "*where it is practical to do so*". This allows scope for local constraints (which may include cost, infrastructure or natural constraints) to modify targets for water neutrality allowing them to be set below the 100 per cent water neutral level. The starting point, however, should be the aspiration to achieve water neutrality. There may different perspectives on constraints from different groups (for example, what may be cost-effective for society may not be cost-effective for a water company). These should be addressed and resolved through discussion at a local level by the body responsible for delivering water neutrality.

Sustainability or longevity of the water neutral status was not really discussed in the Thames Gateway study, rather a period of 10 years to achieve water neutrality was defined, largely because that encompassed the development period. Having achieved water neutrality, the WRZ should ideally sustain that state. This, however, would require long-term monitoring to be put into place and the long-term cost borne by local groups to maintain neutrality. Furthermore, the situation is complicated where additional developments occur in the future within the same WRZ; in these cases, developments might be required to be water neutral unless it is impossible to achieve.

The ethos behind water neutrality should be to achieve it through interventions that are sustainable, in terms of the longevity of water savings. The issue of sustainability of water neutrality still needs to be addressed and could be defined in the target-setting process for a particular area, and could include energy and carbon targets as well.

Water neutrality could be achieved in a combination of ways. New developments could be made super-efficient, but will still require water to fulfil essential needs. This water can be 'offset' by retrofitting existing buildings within the area with more efficient devices and appliances; expanding metering and introducing innovative tariffs for water use which reward moderate water users. As well as the household sector, ways to use water more efficiently with non-domestic users should be developed. Water companies should also reduce demand by improving management of leakage where cost effective.

These are all techniques applied in the current water resource management planning process. However, water neutrality may give additional focus to these activities, and give a coherence to demand management activities that balances the coherence of supply side options.

2.2 Recommended revised definition for water neutrality

Taking the points from the discussion above, the recommended new definition for water neutrality is:

For every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community.

The definition is supported by the following points:

- 'Predicted increase in total demand due to the development' is used because water neutrality needs to be designed at the planning stage. The aspiration should be that 'actual' total water use in the region after the development should be less than or equal to total water use before development.
- The definition of the size of new development will be dictated by local factors and needs to consider phased developments in the region. There may need to be a test for 'significance' which might be determined through carrying out the water cycle study, which should identify tensions between growth proposals and environmental requirements.
- The definition of the region should be agreed between local groups based on local requirements, including the need to consider the range of development sites, water catchment and abstraction issues, water supply issues, and political boundaries. Suitable definitions for the region might include local authority boundaries, river catchment boundaries or river abstraction management areas.
- The term "where it is practical to do so" can be included. This allows scope for local constraints (which may include cost, infrastructure or natural constraints) to modify targets for water neutrality, allowing them to be set below the 100 per cent water neutral level.

3 Strategies for water neutrality

Achieving water neutrality starts at the planning stage of a new development. The suggested overall process is illustrated in Figure 3.1.

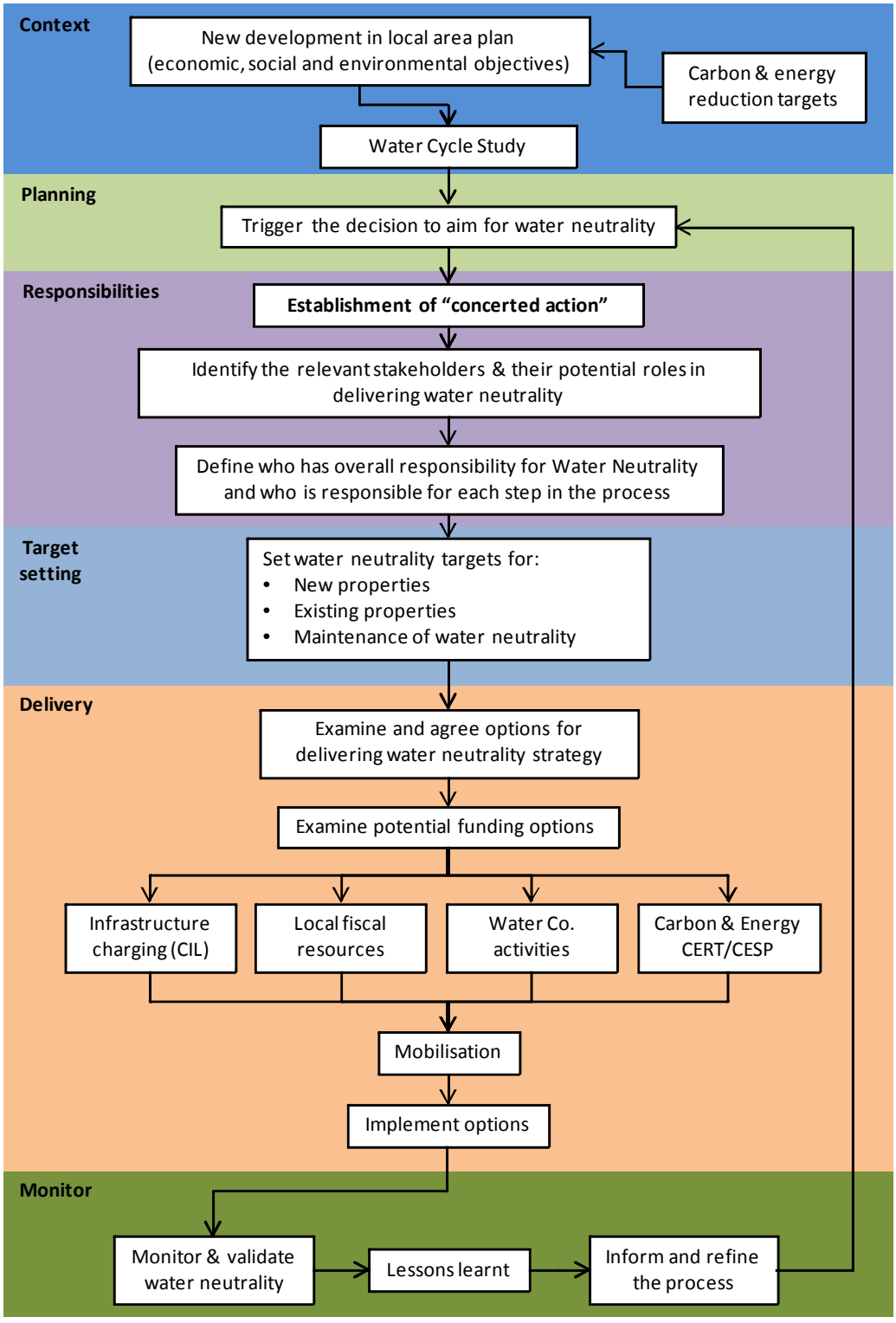

Figure 3.1 Process for achieving and maintaining water neutrality.

3.1 Deciding on water neutrality

The decision to pursue a strategy of water neutrality in any particular location involving the development of new housing, businesses and public building is driven by the heightened level of water stress in that location. This stress acts as a constraint on new development and further supply exploitation of the water resource will result in damaging the environment.

Other motivations for striving for water neutrality might include:

- Its contribution to achieving local authority targets on adaptation and mitigation activities to climate change.
- Its contribution to supporting Regional Development Agency and local authority policies on carbon reduction, energy efficiency and sustainable development.
- Its contribution to local authorities' wider policies for future environmentally sustainable development.

When looking at intervention measures for water neutrality, a number of important issues need to be considered. These include:

- The significance of the development, which might be the scale or types of properties involved. This will also need to take into account phased developments in an area, where collectively they might become significant.
- The supply-demand balance (SDB), whether there is a deficit within the normal WRM planning period, the availability of supply-side options, amount of headroom in the SDB, level of water stress, and local catchment abstraction management strategy (CAMS).
- The current level of demand management activity (may define the capacity for further activity).
- Current meter penetration or use of sophisticated tariffs, which again may define the capacity for further metering or tariff options.
- Sociodemographics of the WRZ: mix and age of properties, social classification groups and so on. All may influence the behavioural responses to demand management.

A parallel project is considering a range of options for assessing the water neutrality potential based on measures such as the 'potential capacity to offset consumption' against 'environmental drivers'.

The Environment Agency is encouraging local authorities to carry out a water cycle study (WCS) as part of the planning process and these will be a mandatory requirement for eco-towns and for areas designated as growth points. There is a comprehensive set of guidance (Environment Agency, 2009a) for conducting a WCS, which is partly aimed at identifying any tensions between proposed developments and the needs of the local water environment. Ideally, a water cycle study will have been carried out in a development zone as a precursor to any decisions on water neutrality, and will include an assessment of the water resource situation and identify areas of environmental and water stress.

Another advantage of carrying out a WCS prior to implementing water neutrality is that the process will have brought together the main groups likely to be involved in the planning and delivery of water neutrality.

3.2 Options for implementing water neutrality

Water neutrality could be achieved in a combination of ways:

- making new developments more water efficient;
- 'offsetting' new demand by retrofitting existing homes with water-efficient devices;
- encouraging existing commercial premises to use less water;
- implementing metering and tariffs to encourage the wise use of water;
- education and awareness-raising amongst individuals.

A range of devices and strategies for buildings and homes are available; in this report, these are termed 'interventions'. Interventions can be designed for incorporation in new buildings or for retrofitting into existing ones, in the domestic or commercial sector. Interventions range from dual-flush toilet retrofits, efficient showerheads and garden water butts to large-scale rainwater recycling systems and extensive publicity campaigns to promote the wise use of water.

Potential interventions include (see Appendix B for more detailed descriptions of each):

- Promotional campaigns
- Education
  - Encourage schools, hospitals and other community establishments to carry out self-audits on their water use.
  - Deliver the water conservation message to schools and provide educational visual material for schools.
- Water-efficient measures for toilets
  - Cistern displacement devices, such as a Hippo or Save-a-Flush.
  - Retrofit dual-flush devices, such as the ecoBETA.
  - Retrofit interruptible flush devices, such as the Interflush.
  - Replacement dual-flush toilets.
  - Replacement low-flush toilets.
- Water-efficient measures for taps
  - Tap inserts, such as aerators.
  - Low-flow restrictors.
  - Push taps.
  - Infrared taps.
- Water-efficient measures for showers and baths
  - Low-flow showerheads.
  - Aerated showerheads.
  - Low-flow restrictors.

  - Shower timers.
  - Reduced volume baths (for example, 60 litres).
  - Bath measures.
- Rainwater harvesting and water reuse
  - Large-scale rainwater harvesting.
  - Small-scale rainwater harvesting with water butt.
  - Grey water recycling.
- Water-efficient measures addressing outdoor use
  - Hosepipe flow restrictors.
  - Hosepipe siphons.
  - Hose guns (trigger hoses).
  - Drip irrigation systems.
  - Mulches and composting.
- Commercial properties
  - Commercial water audits.
  - Rainwater recycling.
  - Grey water recycling.
  - Optimising processes.
  - Provide water efficiency information to all newly metered businesses.
- Metering
  - Promote water companies free meter option.
  - Compulsory metering (in water-stressed areas).
  - Smart metering (to engage the customer with their consumption).
  - Provide interactive websites which allow customers to estimate the savings associated with metering (environmental and financial).
  - Innovative tariffs (seasonal, peak, rising block).
  - Customer supply pipe leakage – supply pipe repair and replacement.
- Other
  - Household water audits, including DIY or with help of plumber.
  - Seek-and-fix internal leaks and/or dripping taps.
  - Water-efficient white goods, including washing machines and dishwashers.
  - Ask customers/public to spot and report leaks (Leakspotters).

Aiming for water neutrality is an ideal opportunity to install a basket of measures to maximise water efficiency. A combination of products or actions can yield greater

water savings than a single device or intervention. In addition, this may result in economies of scale for delivering measures. For instance, a campaign or delivery programme of water-efficient devices might include a number of different messages or devices or be targeted at specific household or commercial groups. However, some combinations of measures may not be cost-effective, particularly where end users are in more scattered groupings. Decisions on interventions would need to be made in the context of local circumstances. Interventions could be installed into new and existing homes, commercial and public buildings to deliver water savings for water neutrality.

Manufacturers are continuously working to improve the performance, desirability and price of efficient water-using products. Water neutrality would be an ideal opportunity to install the "best in class", making water neutrality a gold standard of water efficiency and thus using the best and most efficient products available. In order for water neutrality to be realised, this would require different water efficiency interventions to be undertaken at their full potential. To achieve water neutrality, the boundaries of interventions in terms of their implementations must be stretched. The devices and the strategy adopted to implement them must be designed to operate at the highest level.

Uptake of such devices will vary depending on cost, ease of installation and manner in which these are promoted. These factors will have a potentially important, but as yet unquantifiable, impact on predicted yields and therefore the effectiveness of each measure can be variable across different communities. The uptake rate will also depend on a range of factors – not just cost. The effectiveness and success of a water efficiency measure and therefore its desirability for implementation to help to achieve water neutrality cannot therefore be considered by the yield it may give alone. Delivery mechanisms must include practical and behavioural options. Many interventions are designed to reduce demand when operated in a particular way and ultimately rely on the user being aware of and engaged with their water consumption. Savings of some interventions are undermined if the message of 'wise water use' is not acted on. Publicity and water efficiency advice is thus an important intervention itself.

There will be opportunities and benefits of joining up different sectors. There is a link with water and energy as the reduction in the volume of heated water used will save both water and energy, and hence carbon. There is an opportunity to combine water efficiency initiatives with energy efficiency and some devices will be able to deliver savings for both. This is an important synergy to recognise and support in the future, and will have implications for water neutrality in the wider context. Energy savings can also be made within a water company's treatment process and network. If demand is suppressed, less water will need treating and pumping around the infrastructure. Although real, these savings are relatively small compared to energy savings associated with heated water in the home. When household and water company emissions are considered together, around 90 per cent of emissions in the water system can be attributed to 'water in the home' (Environment Agency, 2008).

Table 3.1 summarises the interventions and identifies whether the intervention is aimed at peak or average demand, and if it potentially has an impact on energy.

Table 3.1 Possible interventions to deliver water neutrality.

Intervention	Applicable to:		Type of demand reduced:		Reduces energy & carbon in the home
	Households	Commercial	Average	Peak	
Toilets/WCs	✔	✔	✔		
Tap use	✔	✔	✔		✔
Showers/baths	✔		✔		✔
White goods	✔		✔		✔
Rain-water harvesting	✔	✔		✔	
Grey-water reuse	✔	✔	✔		
Water butts	✔			✔	
Hose trigger guns	✔			✔	
Drip irrigation	✔			✔	
Mulches	✔	✔		✔	
Industrial process		✔	✔		✔
Water audits	✔	✔	✔	✔	✔
Education, publicity, and behaviour change	✔	✔	✔	✔	
Metering	✔		✔		✔
Tariffs	✔			✔	

3.3 Water company water efficiency activity

Water companies have a statutory obligation to promote water efficiency to their customers (see Section 1.4.5). Many companies have a comprehensive programme to promote water efficiency to households and commercial customers. The aim of this activity is to contribute to the supply-demand balance but also to encourage responsible use of water. The water industry is often criticised for not doing enough to promote water efficiency, but all water companies have increased their water efficiency activities (WaterUk) and this is set to continue to increase following the introduction of water efficiency targets by Ofwat.

Water companies adopt a 'twin track' approach when preparing their water resource management plans (WRMP). A combination of demand management and resource development options are chosen to meet any future deficit in supply and demand. Water companies are required to adopt a 'least cost' approach to water resources planning to ensure that customers are paying a fair and reasonable cost for their water services. Demand and resource options are appraised using the EBSD guidelines (UKWIR, 2002) which require all costs and benefits to be assessed, including uncertainties. The inclusion of uncertainty in the analysis is a problem for demand management options, in that the evidence base for actual savings is relatively weak. This can result in larger uncertainties being attached to demand side measures, which can lead to the most attractive options for balancing supply and demand being supply side options.

A further issue identified in the Waterwise 'Evidence base project' (Waterwise 2008) is the capex/opex classification of costs of delivering water efficiency. Supply-side schemes are normally capital intensive and will increase the asset value of the company. They may also offer opportunities for the company to out-perform and make

additional gains on capital expenditure (capex). Schemes which deliver water efficiency incur costs classed as operational expenditure (opex). As such, they do not have the same potential benefits as capex schemes, and the opex nature of large-scale water efficiency programmes can potentially act against water companies' financial performance targets, unless the opex spend is classed as 'atypical'. This is discussed in more detail in the Waterwise report (Section 3.1, Waterwise 2008).

As mentioned above, the actual outcomes from water-saving measures can have large uncertainties. As a consequence, when including them in EBSD analysis, companies need to assess the risk against water saved. If a company decides to take a low risk approach (for example, they may wish to be 95 per cent certain that the water savings will be achieved), the value they include for water savings in the analysis will be lower than if they adopt a higher risk. This results in a low estimate for water savings in the financial analysis, and hence the option might look less attractive than a supply-side scheme with a higher certainty of success. High uncertainties are a direct result of uncertainties about take-up rates of devices, successful installation rates, performance of the devices, and user behaviour. One way to mitigate these uncertainties is to ensure take-up, installation and performance of devices is maximised. Therefore water neutrality would require the 'best in class' of water efficiency in terms of take-up rate and innovative devices to make water savings, with a funding mechanism to support this.

To improve the evidence base to demonstrate the economic case for interventions, water companies have conducted a series of long-term and large-scale water efficiency pilots or trials. Most water efficiency projects to date have used combinations of interventions rather than single ones as this is considered to be the most effective in terms of cost and water savings. However, if a combination of measures has been retrofitted into a home, for example, it can be difficult to disaggregate which specific device gives the greatest saving.

In addition to schemes concentrating on the effectiveness of devices, research has been carried out to understand various aspects of demand management activities including the sociology of water use, how and why consumption varies, and programmes to improve demand management. This highlights the importance of behaviour on water use and the impact of education on consumption.

3.4 Policy interventions

Changes in policy help to meet water neutrality by introducing standards for water use in new and existing homes. As the gold standard of water efficiency, standards to be adhered to in homes within a water neutrality area would be expected to be ambitious and challenging.

Following the water shortages of 2007 the Government issued its response to a consultation on water metering in areas of serious water stress. The proposal adopted is described below:

"The Secretary of State would, after consulting the Environment Agency, designate those company areas (in whole or in part) which he considered to be areas of serious water stress under new regulation 4 of the Prescribed Conditions Regulations 1999. He would also, under Section 37A(3)(d) of the Water Industry Act 1991, direct water companies whose areas had been designated as areas of serious water stress. The effect of this direction would be to require them, in drawing up and consulting on their draft statutory water resource management plans (WRMPs), to formulate and include an assessment of the costs and benefits of compulsory metering alongside the costs and benefits of other water supply and demand measures."

Water companies now have powers to compulsorily meter customers in areas of water stress if they can demonstrate the cost-benefits of doing so to Defra and following the wider public consultation of their Water Resource Management Plans. This could be expanded to include all water neutral areas and thus increase the meter penetration in a designated area (such as a water resource zone).

Changes already made in policy and legislation will help new and existing buildings to be more water efficient (as discussed in Section 1.4). Changes to Building Regulations will ensure that minimum standards for water-using products are introduced. For example, a maximum cistern size of six litres is stated for all new toilets. As a result all new toilets retrofitted during the refurbishment of bathrooms (both in the domestic and commercial sector) will have this maximum flush volume. If the new toilet cistern replaces an old toilet with a larger cistern size, this will result in a water saving.

A review of the Water Supply (Water Fittings) Regulations 1999 is currently underway and is due for consultation in 2009 and publication in autumn 2009 or early 2010. The regulations could adopt a more draconian approach for devices which use a large volume of water, by increasing the tax on these products or even banning them. More ambitious changes to the Building Regulations could help achieve water neutrality in the long term through market transformation. An amendment to the Building Regulations will include a requirement for a minimum standard of water efficiency in new homes, due in October 2009. A stretching target in water neutral area would set a good example.

In addition, regulations could enforce better labelling of water-efficient products, both at point of sale and on the product itself. Enforcing a labelling scheme would ensure that consumers are educated on which devices are water-efficient. The device itself also requires a degree of labelling, such as dual-flush toilet systems, so that users understand how to use the device properly and water savings are maximised.

The introduction of the Code for Sustainable Homes (CSH) is a critical piece of guidance for new buildings and will be important in achieving water neutrality. The code has been developed to enable a “step” change in sustainable building practice for new homes. The code is intended as a single national standard to guide industry in the design and construction of sustainable homes. It applies to England, Wales and Northern Ireland. Code Level 3 is mandatory for all government-funded housing, such as social housing. From 1 May 2008 a minimum of Code Level 3 has been required for all new housing promoted or supported by the Welsh Assembly Government or government-sponsored bodies. From 2 June 2008 Code Level 3 has been required for all new self-contained social housing in Northern Ireland. From 1 May 2008 it has also been mandatory for a code sustainability certificate or a nil-rated certificate (where an assessment has not taken place) to be included in the Home Information Pack for prospective purchasers of properties in England (this applies to all new homes marketed for sale). It is likely that the code will be made mandatory for other homes in the future. Eco-towns will be required to meet specific levels of the code. The CSH includes six levels, but only three for water. These are:

- Levels 1 and 2: 120 l/person/day
- Levels 3 and 4: 105 l/person/day
- Levels 5 and 6: 80 l/person/day

These are minimum standards and more points are available for greater efficiencies. The standards are expressed as litres per head per day value, which is calculated using a method described in the CSH for indoor water use. Because these figures are for indoor water use, an uplift should be added to take account of external use; CLG estimate that four per cent is a suitable allowance for external water use (CLG 2007).

Meeting the target does not mean that the home will deliver a pcc of 120 l/person/day when it is built and occupied. Although a building may be designed to be efficient, actual water used will depend on the behaviour and habits of the occupiers. For CSH to be effective in achieving water neutrality, this must be coupled with information about how to use the installed devices correctly and how to avoid wasting water.

3.5 Metering

Appendix B contains a discussion of metering in summarising the different types of water efficiency interventions that can be used to meet water neutrality.

3.5.1 Current metering strategies

Metering is an active part of every water company's activities. Methods of metering currently available for water companies are:

- Optant metering. Water consumers can opt to have their water charged on a volumetric basis following the installation of a meter. Free meter options are a well-established policy within the water and sewerage companies and they are funded to install meters, where it is cost-effective to do so. Where metering is not possible or would result in a disproportionately high cost, it may be possible for the customer to go onto an assessed charge which is based upon the consumer's estimated volumetric consumption rather than rateable value.
- Change of occupancy metering. Since the Water Industry Act of 1999 water companies have had the power to install domestic meters when a property has a change of occupier. Several water companies are pursuing this method of metering to increase meter penetration as stated in their recent water resource management plans.
- Compulsory metering. Until recently, compulsory metering was only allowed where a water company had been given 'water scarcity status' following the appraisal of available water resources by the Environment Agency and Defra. During 2007, however, the Environment Agency consulted on defining 'water stress' and Defra consulted on allowing compulsory metering in water stressed areas. Companies who are now designated as water stressed areas can now include compulsory metering in their water resource plans, though they still need to make the business case for its implementation.

3.5.2 Potential demand savings and issues arising from current metering strategies

The general consensus within the industry is that household metering helps to reduce consumption. Research has shown that domestic metering reduces water use by five to fifteen per cent[4],[5] with larger peak savings. A recent UKWIR study analysed all of the available evidence on metering and consumption and deduced that the acceptable reduction in consumption from metering is 10 per cent. This includes all different

[4] *The effect of metering on peak and average demand* – UKWIR, 2005, UKWIR 05/CU/02/1.
[5] National Metering Trials Working Group, 1993.

metering strategies; optant, compulsory and change of occupier as described above. Ofwat has recognised this study as a credible evidence base and therefore a 10 per cent reduction in demand is a reasonable assumption to make.

Consumers tend to use less water when they pay for it by volume, rather than on the basis of an assessed charge, and where there is a fiscal incentive for the consumer to use water wisely. Metering allows the consumer to manage their consumption. A further saving can be made if hot water in the home is minimised as this will save energy and therefore money.

Water conservation is a major issue largely driven by changing patterns of water use and climate change and this cannot be viewed in isolation from metering. There will be a benefit to the environment, particularly in water stressed areas, as reduced demand will result in reduced abstraction. The positive environmental consequence of wise water use is the motivation for some consumers to be frugal with their water, as it is sometimes regarded as the responsible thing to do. Metering allows the consumer the potential to monitor their water use and take action to reduce it.

Metering will inevitably be of benefit to some, but a proportion of consumers may be disadvantaged if they start paying on a volumetric basis. Affordability of water is a concern for households with low incomes and high water needs. Adequate safety nets must be in place to ensure that vulnerable customers are protected. The Walker Review is investigating future water charging, including the risk of any detrimental impacts on vulnerable groups and suitable methods to protect them. It will also make recommendations on future water charging.

As stated previously, metering can expect to bring about a 10 per cent reduction in demand. Leakage from customer-owned supply pipes can be reduced (if the meter is installed at the property boundary); the amount of leakage saved will depend on a range of factors, but figures of 10 to 20 litres/property/day are typical. Other studies estimate in the region of five to fifteen per cent. To achieve the greatest reduction, it is vital that customers understand why they are being metered and possible gains associated with it. Often, customers are unsure about how a metering initiative may affect them, or may be distrustful about the motives for implementing a metering programme, particularly a compulsory one. It is important therefore for a water company to communicate exactly what is happening and why and what the potential benefits will be to the customer.

Metering also allows water companies to communicate with their customers on a more frequent basis and enables more information to be conveyed to the consumer about their water use. This will help them to understand and therefore manage their consumption. Figure 3.2 is an example of a water bill form Yarra Valley Water Australia. The bill outlines household consumption over the last quarter and compares this with usage over previous quarters. Information on the bill also allows comparisons against average households of a similar size against best practice levels. This kind of bill is extremely useful in helping customers to put their levels of consumption into perspective and adjust their behaviour accordingly. This type of bill is currently being evaluated by at least one water company in England.

Current metering is based on standard uniform volumetric charges derived from manually read meters yearly (sometimes twice yearly) resulting in an annual bill. This bill is retrospective of the customer's consumption. The current technology in use limits the range of tariffs which could be offered to further reduce demand. Intelligent or smart meters allow innovative tariffs to be introduced as discussed in Section 3.6.

