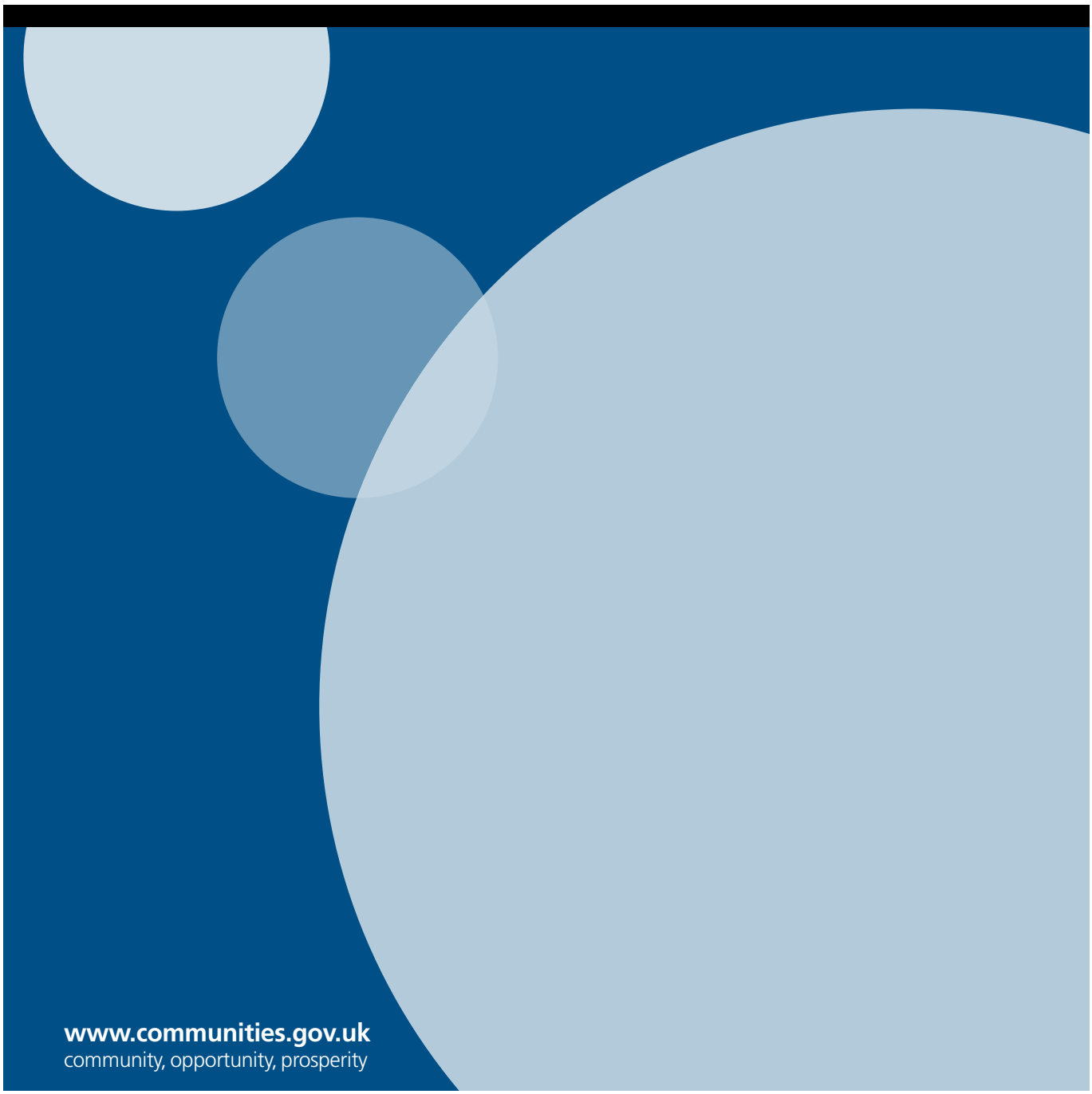
Communities and Local Government

The Water Efficiency Calculator for new dwellings

The Government's national calculation methodology for assessing water efficiency in new dwellings in support of:

