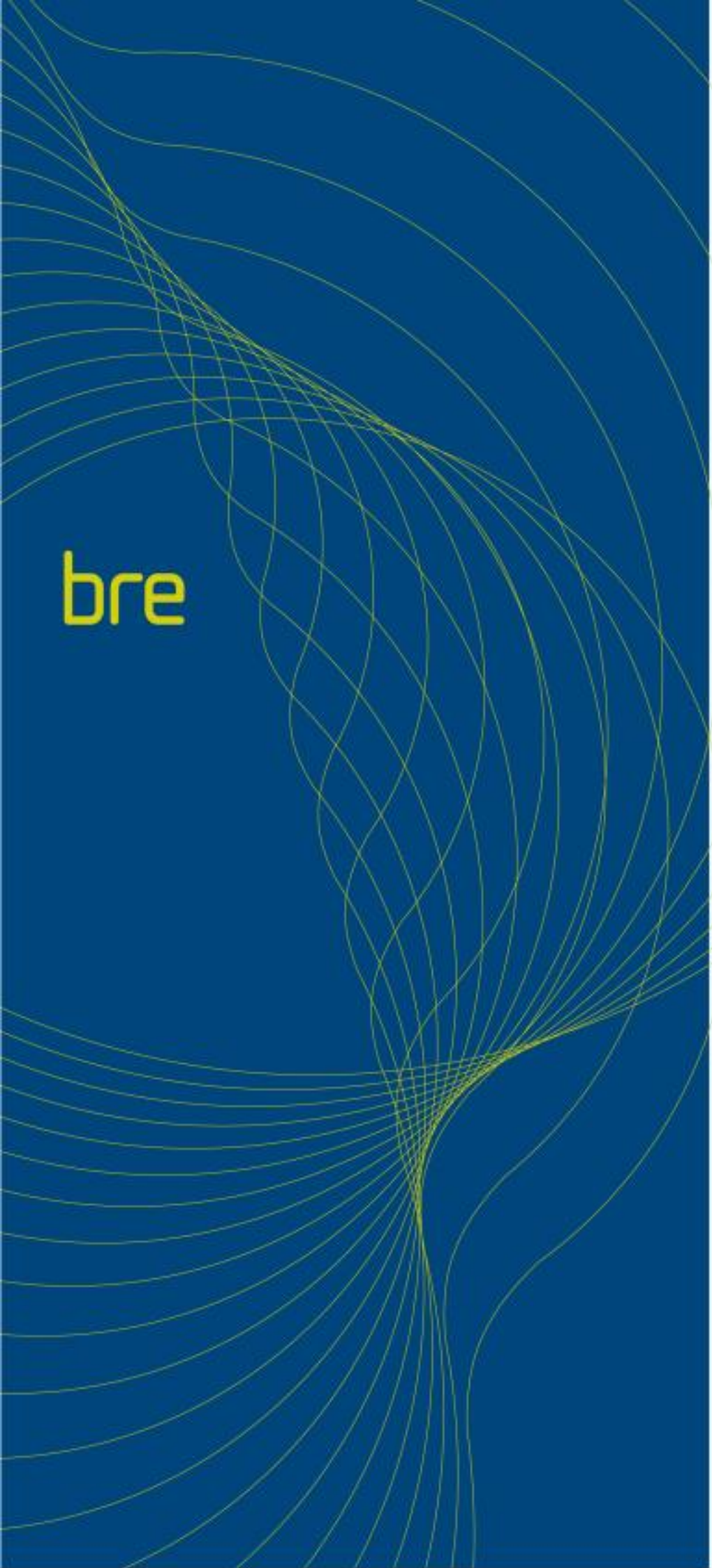

Code Water Calculator Update

BRE Global - March 2009

Project Number: BRE014

For: Communities and Local Government

Issue change summary

Date	Version	Issued by	For	Info.
18/02/09	Rev 1	GS	JH	First draft discussed at stakeholder meeting 18/02/09
17/03/09	Rev2	GS	JH	Final version issued

Contents

1. Summary
2. Introduction
3. Overview of changes
4. Quick wins for inclusion now
5. Potential actions needing further consideration
6. Issues put on hold
7. Normalising the use factors
8. Use factors
9. Examples of compliant specifications

1. Summary

Following Faber Maunsell's review of the Code for Sustainable Homes Water Calculator (herein referred to as the Code Water Calculator), this report outlines BRE Global's changes applied to the Water Calculator, based on an analysis of Faber Maunsell's review and from BRE Global's technical expertise in this area.

It is important at this point to take a step back and look at the key issues that this review set out to address. The main issues with the Water Calculator are:

- The Code Water Calculator is currently overestimating water consumption
- The overestimation is causing difficulties with achieving the Code Water targets leading to the use of fittings that are not acceptable to users and in some cases compromise design quality

The review of the Code Water Calculator needs to result in the production of a revised Calculator that estimates water consumption in line with average UK consumption levels of 150 litres per person per day. It also needs to ensure that the range of fittings required to meet each level are of an appropriate level of water efficiency. Its current status results in a limited number of sanitary-ware options in order to meet the defined targets. This is having a negative impact on those trying to meet the Code for Sustainable Homes (the Code) target levels leading to the industry perceiving the Code water methodology as being a flawed and potentially damaging the Code's reputation and uptake.

From the 27 recommendations made by Faber Maunsell, a total of thirteen recommendations are proposed to be included as quick wins in the Water Calculator or supporting documents (e.g. part G or the Code technical guide). Seven further issues could potentially have been included at this time however additional work is required and given the short timeframe (final report received from Faber Maunsell on 06/02/09 and that Ministerial sign off is required on 4th March. There is insufficient time to carry out the additional necessary work for inclusion at this time. This does not mean that we do not support all such changes and therefore actions have been identified to indicate what is needed in order to include these changes. The remaining issues cannot at this present be included in the current amendment of the Calculator or are issues to take on board for future updates of the Water Calculator.

The proposed changes suggested for action now are those that meet a defined set of objectives in order to address the key issues with the Code Water Calculator, highlighted in Faber Maunsell's review, taking into account BRE Global's experience of such issues from managing the Code. These issues are considered to need either none or minimal further work in order to include them in a revised Code Water Calculator with immediate effect. The impact of the quick wins has been analysed in Section 7, Example Specifications.

Table 1 summarises what will and will not be included in the Code Water Calculator at this time.

2. Introduction

2.1 Background to the Code Water Calculator

The Code Water Calculator was developed in January 2007 to provide a mechanism for assessing the water efficiency of new homes against target performance levels set out in '*Code for*

Sustainable Homes: A step-change in sustainable home building practice'. In '*The Future of the Code for Sustainable Homes – Making a Rating Mandatory: Summary of Responses'*, Nov 07, the consultation feedback indicated that a majority of consultees agree that a whole house assessment methodology was the preferred option compared to the use of set performance targets for individual fittings. The outcome of the review carried out by Faber Maunsell recognised alternative approaches used internationally but found that a whole house method was a reasonable approach to take. The review highlights a number of major issues with the Calculator method and the changes highlighted in this report go a long way to addressing the majority of issues or highlight the way forward for addressing these in the future.