3.5.3 Intelligent meters

Intelligent (or smart) meters are a generic term for meters which have enhanced functionality. The majority of meters installed in domestic properties in the UK simply record the volume of water passed through the meter. It is necessary to read the value from the meter on a periodic basis at the start and end of the billing period to calculate the volume consumed by the customer. Intelligent meters have the ability to: transmit information on demand or at specific periods to the water utility, store data for retrieval at a later date, convey information to the consumer on water consumption, produce an alarm for events such as a leak in downstream plumbing or a failure in the meter, process data in the meter and retransmit that as useful information, and so on.

In the context of water conservation, intelligent meters have a number of benefits:

- They allow more sophisticated tariffs (such as rising block or seasonal or time of day tariffs) to be implemented.
- They enable consumption data to be presented directly to the consumer, to allow them to modify their water-using behaviour.

3.5.4 Funding

As previously stated, water companies are funded to install meters to all customers who opt to have one, where cost-effective to do so as a baseline metering activity. The additional metering policies of compulsory and change of occupancy are available for water companies to implement, again, if cost-effective to do so and the business case has been approved by the regulator Ofwat.

In the context of water neutrality, it might be possible to mobilise existing funding for metering as part of the water company business and water resource plans into the water neutrality area. This would have to be justified to Ofwat. Alternatively, it would be necessary to raise finance to fund an increased level of metering in an area beyond the level already funded by the water company regulation process.

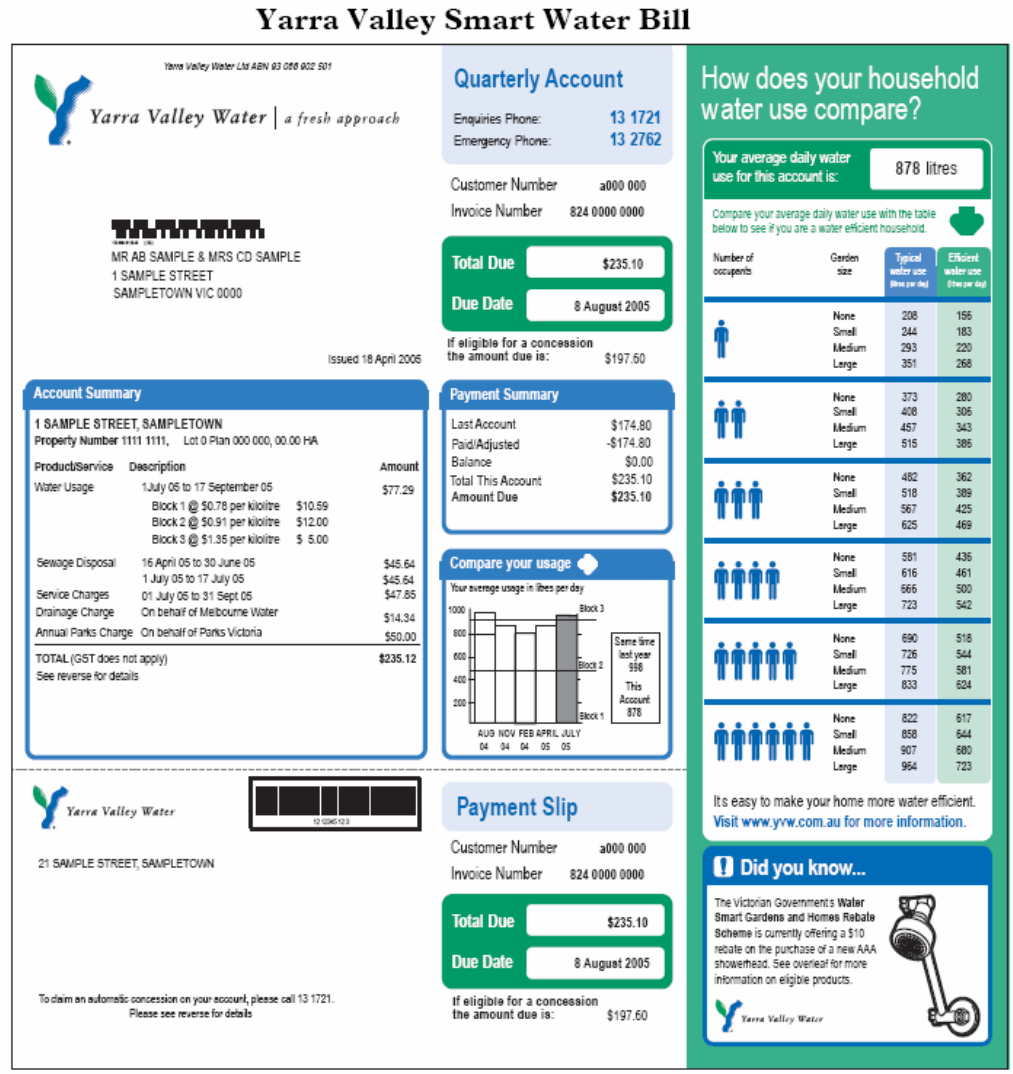

Figure 3.2 Yarra Valley smart water bill (Source: Yarra Valley Water).

3.6 Tariffs

Currently, a single bill is generated by the water company for the customer. This is a retrospective, once yearly bill, based on actual measured consumption from a meter reading. With the aid of intelligent or smart metering systems, it is possible to introduce alternative tariffs to:

- increase the cost of water as more water is used (rising block tariff);
- increase the cost of water during certain time periods (seasonal tariff);
- protect vulnerable groups from the affordability issue associated with metering,

3.6.1 Rising block tariff

A rising block tariff is a volume-related tariff which increases in price as the volume of water increases, as shown in Figure 3.3. This tariff encourages water conservation, as beyond a threshold volume the consumer is paying a premium for the water used. This

can be billed on an annual basis or can be more frequent. This tariff could potentially be used to assist those for whom affordability is an issue because the initial volume of 'essential' water use can be set at a lower value which would be affordable to low income groups. As the tariff steps up into the higher values, this would include water beyond that volume deemed necessary for basic health and hygiene. This discretional or non-essential use would include garden watering or car washing and the water used for this purpose would be charged at a premium rate.

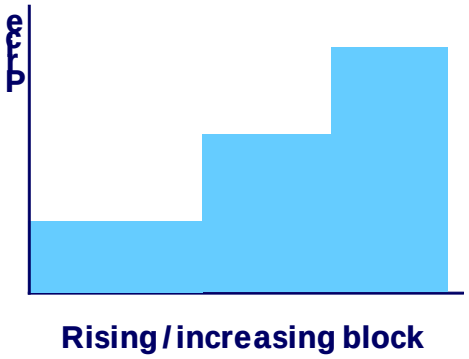

Figure 3.3 Rising block tariff.

3.6.2 Seasonal tariff

A seasonal or daily tariff is a time-related tariff which increases the volumetric price of water during certain time periods, as shown in Figure 3.4. This can be during seasonal, peak or daily time periods. During the peak time, the unit price of water will increase. This tariff is designed to encourage frugal use during these peak times.

For example, a seasonal tariff could be split into an eight-month 'off peak' period where the water is charged at a low price per volumetric unit (pence/m^3) when seasonally the water is more plentiful. During 'peak' periods, such as four months in summer when there is a potentially greater strain on water supply, this water use is charged at a higher rate. This tariff structure targets water conservation during peak periods. Alternatively, a different rate can be applied to water used at certain times of the day, similarly to an 'economy7' energy tariff.

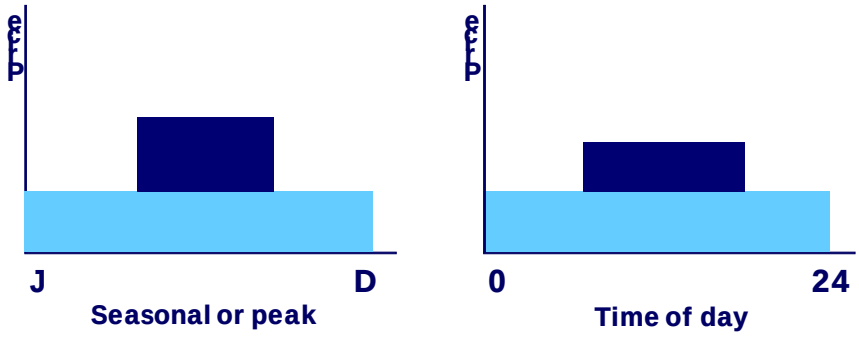

Figure 3.4 Seasonal and daily tariffs.

3.6.3 Affordability tariffs

Affordability of water is a potential concern for households with low incomes and high water and sewage bills, for example in large families or those with medical needs. The risk of "water poverty" is significant and concern has been expressed that metering may encourage households on low incomes to economise on water use excessively, to the extent which could potentially compromise hygiene and even health. Conversely, it metering can actually help affordability by providing special tariffs which capture these vulnerable groups and enable them to pay what they can afford for water services.

Water companies are required make provisions to assist such households and develop more sophisticated customer relationships, including debt management systems and enabling those who are unable to pay to contribute to their water bills. The industry consensus is to introduce metering accompanied by a single, inclusive and adaptable conservation-oriented tariff. The tariff structure should explicitly differentiate between basic and other water use in the home. As a result, any risk of reducing water consumption to a level detrimental to health and hygiene is prevented.

Numerous studies[6,7,8] have examined the issues associated with metering and affordability. All studies state that with the provision of social tariffs, the issue of affordability should not be a reason against metering.

3.6.4 Occupancy

Tariffs applied to properties for water charges must take into account levels of occupancy. Otherwise, the uplift in price per unit volume will disadvantage homes with high numbers of occupants.

Generally, water companies do not have detailed or accurate information about occupancy. As a result assumptions are made about occupancy in homes across the water company area. There are three ways to account for occupancy:

1. Collate actual information about occupancy and keep it up to date.
2. Apply a proxy for occupancy base on a specific factor, such as type or age of house, demographics or rateable value.
3. Base the future tariff on a historical normal use (from October-December for example) which naturally takes account of occupancy. Rising blocks can then be based on a percentage increase over normal use, and therefore should not penalise properties which higher numbers of occupants Although this approach is more complex, the technology is currently available, and at least one water company is trialling this method.

3.6.5 Evidence

There is some evidence in the UK to suggest that consumers will respond positively to new tariff structures. To know the impact tariffs may have on consumption in the UK is, however, limited. Tariffs have been implemented overseas and there are a small number of examples of the effects of tariffs upon demand. The transferability of the impact of these tariffs on demand is, however, unknown.

[6] Dresner and Ekins, 2004. *Towards the design of an environmentally and socially conscious water metering tariff.*
[7] South West Pilot Scheme on Water Affordability: Defra. November 2007.
[8] Herrington, Paul. *Waste not want not? Water Tariffs for Sustainability*. Report to WWF, September 2007.

To ensure that changes in tariffs are based on evidence, a number of trials are underway by UK water companies investigating a range of tariffs. Preliminary data from these trials are not conclusive, but more data is expected to be available over the next couple of years. At this stage, it is difficult to recommend the best tariff structure to reduce demand whilst not disadvantaging vulnerable customers within the water neutrality area.

3.7 Education and campaigns to target behaviour

In addition to retrofitting water-efficient devices, it is vital that education and publicity campaigns feature highly in any water efficiency programme. This will be particularly true for water neutrality areas. Information and advice on using water wisely should be used to encourage changes in behaviour.For example, a new home built to CSH Level 4 will not automatically result in 80 literes/person/day unless the occupiers manage their water consumption and alter their habits.

Ultimately a lot of the measures used to achieve neutrality will require public support and the active change of water users in all sectors. Changing the behaviour of the public can either be by cooperation or compulsion. Cooperation relies on the good will and the choice of the end user to use their water wisely. Alternatively public participation could be achieved by changing regulation and compulsorily making changes for positive change towards water efficiency. Water neutrality could be seen as a positive for policy development

Many water company water efficiency trials have gathered transferrable information about public acceptability and willingness to aspire to water neutrality. Public acceptance at a voluntary level often results in low uptake rates. Typically in trials undertaken by water companies, rates of 10 per cent have been realised, depending on the device and any incentives offered.

If water neutrality was implemented in a water resource zone, people living remotely from a new development would need to change their behaviour to accommodate the development, as well as those living closer or in immediate proximity. This may bring a new range of difficulties and complications in the wider water resource zone if a community action is not generated. This would require the introduction of a Water Neutrality Steering Group' or similar, possibly at a local authority level with a high profile whose responsibility would be to drive water neutrality forward by disseminating a consistent message to all water users and to ensure a coordinated projection of what water neutrality will achieve for the whole wider community.

3.8 Evidence

As discussed in the previous sections, a wide range of interventions can help to reduce average and/or peak demand at home or at work. The biggest risk with demand management is evidence to support assumptions made about water savings, and in particular how the devices might affect those savings over time.

A large proportion of water use in the home is governed by behaviour, that is, the length of time spent in the shower or frequency of car washing. This is difficult to control, even with greater effort to promote responsible water practices. As a result, the yield expected from demand management is uncertain. Many assumptions can be made in calculating what might occur in the home, using best available data and expert judgement, but ultimately the outcome is uncertain. This is therefore a risk which the

the water company would have to bear. To increase this risk by attempting to achieve water neutrality might result in a higher headroom or additional risk and uncertainty factor in the resource plan to accommodate this. This issue also highlights the need to monitor water neutral areas over the long term to ensure that water savings are being made and to gather evidence for the future design of water neutrality.

A study carried out by the water industry (UKWIR 2007) developed an approach for quantifying the value and uncertainty associated with demand management measures. This included a spreadsheet to allow uncertainties in the costs and benefits for different demand management measures to be calculated.

In addition to behaviour, little information is available on how individual devices might operate post-installation. Information is available from water company trials about the ease, cost and time of installation for a device, and the short-term water savings that result, from the first few weeks or months. However, little is known about the longevity of these savings. Once installed, how do these devices operate after two or five years and is the water saving achieved after day two the same as after year two? It is not known how devices may operate in situ over time. The best current assessment of how to quantify the longevity of water saving measures is contained in the Waterwise evidenc- base report (Waterwise, 2008). This introduces the concept of a half-life for water savings which can be calculated based on the asset life of the device. The method is described in the Waterwise report and results in a best estimate, best case and worst case for the persistence of the water savings from a water efficiency measure. This is illustrated in Figure 3.5.

As more devices are installed the industry's knowledge of how water savings persist will improve, and this highlights the importance of monitoring savings over long periods.

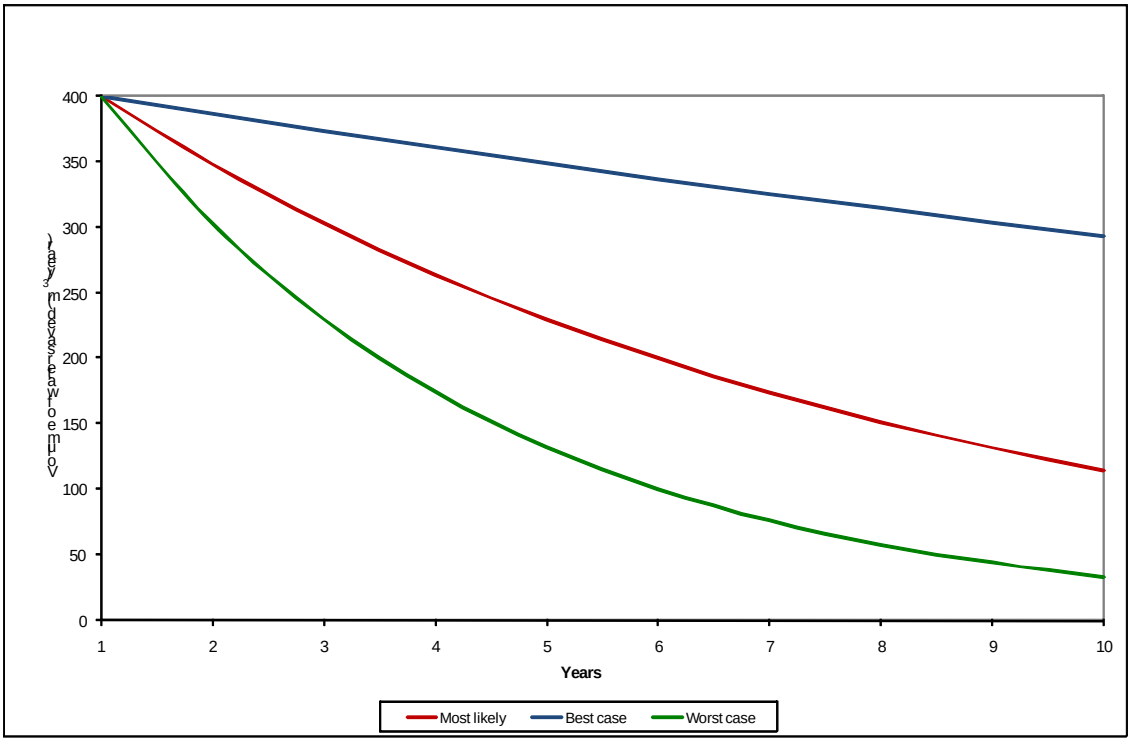

Figure 3.5 Illustration of longevity of water savings using half-life analysis.

The evidence base on the impact of water efficiency measures is growing as water companies pool their evidence and data. Waterwise produced a major report on this in 2008 (Waterwise, 2008) and it is hoped that the evidence will continue to be collated

and reported in a consistent way. As more long-term evidence is gathered, the risk and uncertainty of the long-term yield from water saving measures will reduce.

A summary of water savings for the range of interventions covered in the Waterwise report is provided in Table 3.2.

Table 3.2 Water savings from interventions.

		Water savings (litres/property/day)			Number in sample
	Water efficiency measure	**Max**	**Min**	**Mean**	
Toilets	Cistern displacement devices	34.60	0.01	11.47	16
	Dual-flush replacement (social housing)	145.29	61.32	103.31	2
	Dudley turbo 88 retrofit dual-flush	24.39	4.19	16.23	6
	Ecobeta retrofit	53.49	5.73	21.16	8
	Ecoflush (variable flush device)	22.14	16.90	19.52	2
	Variflush (variable flush device)	24.00	22.14	23.37	3
Showers	Shower timer	26.05	0.23	4.32	8
	Shower flow restrictor	6.18	6.18	6.18	1
	Shower heads	39.50	1.14	12.40	11
	Bath measure	4.44	4.44	4.44	1
	Replacing bathing with showering	39.46	37.31	38.39	2
Taps	Tap inserts and restrictors	24.89	2.07	10.19	9
	Tap washers (repairing dripping taps)	13.08	0.47	7.54	5
	Turning tap off when brushing teeth	29.75	10.31	21.55	4
Outdoor	Water butts	4.76	1.58	2.65	4
	Hose guns	1.58	0.28	1.13	8
	Soil crystals	0.02	0.02	0.02	1
	Efficient washing machines	26.79	26.79	26.79	1

3.9 Public sector procurement

achieve water neutrality, the Government should lead by example and only procure devices and fittings which are water efficient. This would show that the concept of water neutrality is fully supported at the highest level. There should be a restriction on government procurement policy so that only water efficient products from a certified list are purchased. This list would be a 'gold standard' of water-efficient products, not necessarily the cheapest on the market.

In June 2006, the Prime Minister and Secretary of State for Environment, Food and Rural Affairs announced a new set of sustainable operation targets for the Government Estate (Defra 2008b). These include commitments on water consumption to:

- reduce water consumption by 25 per cent on the office and non-office estate by 2020 (relative to 2004/2005 levels);
- reduce water consumption to an average of 3 m^3 per person/year for all new office builds or major office refurbishments.

The last report on departmental performance against targets, produced by the independent watchdog the Sustainable Development Commission (SDC), was in March 2007. The report highlighted the need for further progress in some government departments.

In March 2007, the Government presented a package of actions within the Sustainable Procurement Action Plan to deliver the step change needed to ensure that supply chains and public services will be increasingly low carbon, low waste and water efficient, respect biodiversity and deliver our wider sustainable development goals.

3.10 Implementing interventions

This section highlights different methods of achieving the maximum benefit by increasing uptake rates of interventions. Further details of specific mitigation strategies are presented in a parallel report (Environment Agency, 2009b). A wide range of interventions can be installed in domestic and non-domestic buildings to help to reduce water consumption. When water companies have undertaken such activities, uptake rates have typically been in the region of two to ten per cent. For water neutrality to succeed, greater adoption of interventions must be realised, as 10 per cent on a voluntary basis may not be sufficient to offset demand (Environment Agency, 2007b). Both the scheme to implement the interventions and a way to encourage consumers to increase uptake rates must be optimised.

Improving consumer attitudes to using water wisely will help change behaviour, increase uptake rates and increase the use of water efficient products. As a result ongoing promotion and publicity campaigns will assist consumer choice with regards to installing water efficient products and using them in a water wise manner. There are ways of encouraging the take-up of water efficiency measures, consumer choice can be influenced by offering incentives and in some cases compulsory measures might be also be considered.

The success of water efficiency schemes to offset demand will be greatly affected by uptake rates and willingness of the public. Use of water-efficient devices can be achieved by the following.

1. **Relying on discretionary choice**

   This option relies on the consumer (domestic or non domestic) opting to install water-efficient devices. The consumer may decide based on the 'greater good' or on the basis of financial savings. Publicity and education can shape consumer attitudes to water saving, which in turn will improve uptake rates, use of products and behaviour change. Ongoing promotion and publicity campaigns will assist consumer choice with regards to installing water efficient products and using them in a water wise manner.

2. **Incentives**

   Consumer choice can be influenced by offering incentives in the form of vouchers, subsidised products, tax exemption or money-back offers. Incentives can make a particular choice more attractive. Incentives usually have a monetary aspect and attempt to sway behaviour more than relying on good will alone.

3. **Compulsory action**

   In some cases, compulsory action could be used to increase the adoption of interventions. This is a more draconian approach which in some cases might be justified, but would require a legislative driver. An example might be to compulsory meter a water neutral area. Alternatively, certain products could have minimum standards set or their installation minimised.

3.10.1 Publicity and awareness campaign

In any water efficiency scheme, it is important to focus on customer attitudes to water saving. The first phase of any intervention scheme should involve a widespread publicity campaign on the importance of wise water use and advantages to the environment and consumer purse through reduced water and energy bills. Water neutrality should be explained in terms which relate to the consumer and arguments for a change in consumer behaviour. If water neutrality is implemented in a large area, people living remotely from a new development would need to change their behaviour to accommodate the new development. This may bring a new range of difficulties and complications if a community action is not generated. Therefore the benefits to the local community of achieving and maintaining water neutrality should be clearly communicated.

The campaign should explain how the local community will be engaged in water neutrality activities, what the range of activities will be and who they will target. The fact that water use in the new development will be minimised and how this will be achieved should be explained. The scale of the challenge should be explained and put into context, and the timescales over which water neutrality will be achieved and maintained need to be conveyed.

The approach should build on the "4 Es" model used by Defra (2005)[9]. The 4 Es are:

- Enable – making it easier and removing barriers to change.
- Encourage – giving the right signals and incentivising.
- Engage – getting people and the community involved early on.
- Exemplify – water companies and local government can lead by example.

Targeting existing homes

A wide-ranging publicity campaign would seek to educate the public on water neutrality and the wise use of water in the home. In addition, the campaign would inform the public of forthcoming retrofit activities, the reasons behind them, how it affected them, and what they would need to do to take advantage of the schemes. The campaign could include TV and radio adverts and using the local media to reach most domestic homes, in addition to targeted mail drops to all homes in the area. Each group would have a specific role in the communications campaign making use of existing channels, such as including information in utility bills from energy companies and water companies or literature from local authorities. However, the campaign would need to carry a consistent message and not be confusing to the home owner.

Targeting new homes

Given the pressures exerted on existing systems by new developments, it is vital that new homes are built with water efficiency as a priority. New developments should lead by example. Publicity is again important with new homes, but the audience would be developers and the campaign should include information about how to build water-efficient homes, what products to install and where to get further information. An example can be found on the water efficient buildings website which provides water and planning guidance for planners and developers (Water Efficient Buildings, http://www.water-efficient-buildings.org.uk/?page_id=186). The local authority planning department would disseminate the concept of water neutrality and thus promote incorporation of this into new developments within an area.

[9] *Securing the future, delivering UK sustainable development strategy*, Defra, March 2005.

Targeting industrial/commercial properties

Industrial and commercial buildings are responsible for a significant proportion of water used within a designated area, for example a water resources zone. This collection of buildings includes retail outlets, offices, manufacturing and other services including hotels and sports centres. The publicity campaign would aim to inform businesses of the issue and the need to use water wisely and options available to achieve this. This could be promoted through local business networks as well as in water company bills. In addition landlords and property managers would also be targeted to ensure that all the appropriate people who could make a decision to become water-efficient were targeted.

Targeting public buildings

Public buildings can also be responsible for a considerable volume of water within the total water balance of an area. Public buildings include government funded buildings, schools, hospitals, police stations, fire stations, libraries, some sports centres and green spaces and parklands.

It is important to include these in the publicity and awareness campaign. Targeting these buildings will also demonstrate leadership in the wise use of water by applying best practice in public areas. Public buildings could also be used as exemplars or showcases for water efficiency technology.

3.10.2 Installation (uptake) of interventions (devices)

The success of offsetting demand to achieve water neutrality depends on uptake of water-efficient devices. This can be achieved by relying on consumer 'good will' and making a moral judgement to use water-efficient products. This would also involve using water wisely by modifying behaviour. Uptake can be encouraged by offering incentives, point of sale information or in some cases making it compulsory through legislation. Product development and innovation plays a role in bringing to market water-efficient products which are not seen as 'downgrading' to a poorer performance.

Targeting existing homes

Plumber-assisted water audits and retrofits can be coordinated with other actions such as compulsory metering or retrofitting of energy-efficient devices and insulation, taking advantage of the need to visit a property for meter installation or survey. Other legislative measures could be taken: for example, including water efficiency in the HIPS for homes during the house sale process could raise the importance of water efficiency on existing homes, and encourage the installation of simple low cost devices.

