Building Regulations Sustainability Review

Draft Guidance for requirement G2 (Water Efficiency) and Appendix A (water efficiency calculation methodology) for Approved Document G

Requirement G2 and Regulations 36, 36A and 37

This approved document deals with the following requirement from Part G of Schedule 1 and regulations 36, 36A and 37 to the Building Regulations 2010 as amended.

Requirement	Limits on application
Water efficiency	
G2. Reasonable provision must be made by the installation of fittings and fixed appliances that use water efficiently for the prevention of undue consumption of water.	**G2 only applies when-** **a dwelling is –** (a) erected (b) formed by a material change of use of a building within the meaning of regulation 5 (a) or 5 (b).
Water efficiency of new dwellings **36.**—(1) The potential consumption of wholesome water by persons occupying a dwelling to which this regulation applies must not exceed the requirement in paragraph 2 as measured in either case in accordance with a methodology approved by Welsh Ministers. (2) The requirement referred to in paragraph (1) is either - a) 110 litres per person per day, when a dwelling is erected; or b) 125 litres per person per day, when a dwelling is formed by a material change of use of a building within the meaning of regulation 5 (a) or 5 (b);	
Water efficiency of non domestic buildings **36A.- (**1) Sanitary facilities shall be designed and installed with water efficient fittings to prevent the of undue consumption of water in accordance with the requirements of Welsh Ministers.	**G2 applies when a non domestic building is-** (a) erected (b) extended
Wholesome water consumption calculation **37.**—(1) Where regulation 36 applies, the person carrying out the work must give the local authority a notice which specifies the potential consumption of wholesome water per person per day calculated in accordance with the methodology referred to in that regulation in relation to the completed dwelling. (2) The notice shall be given to the local authority not later than five days after the work has been completed.	

Performance

In the Welsh Ministers view Requirement G2 will be met if:

NEW DWELLINGS

a. the estimated consumption of wholesome water resulting from the design of cold and hot water systems (calculated in accordance with the guidance set out in this Approved Document and taking into account the use of any alternative sources of water provided in accordance with G1(2)) is not greater than the standard set by the Welsh Ministers of 110 litres/person/day (or alternatively 125 litres/person/day for a dwelling formed by a material change of use) of wholesome water;

b. the manner in which ***sanitary appliances*** and white goods used in the design calculation undertaken to demonstrate compliance with paragraph (a) are provided and installed in the dwelling takes account of the other provisions in this Approved Document;

c. the manner in which any alternative sources of water used in the design calculation undertaken to demonstrate compliance with paragraph (a) are supplied to the dwelling, takes account of other provisions in this Approved Document;

d. a record of the ***sanitary appliances*** and white goods used in the water consumption calculation and installed in the dwelling is provided along with sufficient other information enabling ***building*** owners or occupiers to maintain the ***building*** and its services so as to maintain the water efficiency of the ***building***. In this context, relevant white goods are washing machines and dishwashers;

e. a record of the alternative sources of water used in the water consumption calculation and supplied to the dwelling is provided along with sufficient other information enabling ***building*** owners or occupiers to maintain the ***building*** and its services so as to maintain the water efficiency of the ***building***.

NON DOMESTIC BUILDINGS

a. The estimated water consumption of sanitary fittings are in accordance with the guidance set out in this Approved Document.

Section 1 - Dwellings

General

2.1 The water used by ***sanitary appliances*** and relevant white goods in a new dwelling should be calculated using the manufacturer's declared value for water consumption of each of those appliances and white goods.

2.2 The estimated water consumption of a new dwelling should be calculated in accordance with the methodology set out in the "Water Efficiency Calculator for New Dwellings".

2.3 The estimated consumption of ***wholesome water*** of a new dwelling should be not more than 110 litres/person/day (l/p/d), or alternatively not more than 125l/p/d for dwellings formed by a material change of use. These figures include a fixed factor of water for outdoor use of 5 l/p/d, unless a rainwater storage unit (e.g. water butt) with a minimum storage capacity of 100 litres is installed, per dwelling, for external irrigation/watering.

2.4 Where alternative sources of water are to be used in the dwelling design, this should be reflected in the estimate of water use.