The Code Water Calculator was based on BRE's EcoHomes Water Calculator that was first released as part of EcoHomes in 2000 and subsequent versions, but the methodology was first developed for BRE's Office Toolkit, published in 1995. In order to adapt the BRE Water Calculator for the purposes of the Code for Sustainable Homes, a revised version of the Code Water Calculator was put together by the Environment Agency (EA) to support the EA's '*The Cost of Compliance with the Code for Sustainable Homes, UC7231'*. This included updating the Calculator to allow the use of a much greater range of fittings with use factors largely derived from the Water Research Centres CP187. The BRE Water Calculator was then updated in accordance with this and the methodology was then written into the Code Technical Guide by BRE Global on behalf of Communities and Local Government.

In developing the Code Water Calculator, a key consideration was the fittings required to meet each level of the Code. The type of fittings required and level of performance were agreed through a stakeholder group including DEFRA, EA, BRE, BSRIA, CLG, DTI, Housing Corporation and English Partnerships (the latter two organisations now form part of the Homes and Communities Agency). The agreement between stakeholders was that the levels should achieve the following levels of performance:

CSH Levels	Per capita consumption	Level of performance
1 & 2	120 litres/person/day	The use of a combination of fittings better than current practice or regulator minimums
3 & 4	105 litres/person/day	The use of best practice readily available water efficient fittings, without the need for water recycling
5 & 6	80 litres/person/day	The use of advanced best practice water efficient fittings combined with the use of water recycling

There was also an agreement between stakeholders that the Code should be flexible in its approach as to how homes are designed to meet the target performance levels. It was agreed that it should not cause a ban on water consuming items such as power showers, although agreed that it should not be easy to comply with the higher levels of the Code. Whilst such items do have a detrimental effect on water resources, a policy decision was made that it is not the Codes place to effectively ban these items. However, where such items are desired and if the homes are to achieve a Code rating, the homes need to be designed to offset such high consuming items by specifying other fittings that are much more efficient, or the use of rain and/or greywater.

2.2 Aims of the Water Calculator

The aim of the Code Water Calculator is to provide a method for assessing the water efficiency of homes taking into account their whole house performance. This is in the context of government policy to make a step change in water efficiency to aid water demand management and both current and future concerns over the availability of water resources. A secondary aim was also to stimulate market growth in innovative water efficient fittings.

2.3 Current status of the Code Water Calculator

The Code for Sustainable Homes has been in place now for nearly 2 years and in this time there has been significant feedback on issues with the Water Calculator and problems that it is causing in relation to achieving the Code Water targets. The main problem is the small selection of fittings available that will achieve the water targets particularly for Code level 3. Evidence presented in Faber Maunsells' review of the Code Water Calculator indicates that the fittings required are pushing beyond the limits of user satisfaction. There is also evidence of a number of other issues such as the Calculator leading to poor design and so called 'game playing'. This is in relation to where the methodology allows offsetting of fittings against one another which may not always lead to the most sustainable solution.

Whilst it is agreed that the current Calculator is leading to a number of undesired outcomes, the majority of issues are a result of the fact that the Calculator is overestimating consumption leading to some rather drastic measure to achieve the targets or elements of 'game playing' as described above. Bringing the Code Water Calculator back into line with typical water consumption levels should eliminate such issues. It is however important to ensure where there is a risk of such elements of game playing and areas where the Calculator is having a negative impact on future occupants and overall sustainability, that these issues are addressed in the review.

From the expert group workshops carried out as part of the review it was evident that the water Calculator is also being used for purposes beyond for which it was intended. This includes use of the Calculator as a tool to assist with water demand management and as a design guide to determine the fittings to specify for a home. The overestimated consumption calculated by the Water Calculator has led to the specification of fittings based on meeting the targets, rather than a balance between the fittings meeting water efficiency requirements and the functional requirements of the users.

Having now gone under a major review and with the imminent launch of the Part G consultation and Code April 09 update, it is essential that changes should be made to the Calculator to address the current issues.

This report sets out BRE Global's recommendations for updating the Code Calculator based on our assessment of the recent review of the Code Water Calculator by Faber Maunsell.

2.4 Update Objectives

Whilst it is critical to ensure current issues with the Calculator are addressed, the recommendations set out in this report follow a set of objectives to ensure that a consistent approach is followed as to the justification for such changes. It is also important to try and minimise the changes made to the Calculator, focusing on addressing the most significant issues to minimise the potential impact on the assessment process, manufacturers and specifiers. As part of this, ensuring the Calculator can remain a simplified method is a key consideration, particularly due to potential impacts on the current Code assessment process and the Calculators incorporation into Part G. The changes to be made are based on recommendations set out in Faber Maunsell's review of the Code Water Calculator plus any additional issues suggested by BRE's code technical team. In order for such recommendations to be taken forward, they must adhere the following objectives:

1. Be based on a scientifically robust evidence allowing changes to be defended and ensuring changes correspond to existing research, where this is not possible, any assumptions made, should be clearly stated and transparent;

2. Consider the impact on a non technical audience in interpreting the assessment method minimising complexities where possible;
3. Consider the broader policy objectives of the Calculator in reducing water efficiency and driving innovation;
4. Take into account the impact on product manufacturers and specifiers;
5. Consider the impact on both the Code for Sustainable Homes and Part G;
6. Take into account impacts on auditing through the Code.
7. Feasible to action (in line with above objectives) in the time available

Where recommendations have not been included as issues to be actioned now, this will related to the fact that they do not meet the above set of objectives. The report details issues which prevent the change from being made and what would be needed to address such issues. If an issue is not to be included in this update, it does not mean that BRE necessarily disagree with the principle of such changes, to the contrary, a large majority of the proposals made BRE is in support of. There may however be further work required in order to ensure such changes proposed do not have negative impact and to justify the changes with further evidence.

As changes to the Calculator can have such considerable impacts, more so now with it supporting part G, the above approach aims to give confidence in the decisions made about the recommendations being adopted and the method for doing so.

3. Overview of changes

Table 1: Changes for inclusion within the Water Calculator

Key:

	For action now		Further research needed, not for inclusion now		Issue on hold		Calculator review process issue

Item Ref.	Recommendation	Priority	Next stage
001	Establish Code Water principles and Calculator objectives	Action now	Establish principles and objectives for inclusion in Calculator where possible.
002	Modify Calculator results for typical sanitaryware is 135 – 150 litres/person/day	Action now	Compare revised Calculator to typical consumption, consider normalisation factor where significant difference remains.
003	Modify Calculator algorithms to reduce water savings scope	Action now	Amend Calculator with fixed use volumes for taps which limits the impact of reduced flow rates to a more realistic level.

