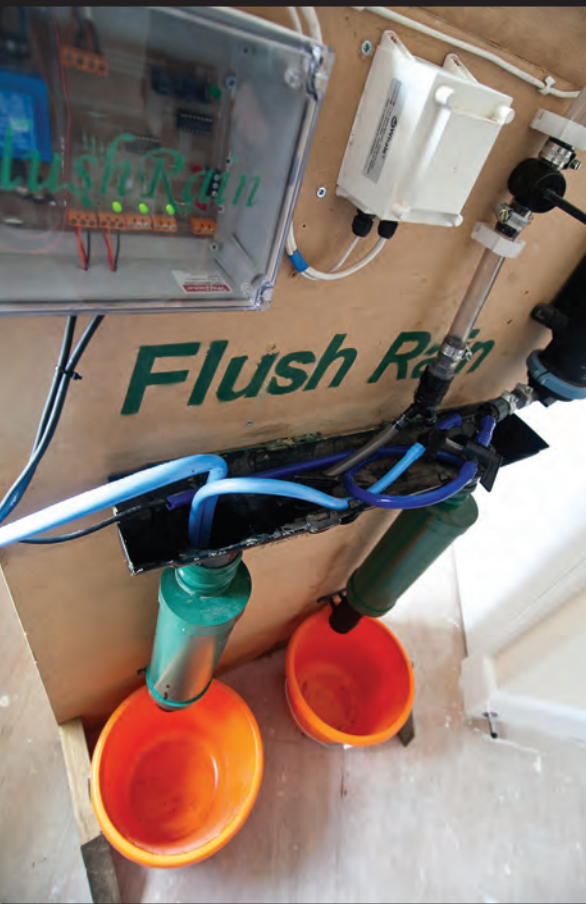


Water Efficiency Retrofit Report 2011

July 2011



A report that explores how to retrofit homes in the South East of England to reduce water consumption to an average of 130 litres per day, in line with Defra's vision.



Introduction

While much of our environmental focus is rightly on energy efficiency improvements, water efficiency is also very important, particularly in areas of water stress such as the South East. An increasing population, more prosperous lifestyles (meaning more luxurious use of water such as power showers and Jacuzzi's) and an overall reduction of rainfall threatens the availability of water supplies in the South East region.

In 2006 the population of the South East was approximately 8.3 million¹. Using current water consumption figures, this means that the South East uses an average of 1,300 million litres of water each day². This water needs to be transported, filtered, heated and taken away from homes, which requires energy. However, according to the Office for National Statistics, the population of the South East is expected to increase by more than 11% between 2006 and 2021³. This means that in 2021 the South East could have a population of 9.2 million and therefore that, nearly 1,500 million litres of water would be consumed each day, if current consumption rates of 160 litres of water per person per day (l/p/d) did not diminish.

The Department for Environment, Food and Rural Affairs's (Defra) *Future Water* (2008) sets out the Government's strategy for water in England. This strategy identifies Defra's vision for each person, on average, in England to be using 130 l/p/d by 2030 in order to create a sustainable balance between water demand and water supply. Reducing water consumption will also help to reduce energy consumption: it is estimated that 25% of household energy bills are due to hot water use⁴. Therefore a considerable amount of action is needed in order to reduce the current level of water consumption and one significant way of achieving this is to retrofit housing in the South East.

Figure 1: Borough Grove, Petersfield, Hampshire (before refurbishment works)



This report builds upon the research undertaken by Radian in partnership with the Environment Agency, of which the findings are published in Water Efficiency Project-Final Report (May 2010). Using the retrofit of Borough Grove, this report sets out to explore how to retrofit homes in the South East of England so that Defra's vision of an average of 130 l/p/d of water consumption can be achieved.

¹ SEEDA. The South East of England Profile. February 2010

² 160 l/p/d

³ SEEDA. The South East of England Profile. February 2010

⁴ http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/the_facts/hot_water_and_energy.html

Borough Grove, Petersfield, Hampshire

This section describes the challenges faced by social housing in retrofitting their housing stock. Then this section also explains what water efficiency measures were used at Borough Grove.

Information on social housing and the retrofit project at Borough Grove

Social housing provides an opportunity to make potentially large carbon savings. “Housing associations provide about two and a half million homes for more than five million people across England”⁵. In the Green Paper, ‘Quality and Choice: A Decent Home for All’ (July 2000), a target was set to bring all social housing to a Decent Homes standard⁶. As well as other factors, this has meant that kitchens and bathrooms are replaced about every 20 and 30 years respectively. Whilst a housing association makes these refurbishments this is an ideal opportunity to retrofit homes with appliances that are water (and energy) efficient.