The Code for Sustainable Homes, May 2009 and subsequent versions

The Building Regulations 2000 (as amended)



www.communities.gov.uk
community, opportunity, prosperity

Communities and Local Government

The Water Efficiency Calculator for new dwellings

The Government's national calculation methodology for assessing water efficiency in new dwellings in support of:

The Code for Sustainable Homes, May 2009 and subsequent versions
The Building Regulations 2000 (as amended)

May 2009
Department for Communities and Local Government

Produced on behalf of Communities and Local Government by:

BRE Global Ltd
Bucknalls Lane
Watford
WD25 9XX

This document outlines the assessment methodology to support the March 2009 version of the Water Calculator for new dwellings. It is important to ensure that the most up to date version of this document is being used. Updated versions of this document will be published by Communities and Local Government on www.planningportal.gov.uk

Communities and Local Government
Eland House
Bressenden Place
London
SW1E 5DU
Telephone: 020 7944 4400
Website: www.communities.gov.uk

Communities and Local Government Publications
Tel: 0300 123 1124
Fax: 0300 123 1125
Email: product@communities.ssi.gov.uk
Online via the Communities and Local Government website: www.communities.gov.uk

75% recycled
This is printed on
75% recycled paper

May 2009

Reference: 08 SB 05872

ISBN: 978-1-4098-1378-1

Contents

Section 1

The Water Calculator Methodology

1.1 The following document sets out the Water Calculation Methodology for assessing the whole house water efficiency of new dwellings. The calculation method is to be used to assess compliance against the water performance targets in Building Regulations Part G and the Code for Sustainable Homes (referred to in this document as the Code) as set out below. It is not a design tool for water supply and drainage systems. It is also not capable of calculating the actual water consumption of a new dwelling. Behaviour and changing behaviour can also have an effect on the amount of potable water used throughout a home.

Performance target	**Maximum Consumption (litres/person/day)**
Part G Compliance	125
Code for Sustainable Homes (Level 1/2)	120
Code for Sustainable Homes (Level 3/4)	105
Code for Sustainable Homes (Level 5/6)	80

1.2 The calculation method requires the use of water consumption figures provided from manufacturers product details. Before the assessment can be carried out, figures will need to be collected from manufacturers product information to determine the consumption of each terminal fitting, including:

a. WCs

i. Flushing capacity for the WC suite including consumption at full and part flush for dual flush WCs.

ii. Where multiple WCs are specified with various flushing capacities, the average effective flushing volume must be used as set out in section 2.5.

b. Taps

i. Flow rate of each tap in litres per minute measured at a standard three bar dynamic pressure (0.3MPa) which is based upon EN200:1992, (Sanitary tapware. General technical specifications) including any reductions achieved with flow restrictors.

ii. Where multiple taps are to be provided (e.g. separate hot and cold taps) the flow rate of each tap will be needed in order to calculate an average flow rate in accordance with section 2.5.

c. Baths

i. Total capacity in litres to overflow (excluding displacement, this is already included in the use factor for baths)

ii. Where multiple baths are specified with various capacities the average must be used as set out in section 2.5.

d. Dishwashers

i. Litres per place setting derived from the figures quoted on the EU Energy Label

ii. Where no dishwasher is to be provided and therefore consumption figures are unknown, a figure of 1.25 litres per place setting must be assumed

iii. Where multiple dishwashers are specified with various consumptions, the average must be used as set out in section 2.5.

e. Washing machines

i. Litres per kilogram of dry load derived from the figure quoted on the EU Energy Label

ii. Where no washing machine is to be provided and therefore consumption figures are unknown, a figure of 8.17 litres per kilogram must be assumed

iii. Where washing machines are specified with various consumptions the average must be used as set out in section 2.5.

f. Showers

i. Flow rate of each shower in litres per minute measured at a standard 3 bar dynamic pressure (0.3MPa) and a delivered temperature of 37 Celsius including any reductions achieved with flow restrictors

ii. Where multiple showers are specified with various flow rates, the average must be used as set out in section 2.5.

g. Water softeners (where present)

i. Percentage of total capacity used per regeneration cycle.

ii. Water consumed per regeneration cycle (litres).

iii. Average number of regeneration cycles per day.

iv. Number of occupants (based on two occupants in the master bedroom and 1 occupant per additional bedroom).

h. Waste disposal units (where present)

i. Where present, a standard consumption of 3.08 litres per person per day must be assumed.

i. External taps

i. Flow rates of external taps are not included in the calculation as a fixed allowance of five litres per person per day is assumed for external water use in Part G. The Code considers water use as part of a separate issue Wat 2, External Water Use.