004	Introduce limits to design flexibility to maintain functionality and user acceptability	Action now	Add recommended minimum flow rates to the Code in line with BS6700:2006 (Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Specification), 5.3 Hot Water Services, Commentary and recommendations on 5.3.2.
005	Establish a Code Water technical review mechanism	Issue for future Calculator review process	Add to list of considerations for future Calculator revisions
006	Revise Calculator algorithms to include average flow intensity for shower and reduce the average flow intensities for taps from the current 2/3 'use factor'	Action now	Add percentage of use factor to Calculator using assumptions made from analysis of WRc CP337.
007	Revise Code Water Calculator algorithms to include non-linear average flow intensity for showers	Further consideration needed, not for inclusion now	Pending further research to demonstrate actual evidence
008	Ensure current and future Code Water Calculator revisions account for micro component study methodology when adopting or deriving factors for use in Calculator algorithms	Issue for future Calculator review process	Add to list of considerations for future Calculator revisions
009	Update frequency and duration of use factors used in Code Water Calculator algorithms based on WRc CP337	Action now	Incorporate updated use factors, obtain references from WRc CP337, merge frequency, duration and percentage of use factors into one use factor to simplify calculation method.
010	Remove bidets from the Code Water Calculator	Action now	Remove from Calculator
011	Use weighted averages in Water Calculator algorithms for design flow rate for multiple taps, showers and fill volumes to overflow for multiple baths.	Further consideration needed, not for inclusion now	Include proposed method as outlined in this report. Calculator sensitivity analysis required.
012	Revise Code Water Calculator algorithms for basin taps and kitchen sink taps to include fixed proportion of water use	Action now	Add fixed usage for kitchen sinks based on DEFRA future water. Consider adding factor for wash hand basins.

013	Improve Code technical guidance on Calculator inputs for mixer taps, separate hot and cold water taps and showers with multiple flow rates	Action now	Provide improved instructions in Water Calculator based on existing text in code technical guide
014	Revise Code Water Calculator algorithm for water softeners to include all water uses supplied by the water softener and to derive regeneration frequencies based on daily demand for softened water	Further consideration needed, not for inclusion now	Pending analysis of Calculator sensitivity. Research updated Calculator algorithm for water softeners.
015	Review the role of grey and rainwater systems in meeting Code Water levels	Issue on hold	Not to be included as part of Calculator update.
016	Revise Code Water Calculator algorithm for rain and greywater based on the new British Standards	Action now	Update Calculator methodology for rainwater based on BS8515:2009
017	Establish a water hierarchy to guide ongoing development of the Code approach to water efficiency	Further consideration needed, not for inclusion now	Add to list of considerations for future Calculator revisions
018	Move to Calculator inputs based on measurement or best estimate of site/system water pressure	Further consideration needed, not for inclusion now	Review method used to determine site pressure. Gauge impact on manufacturers.
019	Consider applying an occupancy factor to the Code Water Calculator figure for household water demand	Issue on hold	Not to be included as part of Calculator update.
020	Limit all Calculator inputs and outputs to values rounded to nearest 0.5 litres	Further consideration needed, not for inclusion now	Pending analysis of Calculator sensitivity. This also has potential impacts where the Calculator is to be included in an Excel based format as Excel does not allow rounding to the nearest 0.5. Set the Calculator to 1 decimal place for the time being.
021	Add waste disposal units in line with revised Part G	Action now	Add waste disposal units to Calculator.
022	Consider adding external water use to align Code Water Calculator results with results for the Part G Calculator	Action now	Add additional row to indicate external water use and total consumption figures for both Code and part G purposes.

023	Add an allowance for leakage to the Code Water Calculator and consider including an equivalent saving for specification of leak detection and avoidance measures	Issue on hold	Not to be included as part of Calculator update.
024	Undertake a scoping study to determine relative impacts of microcomponents of water use and saving measures not currently included in the Calculator or addressed in the Code methodology. Use this as the basis for planning for the expansion of the Calculator scope in future revisions.	Issue for future Calculator review process	Add to list of considerations for future Calculator revisions
025	Expand and improve Code Water technical guidance	Action now	Add any further useful references to good design advice and water efficiency best practice where practical.
026	Involve stakeholders in regular reviews of the Code Water Calculator	Issue for future Calculator review process	Add to list of considerations for future Calculator revisions
027	Review higher target levels of the Code and relative spacing of the targets along with the range of water efficiency options currently available to meet each target level	Issue on hold	Not to be included as part of Calculator update.

4. Quick wins for inclusion now

From the recommendations set out in Faber Maunsell's report, the following are those issues that BRE Global suggests should be incorporated into the review of the Code Water Calculator as quick wins. These issues are those that meet the objectives set out in this report and changes that can be made in the timescale available. It is recommended that these changes should be made to the Water Calculator now for the version used for Part G and the April 2009 version of the Code. The impact of these changes on the Code Water Calculator has been illustrated in section 7, Example Specifications. This indicates the impact of the changes and the fittings that can now be used to achieve the Code Water targets.

4.1 Item Ref 001: Establish Code Water Calculator principles and objectives

BRE Feedback

It is important to maintain users expectations of the Calculator's purpose to ensure this is understood and we recommend such principles are considered for inclusion. The purpose of the Water Calculator is to assess the water efficiency of new homes against a set performance target. Water efficiency is assessed in the Calculator by looking at the contribution each fitting has on household water consumption, based upon normalised use factors established from research on typical water consumption in new homes.

Recommended action

- Review principles established from the Faber Maunsell report.
- Add detail to CSH technical guide and draft text for Part G.

4.2 Item Ref 002: Modify Calculator so results for typical sanitaryware is 135-150 litres/person/day

BRE Feedback

The recommended action from Faber Maunsell is to modify the algorithms within the Calculator so that there is a reasonable statistical correlation between calculated results comparable to typical UK consumption.

BRE agrees that this is needed to ensure that the Calculator is proportioning relative water consumption for each fitting to a level comparable with typical consumption. This is to ensure that the impact of each fitting on overall water efficiency is assessed correctly. It is also to address a key criticism of the Code Water Calculator so that the results presented by the Calculator show such a correlation with typical use.

Modifications to the use factors in the Calculator should be limited to changes that can be supported by evidence so that changes made are based on robust data and can be defended when questioned. As the evidence base is quite limited, there is a risk that modifying the Calculator may still not achieve a reasonable statistical correlation with typical use. To establish whether this is the case, the Calculator has been tested against typical UK consumption to identify how the amended Calculator correlates with typical use as illustrated in Annex 1. This has been done by comparing the calculated use of typical UK fittings with the typical UK consumption per person from Ofwat data. The illustration shows that whilst the use factors within the Calculator have been updated using the latest research (as per recommendation 009), the Calculator is still overestimating water consumption compared to typical UK consumption.

Recommended action

Recognising the limited potential for achieving a reasonable correlation with typical UK consumption, in order to fulfil the recommended action, a normalisation factor is recommended in order to calibrate the calculated use in line with typical use. This is purely a presentational issue to adjust the calculator so that it shows a closer relationship between calculated consumption and average UK water consumption.

The normalisation factor is based on the percentage difference between calculated results for typical fittings and measured results for UK consumption. The normalisation factor is derived as follows:

$$\text{Normalisation factor} = \frac{\text{Measured typical UK consumption}}{\text{Calculated consumption for typical fittings}}$$

Where:

Measured typical UK consumption = 150 litres/person/day
Calculated typical UK consumption = 165 litres/person/day
Normalisation factor = 0.91

The normalisation factor assumes a typical fitting specification based on anecdotal evidence of the typical fittings in the UK. The use of a typical fittings specification has been used in several areas of the Calculator algorithms proposed by Faber Maunsell such as determining the percentage of flow rate for taps and also in calibrating the Calculator against typical consumption.

Applying a normalisation factor can be seen as a means to openly recognise that the Calculator has a degree of inaccuracy compared to typical consumption and shows that this has been recognised and taken into consideration in the Calculator. This is to show that calculated predicted use has been brought in line to better reflect actual use.