Targeting new homes

From 2008, a minimum of Code Level 3 is required for all new housing promoted or supported by Government. This is likely to only cover a small proportion of new homes in a development. A developer could choose, or be persuaded to build, a greater proportion of homes to a particular CSH level. Financial incentives could be offered to a developer to increase the incorporation of water efficiency in the buildings they design and develop. For example, the infrastructure charge paid to a water company might be reduced. This could include a wider package of measures relating to connection charges, refurbishment charges as well as infrastructure charges but would require additional funding from outside of the water company funding process. A compulsory approach could be taken to demand that a certain proportion, or all, homes within the new development are built to a certain level of the Code. This would state that developers 'must' achieve a particular pcc for each property. This could be

decided through a Section 106 agreement or a community levy agreement at a local authority level.

Targeting industrial/commercial properties

Some companies would be willing to opt to reduce water onsite, to make financial savings by reducing their water bill. Many companies now have active policies which include environmental considerations and companies could actively incorporate good practice within the business. Accreditation of ISO 14:0001 includes environmental obligations which could be achieved by reducing water use.

Reduced water and energy bills also offer an incentive through water audits. A water audit could identify areas within the building and/or process which could be optimised to save water. There is already an infrastructure of organisations to support this, such as Envirowise and NISP (see Section 4) which have carried out water audits on larger businesses. It would be especially important to target small to medium-sized enterprises (SMEs) and offer them water audits. Tax incentives such as the Enhance Capital Allowance (ECA) scheme and Water Technology List (WTL) and other subsidies could be offered to help incentivise businesses to adopt water wise practices and to install water-efficient devices. For example, a free audit could be undertaken but the business would have to pay, or part pay, for the installation of retrofitted devices.

Compulsory measures could be taken to ensure that water is used wisely within a business. For businesses with their own supply, licence conditions could be changed to encourage water efficiency. For example, seasonal tariffs could be applied at peak periods when water is more stressed, or compulsory water audits done at agreed frequencies to ensure that the water supplied is being used correctly and wastage is minimal. Alternatively compulsory rainwater recycling systems could be retrofitted to use the large roof space of some commercial buildings. This resource could then be used internally and/or made available for other purposes, such as to the local authority for garden watering to reduce the pressure on mains supply.

Targeting public buildings

In the context of water neutrality, government has a duty to lead by example on water efficiency. Government policy should promote the gold standard of water efficiency and incorporate products in all its public buildings. This could be carried out in conjunction with energy saving measures for buildings.

Incentives could be adopted, such as rateable grants and rebates. For example, 68 per cent of funding to the local authority is secured from the revenue support grant. A penalty could be applied to those LAs underperforming on water efficiency within their control. Alternatively, a ‘frontier’ type approach for building types could be implemented, with the best performing buildings given fiscal rewards for outperforming. All other buildings could endeavour to move towards that goal of similar water consumption.

Compulsory measures could be taken to further increase the adoption of water efficiency, such as ensuring that all plants in green spaces must be watered with non-mains water during peak times. This could include ensuring that all future plants must be drought-resistant varieties which do not require watering in dry peak periods.

3.11 Monitoring and ongoing evaluation

Following the installation of interventions it is necessary to monitor an area. This can evaluate the effectiveness of the interventions and provide evidence to guide future schemes; it can also measure water savings to check whether water neutrality has been achieved. Many interventions are not one-off measures, but may require replacement and maintenance over time. Monitoring would allow any deterioration in the device to be noticed and acted upon, ensuring the maintenance of water neutrality. Monitoring could also be in the form of repeat publicity campaigns to maintain the profile of water efficiency and to stress the importance of using water wisely.

The current definition of water neutrality says that demand offsetting should be based on the Dry Year Annual Average (DYAA) demand scenario – this brings it in line with the final planning table in WRMPs. However, this means that overall demand at WRZ level cannot be monitored, as demand must be modified for changes in leakage, wet summers and so on. Potential options for monitoring and evaluating performance are:

- To monitor overall demand at the WRZ level before and after the development has been completed and report it as a DYAA value.
  - Pros: water companies do this already at WRZ level.
  - Cons: need to normalise the demand to the DYAA, which needs additional data and some modelling.
- Create consumption monitors for the WRZ representative of existing housing and new development stock. To achieve water neutrality, targets are set for reduction in existing stock and consumption in new stock. These can be measured in a random sample of each stock and assessed at the end of the development process.
  - Pros: consumption monitor set-up and operation has regulatory processes and best practice.
  - Cons: relies on a representative sample and may not get the numbers of properties, which could be up to 1,000 monitored properties. New properties should be relatively easy to monitor, but existing stock will need meters.
- Set ‘activity’ targets based on water efficiency measures (similar to Ofwat’s water efficiency targets). Each action or activity (Cistern Displacement Device (CDD), meter installation, audit and so on) is assigned a value of water saved (from Ofwat and Waterwise evidence bases). For new builds a design standard is set (from building regulations or CSH). Hence, overall targets could be set to achieve neutrality over the development period. Achievement is validated by checking that design standards have been met and actions delivered, for example 30,000 audits, 100,000 CDDs installed, 50,000 meters installed.
  - Pros: easy to set up and could be checked through self-certification and/or auditing a sample.
  - Cons: actual level of water saving is not quantified and demand planners are likely to build more into headroom as a result. Also, this moves water neutrality from an achievement to a design criterion.

3.12 Scenario examples

The purpose of these scenarios is to show the user the potential scale of interventions that could be achieved and indicate appropriate interventions or mitigation strategies. These scenarios have been developed further in a separate report (Environment Agency 2009b) which provides technical supporting information.

3.12.1 Indicators for offsetting potential

It is useful to identify indicators to examine the potential for offsetting consumption to achieve water neutrality. Key indicators are based on readily available information which should be accessible to planners and other groups.

A selection of key indicators is described below.

- **Percentage of new households to existing homes in the area**

  This could give an indication of the potential for domestic retrofits in an area. The level of saving that might be achieved on a range of retrofits is roughly 25 l/prop/day (based on the Waterwise evidence base, with estimated savings of 25 l/prop/day, while company trials showed five to 50 l/prop/day), average pcc of a new property built to Code Level 3 is about 250 l/prop/day. Therefore for every new household, retrofit would need to be achieved in 10 existing homes. The indicator could be developed further by subtracting the number of houses in the area already retrofitted through previous water company projects.

- **Ratio of household to non-household consumption**

  This could indicate whether it is best to target retrofit and water efficiency measures at existing households or non-households.

- **Percentage of meter penetration**

  The gives an estimate of the scope for additional meter installations, over and above that currently planned. The indicator might need to be derived for each year over the development period. The indicator could be further refined by including the type of meter installation, such as smart or intelligent meter penetration, introducing the potential for more sophisticated tariffs. Alternatively meters might be classified by internal or external installation; external installation would allow customer supply pipe leaks or bursts to be identified.

- **Percentage of homes built prior to 2000**

  This provides an indication of the scope for retrofitting lower flush volume toilets or installing cistern displacement devices. After 2000, water fitting regulations required the installation of six-litre cisterns on WCs, prior to this nine-litre, 12-litre or larger cisterns were used. However, many would have their bathrooms replaced, so the scope may be much smaller.

3.12.2 Example application of water neutrality with scenarios

The following example is intended to illustrate how water neutrality could be achieved in a community, by implementing at each stage from planning through to monitoring.

The example uses interventions and evidence for water savings from the Waterwise evidence base report (Waterwise 2008). Within the example, a number of scenarios are explored showing how the increase in water use from the new development could be offset. The scenarios present different 'baskets' of mitigation measures. In reality, the measures implemented would be guided by local factors, and would require an in-depth assessment of:

- water savings (yield)
- longevity (sustainability) of yield
- longevity of the device (asset life)
- uptake rates
- specific delivery mechanism
- risks and uncertainty
- cost-effectiveness.

Planning stage

The definition of water neutrality will be taken as: "*For every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community*".

The size of development in this example is 5,000 homes and 200 non-households. The development area is defined as a water resource zone with a total property count of 69,000, and it lies in a region which is designated as water-stressed. The detailed description of the area is shown in Table 3.3.

The increase in demand for the development is included in the water company's water resource management plan, and is met through a combination of demand management and resource options funded through the business planning process. The fact that the area now has to meet water neutrality means that some of the planned interventions in the WRMP might help achieve this. This raises the issue of where water neutrality sits within the WRM process, and it is recommended that when the WRMP guidelines are revised, water neutrality issues should be included.

The local authority has proposed a policy of requiring new developments to achieve the highest possible water efficiency standards, since it understands that new developments will be in an area of water stress.

Table 3.3 Characteristics of example area.

Characteristic	Value	Units
Numbers of new households (HH) proposed in the new development	5,000	
Numbers of new non-HH proposed in the new development	200	
Number of existing unmeasured HHs	45,000	
Number of existing measured HHs	20,000	
Number of existing non-HHs	4,000	
Existing unmeasured HH consumption (Ml/d)	16	Ml/d
Existing measured HH consumption (Ml/d)	6	Ml/d
Existing non-HH consumption (Ml/d)	4	Ml/d
Number of HH built before 2000	61,100	
HH supply pipe leakage	0.5	Ml/d
Unmeasured HH pcc	155	l/person/day
Measured HH pcc	125	l/person/day
Company average pcc	150	l/person/day
E&W average pcc	148	l/person/day

Responsibilities

The local planning authority has carried out a water cycle study for the area. The study was overseen by a steering committee comprising the local planning authority, the incumbent water company (a water and sewage company), and the Environment Agency. The water cycle study was carried out by a technical consultant. The study found that water resources could be a constraint on growth, and the recommendation from the study is to propose water neutrality as a solution.

The developer has submitted outline plans for the new development (as described in the section above). The steering committee for the study has identified the following partners and responsibilities for a concerted action plan to meet water neutrality:

- As this is a community-focussed project, the local planning authority will take the lead on planning through to delivery, including identifying funding options.
- The water company will be responsible for supporting planning and delivery, with specific responsibility for some elements of the interventions.
- The Environment Agency will support the local authority with technical guidance and support.
- The developer will be responsible for elements of the funding, building the new property stock to a specific standard of water use.

The above will form the basis of the ‘cooperative’ group to achieve water neutrality with the LA taking the lead. As the project develops, other groups may be brought into the project on specific items such as plumbers to help install devices, the local education authority to support communications through local schools and so on.

Target-setting stage

The target is set to meet full water neutrality, based on the following arguments:

- New properties represent an increase of about 7.5 per cent to the overall property stock; therefore, at least 14 existing properties for every new property could be targeted for retrofitting. The original Thames Gateway study found that between five and eight existing properties would need to be retrofitted to achieve neutrality. This area has 14 existing properties for every new property, which means that excessively high take-up rates are not required.
- The current meter penetration is approximately 30 per cent, rising to 45 per cent over the next five years under current plans in the WRMP, allowing scope for further expansion of meter penetration in this area.

The new households are required to meet the CSH Level 3 for internal water use (105 l/person/day) and the expected occupancy rate for households in the plan is two. This gives an estimated household consumption for the new households of 1.1 Ml/day. The estimated consumption of new non-households is 0.16 Ml/day.

Thus, the predicted increase in demand from the new development is 1.26 Ml/day. This volume is required to be offset by demand reductions in the area under the definition for water neutrality.

This equates to approximately a five per cent reduction in demand from the existing stock of properties, assuming that all CSH operate at their design standard when occupied.

Delivery stage

In this section, we present three different scenarios, each with a different range of interventions involving different groups and funders. These are not exhaustive, but the scenarios are used to indicate some of the issues relating to offsetting, funding and synergies with water company activities.

Delivery is planned over a five-year period, and is broken down as follows:

- Wide-scale community campaign to explain what is going on, why, and how each member of the community is affected and what part they play (schools through to homeowners and businesses).
- Specific interventions aimed at:
  - existing households
  - new households
  - existing non-households
  - new non-households
  - public buildings.

For each of the three scenarios, the mitigation measure is discussed including a description of the measure, source of evidence for water savings, funding issues, and who should be responsible for delivery. A table identifies the water savings, building up to complete offset of the water neutrality target. Following this, a graph shows the increase in water demand and water savings during the life of the development, plus a projection of longevity and maintenance of water savings. Assumptions are explained.

Scenario 1

This scenario is constructed from the following interventions:

Community wide communications campaign:

The purpose is to ensure the whole community understands what is going on and hopefully responds more positively to offers for water audits and so on. It should be led by the local planning authority, but involve water companies, energy companies (if measures are planned that target both water and energy) and local education authorities as necessary. There is clearly a need for coordination and planning. The campaign should allow for enthusiastic customers to request a simple home audit pack (CDD, tap aerators and shower timer, plus advice). Over the development period, assume that 2,000 people respond and use the pack (a take-up rate of three per cent).

New properties – developer builds 20 per cent of homes to CSH Level 6

The target set in the water neutrality plan was originally for all properties to be built to CSH Level 3 (105 l/person/day), but the developer is able and willing to build 20 per cent of the properties to CSH Level 6 (80 l/person/day).

Increase metering in the area to 55 per cent

Metering is already included in the WRMP to 45 per cent (which means that 9,250 meters will be installed in the area over the development period). Increasing the penetration to 55 per cent will require a further 6,500 meters to be installed. This could be achieved by the water company mobilising metering planned for other areas into the water neutrality area, or it may require additional funds.

It is assumed that metering will bring a water saving of 10 per cent in unmeasured pcc per property metered (based on current guidance by Ofwat), plus 10 litres/property/day from customer supply pipe reduction (properties metered externally should see a reduction in customer supply pipe leakage, as it allows the water company to identify leaks and repair them).

Water audit pack fitted alongside meter programme

The audit pack consists of a cistern displacement device, tap aerators, and an aerated shower head. This will bring savings in water and energy (as tap aerators and shower head should result less hot water used). Packs will be delivered (and support in fitting offered) during the customer contact/survey stage of the meter installation programme. Customers are told that the pack will help them reduce water and energy bills. The packs will be delivered to the first 5,000 properties that agree to fit them (requiring a take-up rate of 7.7 per cent). The water saving is estimated at 34 litres/property/day (based on average savings for each measure reported in Waterwise report, 2008).

Dual-flush retrofit in social housing

This requires the local authority and social housing association to work together to retrofit 2,000 dual-flush mechanisms into 2,000 social housing properties (targeting about 10 per cent of social housing in the area). There may be scope for combining plumbing visits with other plumbing activities carried out by the housing association.

Water companies water efficiency target:

This is not a specific intervention, but is a baseline level of water efficiency that Ofwat expects all water companies to achieve under their duty to promote water efficiency. The water company is required to deliver one litre/property/day water saving per year. At the end of the five-year development period, this equates to five litres/property/day. This water saving should be allowed to count as part of the offsetting of consumption. It is already funded by the water company and will result in water savings in the water

neutrality area. (Assuming that the average water saving from a single property targeted for baseline level water efficiency is 40 l/property/day, 2.5 per cent of existing properties each year will need to be targeted or 12.5 per cent over five-year period).

Water efficiency savings from targeted large industrial water users

A campaign could be launched to target the top large industrial/commercial users (representing 10 per cent of overall non-household demand). The campaign could be run in conjunction with government business advice centres to offer a free water audit to these users, and persuade them to implement the savings. The range of measures that might be applied will be specific to the types of industrial/commercial organisation. These are likely to include: within process water reuse, water efficiency devices for domestic water uses (toilet flushing, washing) and rainwater harvesting (RWH) for toilet flushing. Water saved would equate to savings on water bills and potentially energy bills. We have assumed that 15 per cent of the large water use is saved.

The overall savings are summarised in Table 3.4.

Table 3.4 Scenario 1 water savings.

Water saving measures	**Water saving (Ml/day)**
Community wide communications campaign	0.043
New properties – developer builds 20 per cent of homes to CSH Level 6	0.053
Increase metering in the area to 55 per cent	0.74
Water audit pack delivered and fitted alongside meter programme	0.17
Dual-flush retrofit in social housing.	0.042
Water companies water efficiency target	0.33
Water efficiency savings from targeted large industrial water users	0.06
Total water saving	**1.44**
Target water saving	**1.26**

This scenario achieves water neutrality, with a small excess saving at the end of the development period. The increase in metering accounts for about half of the water savings, with various water efficiency measures making up the rest. Overall approximately 26 per cent of the existing housing stock is targeted for retrofit water efficiency measures (or about 3.4 existing homes for every new home).

Water consumption for the new development, water savings from the actions above and the lon- term maintenance of water neutrality is shown in Figure 3.6.

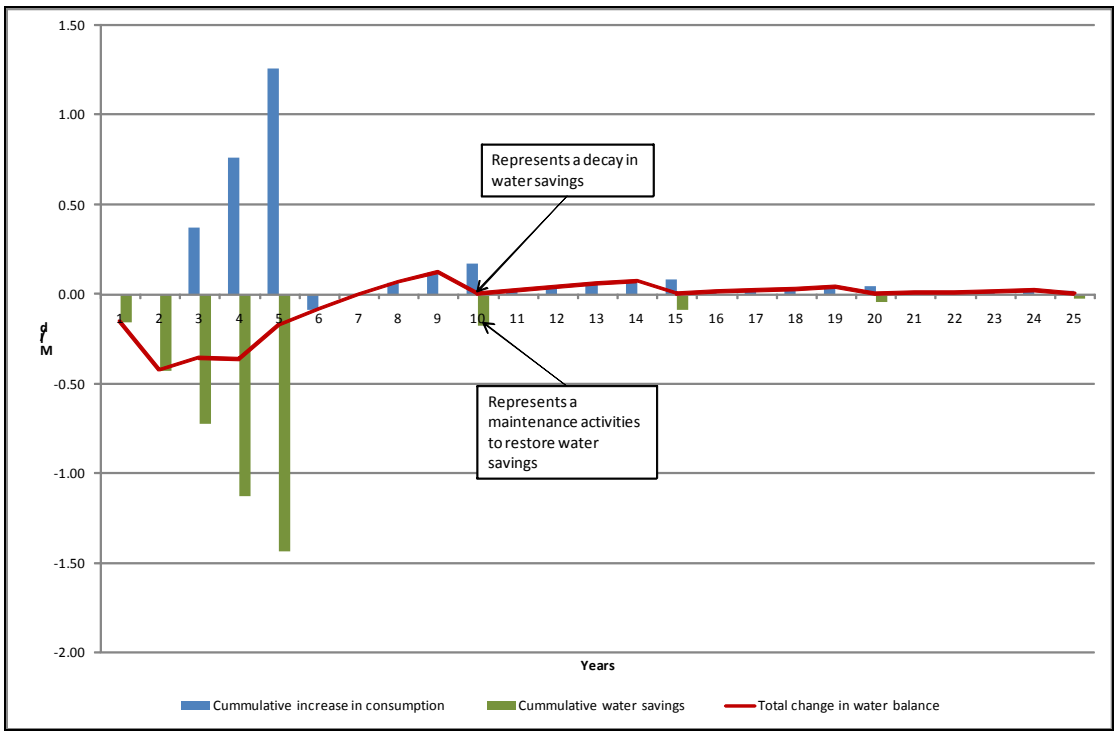

Figure 3.6 Scenario 1 water balance graph.

The graph shows how water savings from the interventions might decay (as explained in the Waterwise evidence base report (Waterwise, 2008). For the decay, it has been assumed that savings from metering do not decay (there is no 'bounce back'), but for other interventions water savings decay as explained in the Waterwise report, with a half-life of five years. After the development period (following Years 1 to 5) it is also assumed that some maintenance is necessary to maintain water neutrality on a five-year period. The graph only indicates water neutrality activities; it does not include any underlying trend in consumption due to other activities, weather or climate.

Scenario 2

This scenario is constructed from the following interventions:

Community-wide communications campaign

The purpose is to ensure the whole community understands what is going on and hopefully responds more positively to offers for water audits and so on. It should be led by the local planning authority, but involve water companies, energy companies (if measures are planned that target both water and energy) and local education authorities, as necessary. There is clearly a need for coordination and planning. The campaign should allow for enthusiastic customers to request a simple home audit pack (CDD, tap aerators and shower timer, plus advice). Over the development period, assume that 2,000 people respond and use the pack (a take-up rate of three per cent).

New properties – developer builds 20 per cent of homes to CSH Level 6

The target set in the water neutrality plan was originally for all properties to be built to CSH Level 3 (105 l/person/day), but the developer is able and willing to build 20 per cent of the properties to CSH Level 6 (80 l/person/day).

Increase metering in the area to 45 per cent

This level of metering is already included in the WRMP to 45 per cent (which means that 9,250 meters will be installed in the area over the development period).

It is assumed that metering will bring a water saving of 10 per cent from unmeasured pcc per property metered, plus 10 l/property/day from customer supply pipe reduction (properties metered externally should see a reduction in customer supply pipe leakage as it allows the water company to identify leaks and then repair them).

Audit pack delivered 5,000 props via water and energy saving campaign

This is a campaign targeted at larger houses (high water and energy users). Mail out to 20,000 properties; because of targeted nature of the mailing and the energy plus water focus, expect to deliver 5,000 audit packs which consist of taps aerators and high quality showers heads (one for each shower). This will require a take-up rate of three per cent, which will bring savings in water and energy (as tap aerators and shower head should result in less hot water use). The reduction in hot water use potentially allows carbon credits to be obtained through CERT (once approved by Ofgem), effectively subsidising implementation of the measure through trading of the carbon credits or involving an energy provider in delivery of the water-saving measure.

Dual-flush retrofit plus hot water reduction to 2,500 social housing properties

This requires the local authority and social housing association to work together to retrofit 2,500 dual-flush mechanisms plus tap aerators and shower heads into 2,500 social housing properties (targeting about 13 per cent of the social housing in the area). These will bring savings in water and energy (as tap aerators and shower head should result in less hot water use). There may be scope for combining the plumbing visits with other plumbing activities carried out by the housing association. The water saving is estimated at 44 l/property/day (based on average savings for each measure reported in the Waterwise report, 2008).

Bathroom refurbishment (dual-flush plus shower) for 2,000 social housing units

In order to meet decent homes standards there may be opportunity to carry out a bathroom refurbishment programme, which would include replacement of all water fittings (whilst not designed to improve the water efficiency of buildings, the updating of bathrooms to modern standards can improve water efficiency if suitable fittings are used and a shower is included in the upgrade). The fittings included would be a water-efficient toilet and shower head. The water saving is estimated at 100 l/property/day (based on a similar project in the Waterwise report). Two thousand properties are targeted (assuming that 2,000 properties qualify for refurbishment over the development period). This targets about 10 per cent of social housing in this area.

Water company targets

This is not a specific intervention, but is a baseline level of water efficiency that Ofwat expects all water companies to achieve under their duty to promote water efficiency. The water company is required to deliver one litre/property/day water saving per year. At the end of the five-year development period, this equates to five litres/property/day. This saving should be allowed to count as part of offsetting of consumption. It is already funded by the water company and will result in water savings in the water neutrality area. (Assuming that average water saving from a single property targeted for baseline water efficiency is 40 l/property/day, 2.5 per cent of existing properties each year will need to be targeted, or 12.5 per cent over the five-year period).

Water efficiency savings from targeted large industrial water users

A campaign could be launched to target the top large industrial/commercial users (representing 10 per cent of overall non-household demand). The campaign could be run in conjunction with government business advice centres to offer a free water audit to these users, and persuade them to implement the savings. The range of measures that might be applied will be specific to the types of industrial/commercial organisation. These are likely to include: within process water reuse, water efficiency devices for domestic water uses (toilet flushing, washing) and rainwater harvesting (RWH) for toilet flushing. Water saved would equate to savings on water bills and potentially energy bills. We have assumed that 15 per cent of the large water use is saved.

Water efficiency savings from targeted public buildings

Target public buildings (schools, police stations, leisure centres and so on) with water efficiency audits and actions. Target the domestic use categories, through water-saving devices on toilets, urinals and washbasins, and where practical RWH for toilet and urinal flushing. Estimate a saving of 0.02 Ml/day.

The overall savings are summarised in Table 3.5.

Table 3.5 Scenario 2 water savings.

Water saving measures	Water saving (Ml/day)
Community wide communications campaign	0.043
New properties - developer builds 20 per cent of homes to CSH Level 6	0.053
Metering the community to 45 per cent	0.44
Audit pack delivered 5,000 props via a targeted water and energy saving campaign	0.11
Dual-flush retrofit plus hot water reduction to 2,500 social housing properties	0.11
Bathroom refurbishment (dual-flush plus replace/add shower) for 2000 social housing units	0.21
Water companies water efficiency target	0.33
Water efficiency savings from targeted public buildings	0.02
Water efficiency savings from targeted large industrial water users	0.04
Total water saving	**1.34**
Target water saving	**1.26**

This scenario achieves water neutrality, with a small excess saving at the end of the development period. This scenario has a lower level of metering for existing homes than the previous scenario. As a result, more water-saving measures have to be implemented to offset new demand. Overall, around 30 per cent of existing housing stock is targeted for retrofitting (or about four existing homes for every new one). This scenario also relies on measures targeted at social housing.

Water consumption for new development, water savings from the actions above and long-term maintenance of water neutrality is shown in Figure 3.7.

