

AN INDEPENDENT INFORMATION PAPER ON

THE WATER AND SEWERAGE SECTORS APPROACH TO DETERMINING WATER DEMAND



EXECUTIVE SUMMARY

WASC’S & WOC’S COMPARISONS OF WATER DEMAND FOR NEW DEVELOPMENT

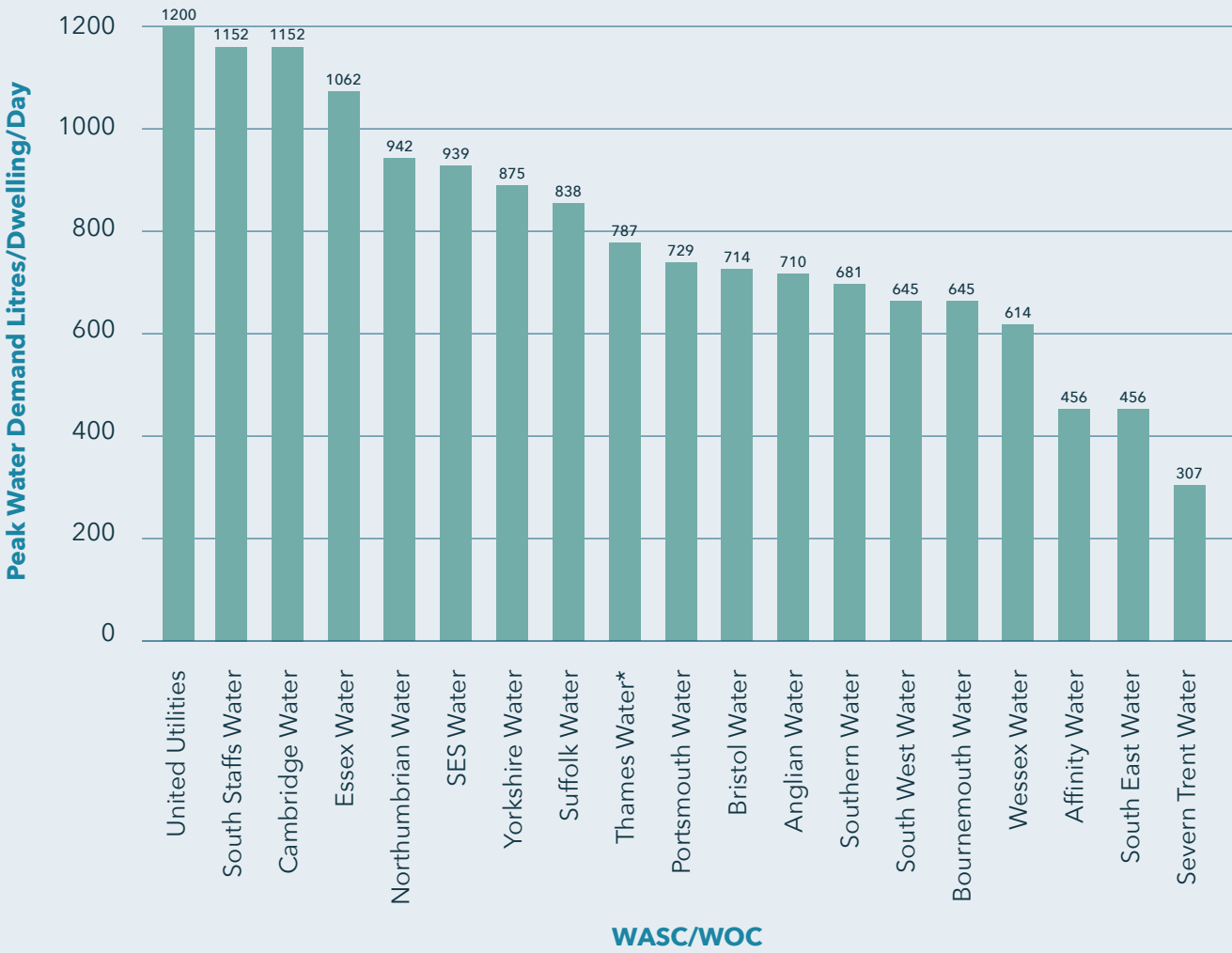
AN INDEPENDENT INFORMATION PAPER – JANUARY 2021

The criteria used by both Water Companies and Water and Sewerage Companies to determine the water demand of a new property remains of one of the most fundamentally important aspects of Water and Sewerage Legislation. Moreover, water demand is the foundation on which a range of charges House Builders and Developers have to pay for the provision of water and sewerage infrastructure provision for new homes are based.