4.3 Item Ref 003: Modify Calculator algorithms to reduce water savings scope

BRE feedback

This issue is addressed in point 4.8, Item Ref 012, by setting a fixed proportion of use for basin and kitchen taps.

4.4 Item Ref 004: Introduce limits to design flexibility to maintain functionality and user acceptability

BRE Feedback

This is one of the key criticisms of the Code and it is recognised that this needs to be addressed to reduce the impact on home owners and to maintain the reputation of the Code and not damage the potential uptake of the Code.

The suggestion that a Code technical review board could review situations where flexibility to these limits can be allowed is questionable, particularly related to limits defined by BS6700. A minimum capacity WC should not be set but the requirement should be that the WC meets BS EN997:2006 for Class 2 WC suites. The bath size suggested does not appear to be related to a specific standard and including this would be hard to justify and also situations where a more intelligent bath size of a smaller capacity could still meet user satisfaction.

Recommended action

Add recommended minimum flow rates into the Code technical guide in line with BS6700:2006, 5.3 Hot Water Services, Commentary and recommendations on 5.3.2. This is to tackle the issue of the specification of fittings that do not meet minimum user satisfaction levels. Consideration needs to be given as to how this can be taken account of in part G.

CLG may need to review the impact on manufacturers that produce fittings of a lower flow rate than those set as minimums however including the flow rates as recommended rather than required would make this less of an issue. This issue is further looked at in part 9 of this report which looks at fundamental issues which would be created where minimum recommended flow rates are not included.

4.5 Item Ref 006: Revise Calculator algorithms to include average flow intensity for showers and reduce average flow intensities for taps from the current 2/3 use factor

BRE Feedback

The 2/3 factor for taps was introduced as a short-term approach to adjust the rates so they better reflect typical tap use. This was a fair assumption that users will not use taps at the full flow rate all the time. The assumptions made in the recommendations from Faber Maunsell and the basis of this has been analysed and seems sensible and we suggest this should be adopted as it is based on analysis of the new WRc CP337 identiflow research.

In relation to showers, the proposed method for accounting for non linearity in shower flow rate is not based on any specific research and therefore cannot be included as part of a revised Calculator. Whilst the average flow rates indicated are based on a Market Transformation Programme publication (BN DW Shower: Actions to improve shower design and efficiency - Briefing Note relating to Policy scenario objectives in Policy Brief), the maximum design flow rates assumed have no evidential basis and therefore the non linearity relationship is an assumed one rather than an evidence based theory. Insufficient evidence has been provided to demonstrate that there is a non linearity between design flow rate and actual flow rate in order to account for this issue at present.

Recommended action

Incorporate the updated average flow intensities for taps based on WRc CP337.
Add the non-linear relationship of average shower flow rate and maximum shower flow rate to the list of issues for further research.

4.6 Item Ref 009: Update frequency and duration of use factors used in the Code Water Calculator algorithms based on WRc CP337

BRE feedback

We agree with the principle that the most up to date use factors based on new homes need to be incorporated into the Calculator in order to more closely reflect the impact that fittings will have on water consumption. We also recognise the limited data available from other sources to provide such an update.

The issue related to the introduction of adjustments applied to individual use factors to take account of inaccuracies in research is not a change that could be easily defended when justifying changes made to the Calculator. This change relates to the inaccuracies with the WRc use factors where a 5% adjustment is made to take account for 'lost days' from the dataset. There is insufficient evidence or explanations given in Faber Maunsell's recommendations in order to justify

such an adjustment and we do not feel this is a defendable position without further details and research to demonstrate how this figure was established. We recognise that lost days may be causing the use factors to overestimate consumption but until this can be properly quantified do not recommend this can be incorporated at present.

Recommended action

Amend Calculator to reflect latest WRc CP337 report as included in the proposed algorithms.

Carry out further reviews of the WRc identiflow data to establish the impact of lost days on the accuracy of use factors and identify potential adjustment factor. This second action should be added to the list of issues for further research.

4.7 Item Ref 010: Remove bidets from the Code Water Calculator

BRE feedback

From the review, the current method has been deemed as overestimating consumption when the expert opinion is that bidet water consumption is negligible. There is not a strong evidence base to justify the level of water allocated to the use of bidets and as such we suggest that due to this they should be omitted from the calculation.

Recommended action

Remove Bidets from the Water Calculator. We suggest that the consumption of water in bidets could be an issue that is included in future microcomponent studies. Whilst the inclusion of bidets was appropriate at the time the Calculator was developed, the recent extensive expert review has deemed that this is an overestimate and their consumption is in fact negligible. It is also the case that bidets are very rarely put in place in new homes and combined with the minimal water consumption which generally is replacing the function of other fittings in the home, their removal from the calculator is well justified.

4.8 Item Ref 012: Revise Code Water Calculator algorithms for basin and kitchen sink taps to include a fixed proportion of water use

BRE feedback

Although including an issue which may make it harder to reach the targets may not seem logical considering the Calculators current status, for fittings where there is generally a fixed use (kitchen sinks) the Calculator gives no limit to savings, whereas it should be limited to the fixed volume use typical of such fittings. This is to ensure savings are not overestimated.

It is agreed that a fixed usage factor for wash hand basin taps is required and should be included. Whilst the figure included for basin taps is not based on any specific research it is widely recognised that basin tap usage does have a fixed proportion of use (e.g. for washing and shaving etc.). The figure assumed is a reasonable estimate (9% of basin taps usage per person per day) and not including a fixed usage would allow an overestimate in the savings that can be achieved for taps and make basin taps inconsistent with the way kitchen taps are assessed. We recommend this assumed level should be included in the revised calculator however making it clear that this is an estimate and needs further research to improve this figures accuracy in the future.

Recommended action

Setting fixed usage levels based on Defra's '*Future Water'* publication into Water Calculator for kitchen sinks is a good recommendation that should be actioned. A fixed usage for basin taps should be included at the moment as an estimate. This should be improved at a later date when further research is presented on the fixed usage from basins and sinks.

We recommend that the fixed proportion of usage applied to taps should be added to the list of issues for further research.

4.9 Item Ref 013: Improve Code Technical Guidance on Calculator inputs for mixer taps, separate hot and cold water taps and showers with multiple flow rates

BRE feedback

BRE recognises that the guidance in the technical guide could be improved to enhance technical clarity and are aware of this issue based on Code assessor feedback.

Recommended action

Review the October 2008 tech guide to look for improvements that can feed into the new Calculator document.

4.10 Item Ref 016: Revise the Code Water Calculator algorithm for rain and grey water systems based on the new British Standards

BRE feedback

BRE agrees with this recommendation. It is important that the Calculator is based on current best practice. The British Standard does however only cover rainwater and not greywater. The assessment method for greywater seems to be an area which has been omitted from this review.

Recommended action

Update CSH rainwater calculation in line with new BS8515 and require rainwater harvesting systems to be designed in line with this new standard. Further consideration needs to be given as to what requirements are set in Part G for the design of rainwater systems however this is outside the scope of this project.

A new British Standard for greywater is also due to be developed and we recommend that this is included in the Code at a later stage when this has been formally released.

4.11 Item Ref 021: Add waste disposal units in line with revised part G

BRE feedback

We understand that it is important to ensure all water consuming fittings are considered and to bring the CSH and Part G into line. Waste disposal units will be added to the Calculator to address this.