Fittings approach

2.5 As an alternative to calculating the water consumption (as paragraph 2.2) a fittings approach that is based on the water efficiency calculator may be used.

2.6 Where a fittings approach is used, the water consumption of the fittings provided must not exceed the values in Table 2.1. If they do, the water efficiency calculator must be completed to demonstrate compliance. Similarly, where a waste disposal unit, a water softener or water re-use is specified the water efficiency calculator must be used.

2.7 The configurations outlined within Table 2.1 have been developed to allow for higher water consumption in certain components to be offset by other high efficiency components.

2.8 Where a fittings approach is used, the notice given under regulation 37 should state “Less than 110 litres/person/day using the fittings approach”.

Table 2.1 Maximum fittings consumption

Performance standard Option 1 Component	Maximum performance level
WC – Dual flush	6.0 / 4.0 litres per flush
WC – single flush	4.5 litres per flush
Wash hand basin tap	4.0 litres per minute
Shower	8.0 litres per minute
Kitchen tap	5.0 litres per minute
Bath	170 litres capacity

This option allows for relatively high flush volume toilets, with options for both dual and single flush mechanisms. It also allows for a reasonable flow rate of 8.0 litres per minute for the shower. The flow rate of the wash hand basin taps and kitchen taps within the scenario are relatively low to counteract the higher water using components.

Performance standard Option 2 Component	Maximum performance level
WC – Dual flush	4 / 2.6 litres per flush
Wash hand basin tap	5.0 litres per minute
Shower	8.0 litres per minute
Kitchen tap	6.0 litres per minute
Bath	170 litres capacity

This approach includes for a dual flush toilet, which is actually the lowest flush volume currently available on the market. The flow rate for the shower is as per Option 1, while the low flush toilets actually allows for higher flow rates of both the kitchen and wash hand basin taps within the dwelling.

Performance standard Option 3 Component	Maximum performance level
WC – effective flush volume	4.5 litres per flush
Wash hand basin tap	5.0 litres per minute
Shower	7.0 litres per minute
Kitchen tap	6.0 litres per minute
Bath	185 litres capacity

This third option includes a higher capacity bath, effective flush volume for the toilet and slightly lower flow rates for the showers. The flow rates of the taps within a dwelling remain in line with Option 2.

Performance standard Option 4 Component	Maximum performance level
WC – dual flush	4.5 / 3.0 litres per flush
Wash hand basin tap	5.0 litres per minute
Shower	9.0 litres per minute
Kitchen tap	5.0 litres per minute
Bath	170 litres capacity

The maximum performance of the toilet is a dual flush volume of 4.5 / 3.0 litres per flush. The incorporation of a dual flush toilet will allow for a higher flow rate for the shower.

2.9 Washing machines and dishwashers are not considered within the fittings-based approach.

Rainwater Storage

2.10 If a rainwater storage unit (e.g. water butt) with a minimum storage capacity of 100 litres is installed for external irrigation/watering of the dwelling, then the fixed factor of water for outdoor use of 5 l/p/d can be removed from the "Water Efficiency Calculator for New Dwellings".

The rainwater storage unit should be appropriately sited and comply with the following conditions:

- have no open access at the top of the collector (a child-proof lid is allowed)
- have a provision of a tap or other arrangement for drawing off water

• have a connection to the rainwater downpipes with an automatic overflow into the conventional rainwater drainage system

• have a means of detaching the rainwater downpipe and access provision to enable the interior to be cleaned

• where the collection system is to be sited outside, and not buried, it must be stable and adequately supported; the material used for the container shall be durable and opaque to sunlight

• where the system is part of a rainwater collection system providing internal water, water for external use may be provided in a separate tank to water required for internal use. This could be an overflow pipe leading from the main tank to a correctly specified water butt for external water use.

Section 2 – Non domestic buildings

General

2.11 The water used by ***sanitary appliances*** in non domestic buildings should be calculated using the manufacturer's declared value for water consumption of each of those appliances and white goods.