On 1st January 2021 and for the first time in over thirty years since the Water and Sewerage Sector was privatised in 1989, each Company published their respective calculations for the water demand for a new property. The chart on page 3 crystallises the results for each Company – the degree of variation is staggering to the point of being of serious concern for all House Builders and Developers.



COMPARISONS OF WATER DEMAND PER PROPERTY



This Independent Information Paper looks at the consequences of this recent disclosure specific to water demand data, together with its far-reaching effect on a number of key areas – typically:

1. The significant effect it has on all forms of off-site network reinforcement, together with infrastructure charges and where a conservative estimate suggests there could be overpayments of £0.5 billion from House Builders and Developers.
2. Why are House Builders and Developers still hydraulically designing new foul sewers on new developments using 4,000 litres per property?
3. As a result of the 4,000 litres per property are new foul sewer pumping station requiring more storage than is hydraulically necessary?
4. Are water mains on new developments being oversized which results in lower income offsets/asset payments?

WASC'S & WOC'S COMPARISONS OF WATER DEMAND FOR NEW DEVELOPMENT

AN INDEPENDENT INFORMATION PAPER – JANUARY 2021

This Independent Information Paper is the product of a review of each Water and Sewerage Company's individual Design and Construction Specification (DCS) for adoptable water infrastructure and which came into force in England on 1st January 2021.

A generic DCS had been produced by a dedicated Project Steering Group constituted under the auspices of Water UK. As such, it was seen as being integral to the Water Asset 'Adoption Code', produced and introduced by Ofwat as part of a series of sectoral reforms that started in April 2018.

Preparation of both the Adoption Code and the DCS have not been without their underlying problems both from a technical and legal perspective. The time taken to resolve these difficulties has resulted in a significant delay. Originally intended to commence on 1st April 2020, compliance with the Adoption Code and its supporting guidance and documentation did not become a mandatory requirement until 1st January 2021 – a date when previously undisclosed but key information also became available.

The intention was for the DCS, as produced by the Water UK Steering Group, to be the generic document used by all Water Companies with little inter-company variation.

Whilst the Adoption Code, DCS and Model Adoption Agreement have more to do with the Self-lay provision of water infrastructure they nonetheless have wider repercussions for all House Builders and Developers.

Turning aside other important issues specific to the 'Code', inclusive of aspects associated with its supporting documentation, this Information Paper centres on the fundamentally important matter of how water demand for new residential development is determined and the consequences that distil from the approach taken by Water & Sewerage Companies.

Prior to January 2021, it had never been possible to complete any meaningful assessment of key aspects of the DCS, or its subsequent nineteen variants, until such time as Water Companies disclosed their own preferred version (i.e., 1st January 2021). For over thirty years, water demand information had never been readily available for scrutiny by House Builders, Developers or Consultants.

The starting point for determining all charges in relation to water main requisitioning, sewer requisitions and water and sewerage infrastructure charges is what the water demand per property will be for a new development. Moreover, the fundamental importance of this key criteria cannot be understated.



Its importance lies in the fact that to provide a water demand figure that is too high and therefore unrepresentative, would result in developers inappropriately and unnecessarily funding works which would provide non-consequential asset betterment for the incumbent Water and Sewerage Company. Likewise, it would constitute a means of subsidising existing customers bills, especially with regard to water and sewerage infrastructure charges paid by House Builders and Developers over the last thirty years.

Three principal considerations inform the water demand profile of a new residential dwelling, namely:

- 1. **Daily per capita consumption - Litres/person/day**
- 2. **Average household occupancy rates**
- 3. **The application of a Peak Flow Factor (Pff)**

There is a possible fourth consideration, namely, the inclusion of an allowance for leakage. In 2018/19 this stood at 130 litres/dwelling/day for metered properties, as confirmed in Water and Sewerage Company returns, and which have been disclosed to the Government's Public Accounts Committee. In other words, an equivalent water loss marginally in excess of the current, mandated Building Regulation water use requirement of 125 litres/person/day – see AD 'G'.