Recommended action

Add waste disposal units in line with calculation procedure set out in the recommendations.

4.12 Item Ref 022: Consider adding external water use to align Code Water Calculator results with results for part G

BRE feedback

Our understanding of this recommendation is that this is to bring consistency between Part G and the Code. For the Code, external water use is included in the assessment of Wat 2 and it would not be appropriate to include it in the assessment of Wat1 as this would impact on the targets which are fixed at their current level. It does however make sense to include external water use in the Calculator tables to indicate the consumption for Part G which can be a separate figure to that indicated for the consumption calculated for the Code. This needs to illustrate that this figure is an additional inclusion for Part G and explain the reasons why this figure is not included in the Code.

Recommended action

Add a line to Calculator tables to indicate consumption for external water use, with a row to calculate consumption for the Code (excluding external water use) and another row to indicate consumption for Part G (including external water use).

4.13 Item Ref 025: Expand and improve Code Water technical guidance to improve good plumbing design and specification

BRE feedback

It needs to be recognised that the Code is not a design guide; it is a standard for the assessment of the sustainability of a home. The inclusion of expanded technical guidance to improve plumbing design and good specification would be an expansion on the Codes current scope and this would also need to be expanded for other areas of the Code.

Recommended action

Review potential additional references to further design guidance such as British and European standards that can be included in the Code technical guide. This should just be limited to a list of additional guidance and references rather than including the guidance within the technical guide.

4.14 Item Ref 011: Where fittings have varying specifications, use weighted averages in Water Calculator algorithms for design flow rate of: multiple basin taps, multiple kitchen/utility room taps, multiple showers and fill volume overflow for multiple baths.

BRE feedback

We understand the aims of this recommendation. We are concerned that this recommendation is not based on any specific research and there is a risk that the inclusion of this is not defendable.

We are also concerned that the impact of including such a method in a word format for part G may cause an impact although the development of software to support this method would negate this impact. This issue is however important to address to reduce the potential for game playing within the Calculator. Game playing is where highly efficient fittings are put in place which may not be acceptable to users in order to offset the consumption of a high water using fitting

elsewhere. This can be done as the current calculator allows the consumption of fittings to be averaged. Providing a means of averaging does however allow recognition for where a range of fittings are to be provided.

Recommended action

BRE agrees that it is important to include this in the Calculator however suggest that the proposed method is analysed further to look at:

- the impact of including this measure in the updated Calculator
- the potential for including this in a tabular format for Part G with testing carried out to assess ease of use

We have put together an alternative methodology for addressing game playing and this is explained below. We recommend that this method is included in the updated Calculator as this achieves the aim of the recommendation however with a more simplified approach. Further sensitivity testing of the Calculator to look at the impact of including this change is however needed to look at potential impacts.

Proposed method

Where terminal fittings with varying flow rates and capacities are specified (e.g. hot and cold taps with different flow rates, two types of showers etc.), the average consumption should be calculated as set out below in the following Table 2:

a) Enter the full flow rate or volume of each type of fitting into column (a) of the relevant section of Table 2
b) For taps, where there are separate hot and cold water taps, the flow rate of each tap should be entered separately as two tap types to calculate the average flow rate
c) Calculate the total consumption per fitting type
d) Calculate the average flow rate of the fitting types
e) Enter the flow rate of the fitting with the highest flow rate
f) Calculate the weighted average by multiplying the maximum flow rate by a factor of 0.7

Where the average flow rate or capacity is lower than the weighted average, the weighted average must be used as the flow rate or capacity to be entered into the Calculator. This is so that where the average flow rate or capacity is significantly lower than the maximum flow rate or capacity specified, the calculation limits the flow rate or capacity that can be assumed. The factor of 0.7 is not based on any specific research and is just a factor included to reduce the impact of game playing. This figure is not fixed and where it is felt to not reduce game playing to an adequate level, this may be adjusted further however this goes some way to address this issue. Sensitivity testing is needed to look at this further.

Table 2: Example of averaging method: Basin Taps

Tap Fitting Type	Flow rate (litres/min) (a)	Quantity (No.) (b)	Total per fitting type (c) = (a) x (b)
1			
2			
3			
4			
Total (Sum of all Quantities) (d)			
Total (Sum of all totals per fitting type) (e)			
Average flow rate (litres/min) (e) / (d)=			
Maximum flow rate (litres/min) (f)			
Weighted average flow rate (litres/min) [(f) x 0.7]=			

Additional quick win suggested by BRE

4.15 Revise methodology for assessing white goods using a standardised capacity in Kg. (issue not addressed by Faber Maunsell review)

Currently the Code uses the litres/use figure quoted on the energy label. This is the litres per use for the given capacity of the machine which may vary from 2-8kg for washing machines. A smaller machine would be used more frequently, a large machine less often but capacity is not taken account of in the Code.

Recommended action

Scale the litres/use for washing machines and dishwashers to a standard capacity to ensure all white goods are assessed on the same basis using the litres/kg for washing machines and litres/place setting for dishwashers. This should then be scaled up to the typical size of washing machines and dishwashers to account for the typical daily usage of washing machines and dishwashers per person per day.

5. Potential actions needing further consideration

These recommendations are acknowledged as issues that should be included, yet at their current status cannot at present be included, or are beyond the scope of a Code Water Calculator review. Some of the recommendations, BRE is not confident of the evidential basis for inclusion however following further work, may be included at a later date. These issues do not fully meet the objectives set out in the report, but have the potential to meet the objectives with further work carried out to investigate how the objectives can be made.

5.1 Item Ref 005: Establish a Code Water technical review mechanism

BRE feedback

The suggestion that a Code water technical review board could review situations where flexibility to these limits can be allowed is questionable. We do not think that this recommendation should be taken forward as establishing a group to question the validity of limits set out in a published British Standard seems inappropriate.

Recommended action

We recommend that the flexibility to design limits should not be reviewed and that these should be fixed. We do however recommend that a code water technical review mechanism should be maintained to ensure that any issues with the Calculator are reviewed on a regular basis.

5.2 Item Ref 007: Revise Calculator algorithms to include non-linear average flow intensities for showers

BRE feedback

This issue has already been addressed elsewhere in the quick wins (see recommendation 4.5).

5.3 Item Ref 008: Ensure current and future Code Water Calculator revisions account for microcomponent study methodology when adopting or deriving factors for use in Calculator algorithms.

Item Ref 024: Undertake a scoping study to determine the relative impacts of microcomponents of water use and saving measures not currently included in the Calculator or addressed in the Code methodology. Use this as the basis for planning for the expansion of the Calculator scope in future revisions.

Item Ref 026: Involve stakeholders in regular reviews of the Code Water Calculator

BRE feedback

These are issues for further consideration from CLG to inform future revisions of the Water Calculator, Part G and the Code.

Recommended action

It is suggested that these issues are taken on board and that a paper is put together to set out what future updates of the Code should consider.

5.4 Item Ref 014: Revise the Code Water Calculator algorithm for water softeners to include all water uses supplied by the water softener and to derive regeneration frequency based on daily demand for softened water

BRE feedback

The proposed algorithm is incorrect as this assumes the water softener regenerates every day, when in fact this is variable as it depends on the water softener controls, litres of water consumed per day, occupancy and hardness of the water.