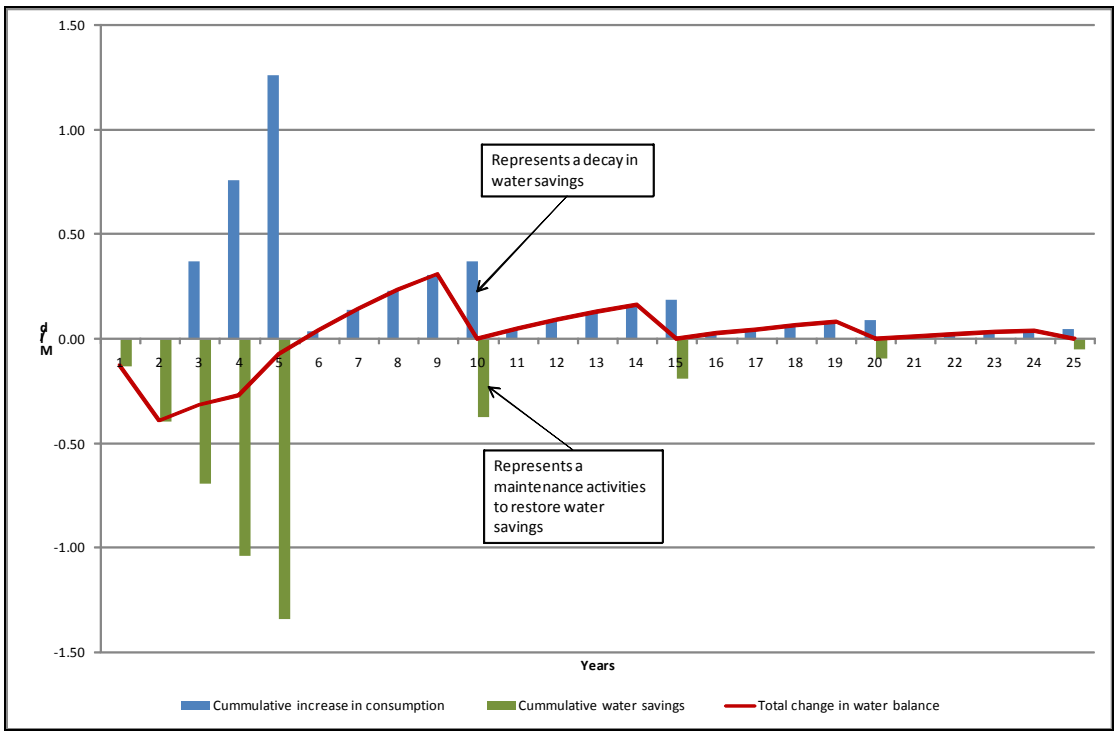

Figure 3.7 Scenario 2 water balance graph.

The graph shows how water savings from interventions might decay (as explained in the Waterwise report (Waterwise, 2008). For the decay, it has been assumed that the savings from metering do not decay (there is no 'bounce back'), but for the other interventions water savings decay as explained in the Waterwise report, with a half-life of five years. After the development period (following Years 1 to 5), it is assumed that some maintenance is necessary to maintain water neutrality on a five-year period. The graph only indicates water neutrality activities; it does not include any underlying trend in consumption due to other activities, weather or climate.

Scenario 3

This scenario is constructed purely from an aggressive metering policy, plus the water company's baseline water efficiency activity.

Increase metering in the area to 70 per cent

Metering is already included in the WRMP to 45 per cent (which means that 9,250 meters will be installed in the area over the development period). Increasing the penetration to 70 per cent will require a further 16,250 meters to be installed. This could be achieved by the water company mobilising metering planned for other areas into the water neutrality area, or it may require additional funds.

It is assumed that metering will bring a water saving of 10 per cent from unmeasured pcc per property metered, plus 10 l/property/day from customer supply pipe reduction.

Community wide communications campaign:

Whilst this scenario focuses on a high meter penetration in the existing housing stock, the campaign will be important to communicate exactly what is happening and why and the potential benefits to the customer. Transparency is important when implementing a metering policy, to boost customer cooperation and help customers take advantage of water-saving measures once they are metered.

Water companies water efficiency target:

This is not a specific intervention, but is a baseline of water efficiency that Ofwat expects all water companies to achieve under their duty to promote water efficiency. The water company is required to deliver one litre/property/day water saving per year. At the end of the five-year development period, this equates to five litres/property/day. This water saving should be allowed to count as part of offsetting of consumption. It is already funded by the water company and will result in water savings in the water neutrality area. (Assuming that average water saving from a single property targeted for baseline water efficiency is 40 l/property/day, 2.5 per cent of existing properties each year will need to be targeted, or 12.5 per cent over the five-year period).

The water savings are summarised in Table 3.6.

Table 3.6 Scenario 3 water savings.

Intervention	Water saving (Ml/day)
Metering the community to 70 per cent	1.20
Water companies water efficiency target	0.33
Total water saving	**1.53**
Target water saving	**1.26**

This scenario achieves water neutrality, with an excess saving at the end of the development period. Most of the saving is generated through the metering programme, with the water company's baseline water efficiency activity contributing the remainder. Overall, around 12.5 per cent of the existing housing stock is targeted for retrofitting (or about 1.6 existing homes for every new one).

Water consumption for the new development, water savings from the actions above and long-term maintenance of water neutrality is shown in Figure 3.8.

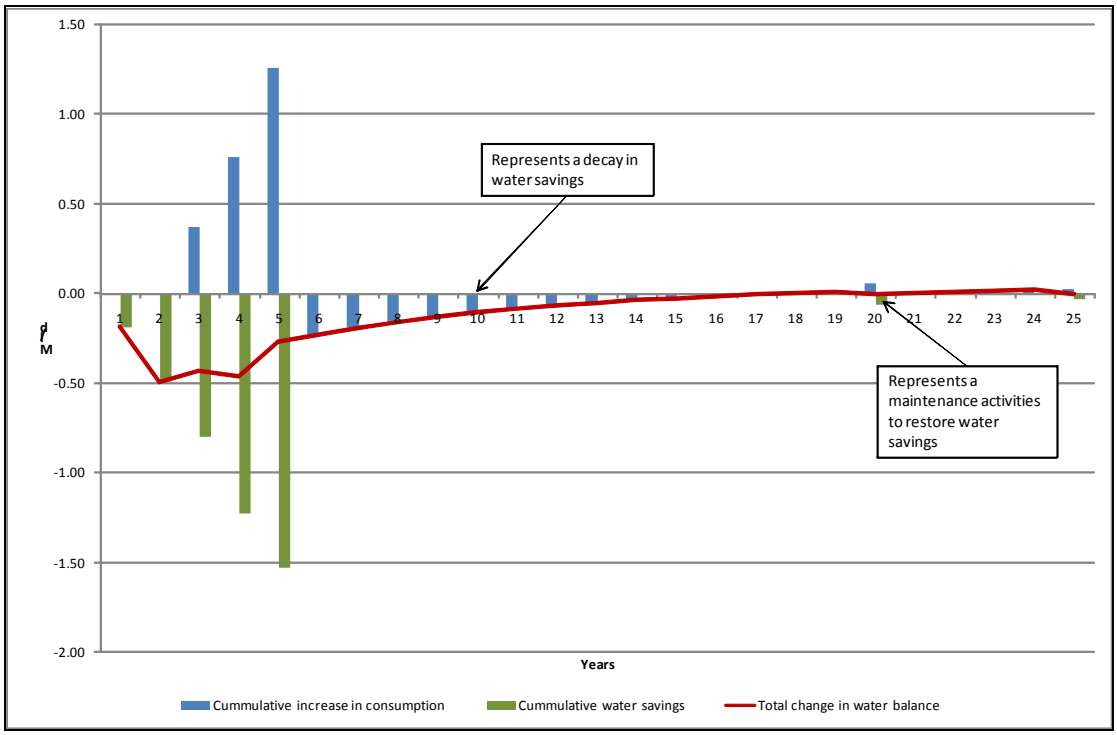

Figure 3.8 Scenario 3 water balance graph.

The graph shows how water savings from the interventions might decay (as explained in the Waterwise report (Waterwise, 2008). For the decay, it has been assumed that savings from metering do not decay (there is no 'bounce back'), but for the other interventions water savings decay as explained in the Waterwise report, with a half-life of five years. After the development period (following Years 1 to 5) it is assumed that some maintenance is necessary to maintain water neutrality on a five-year period. The graph only indicates water neutrality activities; it does not include any underlying trend in consumption due to other activities, weather or climate.

Discussion on scenarios

The scenarios discussed above are based on a fictitious water supply area which is characterised by:

- A fairly low household meter penetration (before applying water neutrality, 45 per cent of households would be metered at the end of the development period, hence there is scope for additional metering to reduce demand).
- A proposed development which will increase the property stock by about 7.5 per cent (indicating a large number of existing properties which can be targeted for offsetting measures).

If the area had different characteristics, the intervention options examined in the three scenarios would probably be different.

In each of the three scenarios, increased demand from the development is successfully offset by a range of intervention measures, described by:

- **Scenario 1**: a moderate increase in meter penetration, actions from the developer to build some new homes to a higher standard than required, an audit/retrofit programme coordinated with the metering programme, and water savings from existing commercial buildings.
- **Scenario 2**: no increase in metering, a wider range of audit and retrofit programmes, some targeted at social housing, some in conjunction with energy efficiency programmes, some targeted at public and commercial buildings.
- **Scenario 3**: greater metering which achieves most of the savings needed.

Scenarios 1 and 2 also feature a concerted publicity campaign. All three scenarios allow the water company's targets for that area to be included in the offsetting.

For all three scenarios, the long-term maintenance of water neutrality is projected forward 20 years. This assumes decay in some water-saving measures as follows:

- Savings due to metering do not decay or 'bounce back'.
- All other water savings which require a device to be installed or retrofitted have a degree of decay, which results in the savings halving over five years.

A number of issues should be noted from these scenarios and the resulting modelling:

a) Scenario 3 shows that in this example, nearly all of the increase in demand could be offset through metering alone, and because of the assumptions made, this saving is sustained over an extended period.

b) Scenario 1 and especially Scenario 2 require long-term maintenance of the water neutrality status. This is due to assumptions made regarding the decay of water savings.

c) The water savings to be gained from metering are significantly higher than those associated with water audits and retrofits, based on industry evidence.

d) If the area characteristics had been different (for example, if the area was fully metered) the mix and scale of mitigation measures needed would be different, and it would most likely be difficult to achieve full water neutrality in the area. However, if the area was already fully metered, it would be expected to have a lower pcc, and the water neutrality target could be set below 100 per cent.

Monitoring stage

Monitoring and feedback on performance on water neutrality are a vital step in the process. Monitoring and data collection will be needed from several sources at different points on the timeline.

- Data will be required on water consumption of the area before development. This might come directly from the water company or via the water cycle study.
- Monitoring of progress of selected intervention measures will be required and validation that the actions have been undertaken will be needed.
- Upon completion of the development phase, monitoring of water consumption for the area will be required for comparison with the 'before' situation. It is important at this stage to understand the reasons behind possible over or under performance of the water efficiency measures, and to feed these back to those responsible for implementing water neutrality.
- Measures need to be set in place to then monitor the longevity of the water neutrality target. It is expected (and shown in the scenarios above) that some water savings will deteriorate. If the water neutrality status needs to be maintained over the long term, additional maintenance will be needed. This could be in the form of water audits, publicity campaigns or other water efficiency measures. The results of these will again need to be monitored and fed back to the those responsible.

Feedback from monitoring should be collated to further develop the evidence base, and to improve guidance on achieving water neutrality.

3.13 Conclusions and recommendations

The need for water neutrality should be triggered by considering the needs of the development and of the aquatic environment. A water cycle study should be considered in areas where new growth is planned.

The aspiration for water neutrality should be to offset 100 per cent of the predicted increase in consumption from the new development. However, the potential for offsetting may be reduced in some areas (for example, where metering levels are already high, or the area already has a high level of water efficiency activity and low

pcc), in these areas, there may be a case for setting the water neutrality target below 100 per cent.

Water companies now have mandatory targets for a minimum level of water efficiency activity. Achievement of these targets in water neutral areas should count towards the offsetting of consumption from new developments in these areas.

There are a range of options to meet water neutrality through offsetting the increase in consumption by reducing water use in existing properties. In some areas (where the size of growth is small compared to the area where water neutrality is to be applied) achieving water neutrality should be reasonably straightforward. Other areas, where the potential for offsetting is lower, will require a step change in water efficiency to achieve water neutrality.

The evidence base for large-scale water efficiency is growing, but more evidence is required. Monitoring the performance of water neutrality implementation will add to this evidence base. Current evidence suggests that water savings may decay over time, so it is important to continue to monitor water neutrality areas over the long term and if necessary, carry out maintenance as required.

From the evidence and modelling of scenarios, it appears that metering the existing housing stock offers the greatest water saving per household. Metering should form a major part of large-scale water neutrality schemes.

Alternative tariffs designed to encourage water saving could be applied to water neutrality areas in the future, but the UK evidence base for their effectiveness is limited, and the impact on water affordability needs to be considered. Trials of different tariffs are underway in a number of water companies and more are planned in AMP5. Evidence from these trials should indicate the impact of alternative tariffs in offsetting for water neutrality.

Water neutrality should be achieved through 'concerted action' centred on the local community. For example, if water neutrality can be achieved through more metering, existing homeowners will need to understand why they are being metered, how they will benefit, who to discuss concerns with, and how to remain fully informed. Done in the right way, this can build trust and help metering proceed more smoothly.

A water neutrality action plan should be developed by local partners, which sets out the goals and aspirations for water neutrality in the area and identifies an overall approach to water neutrality. Water neutrality is then achieved through a series of actions which seeks to offset demand through interventions in the existing property stock.

A key part of this should be a community-wide communications plan to support water neutrality actions. This should seek to involve the community at every level, from schools to parents, to businesses to homeowners, to social and private tenants, and importantly be led by the local authority and local government.

Meeting water neutrality will rely on a series of mitigation actions or interventions. These may include: a range of interventions targeted at specific groups of domestic, commercial and public properties; metering and alternative tariffs; activities which will enforce water conservation standards and regulations; encouraging local retailers to include point of sale information on water conservation; and training local plumbers to offer water conservation advice. The precise measures implemented will depend on the locality and circumstances of the area. Some areas may need to do very little to achieve neutrality, others may require a wider range of complex measures. Actions should be aligned and be part of existing and advanced heat and energy-saving strategies, to allow water neutrality to be implemented more cost-effectively.

An implementation plan should be drawn up which includes the final set of mitigation actions chosen to match the character and needs of the local community. The plan

should identify the lead and key partners, who should sign up to help carry out the plan. The plan should be monitored and the local community informed of progress.

4 Water neutrality funding mechanisms

4.1 Introduction

The funding mechanisms available or potentially available to achieve water neutrality fall under the following categories:

- Infrastructure-related funding (generally from developer payments).
- Fiscal incentives at a national or local level to influence buying decisions of households and businesses.
- Water company activities, either directly funded by the five-year price review or as a consequence of competition and individual company strategies.
- Joint funding through energy efficiency schemes (and possibility to integrate with the heat and energy saving strategy).

In this section of the report, mechanisms that may provide funding for water neutrality activities are briefly described and an assessment of their possible current or future contribution is made. Some mechanisms are directly related to raising funds from the planning system by way of infrastructure charges, and others are in the form of fiscal incentives to property owners. These include the possible expansion of competition in the sector and adoption of funding mechanisms being trialled in the energy sector to lower carbon emissions. The latter offer significant and as yet untapped potential to fund water neutrality, along with emerging government policy on infrastructure charges to support wider regional and local economic, social and environmental needs through to the Community Infrastructure Levy (CIL). Also worth considering is the emphasis on local authorities and Regional Development Agencies to make a greater impact in energy savings and energy efficiency, as discussed in the Heat and Energy Saving Strategy (DECC 2009).

Although the Thames Gateway report (Environment Agency 2007a) did not assign the distribution of cost or benefits, those involved in the study envisaged the main funding for measures to be through water companies' activities. This would rely on inclusion of these measures in water company business plans and acceptance by Ofwat that these should be paid for through the price review settlement. Water companies, under Section 93A of the Water Act 1991, have a requirement to make baseline water savings. Funding for this comes from their operational budgets, as will the funding for company targets during the next price review. This funding is specifically for water efficiency, not for water neutrality. However, where water savings might be coordinated in the area designed for water neutrality, this act of mobilising interventions with their funding becomes centred on delivering water neutrality.

Because of the magnitude of water saving required to offset a new development, a combination of local partnerships will be needed to adopt the measures and mechanisms necessary to achieve water neutrality. A single intervention or funding process is unlikely to achieve the extent of water efficiency necessary for water neutrality, though maximising metering would have the single largest impact.

Funding needs to offer strong incentives and means to fund the highest standard of water efficiency in new developments (thereby ensuring that the offset requirement

through retrofitting is at its lowest level) and support the concerted action of retrofitting, some of which might include mobilisation of existing funds.

Much of the analysis and discussion in this section is speculative. It is difficult to analyse funding mechanisms for water neutrality when none exist, and where those with the most potential are currently under consultation. In order for existing funding means to be applied to water neutrality, changes to regulatory and government policy (such as integrating water and energy efficiency in funded schemes and explicit application of the Community Infrastructure Levy) will need to take place.

Table 4.1 Possible funding mechanisms for water neutrality.

Possible funding mechanism	Assessment of possible effectiveness for WN			Delivery process	Current availability
	High	Medium	Low		
Infrastructure charge funding					
Water infrastructure charge rebates	X			Charges should reflect differential rates according to code levels of water efficiency. A surcharge on those not built to the highest standard might be used for a local retrofit "trust" scheme.	No
Section 106 agreements			X	Are used to meet the costs of infrastructure and services to be provided and paid for by local authorities	No
Community Infrastructure Levy	X			Provides greater flexibility for localising infrastructure contributions and might be used to cover costs associated with water infrastructure not managed by water companies – rainwater harvesting.	No
Water company activities					
Baseline efficiency duty and targets on WI/current metering programmes		X		The effectiveness of current water company activities in meeting water neutrality depends on the companies' ability to concentrate these activities in the area of water neutrality and that this would be accepted by Ofwat.	Yes
Inset appointments	X			Inset appointments are available for new developments and the scope for making greater levels of water efficiency with a community have not been fully exploited by appointees – water neutrality may create a relevant "market"	Yes
Retail competition				The Cave Review indicates that competition will be more effective in water efficiency, but no evidence exists.	No
Fiscal incentive funding (water only and joint funding with energy)					
Community charge rebates		X		Using the model used under CERT by British Gas for a similar scheme with energy efficiency products, the purchase of water efficiency	No

Possible funding mechanism	Assessment of possible effectiveness for WN			Delivery process	Current availability
	High	Medium	Low		
				might attract a local tax rebate. Would need central government support since it provides 75% of local funding, so that local authorities do not lose funding for other services.	
VAT rebates on water-efficient goods		X		This is being aggressively pursued by Waterwise, and could form part of a package of fiscal incentives and encourage uptake from plumbers.	No
Tax rebates on water-efficient goods; ECA[1]			X	Provides tax relief for businesses that invest in water-efficient technologies.	Yes
Direct grants for water efficiency installations		X		Available only as a secondary impact from energy efficiency installations and only available to those on supplementary benefit or income support. Could be expanded to cover a wider group of property owners and would be the mechanism to fund water neutrality from funds raised through CIL.	Yes
Offset funding	X			Works in a similar way to CIL, although the funding for water efficiency retrofitting is ring fenced to a "trust fund".	No
Local authority retrofit offers		X		Good examples overseas of significant impact on water efficiency, but reliant on funds from infrastructure charging.	No
Water company funded schemes though price review process	X			Schemes for water efficiency such as metering are agreed every five years with Ofwat. Other schemes if concentrated in areas designated for water neutrality would help.	Yes
Through energy efficiency funding schemes – see Heat and Energy Saving Strategy		X		Schemes would target energy efficiency and thus hot water using devices in the home and businesses.	No

[1] This includes industrial premises but excludes public institutions which are considered separately.

4.2 Infrastructure charges

Infrastructure charges cover a wide range of payments for infrastructure requirements of new developments and these are generally managed through Section 106 agreements between developers and local authorities, covering roads, community services and amenities managed by public authorities. Currently, water infrastructure is dealt with separately.

Infrastructure charges for water supply are set out in the legislative and regulatory provisions for the water industry. Section 143 of the Water Industry Act 1991 sets out the requirements of the infrastructure charging scheme, stating that such charges contribute to expenditure incurred in enhancing the supply network to meet increased demands imposed by new or additional connections to the water supply system. The charge is payable on a standard domestic property and each water company charges a flat rate for both water and wastewater. These charges are not location-specific, nor

do they provide incentives by way of reduced charges for developers to build to higher standards of water efficiency.

The infrastructure charges that developers pay for connecting properties to water and sewerage services could be used to promote water-efficient homes. This could take the form of discounted infrastructure charges for water-efficient developments and higher charges for those developments meeting basic standards. Communities and Local Government (CLG) reports that Ofwat are investigating this possibility, and such a scheme might make an important contribution to raising levels of water efficiency in new properties. Alternatively, discounted charges might be used to build a fund to retrofit existing properties in a designated water neutrality area. Evidence is needed for this proposition as well as the cost-benefit analysis required for Ofwat approval.

The charges made to developers for the provision of other infrastructure are made through Section 106 Agreements. Section 106 of the Town and Country Planning Act 1990 allows a local planning authority (LPA) to enter into an agreement with developers which can cover almost any development issue and generally include sums of money to cover costs incurred by local authorities at the time and following the construction of the development. Contributions under Section 106 Agreement may be financial or indirect works, and most frequent examples of Section 106 Agreements include affordable housing, roads, pedestrian crossings and other transport facilities, open spaces or equipped playgrounds, libraries and other community buildings.

Although a wide range of infrastructure funding options might be considered through Section 106 planning agreements (including flooding) it is unlikely that Section 106 will allow any infrastructure funding for water supply on new developments or any water efficiency programmes on existing ones. This is because Section 106 covers those aspects of infrastructure and services owned by the local authority or other public authorities in the area. However, where Section 106 contributions are made towards the construction of affordable homes, and buildings and institutions such as libraries, sports facilities and other amenity buildings, it could be on the basis of high specification on water efficiency incorporating, for example, rainwater harvesting.

The proposed introduction of the Community Infrastructure Levy (CIL) provides a good opportunity for identifying infrastructure-based funding support for water neutrality. Although the text of the proposed CIL is ambiguous on water infrastructure, there appears to be opportunities for the CIL to fund water efficiency-related infrastructure such as community rainwater harvesting or grey water recycling facilities. Its emphatic insistence in Paragraph 4 (see box below) on infrastructure funding, however, indicates that the CIL might not fund retrofits of water-saving devices. However this is unclear, since it is possible that where such retrofitting programmes would contribute to the development taking place, the CIL may fund such activity.

Community Infrastructure Levy on water

2.24. Pressures placed on natural resources through water consumption, waste and car use mean that authorities will need to think innovatively in the future about how they plan for and meet their infrastructure requirements. An increasingly important component of infrastructure planning is the area of demand management – that is, measures which prevent a need for new or more costly infrastructure from arising. Demand management measures can sometimes be the best and most cost-effective solutions to delivering sustainable communities. By their nature demand management measures – frequently used to address transport infrastructure needs – enable authorities to make the most effective use of existing infrastructure.

2.25. To the extent that demand management measures can be defined as infrastructure, the Government is keen that CIL should be used to fund them.

Paragraph 4 of the Community Infrastructure Levy document (August 2008) states that "the Planning Bill is clear that CIL may only be spent on infrastructure. The Government believes that CIL should be used to fund the infrastructure needs of development contemplated by the development plan for the area, not to remedy existing deficiencies".

CLG Draft Proposals for CIL, August 2008

The CIL proposal also indicates funding may be available for water infrastructure (see box below), though it is again unclear how this would interact with current mechanisms for water infrastructure charging policy and regulations.

Where new water supply infrastructure would not necessarily be transferred to a licensed water company, such as grey water recycling or rainwater harvesting, it is possible to envisage funding contributions from the CIL within current regulations. However, where measures are funded in addition to those undertaken by water companies in a specific area, it is not clear how these measures might be accounted for within the companies' own water efficiency targets – indeed, would it matter if these measure were funded from the CIL and facilitated the development?

A few local authorities, such as Woking and Milton Keynes, have approached the development of infrastructure charges in a way that will support and contribute to wider climate change adaptation policies of the council, almost pre-empting the nature of the CIL. Possibly the best example of this approach is the Milton Keynes (MK) Infrastructure Tariff in which an enhanced Section 106 package has been proposed for new developments to help meet MK's carbon reduction targets, through payment to a fund to support retrofitting of existing houses to become carbon neutral by offsetting new carbon emissions. However, these still exclude direct payments towards water or wastewater infrastructure. Carbon offset means increased carbon dioxide emissions from a new development are balanced by savings in carbon dioxide elsewhere, by making payments into a carbon offset fund. Any net increase in carbon dioxide emissions from a development will be calculated as tonnes per year. A one-off contribution would be paid to the carbon offset fund, at a rate of around £200 (index-linked) for each tonne of carbon dioxide by means of a Section 106 agreement. For water neutrality funding, this might be a route to consider for the CIL.

Under the initiative, developers are encouraged to ensure that energy efficiency in new developments is maximised, with energy-efficient hot water, lighting systems and double glazing included in new builds. It is proposed that the carbon offset fund will be managed by The MK Energy Agency on behalf of and monitored by the Council and MK Partnership. The fund would be used elsewhere in MK to reduce carbon emissions by cutting energy use or producing renewable energy. The fund will be spent on carbon reduction measures with a lifespan of at least 20 years, equivalent to the increased carbon output from new development.

Sounds familiar! Carbon Neutral

Means there is no net increase in carbon dioxide emissions resulting from the energy used in occupying the new building(s), including space heating, hot water, cooking, lights and appliances. Although carbon neutrality is possible by just using on-site measures, it is recognized that at least for the foreseeable future, it is challenging and expensive and therefore carbon offset is proposed as an alternative more cost-effective option. On-site measures will be encouraged where possible to reduce carbon dioxide emissions, which will of course reduce the carbon offset payment.

The infrastructure tariff model developed under Milton Keynes Policy D4 provides a useful template from which to develop a model for water infrastructure charges through the CIL to meet water neutrality. The model would involve the establishment of an independent fund paid for by developers and landowners by way of reduced residual land values. These payments would be based on increases in water use from new development. The fund generated by these offset payments could be used to support a range of measures to promote water efficiency, and the mix of these measures would depend on the local circumstances. The strategy for spending this fund would be based on agreement on a water neutrality strategy by the local partnership, including the water company and might be used to provide additional funding to the water company's own permissible funded water efficiency programmes. The model also provides incentives for developers to make lower contributions if they can achieve higher levels of water efficiency in new properties.

Supporting this approach, in December 2007 the Government issued a PPS on Planning and Climate Change, which is a Supplement to PPS 1 Delivering Sustainable Development. It sets out how planning, in providing for new homes, jobs and infrastructure needed by communities, should help develop strategies to ensure places have lower carbon emissions and will be resilient to climate change. This suggests that applicants for planning permission should set out in their design and access statements how their development will comply with carbon emission targets. Similarly, a statement on water efficiency targets could be prepared.