Guidance

2.12 Sanitary fittings used in non domestic buildings must not exceed the water consumption in Table 2.2.

Table 2.2 Maximum fittings consumption

Performance standard for non domestic buildings		
Component	**Maximum performance level**	**Stretch target**
WC – Effective flush volume	5 litres per flush	4.5 litres per flush
Urinals	6 litres per flush	3 litres bowl /flush
Wash hand basin tap	9 litres per minute	5 litres per minute
Shower	10 litres per minute	8 litres per minute

2.13 The maximum performance levels apply only those components included within Table 2.2. Water-consuming components including kitchen taps, washing machines and dishwashers are not included within the regulation for non-domestic buildings.

2.14 This proposed regulation does not apply to new Healthcare buildings, due to potential detrimental effects on achieving the correct parameters to maintain a safe water system free of harmful bacteria.

Notification of water efficiency calculation to the *BCB*

Where regulation 36 applies, regulation 37 of the Building Regulations (where the BCB is the local authority) and regulation 20(1) and (4) of the Building (Approved Inspectors etc.) Regulations respectively require that a notice specifying the calculated potential consumption of ***wholesome water*** per person per day relating to the dwelling as constructed be given to the appropriate ***BCB***.

-In most cases, this notice must be given to the ***BCB*** not later than five days after the completion of the ***building work***. However, where the ***BCB*** is an Approved Inspector and the dwelling is occupied before completion, the notice must be given not later than the day that the initial notice ceases to be in force in consequence of regulation 18 of the Building (Approved Inspectors etc) Regulations when this is earlier than five days after the completion of the work.

-It is permissible for the notice to be served on the ***BCB*** electronically provided the ***BCB*** has stated its willingness to receive the document by those means and it is delivered to the electronic address that the body has specified.

-Local authorities are unlikely to be able to give a completion certificate for the building until the notice required under regulation 37 of the Building Regulations has been received. Approved Inspectors are unlikely to be able to give a final certificate until the equivalent notice under regulation 20(1) and (4) of the Building (Approved Inspectors etc.) Regulations has been received.

The water efficiency calculation methodology

A1 This appendix sets out the water efficiency calculation methodology for assessing the whole house potable water consumption in new dwellings. The calculation methodology is to be used to assess compliance against the water performance targets in Regulation 36 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 potable 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 calculated consumption of potable water (litres/person/day)
Regulation 36 para (2)a	110
Regulation 36 para (2)b (material change of use)	125

A2 The calculation methodology 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 paragraphs A8 and A11.

b. Bidets

   i. Bidets are excluded from the water efficiency calculator for new dwellings due to their minimal water consumption, and although there is insufficient research to quantify this consumption, anecdotal evidence shows that there is evidence that bidets often displace other water consumption rather than increase consumption.

c. Taps

   i. Flow rate of each tap, at full flow rate in litres per minute measured at a dynamic pressure of 3±0.2 bar (0.3±0.02 MPa) for high pressure (Type 1) taps, or at a dynamic pressure of 0.1±0.02 bar (0.01±0.002 MPa) for low pressure (Type 2) taps (BS EN 200:2008, sanitary tapware, single taps and combination taps for supply systems of type 1 and 2. General technical specifications) including any reductions achieved with flow restrictions.

   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 paragraphs A8 to A10.

   iii. For 'click taps' and other taps with a 'water break', the manufacturer's stated full flow rate should be used to perform calculations (measured as described above). Do not use the flow rate at the break point. A factor for percentage of flow rate is already assumed within the use factor for taps. There is currently no research to provide a separate use factor for 'click taps' so a standard use factor is applied.

   iv. Taps on baths should not be included in the calculation as the water consumption from bath taps is taken account of in the use factor for baths.

d. Baths

i. Total capacity of the bath to overflow, in litres (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 paragraphs A8 to A10.

iii. Spa hot tubs are not included in the water efficiency calculator as they are generally not filled on a daily basis and their water consumption over a year is minimal.

e. Dishwashers

i. Litres per place setting derived from the value quoted on the EU Energy Label, i.e. annual water use ÷(280 × number of place settings).

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 paragraphs A8 to A10.

f. Washing machines

i. Litres per kilogram of dry load derived from the value quoted on the EU Energy Label, i.e. annual water use ÷(220 × capacity in kg).