It is agreed that the total water consumption of water softeners should be included however further analysis is needed to review the impact of doing this to look at the potential impact on water softener manufacturers.

Recommended action

1. Provide an additional calculation step to determine the number of regeneration cycles per day, based on the total daily water consumption, occupancy and hardness of water. This would only apply to metered water softeners, some water softeners regenerate on a daily basis, so the daily consumption makes no impact, as it will regenerate every day, no matter what the daily consumption is.

This cannot yet be incorporated as a method of assessment needs further consideration to determine the number of regenerations. Further work is needed to look at a standard way of taking into account of the hardness of the water. This needs to be developed in liaison with manufacturers so that a workable method can be developed.

2. Assess the impact of including the total water consumption of water softeners. Where the inclusions of a water softeners total water use makes it very difficult to comply with the water targets using a range of acceptable fittings, it may not be appropriate to make this change in order to minimise the impact on water softener manufacturers. The current method does provide a mechanism to encourage water softener manufacturers to increase water efficiency however so this may not be a negative compromise.

5.5 Item Ref 017: Establish a water hierarchy to guide ongoing development of the Code approach to water efficiency

BRE feedback

There is insufficient evidence to develop a water hierarchy and much further research is needed looking at the merits of water saving devices such as low flow taps and showers verses using water recycling technology. By simply looking at this from the perspective of water efficiency the revised Water Calculator can be used as it can indicate the proportions that each fitting contributes towards daily water consumption. Once issues such as impacts on energy, materials and waste are brought in this gets much more complex and there is insufficient research in order to do this such as life cycle assessments of each technology which would also need to consider replacement intervals. It may be that a different hierarchy would apply in each geographical region due to the varying potential for rainwater harvesting which further complicates this issue. Incorporating a water hierarchy into the calculator would greatly extend the water calculators purpose and at present it is simply to look at total household water consumption. Water savings attributed to each fitting are applied in the Calculator irrespective of the other environmental impacts such fittings have. Changing this would be a fundamental change to the calculator and consideration is needed as to whether the Water calculator is the best medium for considering such issues and BRE is of the opinion that it may not be. This issue is further discussed in section 6.1.

Recommended action

A water hierarchy cannot be incorporated into the water calculator at this point in time. This issue is something that can be considered with a potential review of the role of grey and rainwater however we do not see that this can be included at present until the research to establish such a hierarchy is clear.

5.6 Item Ref 020: Limit all Calculator inputs and outputs to values rounded to the nearest 0.5 litres

BRE feedback

BRE agrees that the Calculator may be looking at this to a too greater level of detail however suggest that the impact of such a change is assessed on completion of a revised Water Calculator to ensure that this change does not have a net negative impact.

Recommended action

Set the calculated water consumption to one decimal place. Review the impact of revising the Water Calculator to the nearest 0.5, particularly for how it could be included in an excel based tool.

5.7 Item Ref 023: Add an allowance for leakage to the Code Water Calculator and consider including an equivalent saving for specification of leak detection and avoidance

BRE feedback

Although we understand the reasons for including this issue so that all areas of water consumption in the home are taken account of. We do not at the moment see a method for incorporating this issue into the Water Calculator, or also see a way for measuring the benefit of leak detection systems and prevention methods. There also needs to be a package of measures developed that could be incorporated into the Code in order to allow the leakage factor to be reduced. The practicalities of such measures need to be further analysed such as the suitability of leak detection

measures on a domestic scale and the criteria that such measures would need to meet in order to offset the leakage indicated in the Calculator.

The inclusion of leakage would also be another factor to make it harder to achieve the levels set out in the Code and the factor of leakage may be allowed for when normalising the typical consumption calculated by the Code to the measured data on typical UK consumption.

Recommended action

We suggest that further research is needed to determine the volume of water that is a result of leakage from new households. There also needs to be further research on the potential measures that could be put in place in order to reduce this volume.

We do not support the inclusion of leakage just for the purposes of taking account of all water uses, where there is no means for this volume to be reduced through the promotion of leak avoidance and detection measures and suggest this is considered further.

6. Issues put on hold

6.1 Item Ref 015: Review the role of rain and greywater systems in meeting Code Water levels

BRE feedback

BRE's understanding of this recommendation is that it is to address questions on the lifecycle impacts of rain and grey water and the need to consider efficient fittings before considering grey and rainwater.

A possible route to achieving this proposed change is to consider whether rain and grey water should only be considered where a minimum efficiency standard has been achieved. This could be set at 105 litres/person/day before rain and greywater can be considered, which effectively means that grey and rainwater is only considered for levels 5 and 6 of the Code. This change would however be a diversion from the policy objectives set out in the development of the Water Calculator and would remove flexibility that is currently allowed in the Code. This may be seen as a good thing in some ways for increasing sustainability to ensure that efficient fittings are provided first before looking at the use of recycled water. Some of the further considerations needed include:

- The impact on published government policies such as the Governments Strategy for Water set out in Defra's 'Future Water' publication which clearly promotes the development and use of grey and rainwater. Changing the role of grey and rainwater in the Code would contradict government policy.
- Consideration of the replacement intervals when comparing water efficient fittings with grey and rainwater systems
- The geographical context of using rainwater
- The impact on market transformation and the potential for slowing down the development of innovative new grey/rainwater systems that may be addressing current criticisms of such technology
- The carbon cost of rain/greywater systems compared to the carbon savings from reduced demand for mains water looking at a variety of systems and geographical regions

Before a conclusion can be made on what role rain and greywater should have in the Code, a much more detailed review is needed to look at some of these issues, BRE are of the opinion that there is insufficient justification for their exclusion from taking such a role in increasing water efficiency or for a need to establish them in some form of water hierarchy at present.

The consideration of life cycle impacts is an issue which is only addressed in the Code in the assessment of major building elements using the life cycle impact assessment technique set out in BRE's Green Guide to Specification. To consider the lifecycle impacts of water fittings, the Code would need to follow a consistent approach so that the lifecycle of other fittings required to meet Code credit requirements are assessed in a consistent manner. An appropriate lifecycle impact assessment technique would also need to be developed and we would need to define the considerations of such a technique such as whether this is an assessment of the product from 'cradle to grave' (extraction of materials and production to end of product life) or whether this is just looking at the products impacts from 'cradle to gate' (extraction and production of materials).

It is not recommended by BRE that life cycle impacts is something that can yet be included in the Code as this is a complex issue that would need further consideration. Such a change to the code would be fundamental and the impact of which would need further consideration.

Recommended action

Setting limits on flexibility for the use of rain and greywater would be a diversion away from published Government policy and would remove an element of flexibility from the Code which could potentially end up in reducing uptake of the Code for certain situations. There needs to be a clear justification for setting such limits and the case for this is not conclusive at the moment. We suggest that a review is carried out to look at the role of rain and greywater in the Code. Such work should determine ways in which such technology could be encouraged to be more sustainable and a set of criteria that could potentially be used to ensure that where such technology is to be used, it meets certain sustainability and design requirements such as not having an increased impact on carbon compared to using water efficient fittings.

6.2 Item Ref 018: Move to Calculator inputs based on measurement of best estimate of site/system pressure

BRE feedback

BRE's understanding of this recommendation is that it is to ensure flow rates indicated in the Calculator are more reflective of the actual flow rates provided on site. At the moment, flow rates may be considerably higher or lower on site compared to the design flow rate. This also helps push developers towards considering site pressure to ensure more appropriate fittings are specified.