4.3 Water company activities

Two aspects of water company activity could help fund water neutrality. First are the targets for promoting water efficiency and second is the longer term prospect of competition in the sector, providing an impetus for new companies to support the goal of water neutrality, building on inset appointments for new developments.

The establishment of "a duty" and "targets" for water companies over the AMP5 period 2010 to 2015 will help meet water neutrality and provide some funding for the measures needed.

Developing targets for water efficiency means that a number of water companies are carrying out projects to retrofit existing homes with water-saving devices. This also forms part of the wider evidence gathering needed to guide future decisions. The opportunities to take advantage of the baseline level of efficiency measures might be important for water neutrality if they could be concentrated in the area for water neutrality. It is uncertain to what extent this might be regarded as discriminatory to other customers for the particular water company and it may require the agreement of Ofwat if other customers were to be denied access to water efficiency support.

SELWE (sustainable economic level of water efficiency) targets might offer an option for raising funds from water companies. SELWE activities are in addition to BSWE activities and consider additional water efficiency activities as part of a sustainable,

economic approach to balancing supply and demand. If water neutrality is required to balance supply and demand, funding through SELWE might be an option.

Further funding opportunities for water neutrality might be derived from competition for water services. The Water Supply Licence regime introduced in December 2005 allows non-domestic customers likely to use at least 50 million litres a year to choose their water supplier (but no customer has yet done so). The inset appointment process, in existence since 1991 and updated in 2005, allows one company to replace another as the statutory undertaker for a particular area. This may include existing customers who are likely to use at least 50 Ml per year in England and 250 Ml per year in Wales, customers who are served by private supplies and those on unserved sites, and where a water company allows another company to replace it.

In recent years Ofwat has permitted inset appointments to be made for large housing developments, rather than just for large industrial or commercial premises. For example it granted Independent Water Networks Limited (IWNL) an inset appointment to allow it to supply a 950-home development at Long Croft Road, in Corby, Northamptonshire. Since inset appointments allow for one supplier to be replaced by another for a specific geographical area, IWNL will serve its new customers by buying water from Anglian Water.

An inset appointment provides the opportunity for a third party to provide water and sewerage services or water only services for a specific area in place of an incumbent provider.

The Cave Review on competition and innovation has recommended changes to the inset appointment regulatory regime and suggests that: *"Assuming a long-term supply of around 180,000 new houses a year, this implies insets could account for around 120,000 connections a year in the long-term…Where inset appointees offer alternative water and wastewater supplies there could also be environmental benefits from sustainable drainage, water reuse and less intensive treatment methods".*

If the inset appointments regime was to provide greater access to new service providers, especially for new developments in areas of water neutrality, it would be possible for developers to contract more innovative forms of service and infrastructure development. Inset competition could be used to encourage new entrants to work with local authorities and developers to support retrofitting. It might also tariff structures that might include reward schemes, lower water bills for less than average use and subsidies for efficient technology installations. With a programme to increase customer awareness of water saving and potential financial benefits, new retail suppliers of water services might generate a more vibrant market for services offering water efficiency in the home. New service companies might be more innovative in developing the type of water service that they offer, with offers that include free or reduced-price retrofitting. This is described in the government's Heat and Energy Saving Strategy, Paragraph 1.29:

"The Government has made it clear that we want to encourage the development of an energy services market. This means Energy Services Companies (ESCos) providing their customers with the warmth, light and power they need, as efficiently as possible, rather than simply selling more and more units of energy in order to make a profit. This means providing a comprehensive energy service to customers, including energy efficiency and options for generating low carbon energy."

Inset appointments may become more developer-focused, and where a water neutrality strategy exists, new contractual arrangements between developers and inset water suppliers could be established which would incentivise new suppliers to adopt innovative approaches, including the provision of retrofitting.

The Cave Review (Sir Martin Cave's Review into competition and innovation in water markets[10]) believes that further competition, together with regulation, could play an increasingly important role in mitigating the effects of climate change. In its Interim Report of November 2008, the Review states that government and regulatory approaches to water efficiency are at present inconsistent, and that regulation also lacks an integrated approach in keeping with climate change objectives.

The review is also examining innovation in the water sector. By forcing companies to constantly develop better products at lower prices to retain and win customers, competition can, it says, of itself be a powerful driver of innovation and if made possible, innovations on water efficiency could include:

- New tariffs tailored to the needs of different customers with different service levels; companies moving towards a 'water service' rather than commodity-based model that would provide new incentives on water efficiency.
- Upstream, more efficient use of existing water supplies, the use of new water sources including rainwater harvesting and grey water recycling, the adoption of new processes for treating water and wastewater.

Cave Review on the Future of Competition

Comment – Reducing domestic water consumption in England

The UK Government has a vision to reduce per capita water consumption of water in England to an average of 130 litres a day by 2030, or possibly even 120 litres per person per day depending on new technological developments and innovation. However, water companies water resource management plans forecast demand of between 120 and 180 litres per person per day by 2035.

The Environment Agency, Waterwise and others have said in their responses to companies' draft water resource management plans that companies should set out how the Government's aspiration of 130 litres per person per day by 2030 could be achieved. However, for most companies this is unlikely to be financially viable, requiring significant investment in water efficiency measures which Ofwat will not sanction because it is not cost-effective. The targets Ofwat is setting are activity-, not outcome-based, so companies could achieve their targets but per capita consumption could still increase. The industry argues that, since water efficiency is a shared responsibility, the solution is for all relevant parties to set out how their activities will contribute to the Government aspiration.

Cave Review Interim Report, Chapter 10 - Box 10.B, November 2008

The review further states its belief that ".*within a competitive framework, retailers (of water services) will have increased incentives to operate as water service companies offering water efficiency advice on how to reduce consumption of water for companies. This would be analogous to the energy service companies that are present in the electricity industry. This could lead to a reduction in the demand for water*".

For the short term, the impact of competition on water neutrality funding is likely to be small. However, inset competition is available and the boundaries for its application seem to be widening since the regulatory revisions of 2005 and in-roads into new developments for inset appointments. Existing inset appointments and their service providers, within new development sites, still have to demonstrate that they will make a contribution to water efficiency and in developing new approaches to customer service.

[10] http://www.defra.gov.uk/environment/water/industry/cavereview/

4.4 Fiscal incentives

Fiscal incentives for domestic households and businesses are used to influence purchasing behaviours in favour of specific types of products. For the domestic user, there is currently little financial incentive to become more water efficient, since the majority of customers remain unmetered. Financial incentives exist on hot water-related purchases, but here any savings realised are on energy bills.

For businesses, the Government introduced the Enhanced Capital Allowance (ECA) scheme for energy-saving technologies as part of the Climate Change Levy package in 2001 to support investment in low carbon technologies. In 2003 the Government extended the scheme to include water-efficient technologies. The ECA scheme seeks to encourage firms to invest in environmentally beneficial products, and in doing so provides tax incentives to business in the form of enhanced capital allowances for the products purchased and installed. It enables businesses who pay income or corporation tax to write off the whole cost of an investment in designated water-efficient technologies and products against their taxable profits of the period during which the investment was made. The water-efficient ECA is delivered through the Water Technology List (WTL). The list was first published in July 2003 and is in two parts, the Water Technology Criteria List and the Water Technology Product List. For large water-using businesses and factories this can be a useful saving, particularly in combination with energy-efficient investments. For small to medium-sized office-based businesses, tax relief on listed products compared to less water-efficient products is not always a favourable incentive. Public awareness of the scheme is low, nor is it widely promoted by retailers or plumbers, and this makes water-efficient goods sometimes difficult to source.

Water companies argue that an increase in ECA claims would place an additional cost burden on them. The ECA is only applicable to items which have been capitalised and therefore includes assets on the balance sheet (capex) rather than in the profit and loss account and claims as a deduction against profits (deemed as opex). The BSWE is all opex, so no additional tax benefit can be claimed. Furthermore, where more than £50 is provided in goods and services, such as plumbing costs, to any customer, water companies are unable to claim back the VAT.

In their report *Every drop counts – Achieving water efficiency* (2006), the Institute for Public Policy Research (IPPR) recommended that greater metering would provide a direct fiscal incentive to save water, particularly in areas prone to droughts. Paying for water according to how much you use provides customers with a more visible incentive to conserve water than the flat rate system. But IPPR argues that with higher rates of water metering, the Government would need to provide safeguards to support low income and vulnerable households which might include:

- Expanding the Vulnerable Groups Scheme to cover a wider range of low income customers. The scheme caps bills of eligible, metered households at the average household bill for each water company area.
- A ‘water affordability’ grant scheme similar to ‘Warm Front’. This would provide grants to replace water-wasting products with more efficient devices like dual-flush toilets.
- Water companies focusing a fixed proportion of their water efficiency schemes on low income and vulnerable households.

The IPPR also suggested that the Government should establish a Water Efficiency Commitment (IPPR 2006), based on the old Energy Efficiency Commitment (EEC), now CERT (Carbon Emissions Reduction Target), which they say has been the principal mechanism driving increases in energy efficiency in existing homes. It

requires electricity and gas suppliers to meet targets to promote improvements in energy efficiency in households. An example of this is the British Gas collaboration with over 60 local authorities (the number continues to increase).

The British Gas council tax rebate scheme provides a direct financial incentive for households to install energy-efficient measures in their homes. The level of council tax rebate varies with each local authority, but is in the range of £50 to £125 rebate for the year of installation, with British Gas paying up to £75 of that rebate through CERT and the balance a discretionary payment by the council. For example the country's largest local authority, Birmingham, agreed to give its 400,000 householders a £60 discount if they installed cavity wall or loft insulation via British Gas. The scheme goes much further, for example some councils have agreed to give further rebates to homeowners installing solar water heaters, or photovoltaic units that generate electricity. The councils - Braintree, Salford, Runnymede, Conwy, South Cambs, and Taunton Deane - typically give a one-off £300 rebate for those installing a £4,000 solar water heating system, with the central Government grant of £400. For those buying an electricity-producing photovoltaic cell system, these councils are promising a £500 one-off rebate – whilst the government grants are around half the £11,000 installation costs.

Council tax rebates are therefore considered to have some value in motivating householders to install energy-efficient measures. The number of participating local councils has risen from 16 in 2005 to 64 in 2008. However the rebates are one-off, and not counting any savings on bills, householders not on income support will at the time of retrofitting still pay more to become energy efficient than they get as a rebate.

Schemes under CERT could integrate water efficiency interventions alongside energy efficiency ones. Though the scheme is national, it works within the local authority area,.

The British Gas/local authority initiative should be evaluated in two contexts; first as a mechanism to provide fiscal incentives through local tax rebates, but also as a delivery mechanism, with funding for water and energy efficiency in a coordinated approach. This is discussed in the next section.

The range of fiscal incentives from “reward rebates” on local taxation, reduction or exemptions on VAT for water-efficient products, subsidised retrofitting of water-efficient devices, fiscal benefits to plumbers on accredited schemes, might all contribute to a situation where customers gain financially in meeting water neutrality. Fiscal measures are popular and are an important funding mechanism for those countries, such as Australia, and large numbers of city governments in Europe and North America, where water efficiency in existing building stock is part of a wider strategy. This has not been the case in England and Wales, because local governments have no direct operational role, financial ownership or influence on water services. Fiscal measures such as these would require national intervention and would be applied on a non-discriminatory basis, thereby supporting water efficiency but not water neutrality as such.

Case study examples of fiscal incentives or support for water efficiency

Australia: as part of the $13 billion national water plan, Water for the Future, the Government is delivering the $250 million National Rainwater and Grey water Initiative to help people use water wisely and this provides grants of up to $10,000 to surfing businesses to install a rainwater tank or undertake a larger water saving project. For households, rebates of up to $500 are provided to install rainwater tanks or grey water systems.

Toronto: the City's Water Efficiency Plan (WEP) supports the identification of actions that will reduce energy consumption and CO_2 emissions. Key elements of the Toronto WEP are: implementation of WEP will cost approximately $74 million, which compares favourably to the cost of providing an equivalent capacity through the expansion of infrastructure, at an estimated cost of $220 million. It has been estimated that through the implementation period, 90,000 tonnes of CO_2 emissions will have been avoided and once fully implemented, annual CO_2 emissions of 14,000 tonnes will be avoided. WEP seeks to achieve reductions in wastewater flows by 123 million litres per day and peak day demands (associated largely with summer lawn watering) of 266 million litres per day. WEP is based on financial incentives to support implementation of water conservation measures within the following sectors: municipal, single-family residential, multi-unit residential, and industrial, commercial and institutional.

All measures are based on voluntary participation and include aggressive targets.

The Toilet Replacement Programme is the measure with the greatest potential water savings in WEP, requiring the replacement of over 700,000 toilets to achieve savings of around 100 Ml/d, and is a priority within WEP representing approximately $42.5 million in incentives (57% of the implementation budget) and continues to be a focus of WEP's public education campaign.

Ottawa: the City Facilities Retrofit Programme consisting of new capital funds is allocated to Real Property Assessment Management (RPAM) for the purpose of undertaking water-efficient retrofits at city facilities in the amount of $100,000 per year, 2007-2009 inclusive. In addition, the City Council makes available a $75 rebate to residents who purchase and install a city-approved six-litre water-efficient toilet. They also make available to residents free of charge, water efficiency kits (one per household) consisting of a water-efficient showerhead, one or more tap aerators and a lavatory displacement bag. For large water users, the city has a "High Volume User" subsidy programme consisting of two elements; subsidies for pre-approved retrofits (e.g. toilet replacements), and subsidies for the retrofit of process equipment to become more water efficient (e.g. water chillers). Both programmes have a maximum limit of $10,000 per application.

4.5 Joint funding with energy efficiency

As discussed earlier, there is a high level of compatibility between water efficiency and energy efficiency in existing properties, though programmes driving energy efficiency are more advanced and well-defined. One reason for this is that energy efficiency has a direct bearing on reductions in carbon emissions, the key target for Government in its climate change mitigation strategy, and energy efficiency is the key mechanism for delivering this target.

A large, and sometimes bewildering, number of funding mechanisms exist on energy efficiency aimed at households and businesses. Examples include:

- Interest-free loans for energy-efficient products from the Carbon Trust.
- ECA for purchase of energy-efficient products (water-saving products included).
- Advice from the Energy Savings Trust.
- Warm Front grants for householders on benefits or income support.
- The low carbon buildings grant programme for micro-generation projects.

- Local authorities may have their own schemes to support energy efficiency.
- Energy suppliers have targets to promote energy efficiency under the Government's Energy Efficiency Commitment (now CERT) and they therefore provide a range of offers to reduce the cost of installing energy-saving and renewable measures.

The Government's Energy Efficiency Commitment (EEC) has been replaced by the Carbon Emission Reduction Target (CERT) which means energy suppliers with a certain number of customers are obliged to meet targets for improving home energy efficiency. Suppliers therefore provide a range of offers to reduce the cost of installing energy-efficient measures; the British Gas programme mentioned above is an example. CERT is due to be replaced after 2011, and its replacement Community Energy Savings Programme (CESP) is proposed as a way of making bigger savings in energy and heating. CESP provides an important opportunity to embrace water efficiency alongside energy efficiency, and in the reinforcement of local community and local authority involvement.

Funding of energy efficiency is extensive is because all those involved can realise tangible benefits: all customers are metered and financial gains are transparent; energy companies under CERT have targets to deliver energy efficiency; local authorities also have targets for carbon reductions and in planning, the PPS22 imposes further commitments; finally, central government's own commitment on carbon reduction and climate change adaptation focuses on energy efficiency.

The Government's is supporting retrofitting of properties with more energy efficient devices through various programmes by incentivising households or energy companies to take action, such as through CERT. Hot water is a significant element of water use in households and sometimes in business processes and where energy efficiency can be realised, so can water efficiency.

Kirklees Council has made use of funding available from suppliers under CERT obligations. The council, which has about a quarter of its population living in fuel poverty, established Warm Zone Plus in 2007. The three-year programme will offer free loft and cavity wall insulation to all homes. Personal visits will offer energy efficiency advice, low-cost insulation and grant-aided measures. Over the three years, the council expects 40,000 homes to take up the free insulation offered. The programme, which will cost £21 million, is funded through capital borrowing with the interest paid from revenue, supplemented with funds through Warm Front and CERT.

Local authorities also have to make carbon savings through their Local Area Agreements (LAAs). Over 380 councils have signed the so-called Nottingham Declaration which establishes a central role for local authorities in responding to climate change. By signing this declaration, councils pledge to "*systematically address the causes of climate change and to prepare their community for its impacts*". Local authorities are also required to report their progress on adaptation measures. This is reported under National Indicator (NI) 188 and provides some incentive to consider and possibly collaborate on measures to meet water neutrality in conjunction with the requirement to make carbon reductions.

The commonality between energy efficiency and water efficiency exists not only in the technical context, but in the people towards whom policy is aimed at influencing – householders and business leaders. Opportunities for adding water efficiency to energy efficiency schemes has been recognised by bodies such as the Energy Savings Trust and a more widespread adoption of water efficiency in the context of delivering energy efficiency targets on the use of hot water devices does not appear to be radical change to current schemes (such as ECA).

Delivering the funding for water efficiency through or in partnership with energy efficiency schemes is one part of the funding for delivering water neutrality. After all these are national funded fiscal incentive schemes, whereas water neutrality is location specific. Water neutrality might better use the planning system as its delivery mechanism, rather than through water company actions or the ad hoc gathering of disparate funding mechanisms. The planning process would also provide a mechanism for joint delivery of water and energy efficiency. A "template" for joint energy and water efficiency delivery is outlined in Section 4.6. Just as in the management of carbon reduction and increased demands for energy, it is the planning system that influences demand for water and delivery of supply networks. Current planning policy is enshrined within a number of Planning Policy Statements which set out a positive framework for planning and decision-making on climate change adaptation and energy efficiency and carbon reductions. There is a strong case for broadening various planning guidelines to encompass water management as a whole beyond the requirements of PPS12; and for water company statutory requirements and interfaces with the planning system to be reassessed with the PPS26 on climate change.

For water neutrality it is the planning system that provides a platform for developing concerted and joint implementation on water and energy efficiency funding. It provides explicit references to carbon reductions, climate change adaptation and energy efficiency and most important it provides this in the context of "place" which is so important for the delivery of water neutrality.

Some local authorities have used PPS22 to develop prescriptive planning policies requiring on-site renewable energy generation to meet a proportion of likely energy demand. This encourages developers to build to high energy efficiency standards while having the potential to create huge markets for micro-generation technologies. The Government might amend PPS22 to require all local authorities to include similar policies in their Local Development Documents.

It is possible to consider a comparable situation in the provision of water services. Enabled by the Local Government Act 2000, some local authorities such as Woking and Kirklees have successfully set up a local authority-private sector partnership with an energy company to deliver energy services to individual buildings as well as across whole local authority areas. The customer pays a guaranteed amount for the energy services, leaving the partnership company to focus on delivering those services as efficiently as possible to maximise environmental benefit and/or profit. However, setting these up for a local authority can be complicated, and it is not clear whether a similar service provision partnership could be replicated in water services under the provisions for inset appointments for instance.

Another aspect of joint energy and water delivery is through national advisory programmes. The Government provides funding for energy and water auditing and efficiency advice for business, delivered through Envirowise and the National Industrial Symbiosis Programme (NISP). Envirowise provides advice to businesses to help them reduce their energy use, water use and waste, whist NISP is a 'swap shop' for waste minimisation, including waste waters. NISP is part-funded by Defra through its Business Resource Efficiency and Waste (BREW) Programme. Some of the regional programmes also receive funding from their respective RDAs and other organisations.

A case study example of NISP in action on water saving and energy efficiency

The food and drink sector uses large quantities of water and there is often a close correlation between water use and energy use at food and drink manufacturing facilities. The Food Company, aware of cost savings associated with efficient use of water, came up with ways to reduce consumption and support implementation of better measures. In excess of 50 cold and hot water saving opportunities were identified, evaluated and prioritised for implementation. The review identified water uses that could be eliminated, and some where measures to control flow were introduced.

Results included:
-Water use reduced by 250,000 m^3 per annum.

-Waste water discharge costs reduced by £250,000 per annum.

-Water-related energy savings – the removal of hot water washing of empty cans would save 8,505,244 kWh of energy and 1,616 tonnes of CO_2 per year.

-Offsite energy and CO_2 emissions associated with energy used by utility company in water treatment, distribution and wastewater reception, treatment and disposal will also be reduced.

In summary, little government funding is available for water efficiency, whereas energy efficiency is supported by a large number of programmes. Like energy companies, water companies provide packages of advice and access to water-saving products, but the extent to which water and energy companies work together to promote efficiency is poor and could be greater. At least one water company is proposing a major trial on water/energy efficiency collaboration in their next five-year business plan. It is unclear whether this will go ahead, but it represents an important shift in thinking and presents an opportunity for cross-utility collaboration to achieve water neutrality.

4.6 Joint delivery of water and energy efficiency

Future planned delivery of energy and heat efficiency solutions to existing households is described in the Heat and Energy Saving Strategy (DECC 2009) and could potentially provide a mechanism for water savings. Water use and energy use are inextricably linked at all stages of the supply process and by the end user as follows: water supply (abstraction, treatment and distribution), water consumption in the home (heating of water and water used/pumped by domestic appliances) and wastewater (sewerage system pumping and wastewater treatment). Across these stages, the largest contributor to greenhouse gas emissions in water use is in the home, with approximately 89 per cent of emissions coming from this source (Environment Agency, 2008). The largest saving of energy, and thus CO_2, relating to water efficiency is the heating of water consumed within the home. Gains can also be made in supplying less water and treating less wastewater. In order to help deliver energy and heat savings in the home through water conservation measures it will be necessary to raise the profile of water efficiency through joint action with energy efficiency and with the energy companies that delivery these efficiencies.

The rationale for delivering water and energy efficiency as a joint action is compelling, and there are incentives for energy and water companies to work together. The fact that they have not indicates that either the incentives are not sufficient, or companies do not have confidence that cooperation between the sectors will bring benefits. In theory, cooperation would bring benefits to both sectors - the installation of aerated showers are allowed under CERT with the carbon credits accrued being decided by Ofgem. A water company can also gain carbon credits from actions that will reduce hot water use in the home. Other more cost-effective opportunities to gain credits,include house insulation. However as the Heat and Energy Strategy document acknowledges,

these “easier” accesses to energy credits will become more difficult from 2011 and hot water savings may become more attractive for joint action.

Changing behaviour in the home is the quickest way of addressing energy and water use. Substantial savings can be made by providing much better information and support to help people manage their energy use and water use. It is necessary to quantify better the link between heated water and energy use. This can then be clearly communicated to all end users. There will be a measurable energy saving, which can be expressed in money saved per household (in energy and water bills) and this would clearly show the potential benefits in terms of financial savings to the consumer. This fact coupled with advice on how to minimise use would encourage behavioural change.

It is also necessary to demonstrate the increasing importance of energy currently used to heat water in the home and how this will change in the future. As insulation in existing homes improves and space heating systems become more efficient, the greatest amount of energy used will potentially come from heating water. So the proportion of energy used within the home for water-related activities is likely increase in the future.

Some potential water/energy saving tools and actions are given in

Table 4.2.

Table 4.2 Energy and water saving tools and actions.

Tools to help people use less heated water	Impact
Aerated tap inserts	Reduction of water, including heated water. This will also reduce energy.
Aerated shower head	Reduction of heated water and thus energy. Aerated shower heads save water without compromising the sensation of a normal shower.
Real time displays of water and energy consumption in the home	Will educate the consumer on their use and highlight the link between energy and heated water.
More informative and accurate energy and water billing	Will allow the consumer to be more in control of their consumption. Water bills should include detailed information about consumption. Energy and water companies should liaise to ensure that water and energy efficiency advice is consistent and clearly communicated to all end users.
Home energy advice to include water efficiency	Significant savings possible where people act on advice and install physical measures. Incentives

	should be offered from both energy and water companies to subsidise physical measures.
Behaviour change	**Impact**
Fix dripping taps	Encourage the home occupier to fix all dripping taps in the home. This can help reduce the wastage of water and energy if a hot tap is dripping. Water companies can offer advice on local plumbers who can fix these problems and conduct heat and energy audits.
Shower timers	To clearly communicate the time spent in a shower and thus modify behaviour to reduce the length of time spent in a shower. This will reduce heat and energy consumption.
Point of sale information and appliance labelling	This would clearly communicate the efficiency of a product in terms of water and energy, encouraging the consumer to buy the more efficient appliance.

It is vital that people receive straightforward advice on how to use these tools, and can access technology solutions or can get them fitted. People need to respond to the information and use new tools correctly to maximise benefits. It should be possible to subsidise the cost of energy and water-saving measures.

Support on energy efficiency advice to households is already available through the Energy Saving Trust and the Act on CO_2 campaign, whilst Waterwise is responsible for advising on water efficiency. Energy and water suppliers, retailers, local authorities, and environmental and consumer interest groups should also supply information about how people can change behaviour to save energy and water in the home. The Government plans to roll out a home energy advice service providing tailored in-home advice, and train domestic energy assessors to provide this advice. This should include water. Assessors must be able to advise consumers on optimising their water use, in particular the wise use of heated water, which would maximise energy reduction.

In addition to advice at point of sale, homebuyers and potential tenants are provided with an Energy Performance Certificate (EPC) when they are looking to buy or rent a property. Water should be included within these assessments or a Water Performance Certificate (WPC) developed to provide the consumer with information about water-using devices within the home. There will be a clear correlation between energy efficiency and water efficiency. Energy and water companies should integrate to provide consistent information to improve water and energy efficiency within the home.

The Government intends to use CERT to provide incentives for energy suppliers to provide real-time displays to consumers, and to support the installation of smart meters in every home. This could be extended to include smart meters for water since the data collected by smart meters, combined with a real-time display, can give consumers and suppliers detailed and accurate feedback on use. Smart meters will allow consumers to understand how they are using, and whether they are wasting, water and energy and will allow suppliers to offer consumers new services tailored to their needs. In the context of achieving water neutrality, metering should mean smart metering.