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 multiple washing machines are specified with various consumptions, the average must be used as set out in paragraphs A8 to A10.

g. Showers

i. Flow rate of each shower at the outlet using cold water (T ≤ 30˚C), in litres per minute measured at a dynamic pressure of 3±0.2 bar (0.3±0.02 MPa) for high pressure (Type 1) supply systems, or at a dynamic pressure of 0.1±0.05 bar (0.01±0.005 MPa) for low pressure (Type 2) supply systems (BS EN 1112:2008, Sanitary tapware. Shower outlets for sanitary tapware for water supply systems type 1 and 2. General technical specifications).

ii. Where multiple showers are specified with various flow rates, the average must be used as set out in paragraphs A8 to A10.

h. 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 first bedroom and one occupant per additional bedroom assuming two occupants in studio flats).

v. Water softeners that do not have a water consumption such as electromagnetic types, are not included in the calculation.

i. Waste disposal units (where present)

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

j. 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.

A3 In some cases rainwater harvesting 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.) have been maximised and further savings are still needed:

a. Greywater (in accordance with BS 8525)
   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 washhand basin, dishwasher and washing machine usage, with the volume collected calculated in accordance with Table A1 or Tables A4.3, A4.4 and A4.5.
   iii. The consumption of fittings where greywater is to be used in accordance with Table A1 which can include WCs and washing machines or Tables A4.1 and A4.2 where greywater is just being used in a proportion of fittings.

b. Rainwater (in accordance with BS 8515)
   i. Collection area
   ii. Yield co-efficient and hydraulic filter efficiency
   iii. Rainfall (average mm/year)
   iv. Daily non-potable water demand

A4 Large water consuming installations such as swimming pools and spa hot tubs where the water is replaced over a greater time interval do not need to be included as part of the water calculations.

Calculation tables

A5 Figures from manufacturers' product details should be entered into Table A1 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), Tables A2.1 to A2.7 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 A3. All values throughout the water efficiency calculator should be rounded to two decimal places with the exception of the total water consumption figures, which should be rounded to one decimal place.

A6 The total calculated use, resulting from Table A1, is the total consumption of all water consuming fittings per person. 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 using figures from Tables A4.6 and A5.5. The litres/person/day figure is then multiplied by a normalisation factor to determine the total water consumption per person.

A7 To calculate the total water consumption, an additional allowance for external water use is added on to the total water consumption. This figure is set at 5 litres/person/day. However, if a rainwater storage unit (e.g. water butt) for external irrigation/watering with a minimum storage capacity of 100 litres is installed for the dwelling, then the fixed factor of water for outdoor use of 5 l/h/d can be removed from the "Water Efficiency Calculator for New Dwellings". (See paragraph 2.10 of Approved Document G for further guidance)

Table A1 The water efficiency calculator		(1)	(2)	(3)	(4)
Installation type	Unit of measure	Capacity/ flow rate	Use factor	Fixed use (litres/ person/ day)	Litres/ person/day = [(1) × (2)] + (3)
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/utility room 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/utility room 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 = (Sum column 4)**			
	(6)	Contribution from greywater (litres/person/day) from Table 4.6			
	(7)	Contribution from rainwater (litres/person/day) from Table 5.5			
	(8)	Normalisation factor			0.91
	(9)	Total water consumption = [(5) – (6) – (7)] × (8)			
	(10)	External water use **Note**: This factor can be removed for dwellings incorporating a rainwater storage unit (see paragraph A7)			5.0
	(11)	**Total water consumption = (9) + (10) (litres/person/day)**			

Consumption from multiple fittings

A8 Where terminal fittings with varying flow rates and capacities are specified (e.g. hot and cold taps with different flow rates, two types of shower etc.), the average consumption should be calculated as set out in Tables A2.1 to A2.7:

a) Enter the full flow rate or volume of each type of fitting into column (a) of the relevant table.

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/volume of the fittings detailed.

e) Enter the flow rate/volume of the fitting with the highest flow rate/volume into box (f) with the exception of WCs, where this step is not relevant.

f) Calculate the proportionate flow rate/volume by multiplying the highest flow rate/volume by a factor of 0.7 with the exception of WCs, where this step is not relevant.