1.3 In some cases rain and greywater recycling may be used as a means of reducing water consumption to achieve higher water efficiency performance levels. This may be needed where options for improving the efficiency of terminal fittings (taps, WCs etc.) has been maximised and further savings are still needed in order to meet the higher levels of the Code for Sustainable Homes. The details needed for such systems to determine the savings that can be made are as follows:

a. Greywater

i. Manufacturer or system designer details on the percentage of used water to be recycled, taking into account the storage capacity of the system.

ii. The volume of recycled water collected from waste bath, shower and wash-hand basin usage and only including the volume collected from such sources in accordance with the volume of water available calculated in Table 1.

iii. The consumption of fittings where greywater is to be used in accordance with Table 1 which can include WCs and washing machines.

b. Rainwater (in accordance with BS8515)

i. Collection area.

ii. Yield co-efficient and hydraulic filter efficiency.

iii. Rainfall (average m/year).

iv. Daily non-potable water demand.

v. Percentage of rainwater collected.

1.4 Large water consuming installations such as swimming pools and jacuzzis where the water is replaced over a greater time interval do not need to be included as part of the water calculations for Part G or for the Code. The Code does however assess such fittings as part of Issue Wat 2, External Water Use.

Section 2

Calculation Tables

2.1 Figures from manufacturer product details should be entered into Table 1 below to calculate the consumption of each fitting in litres per person per day. Where there are multiple fittings of the same type that have various flow rates or capacities (e.g. hot and cold taps with different flow rates), Table 2 should be used to determine the average flow rate or capacity of such fittings. The consumption of water softeners in litres per person per day is calculated using Table 3. All values throughout the Water Calculator for New Dwellings should be rounded to two decimal places with the exception of the total water consumption figures for Part G and the Code which should be rounded to one decimal place.

2.2 The total calculated use, resulting from Table 1, is the total consumption of all water consuming fittings. To calculate the litres of water consumed per person per day, any savings from grey or rainwater need to be deducted from the total calculated use. This figure is then multiplied by a normalisation factor to determine the total water consumption. The resulting figure is used to determine compliance with the Code for Sustainable Homes and Part G water targets.

2.3 To calculate the total water consumption for Part G, an additional allowance for external water use is added on to the total water consumption. This figure is set at five litres per person per day. The allowance for external water use is only applied to Part G as external water use is assessed separately in the Code for Sustainable Homes as part of Issue Wat 2, External Water Use.

2.4 The normalisation factor that is applied has been derived by looking at what consumption the calculator is indicating with typical UK fittings and comparing that with the typical UK water consumption (150 litres per person per day source: Ofwat). The factor then adjusts the calculated use to bring the calculated consumption of fittings in line with typical UK consumption thereby delivering a closer alignment between predicted average and actual average usage. The calculator cannot be used to calculate actual use due to the impact of user behaviour.

Table 1: The Water Calculator for New Dwellings

Installation Type	Unit of measure	Capacity/ flow rate (1)	Use factor (2)	Fixed use (litres/ person/ day) (3)	Litres/ person/day = [(1) x (2)] + (3) (4)
WC (single flush)	Flush volume (litres)		4.42	0.00	
WC (dual flush)	Full flush volume (litres)		1.46	0.00	
	Part Flush volume (litres)		2.96	0.00	
WCs (multiple fittings)	Average effective flushing volume (litres)		4.42	0.00	
Taps (excluding kitchen taps)	Flow rate (litres/ minute)		1.58	1.58	
Bath (where shower also present)	Capacity to overflow (litres)		0.11	0.00	
Shower (where bath also present)	Flow rate (litres/ minute)		4.37	0.00	
Bath only	Capacity to overflow (litres)		0.50	0.00	
Shower only	Flow rate (litres/ minute)		5.60	0.00	
Kitchen sink taps	Flow rate (litres/ minute)		0.44	10.36	
Washing Machine	Litres/kg dry load		2.1	0.00	
Dishwasher	Litres/place setting		3.6	0.00	
Waste disposal unit	Litres/use	If present = 1 If absent = 0	3.08	0.00	
Water Softener	Litres/person/day		1.00	0.00	
	(5)	**Total calculated use (litres/person/ day) = Σ (column 4)**			