The concerns with requiring flow rates to be based on site pressure are that:

- Manufacturers do not all currently provide flow rates for a range of water pressure and so this would make an impact on manufacturers needing to amend the testing methodologies for their products and to amend their product information
- There is no standard methodology that we are aware of in estimating site pressure and there is a concern that site pressure may not be estimated on a consistent basis which would bring inaccuracies in the assessment of this issue due to the complex nature of carrying out such an estimate

Recommended action

We do support that it would be best to require the use of a best estimate of site pressure when looking at flow rates, however, there needs to be further work carried out to determine a standard methodology for estimating site pressure. This includes:

- Establishing what current methods there are for determining site pressure and where possible include a recommended method that can be referred to
- Carry out an analysis of the impact on manufacturers of requiring showers and taps to be measured based on site pressure

6.3 Item Ref 019: Consider applying an occupancy factor to the Code Water Calculator figure for household water demand

BRE feedback

Adding an occupancy factor would make consumption per person in homes with a lower occupancy higher, and homes with a larger occupancy lower. This would mean that homes with a smaller occupancy have to provide more efficient fittings than homes with a larger occupancy. Although it is generally understood that occupancy per person is higher in smaller homes, there is not a clear set of research referred to, to show this relationship.

Recommended action

We recommend that a standard occupancy remains so that all homes need similarly efficient fittings. To include occupancy, there needs to be a greater understanding of which fittings consume more in small homes, rather than requiring an overall greater efficiency requirement. It is questionable why it should be harder for homes with a smaller occupancy, when it may be behavioural issues that will not be affected by more efficient fittings.

We recognise that smaller homes do generally consume more water per person than large homes however there is no basis for this inclusion and the inclusion of this issue needs to be based on a strong evidence base in order to justify smaller homes having to be designed as more efficient than large homes.

6.4 Item Ref 027: Review higher target levels of the Code and relative spacings of the targets along with the range of water efficiency options currently available to meet each target level

BRE feedback

To ensure appropriate targets are set for each level of the code with appropriate fittings for each level.

Review the fittings required to meet the Code Water targets based on the revised algorithm. Assess whether the type of fittings required to meet the various levels are appropriate.

Recommended action

It is not possible to address the targets set out in the Code at the moment as these are fixed. It is however sensible to review the type of fittings that would be needed to meet this level.

This recommendation is highly dependent on a review of the role of grey and rainwater. The results of such a review would need to feed into a potential review of the upper levels of the Code. It would also be appropriated to look at alternative approaches that could be included to reduce water consumption such as leakage rates and other opportunities for saving water that were identified such as long draw-offs. All such issues cannot yet be incorporates into the Calculator as the relative savings cannot yet be quantified due to a lack of available data. This is a

consideration to be looked at as part of the research needed to look at future reviews of the Water Calculator.

7. Example specifications

Typical Consumption: Normalising the Water Calculator

The following illustrates the revised Water Calculator using typical UK fittings as defined in Faber Maunsells review. A normalisation factor of 0.91 has been derived from this to amend the calculation so that the consumption indicated by the Calculator using typical UK fittings correlates with the typical UK consumption of 150 litres/person/day.

The various use factors (duration, frequency and percentage of use) have been merged into one use factor. This is to reduce the number of steps required to carry out the calculation. An explanation of how each use factor is derived is explained below.

Table 3: The Water Calculator for New Homes

Installation Type	Unit of measure	Capacity / flow rate (litres) (1)	Use factor (2)	Fixed use (litres) (3)	Litres / person / day = (1) x (2) + (3)
WC (single flush)	Flush volume	6	4.42	0.00	26.52
WC (dual flush)	Full flush volume		1.46	0.00	
	Part Flush volume		2.96	0.00	
Taps (other than kitchen or external taps)	Flow rate (litres/minute)	9	1.58	1.58	15.8
Bath	Capacity to overflow	225	0.11	0.00	24.75
Shower	Flow rate (litres/minute)	12	4.37	0.00	52.44
Kitchen sink taps	Flow rate (litres/minute)	12	0.44	10.36	15.64
Washing Machine	Litres/place setting	9.66	2.1	0.00	20.3
Dishwasher	Litres/place setting	1.25	3.6	0.00	4.5
Waste disposal unit	Litres/use	If present = 1	3.08	0.00	0
Water Softener					0

	Calculated use (litres/person/day)	**159.95**

Total Consumption (Part G)

Calculated Use (1)	Normalisation factor (2)	External Water Use (litres) [1] (3)	Total consumption = [(1) x (2)] + (3)
160.65	**0.91**	**5.0**	**150.6**

Total Consumption (Code for Sustainable Homes, Issue Wat1)

Calculated Use (1)	Normalisation factor (2)	Contribution from recycled water [2] (3)	Total consumption = [(1) x (2)] - (3)
159.95	**0.91**	**0**	**145.6**

8. Use factors

Use factors

The overall use factors used in the Water Calculator are derived as follows:

(1) x (2) + (3) = overall use factor

Table 4: Illustration of how the use factors have been calculated

Installation Type	Quantity / duration of use Factor (1)	Flow rate modification factor (2)	Uses per day factor (3)	Overall use factor (4)
WC (single flush)	1.0	1.0	4.42	4.42
WC (dual flush)	0.33	1.0	4.42	1.46
	0.67	1.0	4.42	2.96
Taps (other than kitchen or external taps)	0.43	0.39	9.42	1.58
Bath	1.0	0.50	0.22	0.11
Shower	5.6	1.0	0.78	4.37
Kitchen sink taps	0.43	0.29	3.56	0.44
Washing Machine	6.0	1.0	0.35	2.1
Dishwasher	12.0	1.0	0.30	3.6

Waste disposal unit	2.46	1.0	1.25	3.08

9. Examples of compliant specifications

Best new specification

The following illustrates the consumption achieved using the new Calculator with the use of the best available water fitting specification. The fittings used are those that do not go below minimum levels of user acceptability. This is also using the default figures for white goods (49 litre washing machine and 15 litre dishwasher) to reflect the best new specification applicable to social housing, where white goods are rarely provided.