A9 Where the average flow rate/volume is lower than the proportionate flow rate/volume, the proportionate figure must be entered into Table A1. The proportionate figure limits the flow rate/volume that can be specified to a proportion equal to 70 per cent of the highest flow rate/volume. This reduces the benefit of specifying ultra low fittings to bring the average flow rate/volume down, where such ultra low fittings may not be acceptable to dwellings occupants.

A10 The figure which is the greater of the average or proportionate flow rate/volume should be used. This is so that, where the average flow rate/volume is significantly lower than the highest flow rate/volume specified, the calculation sets a limitation for what figure can be assumed.

Table A2.1 Consumption calculator for multiple taps (excluding kitchen sink taps)

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

Table A2.2 Consumption calculator for multiple baths

	(a)	(b)	(c)
Bath fitting type	Capacity to overflow (litres)	Quantity (No.)	Total per fitting type = [(a) × (b)]
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average capacity to overflow = [(e)/(d)]			
(f) Highest capacity to overflow (litres)			
Proportionate capacity to overflow (litres) = [(f) × 0.7]			

Table A2.3 Consumption calculator for multiple taps (kitchen/utility room sink)

	(a)	(b)	(c)
Tap fitting type	Flow rate (litres/min)	Quantity (No.)	Total per fitting type = [(a) × (b)]
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average flow rate (litres/min) = [(e)/(d)]			
(f) Highest flow rate (litres/min) (litres)			
Proportionate flow rate (litres/min) = [(f) × 0.7]			

Table A2.4 Consumption calculator for multiple dishwashers

	(a)	(b)	(c)
Type of dishwasher	Litres per place setting	Quantity (No.)	Total per fitting type = [(a) × (b)]
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average litres per place setting = [(e)/(d)]			
(f) Highest litres per place setting			
Proportionate litres per place setting = [(f) × 0.7]			

Table A2.5 Consumption calculator for multiple washing machines

	(a)	(b)	(c)
Type of washing machine	Litres per kg dry load	Quantity (No.)	Total per fitting type = [(a) × (b)]
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average litres per kilogram of dry load = [(e)/(d)]			
(f) Highest litres per kilogram of dry load			
Proportionate litres per kilogram of dry load = [(f) × 0.7]			

Table A2.6 Consumption calculator for multiple showers

	(a)	(b)	(c)
Shower fitting type	Flow rate (litres/min)	Quantity (No.)	Total per fitting type = [(a) × (b)]
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average flow rate (litres/min) = [(e)/(d)]			
(f) Highest flow rate (litres/min)			
Proportionate flow rate (litres/min) = [(f) × 0.7]			

A11 Where more than one type of WC is provided, the average effective flushing volume is calculated using Table A2.7 below. The average effective flush volume should then be entered into Table A1 in the row 'WCs (multiple fittings)'.

Table A2.7 Consumption calculator for multiple WCs

	(a)	(b)	(c)
WC type	Effective flushing volume* (litres)	Quantity (No.)	Total per fitting type = [(a) × (b)]
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average effective flushing volume (litres) = [(e)/(d)]			
* The effective flushing volume for dual flush WCs is: (full flushing volume (litres) × 0.33) + (part flushing volume (litres) × 0.67)			

Ion exchange water softener

A12 Ion exchange water softeners use water in order to clean the resin that is used to absorb the mineral content of the dwelling's 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 efficiency 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 softener's total capacity which is set at 4 per cent.

A13 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, or lower than this good practice benchmark figure, zero can be entered into Table A1 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 good practice level of 4 per cent.

A14 Litres of water consumed per person per day beyond the 4 per cent good practice level:

= [1 – (4 / (a))] × ((b) × (c))

Where:

(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. This figure should be determined from manufacturer's product details.

A15 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 A3. Where the result indicates zero or a negative figure, zero should be entered into Table A1 for water softeners. The number of occupants entered into the table should be based on two in the first bedroom and one in each additional room. Studio flats should assume for two occupants.