Compared to owner occupiers, the advantage for retrofitting of social housing is that it is easier to access these properties and therefore install water saving measures. However, it is not always easy for housing associations to make their refurbishments more water efficient as they must constantly evaluate the environmental benefits against social costs. For example installing a shower in a bathroom as opposed to the social benefits of using this money to help refurbish another household’s bathroom.

In the case of the homes at Borough Grove a large number of defects were due in order to meet the Decent Homes standard and therefore it was relatively easy to incorporate the fitting of water saving measures. The thirteen 3-bed semi detached houses, which are being refurbished as part of Retrofit South East, are concrete REEMA homes that were initially designed to last 30 years. Although regularly maintained by Radian, before refurbishment most of these homes had old, inefficient devices, such as toilets with large cisterns and baths but without a shower.

Retrofitting of water efficiency devices in houses at Borough Grove

As part of the refurbishment works, homes at Borough Grove have been fitted with low flow taps, dual-flush toilets and showers with aerated showerheads. Figure 2 provides details of these water efficient devices. The table also lists the potential water savings from installing water efficient devices compared to the assumed devices that were in the homes before refurbishment. All figures in figure 2 are worked out per person so that they are comparable. These savings are only estimated and assume a number of factors taken from Water Efficiency Research Report (2010) and the Water Toolkit produced by Radian and the Environment Agency. Some of these factors are listed below figure 2.

⁵ National Housing Federation: <http://www.housing.org.uk/default.aspx?tabid=173>

⁶ The definition of a Decent Home is, ‘A decent Home is one which is wind and weather tight, warm and has modern facilities’<http://www.decenthomesstandard.co.uk/about>

Figure 2: Table listing the water saving devices installed at Borough Grove and the estimated water savings

Water fitting (assumed water usage per 1 time use)	Water saving device installed (assumed water usage)	Estimated water saving for device per 1 time use	Water consumption (l/p/d)
			Before refurbishment- 113
Toilet (6 litres)	Dual flush toilet (6/4 litres)	1.5 litres per flush	105.5
Bathroom basin taps (6 litres)	New taps (aerated/low flow) (5 litres)	1 litre per minute	102
Bath (200 litres)	Shower (8 litres/minute flow)	If shower is used for 7 minutes and flow rate is 8 litres/minute, Saving is at least 10 litres per use	92
Outside tap (water usage unknown)	Water butt (200 litres)	Hard to estimate accurate savings as this is not used regularly	unknown
	Estimated water consumption after refurbishment		92

Factors assumed to make some of the calculations in figure 2

- 1) 18.5% saving
- 2) Taps used 30 seconds, 5 times a day and 1 minute once a day
- 3) Shower used for 7 minutes, once a day

Monitoring of homes at Borough Grove has revealed that before refurbishment, the average water consumption was 113 l/p/d. This level of water consumption is low compared to Defra's target of 130 l/p/d. This may be because households were already carefully using water. Nevertheless, an average saving of 18 l/p/d was achieved, after the refurbishment of these homes.

Generally in the South East the average water consumption is 160 l/p/d. If 20 l/p/d of water can be saved by implementing the same measures as used in Borough Grove, then the average water consumption would be lowered to 140 l/p/d. Installing devices that are more water efficient such as a dual flush toilet that only uses 4 and 2 litres (instead of a 6 and 4 litres per flush) may help to further reduce water consumption.

Monitoring of homes at Borough Grove also revealed that water consumption differed between the summer and winter months: in July and August, water consumption averaged 148 l/p/d for homes that had not been refurbished. Whereas in September, October and November water consumption for these homes averaged 89 l/p/d. For homes that had been refurbished average summer water consumption was 115 l/p/d compared to an average of 80 l/p/d in the winter months.

The presence of the project and the water efficiency devices may also act as a reminder to use water efficiently. Although the same households were living in these properties before as

after the refurbishment household behaviours may have changed, such as using the shower more often than when they just had a bath.

Additional factors that could reduce water use

Installing water efficient devices is a step towards reducing household water consumption. However, there are a number of other factors that can influence the level of water consumption.

Firstly, although mainly for monitoring purposes, water meters were fitted on most of the properties at Borough Grove and some residents chose to switch to a metered water bill. Metered water bills may have reduced water use further, due to the financial incentive to use water efficiently.

Secondly, in number 16 (the Showhome) rainwater harvesting was installed in order to further reduce mains water use (figure 3 provides further details about this system).

Thirdly, a resident liaison officer was employed throughout the early stages of the project and has worked closely with residents to raise awareness of the importance of saving water. Following the completion of most of the properties, residents were invited to an event organised by 'Greening Campaign', which included raising further awareness of saving water. One of the key conclusions from the research carried out as part of The Water Efficiency Project: Final Report (2010) is that behaviour change is key to reducing water consumption. This research particularly found the significance of behaviour on water consumption of using baths and showers. For example, a new shower could encourage the household to use the shower more often than they would have used the bath. They may also use the shower for a long time. Therefore water is not necessarily saved.