Table 5: Illustration of consumption with Best New Specification

Installation Type	Unit of measure	Capacity / flow rate (litres)	Use factor	Fixed use (litres)	Litres / person / day
WC (single flush)	Flush volume		4.42	0.00	
WC (dual flush)	Full flush volume	4.5	1.46	0.00	6.57
	Part Flush volume	2.5	2.96	0.00	7.40
Taps (other than kitchen or external taps)	Flow rate (litres/minute)	4	1.58	1.58	7.90
Bath	Capacity to overflow	165	0.11	0.00	18.15
Shower	Flow rate (litres/minute)	6	4.37	0.00	26.22
Kitchen sink taps	Flow rate (litres/minute)	6	0.44	10.36	13.00
Washing Machine	Litres/kg	8.17	2.1	0.00	17.16
Dishwasher	Litres/place setting	1.25	3.6	0.00	4.5
Waste disposal unit	Litres/use	If present = 1	3.08	0.00	0
Water Softener			1.00	0.00	0
			Calculated use (litres/person/day)		**100.9**

Total Consumption (Part G)

Calculated Use (1)	Normalisation factor (2)	External Water Use (litres) [1] (3)	Total consumption = [(1) x (2)] + (3)
100.9	0.91	5.0	96.8

Total Consumption (Code for Sustainable Homes, Issue Wat1)

Calculated Use (1)	Normalisation factor (2)	Contribution from recycled water [2] (3)	Total consumption = [(1) x (2)] - (3)
100.9	0.91	0	91.8

Best new fittings (beyond levels of user acceptability)

The following table is a specification of fittings beyond the levels of user acceptability. The fittings used are fittings that from BRE Globals experience are currently being used for a number of Code assessments at present to achieve Code level 3. This specification achieves 69 litres/person/day under the revised Calculator which is equivalent to Code level 6 however without the use of grey or rainwater. Due to the fact that fittings are used that go beyond minimum levels of user acceptability, it is unlikely that such a low water consumption would be achieved in practice as the duration of use taken account for in the Calculator is likely to be underestimated. The low flow rates are likely to mean that users have to use the fittings such as showers and taps for longer periods of time in order to fulfil the desired function. Occupants are also likely to replace the fittings with much less efficient fittings if they aren't working. Arguably grey or rainwater could be a much better solution to achieving this level, as at least acceptable fittings could be used and offset by rain or greywater to meet this level of efficiency.

The fact that you can achieve level 6 with the use of inappropriate fittings illustrates the importance of setting minimum acceptable flow rates, otherwise, with the updated Calculator, it may be possible to reach code level 6 by using fittings not acceptable to users and this route is very likely to be taken if not only to achieve the tradable credits available at level 6.

The fact that you can achieve level 6 with a specification currently used to achieve level 3 is also a serious concern. Developers that have achieved level 3 will not be happy that they could now achieve level 6 for Wat 1 with the same specification. There is also the potential for negative press due to the fact that level 6 can be achieved with fittings that are not appropriate (e.g. 2 litre taps). These impacts could be negated with the use of recommended minimum flow rates and capacities for terminal fittings. Whilst these are only recommended, they would emphasise the fact that even if theoretically level 6 can be achieved with unacceptable fittings, it is acknowledged that the fittings are not appropriate. Keeping them as recommended rather than mandatory would reduce impacts on manufacturers of fittings that fall below these minimum levels.

Installing fittings that are below minimum levels is of course the developers choice and the impact of providing fittings which do not meet the needs of occupants may make it harder to sell homes, or cause problems with warranties. These are impacts that developers should consider.

The following table illustrates the use of fittings below user acceptability limits and the water consumption that can be achieved.

Table 6: Illustration of consumption using fittings that go beyond user satisfaction					
Installation Type	**Unit of measure**	**Capacity / flow rate (litres)**	**Use factor**	**Fixed use (litres)**	**Litres / person / day**
WC (single flush)	Flush volume		4.42	0.00	
WC (dual flush)	Full flush volume	4.0	1.46	0.00	5.84
	Part Flush volume	2.7	2.96	0.00	7.99
Taps (other than kitchen or external taps)	Flow rate (litres/minute)	2	1.58	1.58	4.74
Bath	Capacity to overflow	105	0.11	0.00	11.55
Shower	Flow rate (litres/minute)	4	4.37	0.00	17.48
Kitchen sink taps	Flow rate (litres/minute)	2	0.44	10.36	11.24
Washing Machine	Litres/use at 6kg load	40	0.35	0.00	14.00
Dishwasher	Litres/use at 12 place settings	10	0.30	0.00	3.00
Waste disposal unit	Litres/use	If present = 1	3.08	0.00	0
Water Softener					0
			Calculated use (litres/person/day)		**75.8**

Total Consumption (Part G)

Calculated Use (1)	**Normalisation factor (2)**	**External Water Use (litres) [1] (3)**	**Total consumption = [(1) x (2)] + (3)**
75.8	**0.91**	**5.0**	**74.0**

Total Consumption (Code for Sustainable Homes, Issue Wat1)

Calculated Use (1)	Normalisation factor (2)	Contribution from recycled water [2] (3)	Total consumption = [(1) x (2)] - (3)
75.8	**0.91**	**0**	**69.0**

Part G compliant example

Table 7: Illustration of fittings required for Part G compliance					
Installation Type	**Unit of measure**	**Capacity / flow rate (litres)**	**Use factor**	**Fixed use (litres)**	**Litres / person / day**
WC (single flush)	Flush volume		4.42	0.00	
WC (dual flush)	Full flush volume	6.0	1.46	0.00	8.76
	Part Flush volume	4.0	2.96	0.00	11.84
Taps (other than kitchen or external taps)	Flow rate (litres/minute)	6	1.58	1.58	11.06
Bath	Capacity to overflow	180	0.11	0.00	19.80
Shower	Flow rate (litres/minute)	8	4.37	0.00	34.96
Kitchen sink taps	Flow rate (litres/minute)	8	0.44	10.36	13.88
Washing Machine	Litres/kg	10	2.1	0.00	21.00
Dishwasher	Litres/place setting	1.08	3.6	0.00	3.90
Waste disposal unit	Litres/use	0	3.08	0.00	0
Water Softener					
			Calculated use (litres/person/day)		**125.2**

Total Consumption (Part G)

Calculated Use (1)	Normalisation factor (2)	External Water Use (litres) [1] (3)	Total consumption = [(1) x (2)] + (3)
125.2	**0.91**	**5.0**	**118.9**

Total Consumption (Code for Sustainable Homes, Issue Wat1) - Meeting Code level 1

Calculated Use (1)	Normalisation factor (2)	Contribution from recycled water [2] (3)	Total consumption = [(1) x (2)] - (3)
125.2	**0.91**	**0**	**113.9**

Code level 3 compliant example

Table 8: Illustration of fittings required to meet Code Level 3					
Installation Type	**Unit of measure**	**Capacity / flow rate (litres)**	**Use factor**	**Fixed use (litres)**	**Litres / person / day**
WC (single flush)	Flush volume		4.42		
WC (dual flush)	Full flush volume	4.5	1.46		6.57
	Part Flush volume	2.5	2.96		7.40
Taps (other than kitchen or external taps)	Flow rate (litres/minute)	6	1.58	1.58	11.06
Bath	Capacity to overflow	180	0.11		19.80
Shower	Flow rate (litres/minute)	7	4.37		30.59
Kitchen sink taps	Flow rate (litres/minute)	6	0.44	10.36	13.00
Washing Machine	Litres/use at 6kg load	49	0.35		17.15
Dishwasher	Litres/use at 12 place settings	13	0.30		3.90
Waste	Litres/use	0	3.08		0

disposal unit			[redacted]	
Water Softener			[redacted]	
			Calculated use (litres/person/day)	**109.5**

Total Consumption (Part G)

Calculated Use **(1)**	**Normalisation factor** **(2)**	**External Water Use (litres)** [1] **(3)**	**Total consumption** **= [(1) x (2)] + (3)**
109.5	**0.91**	**5.0**	**104.7**

Total Consumption (Code for Sustainable Homes, Issue Wat1)

Calculated Use **(1)**	**Normalisation factor** **(2)**	**Contribution from recycled water** [2] **(3)**	**Total consumption** **= [(1) x (2)] - (3)**
109.5	**0.91**	**0**	**99.6**