It would be relatively straightforward to incorporate water in housing refurbishment programmes, such as social housing or Government housing. Some housing authorities and registered social landlords are already addressing, through their refurbishment programmes, the combined issues of reducing energy demand, reducing the carbon impact of energy use, and adapting social sector homes. Water should be

included within this agenda so that water and energy efficiency is installed throughout all social housing.

4.7 Understanding roles and responsibilities

The crucial phrase for describing roles and responsibilities is “concerted action”. This recognises that no single intervention or funding mechanism will meet water neutrality. Because water neutrality is based on a specific area with its own environmental and social characteristics, the nature of mitigation measures will also differ.

Water neutrality requires a combination of local partnerships to develop the measures and mechanisms needed. Local circumstances and decisions on measures to take forward will influence the source of funding. These activities will to a large extent determine the roles and responsibilities of the partners involved.

Water neutrality is achieved at a local or regional level. Roles and responsibilities should reflect or emerge from local requirements and the different elements of a local strategy. For example, where the main funding is derived from water company activities such as expanded metering, water efficiency promotions and partnerships with landlords, the water company will take the lead. Where water neutrality might rely more heavily on funds raised through developer contributions, which may be possible in a future Community Infrastructure Levy, the local authority would take the lead.

The key organisations in a partnership are the local authorities, water companies and developers. The Environment Agency, operating from regional and areas offices, can act as the catalyst for developing water neutrality strategies, and plays a critical role in the planning process. Responsibilities for raising and managing the required funding for water neutrality broadly reside in the organisations listed in

Table 4.3.

Table 4.3 Organisations and roles.

Organisation	Type of role
National Government (Communities and Local Government)	Provide policies and regulations that enable fundraising from CIL and opportunities for local fiscal measures to be implemented without prejudice to other local funding needs. Provide a framework to achieve water neutrality that is consistent with CERT and in the future, with CESP.
Local authorities	Set local water-saving and energy-saving objectives. Ensure compliance with planning processes and requirements. Be the main "communicator" with property owners and implementation authority for retrofit in the community.
Ofwat	Respond positively to plans from water companies to participate in water neutrality investments.
Water supply companies	Deliver metering and water efficiency plans in the area designated for water neutrality and as agreed through participation in local water cycle studies.
Energy supply companies	Target hot water savings to achieve energy savings (for example, the installation of water-efficient showerheads are allowed under CERT).
All property owners and landlords	Make procurement decisions in support of water neutrality as beneficiaries of funding.
Plumbers	Be the main delivery organisation of water-saving (and heat- and energy-saving) measures in properties as beneficiaries of regulatory change and funding to support their delivery.

One group that has received little attention in the development of policy on water neutrality are the plumbers. Plumbing businesses are the main interface for most customers and will be the primary organisations to retrofit existing properties. In addition, given their relationship with householders, plumbing businesses play an important role in providing advice and education. Policy makers will need to work closely with plumbing organisations to create the energy and water services discussed in the recent consultation on the Heat and Energy Saving Strategy.

The Environment Agency's strategy for achieving water neutrality, where it is an agreed strategy for new development in growth points and for eco-towns, should be led by its regional offices. Local area offices have important local knowledge and these need to be a capitalised on.

Water cycle studies conducted by a partnership of the Environment Agency, water companies and local authorities may be the best policy instrument to develop water neutrality strategies. Water cycle studies need to be actively promoted by the Environment Agency - it is clear through conversations with some local authorities and water companies that there is a lack of awareness about their existence.

The Environment Agency head office should provide technical support for the regional and area offices, and in particular should work with other branches of Government such as Defra, Ofwat and CLG to ensure regulations and policies will not present barriers to water companies, developers and local authorities pursuing a water neutrality strategy.

The Environment Agency should advocate the mandatory use of water cycle studies as a statutory requirement and component of Local Area Development Plans. In doing so the Environment Agency should also promote funding for good practice in water efficiency to help achieve water neutrality.

4.8 Overall assessment of funding mechanisms

There is currently no over-arching funding mechanism for water neutrality, and it is unlikely that water neutrality could be met solely through current water company funding arrangements. A range of funding options has been identified in this report, but their feasibility in delivering the appropriate level of funding is uncertain.

Key findings on funding mechanisms for water neutrality are:

- Water neutrality provides a strategic "meeting point" for all the current mechanisms to be concentrated in a particular place of new development in water stressed areas. A water neutrality strategy provides the opportunity for those with funding roles and responsibilities to work together to maximise the combined effect of their actions to meet water neutrality.
- Water company funding of water efficiency measures does not in itself constitute funding for water neutrality. Mobilising water-saving interventions, if possible under regulations, in a location for water neutrality would automatically bring the funding to that location and would therefore represent funding for water neutrality.
- Water neutrality is delivered at regional and local levels; the responsibility for funding processes such as fundraising from CIL, or from water infrastructure charges, rebates and local fiscal incentives must lie with local organisations.
- There will be links between funding processes. For instance, grants from local authorities could in the future be raised from infrastructure agreements with developers. The Community Infrastructure Levy may also be a vehicle for local payments towards rainwater harvesting and grey water recycling infrastructure, particularly where these are operated and managed by the local authority or their agents, and landlords.
- Currently most of the funding options do not exist. The main funding resource for the delivery of water efficiency measures resides with water company funded schemes and the discretionary buying behaviour of property owners and landlords; these sometimes work as partnerships, such as housing associations working with water companies to refurbish housing stock.
- Funding measures exist for some types of property owners; business can use the ECA, some low-income homeowners receive efficient hot water devices as a byproduct of energy efficiency grants through the Warm Front scheme; and discretionary purchasing by water efficiency "aware" householders or businesses should not be discounted.

- Some major property owners are under the remit of Government, such as schools, libraries, hospitals, government buildings and other public institutions. Funding for water efficiency in these institutions should be straightforward, by stipulating mandatory clauses in the procurement policies of all these institutions. For water neutrality, any public institutions would be among the first to be targeted for water efficiency retrofitting, funded by the government property owner.

Many of the options discussed in this report are not yet available; however, proposals for the Community Infrastructure Levy (CIL) are an important policy focus for those interested in advancing the concept of water neutrality. Implementation of the CIL is due to begin by October 2009. Legislation might have significant implications for local authorities' ability to raise developer contributions for water-efficient measures beyond those agreed by water companies. This will also have implications for developer contributions for other forms of mitigation or adaptation as envisaged for carbon reduction by the policy in Milton Keynes.

The Environment Agency may wish to advocate the planning system to better promote water neutrality and more diverse forms of delivering local sustainable water management, more local forms of safe water supply from grey water recycling and rainwater harvesting, or more encouragement for new licensed suppliers to expand the adoption of inset appointments, without incumbent water suppliers. A small water company for a new development such as an eco-town, with its own resource, may not require an incumbent water company for that area to remain a supplier of last resort. This might be a logical outcome from the current discussions on competition and consequence in the relaxation of rules under Local Government Act 1976 which currently restricts local authorities' ability to run energy or water services.

Outside of the funding derived from water companies, the new Community Infrastructure Levy (CIL) provides the most promising opportunity to create substantial funds earmarked for retrofitting measures required for water neutrality.

CIL could be the catalyst for a change where environmental impacts, including water resource burdens, could be accounted for as part of the planning and development control sector. The local planning authority would consent to a development following an assessment of its water resource impact and proposed mitigation solutions, water neutrality alongside carbon reduction being one of the solutions. The mitigation actions required to offset impacts would be listed in detail as a schedule. This schedule would become legally binding on the part of the developer and planning authority or the RDA which has the power to raise regional funds for regional infrastructure on the basis that this is repaid in the future. The developer would pay a bond prior to the onset of development to ensure the mitigation measures could be paid for. Without the bond in place, the development could not proceed. The bond would be used by a third party to assume responsibility for the mitigation delivery. The developer payment would be used to support concerted actions to install a mix of measures in the designated area.

The cost to developers could be factored into the development uplift value on the land, making it unlikely the developer would suffer significantly in economic terms, because the liability of the increased cost would be reflected in reduced land values. However, developers might argue that all activities associated with the provision of water supply should be the province of water companies.

The key test as to whether CIL could release funding for a water-efficient measure is if the measure helped to enable the new development to take place.

Recommendations to develop mechanisms for funding water neutrality are:

- A policy shift away from regarding water companies as the default funders of measures required for water neutrality is needed. This should be done by evaluating measures that contribute to water neutrality as broader mitigation measures required to accommodate new developments. Central government needs to recognise this and CLG should account for this in the development of the provisions of the Community Infrastructure Levy.
- The Environment Agency needs to lobby Government to ensure that CIL makes more explicit reference to the provision of funding for water infrastructure, where this infrastructure would not be the responsibility of a licensed water company. If implemented in this way, CIL could provide a sustainable funding mechanism for water neutrality, in addition to other environmental benefits.
- The opportunity for linking retrofit offset mechanisms such as that proposed in the Milton Keynes tariff needs to be explored for generic use by local planning authorities to mitigate wider environmental impacts of new development, including pressures on water resources and threats to aquatic habitats. It is recommended that this mechanism for funding be available through CIL.
- All public institutions in the area of water neutrality should have a mandatory requirement to install water-efficient devices and have a water efficiency commitment to match their energy efficiency and carbon reduction commitments.
- Integrated within mechanisms for funding energy efficiency, the Government should establish a coordinated package of fiscal incentives for water efficiency measures for property owners and landlords, and business premises. These should be implemented at local and regional level by RDAs and local authorities and be responsive to the water neutral strategy developed at local level. A water sector version of CERT and the newly proposed CESP should be considered by Government.
- The current consultation on the Heat and Energy Saving Strategy should embrace water efficiency within the concepts being developed for local service delivery and reinforce an integrated energy- and water-saving process.

5 Conclusions and recommendations

i. The definition of water neutrality has been refined to: "*for every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community*". This definition should be used to ensure a consistent understanding of the purpose of water neutrality.

ii. Water neutrality cannot be solely achieved by water companies and these cannot be seen as the default funders of measures to meet water neutrality.

iii. It is technically feasible to achieve water neutrality. However, the way in which water-efficient measures are delivered needs to be improved. Water neutrality can be achieved through the mobilisation of such measures, backed up by adequate funding, in the specific water neutrality area.

iv. Achieving water neutrality should be a 'concerted action' in partnership with the local community, local authority, water companies, the Environment Agency and developers. This should seek to involve the community at every level, from schools to parents to businesses, to homeowners to social and private tenants, and importantly be led by the local authority/government.

v. A water neutrality action plan should be developed by local partners, setting out the goals and aspirations for water neutrality in the area and an overall approach to water neutrality.

vi. Achieving water neutrality will rely on a series of mitigation actions or interventions. These include water conservation in domestic, commercial and public properties; metering and alternative tariffs; activities which enforce water conservation standards and regulations; water efficiency labelling, encouraging local retailers to include point of sale information on water conservation; and training of local plumbers to offer water conservation advice.

i. These actions should be aligned and be part of heat and energy saving strategies, to allow water neutrality measures to be implemented more cost-effectively. Policy makers at national and local level should work closely with the plumbing supply chain to create the type of energy or water services discussed in the recent consultation on the Heat and Energy Saving Strategy.

ii. Plumbing businesses and retailers of plumbing goods are the main interface for most consumers and could be primary delivery organisations for interventions that require retrofitting in existing properties. Given their relationships with householders, plumbing businesses also play an important role in providing advice and education.

vii. The strategy for water neutrality must sit within the planning system if its delivery is to be effective. This will identify the need, bring partners together and focus on the community.

viii. Local authorities are at the centre of the planning process and their involvement in delivering heat and energy efficiency and carbon reduction schemes in the existing housing stock should be harnessed to make similar changes in water efficiency.

ix. To achieve water neutrality it will be necessary to deliver technical and behavioural water efficiency interventions in a co-ordinated and targeted way to maximise take-up rates and water savings.

x. The right mix of information and interventions should be targeted at specific groups. From the evidence and modelling of scenarios, metering the existing housing stock offers the greatest water saving per household. Therefore water neutrality requires metering to be maximised. This increase in metering is not a stand-alone activity and must be part of a community action programme.

xi. Alternative tariffs to encourage water saving could be applied to water neutrality areas in the future but UK evidence for their effectiveness is limited, and the impact on water affordability needs to be considered. Trials of different tariffs are underway in a number of water companies and more are planned in AMP5. Evidence from these trials should indicate the impact of alternative tariffs in offsetting for water neutrality.

xii. Water cycle studies conducted by a partnership of the Environment Agency, water companies and local authorities may be the best policy instrument to develop water neutrality strategies. Funding is available for local authorities to undertake water cycle studies, and this funding can help bring together the local and regional partners needed to achieve water neutrality.

xiii. There is no over-arching funding mechanism to deliver water neutrality. Funding for water efficiency is piecemeal and disjointed, and lacks the policy profile and funding available for heat and energy efficiency. However, water neutrality will require substantial funding with available mechanisms working together. Funding sources will need to be harnessed, including:

- Funding that water companies receive for metering programmes.
- Funds set aside by water companies for water efficiency activities (the achievement of water efficiency targets in water neutrality areas should count towards the offsetting of consumption from new developments in these areas).
- Funds available for heat and energy efficiency under CERT (CESP in the future) and all other retrofit programmes.
- Funds available under the New Growth Point schemes.
- Funds to improve social housing through the Decent Homes schemes.
- Funds may be available under the proposed Community Infrastructure Levy (CIL). Where measures contributing to water neutrality can be identified as contributing to the development being realised, it should be possible to establish funds to cover the measures required for water neutrality. This funding mechanism does not yet exist.

xiv. The Environment Agency should lobby Government to ensure that CIL makes more explicit reference to the provision of funding for water efficiency related infrastructure, where this infrastructure would not be the responsibility of a licensed water supply company. If implemented in this

way, CIL could provide a funding mechanism for water neutrality, in addition to other environmental and amenity benefits.

xv. The current consultation on the Heat and Energy Saving Strategy should embrace water efficiency within the concepts being developed for local service delivery and reinforce an integrated energy and water-saving delivery process. Government should integrate water efficiency, and explicitly hot water savings, within this strategy. Funding for water efficiency through or in partnership with energy efficiency schemes would help meet water neutrality.

xvi. Innovative infrastructure tariffs are being developed by some local authorities. Where these are negotiated to include support for the delivery of local authority carbon reduction responsibilities, by way of energy efficiency programmes, a targeted and funded approach to include retrofitting of combined energy and hot water-saving devices would support the funding of water neutrality.

xvii. A range of fiscal incentives from reward rebates on local taxation, reduction or exemptions on VAT for water-efficient products, subsidised retrofitting of water-efficient fittings and devices, fiscal benefits to plumbers accredited on water efficiency delivery schemes, would all contribute to a situation where customers gain financially from supporting water neutrality. It is crucial to back up education and campaigns for existing householders with incentives to help meet water neutrality.

xviii. Local authorities must make carbon savings and are expected to do so through their Local Area Agreements (LAAs). Local authorities are also required to report their progress on climate change adaptation measures. This is reported under National Indicator 188 and provides some incentive for local authorities to consider and possibly collaborate on measures to achieve water neutrality alongside carbon reductions.

xix. Although there is a need to gather more evidence on complex solutions, such as integrated suites of interventions, rain water and grey water reuse, and alternative tariffs, this lack of evidence should not delay implementation of solutions as long as the water, heat, energy, and carbon savings are monitored and evaluated.

xx. Monitoring and feedback on the performance of measures are a vital step in the water neutrality process. These will verify that water neutrality has been achieved, assess the longevity of water savings and contribute to the evidence base to inform future strategies.

xxi. It would be worth demonstrating that these conclusions and the delivery of water neutrality are feasible by undertaking an ”exemplar” project in a specific New Growth Point area.

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APPENDIX A - Water Savings Group commitments

Defra

- Review the Water Supply (Water Fittings) Regulations 1999.
- Issue guidance on water efficiency to public bodies in 2009.
- Continue to work with stakeholders to pursue the Future Water ambition of reducing per capita consumption to 130 litres per person per day by 2030.
- Promote water efficiency within central government procurement, to help achieve the existing targets for water savings in government estate.
- Reduce water consumption by 25 per cent on the office and non-office estate by 2020, relative to 2004/2005 levels.
- Reduce water consumption to an average of 3 m^3 per person/year for all new office builds or major office refurbishments.

CLG

- Amend in 2009 the Building Regulations to include a requirement for a minimum standard of water efficiency in new homes.
- Explore the scope for encouraging and delivering water for non-domestic buildings.
- Consult on PPS: eco-towns, including water efficiency for new buildings and wider area water neutrality.

Waterwise

- Develop a long-term national strategy to encourage more efficient use of water.
- Work with manufacturers and retailers to improve the provision of water efficiency information.
- Work with EST as part of a joint LIFE+ project providing combined water and energy information to consumers.
- Maintain and disseminate the evidence base for large-scale water efficiency.

Environment Agency

- Increase awareness and share good practice on water efficiency among business and organisations, including those in the leisure and tourism and retail sectors through the water efficiency awards.
- Improve our understanding of non-household demand for water by assessing optimum use by industrial and commercial customers and identify appropriate options for greater water efficiency.

- Support existing and future research and development projects to improve knowledge and understanding of water demands and how to influence these.

Ofwat

- Ensure that appropriate incentives are in place for companies to improve the promotion of water efficiency.
- Ensure the water company good practice register is updated on a regular basis and includes cost effectiveness information.
- Consumer Council for Water.
- Coordinate the development of a long-term national strategy to encourage the efficient use of water.
- Develop an educational plan which links water efficiency and bill impacts and signposts sources of practical advice.

Water UK

- Raise customers' awareness on water efficiency.
- Continue to support the sharing of best practice across the industry.
- Communicate the results of ongoing large-scale water efficiency projects by companies.
- Develop a long-term national strategy to encourage the efficient use of water.

APPENDIX B - Interventions for water neutrality

Introduction

Intervention measures that constitute mitigation strategies to achieve water neutrality are described in this appendix. Details included here represent current understanding of the evidence of their effectiveness in making water savings. Trials in many parts of the country are ongoing and it is hoped that evidence will continue to be gathered and analysed.

Water efficiency measures for toilets

- Cistern displacement devices, such as a Hippo or Save-a-Flush
- Retrofit dual-flush devices, such as the ecoBETA
- Retrofit interruptible flush devices, such as the Interflush
- Replacement dual-flush toilets
- Replacement low-flush toilets

The changes in the Water Supply (Water Fittings) Regulations in 1999[11], set a mandatory maximum flush of six litres for any toilet installed after January 2000. This policy driver has been successful in reducing the water used for toilet flushing. There remain, however, a large number of large volume cisterns in operation throughout the UK and these are responsible for a major proportion of per capita consumption.

Cistern displacement devices (CDD) are effective in larger cisterns (9-12 litres) to reduce the flushing volume. They come in a range of sizes, but the most popular one in current use typically saves one litre/flush. These devices are limited in their use as they can only really be used in large cisterns. CDD are currently a favoured option for water companies as they can easily be sent to the customer upon request.

Dual-flush toilets are often considered to be more efficient than single-flush systems. They allow a main flush (long flush) of between four to six litres, with a smaller flush (short flush) button that uses around two to four litres. It is possible for dual-flush systems to be retrofitted into single-flush toilets with minimal effort. There is however now growing evidence that many dual-flush mechanisms can fail which can result in leakage[12]. As well as risk of the mechanism jamming and the valves leaking (which go undetected due to the internal overflow) there is also evidence that the user does not know how to operate the dual-flush system properly. Often only the higher flush is used, or sometimes when the smaller flush is used at the wrong time this necessitates a double flush which wastes water. Current devices on the market are not always intuitive and are not usually clearly labelled. Regulations could be amended to improve the labelling of all water-efficient products.

Current water supply and fittings regulations have resulted in a maximum size of cistern at six litres. Some low-flush toilets have an ultra low-flush volume, less than the now standard size. It is vital that consumers are made aware that such devices are available and easy to obtain and to use once installed. Mechanisms to encourage the

[11] Office of Public Sector Information website: www.opsi.gov.uk/si/si1999/19991148.htm
[12] http://www.waterwise.org.uk/images/site/Policy/nwcg/mtp general update and leaky valves.pdf

installation of these devices are vital to raise the profile of water-efficient products. Cooperation with manufacturers, plumbers and stockists (such as DIY stores) could be a way of promoting the most efficient toilet which is the market leader.

One of the main reasons for targeting toilets to reduce demand management is that they will always be used daily, and the yield is more accurate than other devices as it is an engineered defined solution and does not have a behavioural component. There is not a time component of this water use - one flush is one flush and this hopefully will not change over time. Toilet retrofits would reduce annual average demand, but not peak demand.

Water efficiency measures for taps

- Tap inserts, such as aerators
- Low-flow restrictors
- Push taps
- Infrared taps

Personal washing accounts for approximately 25 per cent of water used in the average home[13] and a proportion of this will be tap use. Water-efficient taps can reduce how much water is used in a domestic bathroom and kitchen. A range of devices can be used to reduce the volume of water associated with tap usage. These devices can reduce the actual volume delivered from the tap, or reduce the wastage of water.

Aerators and flow restrictors reduce water by reducing the actual volume of water delivered from the tap. Tap inserts aerate the water discharging from the tap which reduces the volume, but gives the same sensation as a larger flow. This will reduce water use for hand washing, or teeth brushing.

Push and infrared taps are more likely to be used in commercial or public settings. For example, motorway service stations or large office blocks might choose to install such devices, as these reduce the risk of wastage from people leaving taps on.

The advantage of targeting taps is that they are used daily and in a variety of different household rooms and for different purposes. In addition to the range of tap locations, this intervention could save hot water which would also save energy through reducing the volume of heated water. This would result in financial and environmental benefits.

However, given the large range of taps, it would be necessary to offer a wide range of aerators if this was for a retrofit programme. It is unlikely that one type of aerator fitting would fit all tap types within a home or office and many older taps cannot be fitted with any sort of insert and would need replacing. Approximately half of tap events are volumetric-related, such as filling a kettle or a sink, and so water saving would not be achieved. The tap events driven by behaviour, such as choice over how long to wash hands for, are the ones which could potentially bring water saving. There is inherent uncertainty in the yield that might be expected due to the behavioural aspect.

Water efficiency measures for showers and baths

- Low-flow showerheads
- Aerated showerheads
- Low-flow restrictors
- Shower timers

[13] BNWAT28: *Water consumption in new and existing homes*, MTP, 2008.

- Reduced volume baths (such as 60 litres)
- Bath measures

Showers can use between six and 45 litres per minute, but a water-efficient showerhead can save water without changing showering habits, provided the user does not increase duration of showering which relates to behaviour.

A water-efficient showerhead (some of which use similar technology to an aerated tap insert) saves water by aerating the water or varying the spray modes or patterns. The most recently developed aerated showerheads on the market do not feel dramatically different to a regular shower head, despite delivering less water. As a result the showering experience changes less and thus the consumer is more likely to continue using the device. However, aerated showerheads will only aerate where there is sufficient pressure and when fitted to showers supplied from a combi-boiler can cause the boiler to cut-out. This can also be a problem with tap inserts. As well as the sensation and effectiveness similar to a non-aerated shower, this device also saves hot water resulting in a double saving of water and energy. The water savings from these devices would tend to reduce average demand but could also have an impact on peak demand as showering is more frequent in hot weather.

Shower timers are popular devices sent out with other communication (similar to CDDs) which enable the consumer to control their water use. It is a simple device that draws attention to the shower duration, although the yield from this device is extremely uncertain. Similarly to taps, shower devices, whether timers or heads, are beneficial in adapting the behavioural aspect of water use.

Small volume baths are particularly applicable for new homes, to comply with CSH standard or whole bathroom refurbishments. To retrofit only a bath would be unlikely. Aerated taps on a bath would not make the bath more efficient as the bath is volume-related. There is ongoing debate on the acceptability of small baths. A bath is often considered to be a luxury and relaxing activity and this bathing experience will not be same in a small bath. This may result in a small bath being replaced with a regular-sized bath which would undermine the potential consumption of the home.

Rainwater harvesting and water reuse

- Large-scale rainwater harvesting
- Small-scale rainwater harvesting with water butt
- Grey water recycling

Rainwater harvesting is the capture of rainwater for other purposes. Most commonly this is recognised as collecting rainwater from a roof via guttering into a water butt for garden watering. This type of reuse is becoming increasingly common in the UK and several water companies offer water butts at a discounted price. Rainwater recycling can also be implemented at a large scale. For example, large buildings can collect the water from the roof area into big tanks and use it for toilet flushing. Wessex Water head office in Bath uses rainwater to flush all of the toilets within the office which holds more than 500 employees.

Rainwater harvesting requires a large collection area (typically roof area) and a holding tank for the resource until it is required. There may be a delay between rainfall and demand and so the water must be stored. In some cases, depending on the residence time of the tank, treatment of the rainwater might be required to prevent it from stagnating until it is used. Treatment of rainwater will require energy use and therefore increase the carbon emissions associated with this intervention. The pumping of rainwater from an underground storage tank would also increase energy use.

Rainwater harvesting, as the name suggests, is dependent upon rainfall events and thus rainfall patterns typical of an area. Rainwater recycling would, in theory, help to reduce water consumption during times of peak demand, as during these times gardens would be watered and previously the water for this would be obtained from the mains supply. With the installation of a water butt, the garden could be watered via this reservoir. However, this is only if the water butt is full. There is a risk that the rain water system may run empty during periods of hot dry weather and thus the reservoir (water butt) or toilet flushing system would have to be backed up from the main supply. Therefore, although a popular measure, there is uncertainty as to how reliable the yield derived from rainfall might be long term. Although a good measure in theory for peak summer demand, in practise there is a risk that the water butts may be empty. The same problem applies in dry years, which are used for water resource planning and applicable to the definition of water neutrality.

Greywater recycling involves collecting water from wastewater producing activities and using this for toilet flushing. Shower water, bath water and washing up water are examples of the types of wastewater which would be collected. This water would contain large amount of detergents and surfactants and would therefore require treatment before it could be stored and used when required.

Small-scale rainwater collection, like water butts, can be implemented easily in domestic properties. Larger scale units would require significant building and civil works both externally (tanks to collect the water) and internally (to install the infrastructure to treat and transport the recycled water). If treatment is needed, this entails a further level of complexity which could render the option unfeasible or uneconomic. Larger reuse systems are likely to be more appropriate to new builds rather than for retrofitting projects.