Figure 3: Rainwater Harvesting- Flushrain

In previous Radian schemes rainwater harvesting has been trialled using underground tanks as part of the system. However, the following issues with this have been found:

- Rainwater harvesting systems with underground tanks are expensive and often provides some of the water supply for just 1 toilet. A lot of the cost associated with rainwater harvesting is due to the labour in order to excavate a hole.
- In the event of a power cut, the toilet cannot be flushed (this is because the electric pump is needed to pump water to the toilet)
- Appropriate space to place the underground tank is often difficult to find given that there are underground cables and hard surfaces (it is advisable to place underground tanks under soft surfaces). This is particularly hard as the tanks need to be a certain distance from the house.

Therefore Radian sought to explore alternative options to rainwater harvesting tanks underground: Flushrain is one option.

Flushrain is a new system that has not been used before. The system collects water from the gutter downpipes into a tank in the loft that supplies the toilets by gravity. A pump in the roof is alerted by water sensors in the collectors and draws the rainwater in to the roof tank, filtering it on the way. A back-up mains supply is provided for when there is insufficient rain. Therefore the pump is used less often.

Figure 4: Picture of Flushrain demonstration in 16 Borough Grove



Possible options to achieving Defra's target of 130 l/p/d

Refurbishment of the homes at Borough Grove with water efficiency devices was possible as most parts of the house were being refurbished anyway. For example houses were being re-wired and installed with new kitchens and bathrooms. However, it may not always be possible to refurbish homes to this extent. For example a new bathroom may need to be ripped out to install a dual flush toilet. Instead, retrofitting with other devices may be easier and cheaper to install e.g. devices can be retrofitted to convert a single flush into dual flush rather than installing a new dual flush toilet.

There are a number of water efficiency devices that can be more easily installed. Figure 5 provides options of water efficient devices for retrofit of homes. As the average water consumption in the South East is 160 l/p/d to begin with, it is assumed that the given household in figure 5 is using 160 l/p/d. All figures are worked out per person so that they are comparable. Assumptions of savings are taken from Water Efficiency Research Report (2010) and the Water Toolkit produced by Radian and the Environment Agency.

The first option in figure 5 shows that installing an eco-beta into a toilet reduces average water consumption from 160 l/p/d to 130.4 l/p/d. Retrofitting eco-betas into existing homes, where appropriate, can reduce water consumption by 20% in households where there is an older, high flush toilet. The eco-beta will cost approximately £25 and takes about 15 minutes to install, with some competency in drilling needed.

The eco-beta device converts a single flush toilet into a dual flush toilet. To use the toilet, with the eco-beta device: for a short flush the handle does not need to be held down, whereas for a full flush the handle would be held down, for how long it takes to flush the waste away. The advantage of the eco-beta is that it provides the user with control of how much water is used in flushing the toilet.

Where there are limited resources to retrofit toilets, an alternative option is to install a save-a-flush bag. Save-a-flush bags are cheap (they can often be obtained from water companies) and simple to install as their instructions are usually on the bag. These bags (filled with crystals) swell up to displace water in the cistern. These bags are only suitable for single flush toilet cisterns.

Figure 5: Table to show options to reduce water consumption for 1 household

	Water using device	Water saving device	Water Consumption (prior to refurbishment)	Water Saving per 1 time use	Water Consumption (after refurbishment)
Option 1	Toilet	Eco-beta	160 l/p/d	1.4 litres per flush	130.4
Option 2	Bathroom basin taps	Aerator taps	160 l/p/d	4 litres a minute	146.3
	Shower	Aerated showerhead	146.3 l/p/d	21 litres	125.3
Option 3	Washing machine	A rated		80 litres a day	108.59

Assumed factors for calculations made in figure 5

- 1) 18.5% saving for use of eco-beta
- 2) taps used 30 seconds, 5 times a day and 1 minute once a day
- 3) shower used for 7 minutes, once a day
- 4) washing machine used 4.5 times a day

In figure 5, option 2 shows that installing aerator taps on bathroom taps to reduce their flow and installing an aerated showerhead on a shower reduces water consumption from 160 l/p/d to 125 l/p/d. The added benefit is that this reduces the amount of hot water needed and therefore energy used.

When installing low flow taps, the Water Efficiency Report (May 2010) recommends installing taps that use a minimum of 2 litres per minute of water into downstairs cloakrooms. The research found that installing taps with a flow less than 2 litres were not satisfactory to the householder and it took a long time for the hot tap to produce hot water.

Option 3 shows that installing a more energy efficient washing machine can reduce water consumption from 160 l/p/d to 108 l/p/d. This should also reduce the amount of hot water needed and therefore energy use.