Table A3 Water softener consumption calculation

(a) Total capacity used per regeneration (%)	
(b) Water consumed per regeneration (litres)	
(c) Average number of regeneration cycles per day (No.)	
(d) Number of occupants served by the system (No.)	
(e) Water consumed beyond 4% (litres/day) = [1 - [4/(a)]] × [(b) × (c)]	
(f) Water consumed beyond 4% (litres/person/day) = [(e)/(d)]	

Greywater calculations

Greywater demand calculation

A16 Where all WCs and/or washing machines are being supplied with greywater, the consumption values should be copied from Column 4 of Table A1 and entered into Table A4.6 to calculate the greywater savings.

A17 Where greywater is only being supplied to a proportion of fittings such as just to one WC or washing machine, the proportion is calculated by entering details into Tables A4.1 and A4.2.

Table A4.1 Greywater demand calculations – WCs

(a) Effective flushing volume (litres)	(b) Number of fittings present	(c) Quantity using greywater	(d) Greywater demand = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total greywater demand = Sum of (d)	
Average greywater demand from WCs		= (f)/(e) × 4.42	

Table A4.2 Greywater demand calculations – washing machines

(a) Litres per kg	(b) Number of fittings present	(c) Quantity using greywater	(d) Greywater demand = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total greywater demand = Sum of (d)	
Average greywater demand from washing machines		= [(f)/(e)] × 2.1	

Greywater collection calculations

A18 Where greywater is to be collected from all fittings including the shower, bath and wash hand basin taps, the total water consumption of the fittings calculated in Table A1 represents the total greywater collected, the sum of the consumption figures for fittings from which greywater is collected (from column 4 of Table A1) should be entered into Table A4.6. Where greywater is only being collected from a proportion of fittings, such as just some of the taps, the calculations in Tables A4.3 to A4.5 should be followed and the results entered into Table A4.6.

Table A4.3 Greywater collection calculations – taps

(a) Litres per minute	(b) Number of fittings present	(c) Quantity supplying greywater	(d) Greywater supply = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total greywater supply = Sum of (d)	
Average greywater supply from taps		= [(f)/(e)] × 1.58 + 1.58	

Table A4.4 Greywater collection calculations – showers

(a) Litres per minute	(b) Number of fittings present	(c) Quantity supplying greywater	(d) Greywater supply = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total greywater supply = Sum of (d)	
Average greywater supply from showers (where bath present)		= [(f)/(e)] × 4.37	
Average greywater supply from showers (shower only)		= [(f)/(e)] × 5.60	

Table A4.5 Greywater collection calculations – baths

(a)	(b)	(c)	(d)
Litres per minute	Number of fittings present	Quantity supplying greywater	Greywater supply = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total greywater supply = Sum of (d)	
Average greywater supply from baths (where shower present)		= [(f)/(e)] × 0.11	
Average greywater supply from baths (bath only)		= [(f)/(e)] × 0.50	

Greywater savings calculations

A19 Where greywater is to be reused within the dwelling, the savings from greywater can be calculated by entering the following details into Table A4.6:

a) Calculate the water to be recycled from Table A1 and/or using the method set out in section A18 where just a proportion of fittings are being collected from.

b) Determine the percentage of greywater collected to be recycled based upon manufacturer or system designer details of the system specified.

c) Determine the 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. This is determined from the WC and washing machine consumption from Table A1 or Tables A4.1 and A4.2 in paragraphs A16 and A17.

d) Multiply the volume of water to be recycled with the percentage of recycled water (determined in b. above) which will determine the actual volume of greywater available. Where the greywater supply is greater than the demand, the greywater savings are equal to the demand. Where the demand is greater than the greywater supply, the savings are equal to the supply.

e) Enter the greywater saving figure from Table A4.6 into Table A1.

Table A4.6 Greywater collection calculation

(a)	(b)	(c)	(d)	(e)
Bath, shower and wash hand basin usage (litres/person/day)	Percentage of used water (a) to be recycled (%)	Greywater available for use (litres/person/day) = (a) × [(b)/100]	Greywater demand (litres/person/day) (from Table A1 or A4.2 and A4.3)	Greywater savings (litres/person/day) Where (c) is greater than (d), (e) = (d), otherwise (e) = (c)

A20 Where a communal greywater system is to be provided supplying more than one home, Tables A4.1 to A4.5 can be used in the same way. The figures entered into Table A4.6 need to be entered on an individual dwelling basis and not using figures to reflect the communal system as a whole. The percentage collected figure will, however, need to be based on manufacturer or system designer details of the communal system

specified.