Water efficiency measures addressing outdoor use

- Hosepipe flow restrictors
- Hosepipe siphons
- Hose guns (trigger hoses)
- Drip irrigation systems
- Mulches and composting

The typical family uses about seven per cent of their water outdoors[14]. There are several areas in the garden where small changes could result in major water savings.

Climate change is expected to impact on peak demand from increased discretional external use. Hotter summers mean that people are likely to use more water for bathing, watering the garden and filling swimming pools. Currently about six per cent of household water is normally used in the garden, but on hot days this can rise to over 50 per cent[15].

The most obvious saving is to recycle rainwater. In addition, mulching could be used. Mulches such as pebbles, gravel, cocoa shell, chipped bark, and grass clippings not only keep away water-loving weeds, but also keep the soil cool, decrease evaporation, and reduce soil compaction. Many people use hose pipes to water the garden which can waste large amounts of water if left running. Instead watering cans could be used, or a trigger gun on the end of the hosepipe would allow more control over the watering and hence less wastage. This can also be applied to car washing.

[14] MTP: BNWAT27. *Domestic external water use: An overview*. 2008
[15] Source: Environment Agency

These options which target outdoor use attempt to limit discretional water use - non-essential use - which is likely to be during peak times, as garden watering is not necessary during winter months. These options, however, are limited as they may only be taken up in houses which have gardens. In older inner city areas where there are more likely to be flats and less likely to be properties with large gardens, promotion of such interventions may not be as relevant or successful.

Outdoor use is largely governed by behaviour, even more so than indoor use and as a result wise water use would be more likely after receiving and responding to advice.

With the threat of climate change resulting in hotter drier summers, a switch to drought resistant plants should be encouraged. This could be done via a partnership with a garden centre, for example: the promotion of drought-resilient plants in combination with offers on water butts and trigger guns for hosepipes. Drought resistant grass seed is available and developers should be encouraged to use this on new developments. Councils should also be encouraged to use drought-resistant plants as they use significant volumes of water to water parks and recreational areas. Harrow Council in London, however, have decided to stop using hanging baskets as they believe the baskets need too much watering and maintenance and are not "environmentally sound"[16]. They have also decided to replace traditional trees with foreign species which can cope better with dry, hot conditions and allowing sections of parks to revert to wild areas which need less watering and maintenance than lawns and flower beds.

These interventions would reduce water use during peak times, but the yield from such interventions is extremely hard to predict accurately due to the behavioural and seasonal aspect of this water use.

Commercial properties

- Commercial water audits
- Rainwater recycling
- Grey water recycling
- Optimising processes
- Provide information to all newly metered businesses

Many interventions which can be adopted in the domestic environment are also applicable to the commercial setting. The Thames Gateway study indicated that water savings in the non-domestic sector can contribute to a considerable portion of savings.

Commercial water use can be separated into water use integral to the actual business itself, that is, water used within a manufacturing process, and water which is required for domestic purposes such as toilet flushing. The nature of the commercial property will also impact the water which could potentially be saved.

Water audits are a popular and relatively successful way of reducing water use within a commercial setting. Audits trace water use from source to drain to deduce what happens to it and then attempt to identify areas where its use could be optimised. This may lead to an overall reduction in use, and result in water being used more effectively and with less waste than was previously the case.

Other savings could be made in the domestic side of the commercial building. Aerated or infra red or spray taps could be installed in bathrooms to reduce the risk of water wastage from taps which have not been turned off. Dual-flush toilets could also be fitted. It is important for a business to educate its employees on the importance of water efficiency, and this message could result in good practice within the home too.

[16] http://www.harrow.gov.uk/downloads/hp_julyaugust_06_for_web.pdf

On a larger scale, commercial buildings may be suitable for large-scale rainwater recycling systems. The water could be reused within the site or elsewhere.

These interventions can yield significant reductions in water use. With the exception of water reuse, the options are centred on wise water use and minimisation of water waste. Commercial properties are more likely to be metered and there are companies offering their services (e.g. Envirowise) to optimise water consumption on the back of financial savings. These interventions will help to reduce average annual consumption. In addition to businesses, these options can be applied to public buildings such as hospitals, schools. If heated water can be saved, water and energy would be saved.

Metering

- Promote water companies' free meter option
- Compulsory metering (in water-stressed areas)
- Smart metering (to engage the customer with their consumption)
- Provide interactive websites which allow customers to estimate the savings associated with becoming metered (environmental and financial)
- Innovative tariffs (seasonal, peak, rising block)
- Customer supply pipe leakage – supply pipe repair and replacement

Pressure on water resources has had a major influence on metering in England and Wales. The policy of the Environment Agency and Government is that metering should be promoted with vigour in the water-stressed areas of South East England, to encourage households to use water efficiently.

Meter penetration of domestic properties on England and Wales (2007/2008) currently stands at 33 per cent[17]. Penetration of domestic metered properties range from 60 per cent in Anglian Water and South West Water to 18 and 23 per cent in Northumbrian Water and United Utilities respectively. The pace of domestic metering has changed in the UK. Water companies in their Strategic Direction Statements and their draft Water Resource Management Plans have increased their targets for metering over the next two AMP cycles. A number of water companies have also indicated that they will be implementing different tariff structures with trials to be conducted with immediate effect.

Metering is considered to be an effective demand management tool, as it enables customers to control their usage and therefore their bill. Metering is also considered to be the fairest way to pay. A considerable volume of research has been conducted on how much water could be saved by installing a meter and it is currently thought that per capita consumption could reduce by between five and 15 per cent[18,19]. The guidance from Ofwat is to assume that there will be a demand reduction of 10 per cent over the unmeasured demand for selective and compulsory metering policies[20]. Due to the effect on consumption, water companies in areas of high water stress are planning to use metering as a tool for demand management which, in these areas, is the main driver. The Environment Agency has set an ideal target of 75 per cent of households to be metered by 2025, the South East to achieve this by 2015[21]. Water companies now have powers to compulsorily meter customers in areas of water stress, when they can show that it is cost-effective to do so. This could be expanded to include all water neutral areas and thus increase meter penetration in a designated area. An additional

[17] Ofwat: *Water and Sewerage charges*: 2007-8 report, May 2007, pg 22.
[18] *The effect of metering on peak and average demand* – UKWIR, 2005, UKWIR 05/CU/02/1.
[19] Herrington, Paul. *Waste not want not? Water tariffs for sustainability*. Report to WWF, September 2007.
[20] Ofwat, *Water supply demand policy*, November 2008
[21] Environment Agency Water Metering statement. http://www.environment-agency.gov.uk/subjects/waterres/286587/1466399/

benefit of metering is that it can identify customer supply pipe leakage. Leakage from these pipes can be significant, up to a quarter of the total leakage for a water company and if this is reduced, this will affect average demand.

Water companies offer the installation of a free meter to those customers who request one. Optant and compulsorily metered consumption is reported to Ofwat in Table 8 of the June returns. All new homes built are likely to be metered and so metering is only a valid option in existing homes. Exceptions to this are flats, a number of which escape the requirement to be metered due to the complication of shared supplies. If the property has as shared supply, the cost of installing a meter incurred by the water company can be prohibitively high. If water neutrality is kept within the existing water company funding mechanism, the pace of metering and other water efficiency initiatives will be constrained by the Asset Management Planning (AMP) cycle. Currently metering strategies are considered as part of the least-cost planning solution to bridge any supply-demand deficit. To drive metering forward, which would be necessary for water neutrality, this would result in pursuing metering in areas which were previously considered uneconomic to do so. As a result, additional funding mechanisms must be made available to do this outside of the existing water resource planning process.

Metering is believed to reduce demand, but it is not clear for how long this saving is sustained. There is an issue of 'bounce back' which is the possibility that occupants' water-efficient habits will slip over time and so the saving in consumption will also slip. There is a need for evidence, obtained over a long monitoring period, to substantiate this claim.

Metering allows the consumer to be aware of and in control of their consumption. To date, metering in the UK has involved the use of 'dumb' meters – a basic form of metering which merely records the volumetric quantity on a rolling basis. Consumption is measured when the meters are read, usually annually. This form of metering is effective for measuring what water has been used, but is extremely limited in terms of using innovative tariffs to manage demand.

Intelligent (or smart) metering is concerned with the rapid collection, processing and feedback of information on water and energy use from a large base of customers. It allows utilities to understand better the behaviour of their customer base, to apply measures to alter patterns of use and to apply alternative tariff structures. It also enables consumers to be more in control of their water use. Innovative tariffs, such as seasonal tariffs where the consumer pays more for water during peak times, could potentially reduce peak water consumption although this claim cannot yet be supported by UK evidence. Smart metering and innovative tariffs are still in the inception phase, and have yet to be implemented on a wide scale. Several water companies are trialling innovative tariffs but the evidence from these studies has yet to report. The trials include simple tariffs which could help demand management such as rising block tariffs and more complex systems such as seasonal tariffs (with higher costs during peak times) which require intelligent metering. Currently little is known on how effective tariffs will be in reducing demand, but a better idea of this will be achieved as the trials are completed and the results are disseminated across the industry. There is very little evidence to show how the price elasticity of water will influence water use.

Implementing widespread or full metering in an area enables the introduction of more sophisticated tariffs, which can have the effect of reducing demand further. The most common types of alternative tariff are rising block tariffs and peak seasonal tariffs. The type of tariff that can be introduced is largely determined by the sophistication of the meter, and the market has seen the introduction of smart or intelligent metering systems over the past few years. These can range from devices which store monthly total volumes through to fully integrated automatic meter reading systems. Some smart or intelligent meters also have the capability to feed information back to the

customer, either directly through a customer display device or via the web. These systems may offer further demand savings by engaging the consumer in water use.

As well as encouraging customers to use less water, innovative tariffs with intelligent meters could also be a way to protect vulnerable low income groups against the affordability issue associated with metering. Tariffs provide a mechanism to manage the way different types of customers benefit within the current and any future system of charging. The right combination of metering and tariffs has the potential to save significant amounts of water beyond that saved by metering alone. The actual amount that could be saved is not known and requires further evidence-gathering by conducting trials.

The importance of metering in the UK is compounded by Defra's current review of household charging of water and sewerage services; it has just released a call for evidence[22]. Since the last review of household charging in 1997, pressures on water supply and demand have grown along with awareness of environmental issues and the likely impacts of climate change.

In relation to future charging of water and sewerage services the UK Government's aim is for:

- Fair, affordable and cost-reflective water and sewerage charges which encourage environmentally responsible behaviour.
- Universal metering in water-stressed areas by 2030.
- Targeted and appropriate protection for vulnerable customers and those least able to pay.
- Customer appreciation of services and benefits paid through water bills.

Other

- Household water audits, including do-it-yourself or with assistance of a plumber or other professional.
- Seek-and-fix of internal leaks and/or dripping taps.
- Water-efficient white goods, including washing machines and dishwashers.
- Collaborative research.
- Encourage schools, hospitals and other community establishments to carry out self-audits on their water use.
- Engage customers/the public in spotting and reporting leaks (Leakspotters).
- Deliver the water conservation message to schools and provide educational visual material for schools.

Publicity and education are already part of water companies' baseline activities. These activities can be ramped up to ensure that the message is thoroughly encouraged. It is important that all information conveyed to the consumer, both in a domestic and commercial environment, is consistent and easy to understand.

[22] Defra: Walker review of charging: http://www.defra.gov.uk/environment/water/industry/water-charging-review/

APPENDIX C - Environment Agency procedures on water neutrality

As discussed in previous sections of this report, achieving water neutrality relies on organisations working together to support interventions and funding activities. This same principle applies within organisations, such as the Environment Agency, ensuring that the different organisational tiers, functions and regulatory activities work together rather than in conflict to achieve these objectives. In addition there may be regulatory functions within the Environment Agency that, when given greater coherence, would be able to provide the impetus to meet water neutrality.

A workshop involving the different functions of the Environment Agency was thought to be useful to gain better insight into the interactions between various parts of the Environment Agency and to start developing a procedural strategy. Additional meetings or telephone conversations were arranged with those not able to attend the workshop.

The stated aim of the workshop was to identify existing Environment Agency processes that could contribute to a goal of water neutrality. In particular the workshop looked to identify any potential conflicts between the Environment Agency's current regulatory and other statutory processes and the goal of water neutrality, as well as opportunities within the current regulatory arrangements of the Environment Agency that could support a strategy of achieving water neutrality.

The workshop took place at Westbury on Trym, Bristol on the 3 February 2009.

Attendees from the Environment Agency were:

Attended	
John Phillips	Principal Scientist/Project Manager
Michael Lord	Sustainable Development Policy Advisor
Gordon Davies	Water Resources Policy Advisor
Andrea Burton	Water Quality Policy Advisor
Jim Davies	Principal Officer, SEP
Louise Every	Strategic Development Officer
Daniel Bicknell	Sustainable Development Project Manager (Milton Keynes/South Midlands Growth Area)
Juliette Willems	Policy Advisor - Water Demand Management
Invited but unable to attend	
Brian Richards	Manager – Development Control
Adam Mantell	Water Resources (Licensing) Manager
Marius Greaves	Principal Officer, SEP (Thames Gateway)

Water supply and new development

The Environment Agency's regulatory remit in the water sector is wide, covering water quality, water resource management, flood mitigation and the climate change impacts of water management activities. This remit is reflected in its interactions with the planning process and in advising planners on the water quality and water resource impacts of new developments.

The Environment Agency has a well-structured approach to organising its responses to major development planning proposals, and these take place at a regional level and

are used to influence the direction of Regional Spatial Strategies (RSS). At this stage the Environment Agency can raise its concerns about the extent to which draft RSSs have considered environmental limits, constraints and the capacity of infrastructure when setting broad levels and locations for growth, particularly in respect to available water resources, measures to improve water efficiency and the capacity of the wastewater and drainage infrastructure. In addition, the impact of water abstractions and waste water discharges are assessed for their impacts on protected sites, under the Habitats Regulations Assessment (HRA) of RSS, as required by the Habitats Directive.

The various planning documents that guide developers, planning authorities and consultees such as the Environment Agency all tend to support partnership working. PPS3 (Housing) states that planning policy "*advocates a collaborative approach to the preparation of evidence bases to support planning for housing policies*". This provides a strong regulatory driver for the Environment Agency to influence environmental consequences for new development, including opportunities for water neutrality.

Guidelines on water cycle studies (WCS) have provided the Environment Agency, working with partners such as local planning authorities and water companies, with a tool for generating collective agreement on a strategy for investing in water and wastewater infrastructure needs for new growth and development. These investments could easily include measures to achieve greater water efficiency and/or a strategy that included water neutrality.

At the workshop it was concluded that water cycle studies could be an important tool for informing local groups about water neutrality and for identifying the appropriateness and opportunities for developing a water neutral strategy for a new development.

Water cycle studies are increasingly being used as part of the Local Development Framework (LDF) and will be carried out by the local planning authority. The purpose of the WCS is to assist local planning authorities within the planning process and to identify tensions between growth proposals and environmental requirements.

Water neutrality could be incorporated in the WCS, or WCS could highlight the need for water neutrality with an area, and thus trigger the activities required for delivery.

The implications for the Water Resource Management Planning (WRMP) process also must be considered. The WRMP process currently allows water efficiency projects to be funded and it is also a mechanism for public and community involvement through consultation and the possibility of a public inquiry.

It was suggested at the workshop that water neutrality might not follow the 'twin track' approach of giving equal balance to supply side and demand management measures. Water neutrality implementation is biased towards a towards a 'single track' approach focussing on demand management. This might not be favoured by Ofwat as this doesn't follow the existing water resources planning methodology (Economics of Balancing Supply and Demand – EBSD). The EBSD methodology and associated WRMP process is a well-established system for water resources planning.

The workshop discussed whether water neutrality might be more successfully developed as a strategy if it were not incorporated directly into the WRMP process. Water neutrality could be considered as a separate tool to help meet water supply needs of new development, thereby being included within water cycle studies. This would also mean that the responsibility for water neutrality would not fall directly onto water companies. Water neutrality would instead be jointly "owned" by the wider group of partners involved in new development, or led by one outside of the water companies, for example, the local authority. Water companies would then take account of existing or planned water neutrality initiatives within the development during the next WRMP.

Areas of potential conflict

Potential areas of conflict within the Environment Agency and its regulatory policies have also been considered. From the discussions, policy issues that might give rise to conflict of interest turned out to be less significant than potential institutional barriers.

At the moment, water neutrality doesn't have a legislative 'home' in the Environment Agency. This legislative home is important if the Environment Agency is to achieve water neutrality across some of the main new development areas. It is also important if the Environment Agency wants to be an effective advocate for water neutrality.

Sources of institutional conflict within the Environment Agency include:

- The sometimes disconnected relationship between policy development at head office and operational activities in regional and area offices, though feedback from some area offices indicated that this can be overstated and the flexibility afforded to them and local knowledge can actually help to meet water neutrality.
- The workload on the Environment Agency resources required to cover and influence the large breadth of environmental impacts that are likely to be created by plans for major new developments.

Water neutrality is considered to be a 'gold standard' of water efficiency and as a result it was agreed that the Environment Agency would need to establish a more coherent approach to promote this concept. This would then allow the Environment Agency to become an advocate at all levels of the organisation. Local teams at regional and area level have direct contacts and relationships with water companies and local planning authorities, whereas head office has a clear role communicating a consistent message to national partnerts such as Ofwat. Suggestions for "ownership" of water neutrality were Regional Development Control and Water Resource Licensing functions.

Some areas of potential regulatory or policy conflict were also discussed. For example, whist the Environment Agency is a strong promoter of water efficiency, it is also concerned that there are sufficient flows in water courses to safeguard the aquatic ecosystems of those rivers. In some instances and times of the year these flows are highly dependent on discharges from sewage treatment works, and it might be that too much water efficiency could compromise these flows. A similar conflict in policy might also arise from the way in which the Environment Agency advocates sustainable urban drainage in new developments, because this also would have the effect of reducing flows to the treatment works and discharges.

Areas of coherence in approach

The breadth of the Environment Agency's regulatory responsibility can create resource and coherence pressures on its ability to achieve water neutrality. But it is this breadth the enables the Environment Agency to support and champion water neutrality.

The Environment Agency already provides a significant resource for its regional and area offices with the processes, guidance and IT tools required to help area planning liaison teams. The principle resource is the Work Instruction – Managing Planning Application Consultations which provides a comprehensive process for wider Environment Agency involvement and consultation. There is also GP3 National Guidelines for development in an area. Other guidelines include:

- Operational Instruction - Managing Planning Appeals
- Interim Guidance on the Environment Agency's Nature Conservation Remit with respect to the Town and Country Planning System

- Contaminated Land - Development on land affected by contamination
- Easy reference note for development on land near historic landfill sites
- Standard paragraphs for use when responding to consultations on planning applications where land contamination is an issue
- Development Planning System 3 (DPS3)
- Local Development Framework (LDF) and Sustainability Appraisals
- Interim Guidance on Managing LDF & Sustainability Appraisal Consultations
- Guidance: A Practical Guide to Influencing LDFs & Sustainability Appraisals
- Planning and Pre-planning Applications

In addition to these resources used by the Environment Agency to respond and contribute its views where there is new development, the Environment Agency works at higher levels of the planning process, influencing government policy and the Regional Spatial Strategies. At the workshop it was mentioned that the Environment Agency would like to influence the RSS at an earlier stage. This might allow, for example, the Environment Agency to influence the location of new homes to specific sites if the new homes caused problems at the heads of catchments.

Despite the potential institutional conflict within the Environment Agency, within Environment Agency regional and area offices there is a degree of flexibility to pursue local policies and this would be advantageous for the pursuit of water neutrality. Local offices have better links with local groups and have better knowledge of the local situation. Two teams operating at area level were singled out as important for the delivery of water neutrality; Sustainable Development Team and the Environmental Planning Team (ex-Water Resources Team).

Other areas of the Environment Agency's regulatory authority might also provide an opportunity to promote water neutrality. Implementation of the Water Framework Directive (WFD) which takes a broad view of the ecological sustainability of water may provide the basis for including water neutrality projects as part of the programme of measures, thereby providing an opportunity for funding work on water neutrality and led by the Environment Agency. The WFD includes an education and public awareness component which is another opportunity to promote messages about water neutrality.

The Environment Agency plays a significant role in the country's climate change mitigation and adaption strategies. Carbon reduction is a key component of water efficiency where hot water use is saved in the home. Government targets for local authorities to reduce CO_2 by nine per cent though the Energy Services Directive and Energy End Use Efficiency programme provide an opportunity to include water efficiency through these policies as a reduction in secondary carbon costs.

In this respect, the Environment Agency is in a strong position to gather organisations from different sectors to promote solutions to common environmental problems. The Environment Agency can play a role in promoting water neutrality as a broader environmental measure that embraces carbon reduction, water supply security and sustainable urban management.

Finally, the workshop heard of a good example of the Environment Agency working on new developments planned for Harlow (where up to 25,000 new homes are planned) and this could be developed into a wider case study for the delivery of water neutrality. Three Valleys were going to include a large water efficiency programme in their

DWRMP plan, but this was removed before publication. The developer is planning to build the homes to Code Level 6 (80 l/head/day), and is planning to do this using site-wide grey water recycling.

The recommendations are included in the main report.

APPENDIX D - Water neutrality examples – Thames Gateway

Introduction

The Thames Gateway has been widely studied in previous reports[23]. The Thames Gateway is Europe's largest regeneration project, stretching for 40 miles along the Thames Estuary from the London Docklands to Southend in Essex and Sheerness in Kent. It is home to 1.45 million people living in approximately 600,000 households. There are approximately 140,000 new properties planned for the area over the next ten years.

Figure D1 Thames Gateway area.

In terms of water resources planning, the Thames Gateway growth area is a complex one because the area is covered by three different water companies (Thames, South East Water and Essex and Suffolk Water) and five water resource zones.

Since the last report on water neutrality in the Thames Gateway there have been regulatory changes[24] on compulsory metering in areas of water stress and the government has been developing its strategy for energy and heat efficiency in existing homes. This worked example builds on concepts for water neutrality in the main report and includes compulsory metering and joint delivery of water efficiency retrofits alongside energy retrofitting.

This example only considers the domestic housing part of the Thames Gateway region, and focuses on retrofitting in domestic properties. In the original Thames Gateway modelling study, water consumption from non-domestic properties remained reasonably flat over the planning period.

This case study does not include a cost-benefit analysis, but uses a range of retrofitting options shown to be cost-effective in other areas. A full cost-benefit analysis would need to explore the opportunities for water efficiency retrofitting, metering and tariff

[23] *Towards water neutrality in the Thames Gateway*, *Summary Report*, Science report number: SC060100/SR3. Environment Agency, November 2007.
[24] Defra. *Government response to consultation on water metering in areas of serious water stress between January and April 2007*. August 2007

changes to take advantage of the green service delivery mechanisms being proposed in the joint DCC and BERR Heat and Energy Saving Strategy Consultation[25].

Water demand from the new development

The definition of water neutrality is:*"For every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community."*

The predicted increase in demand from domestic property has been estimated based on the housing growth presented in the table below. These are based on the figures presented in the Thames Gateway water neutrality modelling report[26].

Table D1 Numbers of new domestic properties.

	Base year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Number of properties per annum	0	12781	16327	18435	16561	15905	11922	11428	10458	10089	9190
Cumulative properties	0	12781	29108	47543	64104	80009	91931	103359	113817	123906	133096

In estimating consumption from these new properties, the following assumptions were made:

- Thirty per cent of new homes are funded through social housing schemes and will be built to CSH Level 3 as a mandatory requirement.
- Five per cent of private homes will be built to CSH Level 3.
- The per capita consumption (pcc) for CSH Level 3 homes is 109 l/head/day (based on the standard of 105 l/head/day plus four per cent for external use).
- Two-thirds of homes are nil-rated for the CSH and will be built to the prevailing building regulations.
- The new building regulations standard of 125 l/head/day is fully achieved for new homes built in Year 3 onwards, prior to this date new homes have a pcc of 160 l/head/day.
- Occupancy rates for new homes are the same as those used in the previous modelling report.

Applying these assumptions to the new domestic property figures results in an increase in demand from domestic properties of 36.44 Ml/day at the end of the development period. This is broken down in the table below.

[25] http://hes.decc.gov.uk/

[26] *Towards water neutrality in the Thames Gateway, Modelling baseline, business-as-usual and pathway scenarios.* Science report number: SC060100/SR1. Environment Agency. November 2007.

Table D2 Annual numbers of new properties and consumption figures.

			Development period									
New households consumption	**Units**	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Cummulative number built to CSH Level 3	#	0	4473	10188	16640	22436	28003	32176	36176	39836	43367	46584
Cummulative number built to CSH nil rated pre Build. Regs	#	0	8308	18920	18920	18920	18920	18920	18920	18920	18920	18920
Cummulative number built to CSH nil rated post Build. Regs	#	0	0	0	11983	22747	33086	40835	48263	55061	61619	67592
Demand from new HH built to CSH L3 public	Ml/d	0	1.07	2.45	4.00	5.39	6.73	7.73	8.69	9.57	10.42	11.19
Demand from new HH built to CSH nil rated pre Build. Regs	Ml/d	0	2.96	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66
Demand from new HH built to CSH nil rated post Build. Regs	Ml/d	0	0.00	0.00	3.30	6.26	9.10	11.23	13.27	15.14	16.95	18.59
Total demand from new households	**Ml/d**	**0**	**4.04**	**9.11**	**13.95**	**18.31**	**22.49**	**25.62**	**28.62**	**31.37**	**34.02**	**36.44**

Achieving water neutrality

Following the recommendations in the main report, achieving water neutrality will require the right mix of communication, education and interventions targeted at specific groups. The specific actions are identified below.

Communications and engagement. It will be important to have a targeted campaign to involve the community and communicate the concept of water neutrality for the whole Thames gateway area. This will not deliver specific water savings, but will get the community involved from the start of the process. This action will ensure that the community is fully educated as to why water conservation and offsetting measures are important and hopefully therefore improve uptake rate. This will also remove any barriers to change and make it easy for the community to take part in water conservation, encourage retailers to stock and promote water-efficient devices. It will also be important to communicate successes and keep the community informed on a regular basis, to keep the message of wise water use refreshed.