Table 1: The Water Calculator for New Dwellings *(continued)*					
Installation Type	**Unit of measure**	**Capacity/ flow rate (1)**	**Use factor (2)**	**Fixed use (litres/ person/ day) (3)**	**Litres/ person/day = [(1) x (2)] + (3) (4)**
	(6)	Contribution from greywater (litres/person/day) from Table 4			
	(7)	Contribution from rainwater (litres/person/day) from Table 5			
	(8)	Normalisation factor			0.91
	(9)	Total water consumption (Code for Sustainable Homes) = [(5) – (6) – (7)] x (8) (litres/person/day)			
	(10)	External water use			5.0
	(11)	**Total water consumption (Part G) = (9) + (10) (litres/person/day)**			

2.5 Consumption from multiple fittings

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 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 Table one. 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.

Table 2: Consumption Calculator for multiple fittings for New Dwellings

Taps (excluding kitchen sink 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]=			

Table 2: Consumption Calculator for multiple fittings for New Dwellings *(continued)*

Baths

Bath fitting Type	Capacity to overflow (litres) (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 capacity to overflow (e)/(d)=			
Maximum capacity to overflow (litres) (f)			
Weighted average capacity to overflow (litres) [(f) x 0.7]=			

Dishwashers

Type of Dishwasher	Litres per place setting (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 litres per place setting (e)/(d)=			
Maximum litres per place setting (f)			
Weighted average litres per place setting [(f) x 0.7]=			

Washing machines			
Type of washing machine	**Litres per kilogram of dry load (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 litres per kilogram of dry load (e)/(d)=			
Maximum litres per kilogram of dry load (f)			
Weighted average of litres per kilogram of dry load [(f) x 0.7]=			

Showers			
Shower 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 (litres/min) [(f) x 0.7]=			

Where more than one type of WC is provided, the average effective flushing volume is calculated as follows. The average effective flush volume should then be entered into Table 1 in the row 'WCs (multiple fittings)'.

Table 2: Consumption Calculator for multiple fittings for New Dwellings *(continued)*			
WCs			
WC Type	**Effective flushing volume* (litres) (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 effective flushing volume (litres) (e)/(d)=			

* The effective flushing volume for dual flush WCs is calculated as follows.
= (Full flushing volume (litres) x 0.33) + (part flushing volume (litres) x 0.67)

2.6 Ion Exchange Water Softener

Ion exchange water softeners use water in order to clean the resin that is used to absorb the mineral content of the dwellings water supply. This cleaning process is referred to as the regeneration cycle which occurs on a frequency dependent on the type of water softener specified and the hardness of the water. The Water Calculator looks at the water consumed per regeneration cycle that is beyond a level of good practice. The good practice level has been determined at a level of water consumption as a percentage of the water softeners total capacity which is set at 4 per cent.

The figure entered into the Calculator is the volume of water consumed beyond this level of good practice to promote the use of more efficient water softeners. Where the water softener achieves a percentage that is equal to lower than this good practice benchmark figure, zero can be entered into Table 1 of the Calculator for water softeners. The following formula is used to determine the litres of water consumed per person per day that is beyond the level of good practice of 4 per cent:

Litres of water consumed per person per day beyond the 4 per cent good practice level:

$= [1 - (4/(a))] \times x((b) x (c))$

(a) = % of total capacity* used per regeneration

(b) = Litres of water consumed per regeneration

(c) = Average number of regeneration cycles per day

*the total capacity is the volume of water that flows through the water softener between regeneration cycles. This volume is dependent on the hardness of the water and the total capacity used in this calculation needs to reflect the hardness of water specific to the geographic location of the specific development.