Rainwater calculations

Rainwater collection calculations

A21 Where rainwater is to be used, the following calculation method should be followed by entering the relevant details into Table A5.1 or Table A5.2 to calculate the rainwater collection volume.

A22 For Table A5.1 using the intermediate approach from BS 8515:

a) Calculate the volume of water collected using the collection area, yield coefficient and hydraulic filter efficiency and average rainfall with guidance from BS 8515.

b) Calculate the daily rainwater collection in box (d) using the collection area, yield coefficient, hydraulic filter efficiency and rainfall.

c) Enter the number of occupants into box (e), which can be based on two occupants in the first bedroom and one occupant in each additional bedroom. A studio flat should assume two occupants.

d) Where a communal rainwater system is to be provided supplying more than one home, Table A5.1 can be used in the same way calculating the total volume collected for the communal system and dividing it by the total number of occupants served by the system. This figure should then be entered in Table A5.5.

Table A5.1 Rainwater collection calculation – BS 8515 intermediate approach

	(a) Collection area (m^2)			
	(b) Yield coefficient and hydraulic filter efficiency e.g. 0.7			
	(c) Rainfall (average mm/year)			
	(d) Daily rainwater collection (litres) = [(a) × (b) × (c)]/365			
	(e) Number of occupants			
	(f) Daily rainwater per person (litres) = [(d)/(e)]			

A23 For Table A5.2 using the detailed approach as described in BS 8515, enter details of the total daily rainwater collection (litres) and the number of occupants to calculate the daily rainwater per person (litres) and enter into Table A5.5.

Table A5.2 Rainwater collection calculation – BS 8515 detailed approach

	(a) Daily rainwater collection (litres)			
	(b) Number of occupants			
	(c) Daily rainwater per person (litres) = [(a)/(b)]			

A24 The calculation detailed above in Table A5.2 is sufficient for evaluating the principles of the proposed system in the proposed development. However, for sizing of storage capacity and all other design and installation details, BS 8515 should be followed.

Rainwater demand calculations

A25 Where all WCs and/or washing machines are being supplied with rainwater, the consumption should be taken from Table A1 and entered into Table A5.5 to calculate the rainwater savings.

A26 Where rainwater is only being supplied to a proportion of fittings, such as just to one WC or washing machine, the proportion is calculated using Table A5.3 and A5.4. This rainwater demand can then be entered into Table A5.5 to calculate the rainwater savings.

Table A5.3 Rainwater demand calculations – WCs

(a)	(b)	(c)	(d)
Effective flushing volume (litres)	Number of fittings present	Quantity using rainwater	Rainwater demand = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total rainwater demand = Sum of (d)	
Average rainwater demand from WCs	= [(f)/(e)] × 4.42		

Table A5.4 Rainwater demand calculations – washing machines

(a)	(b)	(c)	(d)
Litres per kg	Number of fittings present	Quantity using rainwater	Rainwater demand = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total rainwater demand = Sum of (d)	
Average rainwater demand from washing machines		= [(f)/(e)] × 2.1	

Rainwater saving calculations

A27 Enter the total volume of rainwater collected per person per day from Table A5.1 or Table A5.2 depending on the BS 8515 approach followed. Enter the total consumption of fittings using rainwater (demand) from column 4 of Table A1, where rainwater is to be used in all WCs and/or washing machines. Where rainwater is only being used in a proportion of fittings, enter the total demand of WCs and washing machines from Table A5.3 and Table A5.4. This figure should then be entered into Table A1 to calculate the internal water consumption.

Table A5.5 Rainwater saving calculations for new dwellings

	Litres per person per day
(a) Rainwater collected	
(b) Rainwater demand	
(c) Rainwater savings* = [(a)/(b)] or (b)	

*where the amount collected (a) is greater than the demand (b), the rainwater savings (c) are equal to the demand (b)

Fittings approach

A28 The fittings approach given in G2 uses the methodology described in this appendix to calculate the water consumption of ranges of fittings that meet the performance targets.