When using eco-technology including water saving devices, there are certain issues to be aware of. Eco-technology, in both new-build and retrofit, is a relatively new market in the UK. Therefore it is important that the installer is appropriately trained to install the eco-technology. Equally as important is the know-how in maintaining the technology and the awareness of the environmental issue. Otherwise the eco-technology may be installed but not necessarily working.

Photograph 1: Bathroom at Borough Grove pre-refurbishment



Photograph 2: Members of the Superhome network & Jeremy Dickin (Project Surveyor, Radian) look at a bathroom at Borough Grove post-refurbishment



Water efficiency work already being implemented in the South East

By rolling out programmes of water efficient retrofit, like that used in Borough Grove, substantial volumes of water can be saved. It is also important to complement the installation of water efficient devices with the engagement of householders so that they are aware of the importance of, and know how to, save water. Waterwise has developed an evidence base from a range of water efficiency research conducted throughout the UK, by a range of organisations. The findings from the evidence base show that “measured water savings of up to 34 litres per property per day are possible from applying a multi-measure water efficiency retrofitting method in the traditional way, using current technology and means of engaging customers to encourage behaviour change.”

Of large importance to the South East’s water resources is Southern Water’s Compulsory Metering Programme. Water meters help to reduce water use as they create a financial incentive to saving water for householders: water meters have been shown to reduce household water consumption by around 10%. Southern Water’s *Business Plan for 2010-2015* recognises that “universal metering is the necessary first step to sustain the balance of supply and demand for water”: Southern Water will install meters in all homes in their supply area between 2010 and 2015. The Energy Savings Trust and the Environment Agency’s report states that water metering also reduces CO2 emissions⁷. As part of implementing this programme Southern Water are engaging with households so that households know what steps to take to reducing their water use. Southern Water are also carrying out water audits of some households as well as installing simple water saving devices such as showerheads and cistern displacement devices.

⁷ Quantifying the energy and carbon effects of saving water.2009

Conclusion

Saving water is going to be increasingly necessary in order to sustain water supplies in the South East. Monitoring the water consumption of the homes at Borough Grove before and after refurbishment shows that installing a number of water efficient devices and raising awareness of how to save water can save water. Monitoring also showed that, as expected, water consumption in the summer was higher than in the winter.

The homes at Borough Grove were fitted with a dual flush toilet, a shower and low flow taps. Additionally, as well as installing water saving devices raising awareness is an important part of reducing water consumption. This has meant that average water consumption of these homes has reduced by 18 l/p/d. However, there are other options to retrofitting homes such as installing an eco-beta toilet device that is estimated to save around 29 l/p/d.

Installing a few simple measures such as a dual flush toilet will reduce household water consumption. In 2021, if each person used 130 l/p/d rather than 160 l/p/d then this would save an estimated 304 million litres of water each day. While this report has used social housing to showcase retrofitting, retrofitting of all housing, including private stock, is essential if Defra's target of 130 l/p/d is going to be achieved. By retrofitting all homes with a number of efficient devices and raising awareness about the importance of saving water, the region moves closer to a sustainable environment.

References

Defra. *Future Water-the Government's Strategy for England*. 2008

Environment Agency and the Energy Savings Trust. *Quantifying the energy and carbon effects of saving water*.2009

Radian and the Environment Agency. *Water Efficiency Project-Final Report*. 2010

SEEDA. *The South East of England Profile*. 2010

<http://www.southernwater.co.uk/Aboutus/library/businessPlan.asp>

RETROFIT

South East

This report is the culmination of the Water Efficiency Project, commissioned by Radian in partnership with the Environment Agency, in March 2008 and research undertaken as part of Retrofit South East from 2009 until June 2011.

Dwindling water resources remain in the South East of England due to low rainfall, a high population density and individuals consuming high volumes of water. In 2021 the South East could have a population of 9.2 million, consuming nearly 1,500 million litres of water each day. Retrofitting homes in the South East so that they are more water efficient will have an important part to play in ensuring sustainable water supplies for the future.

This report highlights the relation between saving water and saving energy as water saving appliances also reduce CO2 emissions. The report also recommends that whilst technology is important, behaviour cannot be ignored. There is an enormous potential for saving water by raising awareness and encouraging water efficient behaviour.

Further information is available on the Retrofit South East website: www.radian.co.uk/201004072131/retrofit.html

**For further information
please contact:**

Paul Ciniglio at Radian

Email:

paul.ciniglio@radian.co.uk

Project Partners:

Radian (lead partner)
www.radian.co.uk

Camco
www.camcoglobal.com

Parity Projects
www.parityprojects.com

GESB
www.gesb.eu

Radian Services
www.services.radian.co.uk