To calculate the litres of water consumed per person per day beyond the 4 per cent good practice level, enter details of the water softener into Table 3 below:

Table 3: The Water Softener consumption calculation for New Dwellings		
Total Capacity used per regeneration (%)	(a)	
Water consumed per regeneration (litres)	(b)	
Average number of regeneration cycles per day (No.)	(c)	
Number of occupants served by the system (No.)	(d)	
Water consumed beyond 4% (litres/day) [1-[4/(a)]] x [(b) x (c)] =	(e)	
Water consumed beyond 4% (litres/person/day) [(e)/(d)] =		

2.7 Greywater

Where greywater is to be used, the following calculation method should be followed entering the relevant details into Table 4 below:

a) Calculate the water to be recycled from Table 1 which can only include bath, shower and wash hand basin tap usage

b) Determine the percentage of used water to be recycled based upon manufacturer or system designer details of the system specified. Then determine the non-potable water demand of the fittings to be provided with greywater which can include WCs and washing machines depending on the quality of the treated water. The non-potable water demand is calculated using Table 1

c) Enter the details of the water available for recycling and the percentage of recycled water to be used and multiply together to calculate the volume of greywater used within the home per person per day. This volume will be limited to the calculated consumption of the fittings where greywater is to be used.

Table 4: The greywater collection calculation for New Dwellings		
Bath, shower and wash hand basin usage (litres/person/day) **(a)**	**Percentage of used water (a) to be recycled (%)** **(b)**	**Rain and greywater used (litres/person/day)** **(a) x [(b)/100]**

Where a communal greywater system is to be provided supplying more than one home, Table 4 can be used in the same way however the figures entered need to be apportioned down to an individual dwelling basis.

2.8 Rainwater

Where rainwater is to be used, the following calculation method should be followed entering the relevant details into Table 5 below:

a) Calculate the volume of water collected using the collection area, yield coefficient and hydraulic filter efficiency and average rainfall with guidance from BS8515:2009

b) Calculate the daily rainwater collection per person in box (d) by entering the collection area, yield co-efficient, hydraulic filter efficiency and rainfall and calculating as set out below

c) Enter the percentage of rainwater collected in box (e) based upon the daily rainwater yield per person calculated in line with BS8515:2009 divided by the daily non-potable water demand per person. The daily non potable water demand per person to be supplied with rainwater should be calculated using Table 1 which can only include water use for WCs and washing machines. Where the daily rainwater yield is greater than the daily non-potable water demand, the percentage collected is equal to 100 per cent

d) Enter the number of occupants into box (f) which can be based on two occupants in the master bedroom and one occupant in each additional bedroom

e) Where a communal rainwater system is to be provided supplying more than one home, the Table 5 can be used in the same way however the figures entered need to be apportioned down to an individual dwelling basis.

Table 5: The rainwater collection calculation for New Dwellings		
Collection area (m^2)	(a)	
Yield co-efficient and hydraulic filter efficiency e.g. 0.7	(b)	
Rainfall (average mm/year)	(c)	
Daily rainwater collection (litres)	[(a) x (b) x (c)]/365 = (d)	
Percentage collected (%) (e)	(e)	
Number of occupants (f)	(f)	
Daily rainwater per person (litres)	$\frac{(d) \times [(e)/100]}{(f)} = (g)$	

The above calculation is sufficient for evaluating the principles of the system in the proposed development however, for sizing of storage capacity and all other design and installation details, BS8515 should be followed.

Section 3

References

Code for Sustainable Homes Technical Guide, Communities and Local Government, 2009

Future Water, The Government's Water Strategy for England, Defra, February 2008

The Building Act 1984, The Building Regulations 2000. Proposals for Amending Part G (Hygiene) of the Building Regulations and Approved Document G consultation, Communities and Local Government, May 2008

BS8515:2009, Rainwater Harvesting Systems – Code of Practice

BNWAT28: Water Consumption in New and Existing Homes, Market Transformation Programme, 2008

EN200:1992, (Sanitary tapware. General technical specifications.)

Washing Machine and Dishwasher Rankings, Waterwise, 2007.

ISBN 978-1-4098-1378-1

ISBN: 978-1-4098-1378-1