Full metering. The Thames Gateway area is in an area of water stress, therefore there is potential to move beyond optant and change of occupier metering to implement compulsory metering. This would require a full cost-benefit analysis, revision to the water resource management plans and approval by Defra. This could be an opportunity to achieve substantial water savings, implement the meter programme at lower unit cost (through economies of scale), provide a widespread pricing indication and provide the majority of consumers with the means to monitor and manage their water consumption. For this exercise we have assumed that 'full metering' is not 100 per cent, but set at a lower value to recognise that some properties will be more difficult or too costly to meter. A recent study for the Environment Agency on metering[27] found that average meter penetrations in excess of 90 per cent are possible. For this example we have assumed the meter penetration figures shown in the table below.

Table D3 Metering penetration figures for each resource zone area in Thames Gateway.

Water resource zone area	**Meter penetration at the end of the development period (year 10)**
Burham	85%
North Downs	85%
Kent Medway	85%
London	60%
Essex	85%
Average for the Thames Gateway	**76%**

[27] *The costs and benefits of moving to full water metering*. Science SC070016/SR1 (WP2). Environment Agency. May 2008.

Water savings associated with metering have been estimated on the following basis:

- A 10,per cent reduction in consumption (based on the unmeasured household consumption).
- A reduction of 10 litres/property/day in customer supply pipe leakage.

Water companies' base level of water efficiency activity. Water companies have to carry out a base level of water efficiency activity and achieve an average target of one litre per property per day each year. We have assumed that this saving will count towards the achievement of water neutrality, and will continue over the whole period.

Social housing WC and hot water retrofit. This intervention requires cooperation with social housing associations who would work together to retrofit dual-flush mechanisms to toilet cisterns, and fit tap aerators and water-efficient shower heads into social housing properties. The tenants will also be provided with information on how to use the devices correctly and other educational material about water-saving tips within the home. These devices will all deliver savings in water and the tap aerators and shower heads will lead to energy savings due to the reduction in heated water.

The water saving is estimated at 44 l/property/day, consisting of:

- tap aerators = 10 l/property/day
- shower heads = 13 l/property/day
- dual-flush retrofit = 21 l/property/day

(Based on the sum of the average savings for each measure reported in the Waterwise evidence base report – Waterwise 2008).

For this example, it is assumed that 30 per cent of the existing housing stock is social housing and that retrofits are carried out in 30 per cent of these properties.

Hot water - energy audit pack. This is a campaign targeted at larger houses because these are considered to be high water and energy users. This is a campaign focussed on saving water and energy, plus the added benefit of financial savings for the occupier. This activity would require coordination between the water companies and energy companies (or energy saving service) in a combined action. The intervention would be target at the private housing stock (social housing has been targeted in the previous intervention).

The water saving is estimated at 22 l/property/day, consisting of:

- tap aerators = 10 l/property/day
- shower heads = 12 l/property/day

(Based on the sum of the average savings for each measure reported in the Waterwise evidence base report – Waterwise 2008).

For this example it has been assumed that 70% of the existing housing stock is private housing and that retrofits are carried out in 30% of these properties.

Tariffs on metered properties from Year 6. If the water neutrality area is substantially metered, there is potential to apply tariffs which encourage water conservation. Tariffs might be aimed at peak summer use (known as seasonal tariffs) or at general water use (such as rising block tariffs). Because these tariffs are still in development, it is assumed that they will not be applied until Year 6 of development, by which time approximately 60 per cent of the area will have been metered. There is little evidence on the impacts of alternative tariffs, so the assumption is that a further saving

of 2.5 per cent of demand is made (over the existing saving due to metering). We have assumed that all metered properties will be targeted for the tariff savings.

Modelling results

Applying the assumptions outlined above, the following water savings are estimated:

Table D4 Annual water savings from each intervention.

		Development period										
		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Savings from metering	Ml/d	0.00	1.78	3.58	5.40	7.24	9.11	11.01	12.95	14.88	16.84	18.81
Water Efficiency Target savings	Ml/d	0.00	0.00	0.61	1.23	1.84	2.45	3.07	3.68	4.29	4.91	5.52
Social housing WC and hot water retrofit	Ml/d	0.00	0.48	0.96	1.45	1.93	2.41	2.41	2.41	2.41	2.41	2.41
Hot water - energy audit pack	Ml/d	0.00	0.58	1.16	1.74	2.32	2.90	2.90	2.90	2.90	2.90	2.90
Tariffs on metered properties from year 6	Ml/d	0	0	0	0	0	0	8.82	9.39	9.95	10.52	11.08
Total savings	**Ml/d**	**0.00**	**2.84**	**6.31**	**9.81**	**13.33**	**16.88**	**28.21**	**31.33**	**34.44**	**37.57**	**40.72**

This is illustrated in the following graph, along with the increase in demand from the new properties and the resulting water balance.

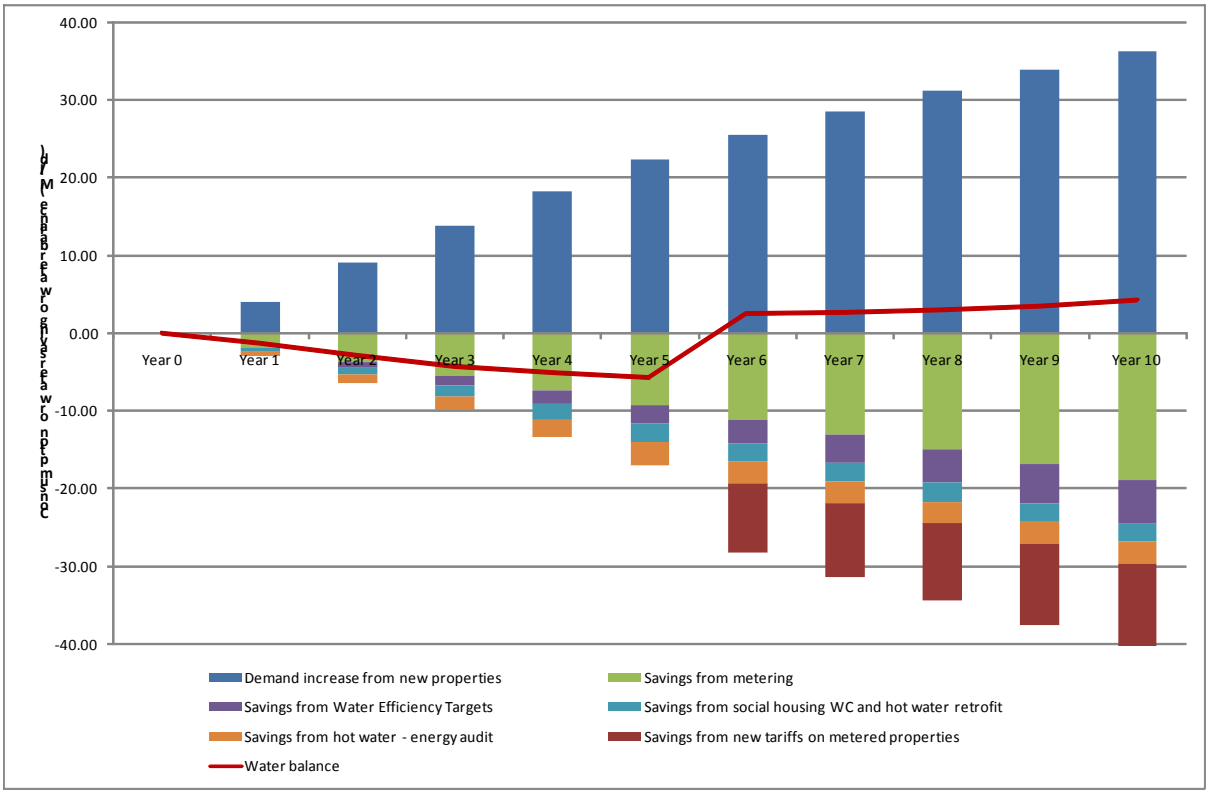

Figure D2 Annual demand from new homes, water savings and water balance.

The results show that water neutrality could be achieved over the development period. During the first five years the balance between new demand and water savings is negative, but then goes positive in the last five years and ends up with around 4 Ml/day of surplus capacity. The largest water savings accrue from metering, followed by the introduction of tariffs from Year 6, and then water saving interventions in the home. There is clearly a need for coordination over the whole area to ensure consistent communications and community involvement, as well as coordination of water conservation measures. This last point is particularly important as it is envisaged that interventions are likely to be delivered via multiple companies (water companies, social housing organisations and energy saving service delivery companies).

APPENDIX E - Water neutrality examples – eco-town

Introduction

This worked example does not use a specific eco-town development, but uses a fictitious area which has many of the attributes of eco-towns currently under consideration. The eco-town has the following characteristics, relevant to water use:

- Around 6,000 new homes to be built over six years.
- All new homes to be built to CSH Level 3 or 4.
- All new homes to include 'smart' metering to help residents monitor their water use and take action to reduce it.
- Rainwater harvesting on domestic properties and drought-resistant gardens to minimise external water use.
- Ten per cent of domestic homes to be built to CSH Level 5 as exemplars for minimising mains water use.
- A full water cycle study has been conducted.

The scale of the water neutrality area needs to be defined. In this case the area has been defined at an appropriate geographical scale to enable the additional demand for water from an eco-town to be directly mitigated by reducing existing demand. In this case we have defined the area as part of a water resource zone that includes 40,000 existing domestic properties. Of the existing properties, approximately 25 per cent currently have a meter installed.

This example only considers the domestic housing part of the eco-town development, and focuses on retrofitting in domestic properties. A full water neutrality analysis would also include the scope for savings in new non-domestic properties, and opportunities for offsetting in existing non-domestic buildings, including public buildings.

This case study does not include a cost-benefit analysis, but uses a range of retrofitting options shown to be cost-effective in other areas. A full cost benefit analysis would need to explore the opportunities for the water efficiency retrofitting, metering and tariff changes to take advantage of the green service delivery mechanisms being proposed in the joint DCC and BERR Heat and Energy Saving Strategy Consultation[28].

Water demand from the new development

The definition of water neutrality is:*"For every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community."*

The predicted increase in demand from domestic property has been estimated based on the housing growth presented in the table below.

[28] http://hes.decc.gov.uk/

Table E1 Numbers of new domestic properties.

	Base year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Number of properties per annum	0	1000	1000	1000	1000	1000	1000
Cumulative properties	0	1000	2000	3000	4000	5000	6000

In estimating consumption from these new properties, the following assumptions were made:

- Ninety per cent of new homes will be built to CSH Level 3.
- Ten per cent of homes will be built to CSH Level 5.
- The per capita consumption (pcc) for CSH Level 3 homes is 107 l/head/day (based on the standard of 105 l/head/day plus two per cent for external use).
- The per capita consumption (pcc) for CSH Level 5 homes is 82 l/head/day (based on the standard of 80 l/head/day plus two per cent for external use).
- Occupancy rates for new homes are two occupants per house.

Applying these assumptions to the new domestic property figures results in an increase in demand from domestic properties of 1.38 Ml/day at the end of the development period. This is broken down in the table below.

Table E2 Annual numbers of new properties and consumption figures.

			Development period					
New households consumption	**Units**	**Base Year**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Cummulative number built to CSH Level 6	#	0	100	200	300	400	500	600
Cummulative number built to CSH Level 3	#	0	900	1800	2700	3600	4500	5400
Demand from new HH built to CSH Level 6	Ml/d	0	0.02	0.04	0.05	0.07	0.09	0.11
Demand from new HH built to CSH level 3	Ml/d	0	0.21	0.42	0.64	0.85	1.06	1.27
Total demand from new households	**Ml/d**	**0**	**0.23**	**0.46**	**0.69**	**0.92**	**1.15**	**1.38**

Achieving water neutrality

Following the recommendations in the main report, achieving water neutrality will require the right mix of communication, education and interventions targeted at specific groups. The specific actions are identified below:

Communications and engagement. It will be important to have a targeted campaign to involve the community and communicate the concept of water neutrality for the whole eco-town development area. This will not deliver specific water savings, but will get the community involved from the start of the process. This action will ensure that the community is fully educated as to why water conservation and offsetting measures are important and will hopefully therefore improve uptake rate. This will also remove any barriers to change and make it easy for the community to take part in water conservation, and encourage retailers to stock and promote water-efficient devices. It will also be important to communicate successes and keep the community informed on a regular basis, to keep the message of wise water use going.

Full metering. For this example, it is assumed that the eco-town is in an area of water stress, therefore there is potential to move beyond optant and change of occupier metering, and implement compulsory metering in the existing housing stock across the water neutrality area. (Note: all new properties would be metered anyway). This would require a full cost-benefit analysis, revision to the water resource management plans

and approval by Defra. But the opportunity will be to achieve substantial water savings, implement the meter programme at lower unit cost (through economies of scale), provide a widespread pricing indication and provide the majority of consumers with the means to monitor and manage their water consumption. For this exercise we have assumed that 'full metering' is not 100 per cent, but set at a lower value to recognise that some properties will be more difficult or too costly to meter. A recent study for the Environment Agency on metering[29] found that on average, metering penetrations in excess of 90 per cent are possible. For this example, we have assumed that meter penetration can be increased to 80 per cent over the development period of eight years. This would require approximately 3,700 meters per year to be installed in existing properties in the water neutrality area.

Water savings associated with metering were estimated on the following basis:

- A 10 per cent reduction in consumption (based on the unmeasured household consumption).
- A reduction of 10 litres/property/day in customer supply pipe leakage.

Water companies' base level of water efficiency activity. Water companies have to carry out a base level of water efficiency activity and achieve an average target of one litre per property per day each year. We have assumed that this saving will count towards the achievement of water neutrality, and will continue over the whole period.

Modelling results

Applying the assumptions outlined above, the following water savings are estimated:

Table E3 Annual water savings from each intervention.

			Development period					
		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Savings from metering	Ml/d	0.00	0.19	0.39	0.59	0.79	0.99	1.20
Water Efficiency Target savings	Ml/d	0.00	0.00	0.04	0.08	0.12	0.16	0.20
Total savings	**Ml/d**	**0.00**	**0.19**	**0.43**	**0.67**	**0.91**	**1.15**	**1.40**

This is illustrated in the following graph, along with the increase in demand from the new properties and the resulting water balance.

[29] *The costs and benefits of moving to full water metering*. Science SC070016/SR1 (WP2). Environment Agency. May 2008.

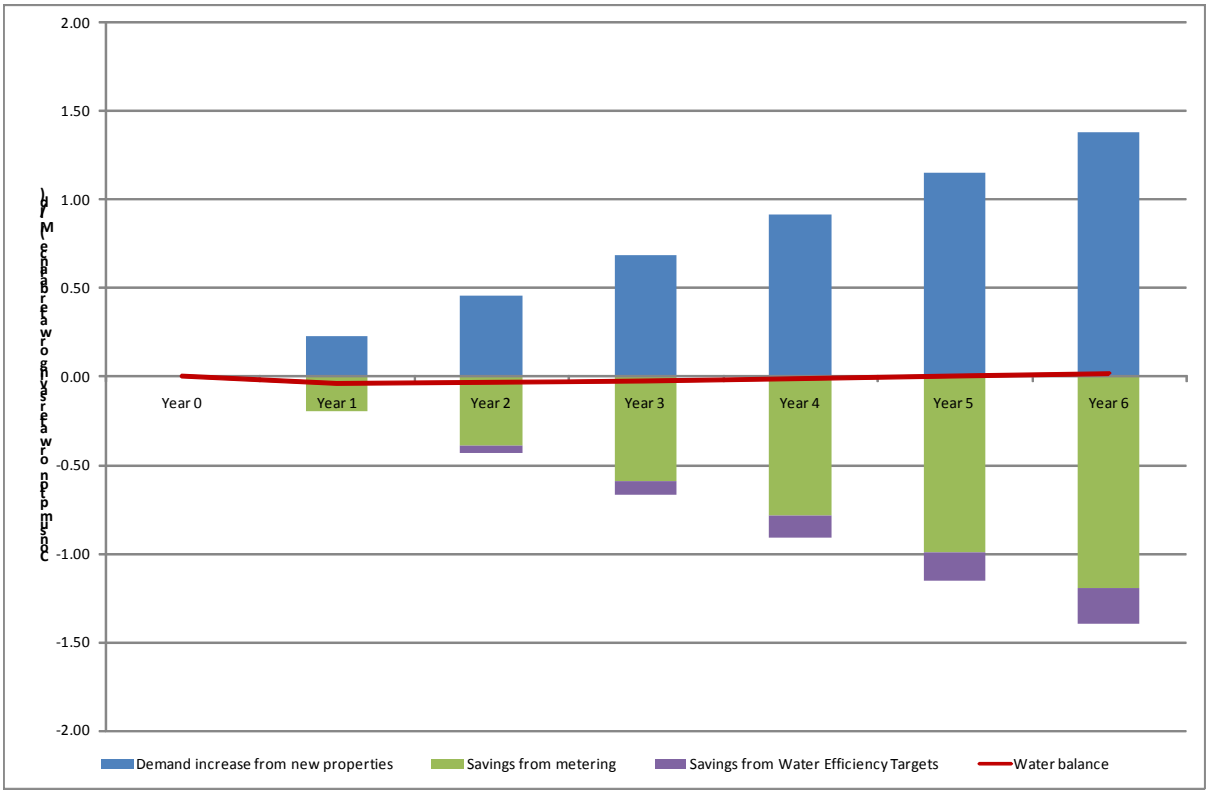

Figure E1 Annual demand from new homes, water savings and water balance.

The results show that water neutrality could be achieved over the development period. This could achieved firstly through limiting the growth in new demand by building all new properties to a minimum of CSH Level 3, and secondly through water conservation measures in existing domestic properties in the water neutrality area. The largest water savings accrue from metering, followed by water-saving interventions in the home through the water company's baseline water efficiency activity. The size of the water neutrality area in this example is not large (there are about seven existing properties for every new property proposed in the development), and the low level of existing metering (25 per cent) led to the selection of metering as the main intervention. If the water neutrality area were smaller, or if metering were already more widespread, then additional water conservation interventions would need to be applied, such as those used in the preceding example for the Thames Gateway.

List of abbreviations

AMP	Asset management plan
AISC	Average incremental social costs
BSWE	Base Service Water Efficiency targets
CAMS	Catchment abstraction management strategies
CERT	Carbon Emissions Reduction Target
CESP	Community Energy Savings Programme
CIL	Community Infrastructure Levy
CLG	Communities and Local Government
CSH	Code for Sustainable Homes
CSR	Corporate Social Responsibility
Defra	Department for Environment, Food and Rural affairs
DSOU	Distribution system operation use
DYAA	Dry year annual average demand
ECA	Enhanced Capital Allowance
ELL	Economic level of leakage
EST	Energy Saving Trust
LDF	Local development frameworks
Ml	Megalitre
pcc	Per capita consumption
phc	Per household consumption
PPS	Planning Policy Statement
RSS	Regional Spatial Strategy
WCS	Water cycle study
WFD	Water Framework Directive
WRMP	Water Resource Management Plan
WRZ	Water Resource Zone
WTL	Water Technology List

Glossary

Term	Definition
Abstraction	The removal of water from any source, either permanently or temporarily.
Abstraction licence	The authorisation granted by the Environment Agency to allow the removal of water from a source.
Annual average demand	The total demand in a year, divided by the number of days in the year.
Asset management plan (AMP)	An appointed water company's detailed description of its investment plans for its underground assets, such as supply pipes, water mains and sewers. AMP1 covered plans for underground assets taken into account at privatisation in 1989 from 1990-95. The subsequent planning periods are AMP2 for 1995-2000, AMP3 for 2000-05, AMP4 for 2005-10 and AMP5 for 2010-15. AMP is often used as a shorthand name for the companies' business plans.
Average incremental social costs (AISC)	The ratio of present social costs over present net value of additional water delivered or reduced demand.
Base Service Water Efficiency targets (BSWE)	The BSWE target represents the minimum activity that we expect companies to carry out. It is made up of three elements: an annual target to make an assumed saving of one litre of water per property per day, on average, through water efficiency activity; a requirement to provide information to consumers on how to use water more wisely; and a requirement that each company actively improves the evidence base for water efficiency.
Carbon Emissions Reduction Target (CERT)	The Carbon Emissions Reduction Target (CERT) is a statutory obligation on energy suppliers to deliver energy efficiency improvements in housing.
Communities and Local Government (CLG)	Communities and Local Government sets policy on local government, housing, urban regeneration, planning and fire and rescue.
Code for Sustainable Homes (CSH)	A single national standard to be used in the design and construction of new homes in England, based on the BRE's EcoHomes© scheme. A set of sustainable design principles covering performance in nine key areas: energy and CO_2; water; materials; surface water run-off; waste; pollution; heath and well being; management; ecology.
Defra: Department for Environment, Food and Rural Affairs	The UK Government department tasked with issues such as the environment, climate change, rural development, the countryside, wildlife, animal welfare and sustainable development.
Demand management	The implementation of policies or measures which serve to control or influence the consumption or waste of water.

Term	Definition
Distribution system operation use (DSOU)	Water knowingly used by a company to meet its statutory obligations, particularly those relating to water quality. Examples include mains flushing and air scouring.
Dry year annual average demand (DYAA)	The level of demand, which is just equal to the maximum annual average, which can be met at any time during the year without the introduction of demand restrictions. This should be based on a continuation of current demand management policies. The dry year demand should be expressed as the total demand in the year divided by the number of days in the year.
Economic level of leakage (ELL)	The level of leakage at which it would cost more to make further reductions in leakage than to produce the water from another source. Operating at ELL means the total cost to the customer of supplying water is minimised and appointed water companies are operating efficiently. The ELL calculation should include all costs and benefits associated with different levels of leakage, including environmental and social ones.
Eco-towns	Eco-towns will be new towns which are exemplar green developments of up to 20,000 homes. They will be designed to meet the highest standards of sustainability, including low and zero carbon technologies and good public transport.
Energy Saving Trust (EST)	UK-based organisation focused on promoting action that leads to the reduction of carbon dioxide emissions. The EST is a source of free advice and information for people across the UK looking to save energy, conserve water and reduce waste.
Environment Agency	The Environment Agency came into being on 1 April 1996 following the 1995 Environment Act, joining together the National Rivers Authority, Her Majesty's Inspectorate of Pollution and waste regulation authorities. The Environment Agency has a statutory duty to protect and enhance the environment in England and Wales. It is responsible for water abstraction and water quality in rivers, lakes, reservoirs, estuaries, coastal waters up to three miles from the shoreline and water stored naturally underground. In addition, it has powers to decide if water quality is up to standard and if not to determine how to improve it. The Environment Agency also controls the amount of water that can be taken from rivers and boreholes.
Growth Areas	In July 2002 the Government said that there was potential to provide 200,000 homes, additional to current plans by 2016. Much of this growth would be contained in the four Growth Areas identified in regional planning guidance for London and the rest of the South East Regional Planning Guidance (RPG9) in 2001. The following Growth Areas were already established: Thames Gateway, Milton Keynes and South Midlands, London-Stansted-Cambridge-Peterborough, and Ashford.

Term	Definition
Growth Points	The Growth Points initiative is designed to provide support to local communities who wish to pursue large scale and sustainable growth, including new housing, through a partnership with Government.
Leakage	Water lost between the treatment works and the customer's home or business.
Local Development Framework (LDF)	A folder of local development documents that outlines how planning will be managed in an area.
Megalitre (Ml)	One million litres.
Meter optants	Properties in which a meter is voluntarily installed at the request of its occupants.
Meter programme	Properties which are to be metered according to current company metering policy.
Micro-component analysis	The process of deriving estimates of future consumption based on expected changes in the individual components of customer use.
Non-households	Properties receiving potable supplies that are not occupied as domestic premises, for example, factories, offices and commercial premises. They also include properties containing multiple households, which receive a single bill (for example, blocks of flats).
Ofwat	Ofwat (The Water Services Regulation Authority) is the economic regulator of the water and sewerage companies in England and Wales.
Per capita consumption (pcc)	The measure of average use per person in an appointed water company's area. Companies are required to report estimates for both metered and non-metered customers. (Typically expressed as litres/person/day).
Per household consumption (phc)	The measure of average use per household in an appointed water company's area.
Planning Policy Statement (PPS)	Planning Policy Statements (PPSs) are prepared by the government after public consultation to explain statutory provisions and provide guidance to local authorities and others on planning policy and the operation of the planning system.
Regional Spatial Strategy (RSS)	The RSS, incorporating a Regional Transport Strategy (RTS), provides a broad development strategy for the region for a fifteen to twenty-year period.
Supply-demand balance	The difference between water available for use (including imported water) and demand at any given point in time (available headroom).

Term	Definition
Target headroom	The minimum buffer that a prudent water company should allow between supply (including raw-water imports and excluding raw-water exports) and demand to cater for specified uncertainties (except those due to outages) in the overall supply-demand balance. Introducing this buffer into the overall supply-demand balance will help ensure that water company's chosen level of service can be achieved.
Water balance	Appointed water companies are expected to balance and account for any difference between the sum of outputs from their distribution system and the amount of water put into supply. This is known as the water balance.
Water cycle study (WCS)	A water cycle study will identify tensions between growth proposals and environmental requirements, and identify potential solutions to addressing them. Effective planning and close cooperation between all parties involved is essential to the success of a water cycle study.
Water Framework Directive (WFD)	A European Directive to provide a coordinated approach to water management within the European Union (EU) by bringing together strands of EU water policy under one piece of framework legislation. Member States must produce plans for river basin management districts that set out a programme of measures aimed at protecting bodies of surface and groundwater. Each plan must include economic analyses of water use and move towards full cost recovery in water pricing.
Water neutrality	For every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community.
Water Resource Zone (WRZ)	The largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers experience the same risk of supply failure from a resource shortfall.
Water Resource Management Plan (WRMP)	An appointed water company's long-term strategic plan for water resource development in its area.
WRP tables	Water resources plan tables used for presenting key quantitative data associated with a water resources plan.
Waterwise	Waterwise is a UK NGO focused on lowering water consumption in the UK by 2010 and building the evidence base for large-scale water efficiency.

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