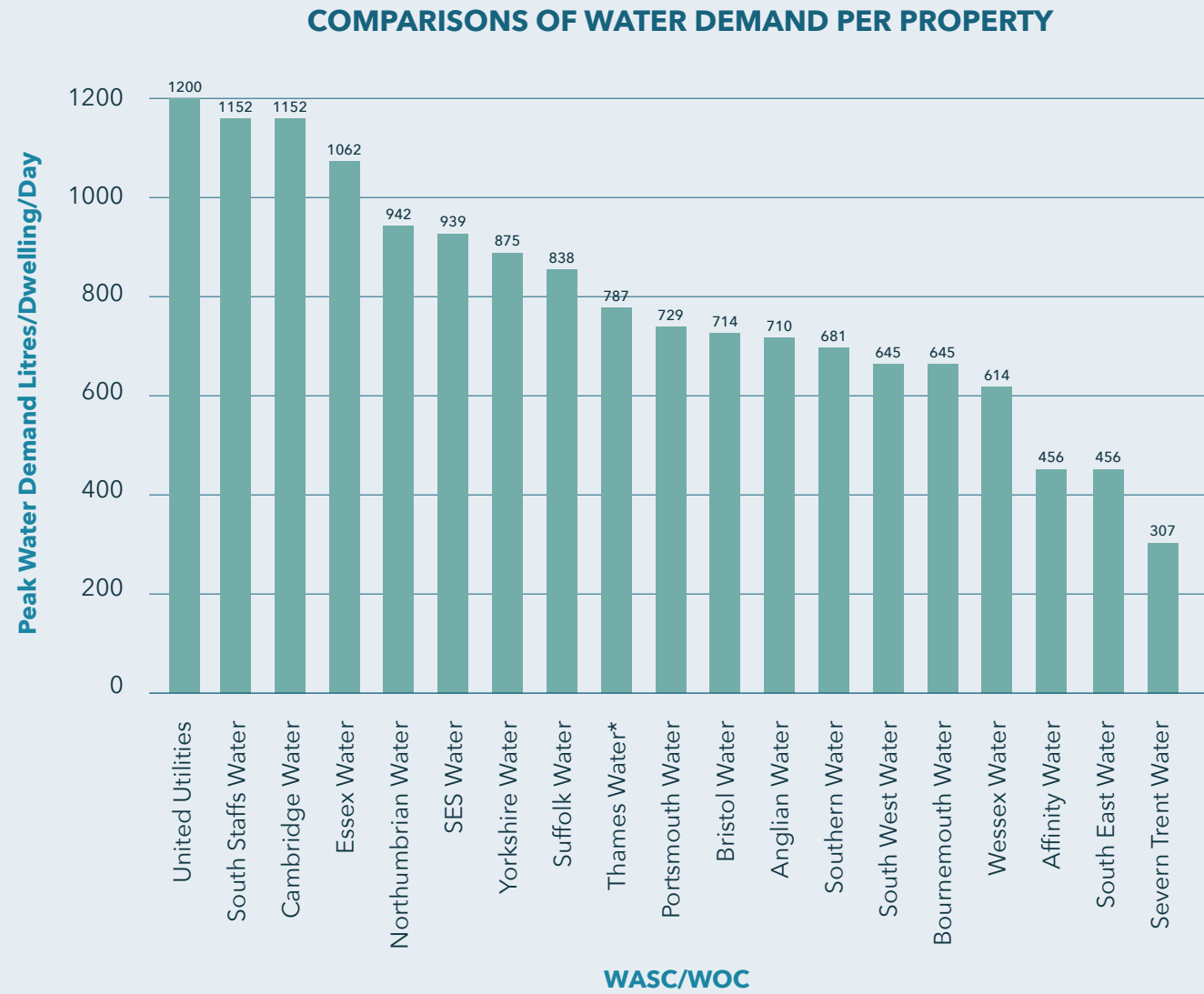
When these three components are multiplied together, it is possible to determine what each Company defines as the water demand for a new dwelling. Moreover, as 90% to 95% of all water supplied subsequently equates to the sewage discharge from a dwelling, water demand/usage forms the basis for determining foul sewage discharge for foul sewer hydraulic design purposes.

In addition, this calculated demand profile also influences if not determines a number of other key aspects/issues:

- a. **It is one of a number of influential input parameter(s) used for determining existing water and sewerage asset/network capacity, especially when undertaking network capacity hydraulic modelling.**
- b. **It will influence the size of all on-site water mains and therefore the basis for determining requisition charges.**
- c. **What off-site water main reinforcement is/may be required to be funded by water infrastructure charges.**
- d. **The size of on-site/off-site foul sewers and pumping stations, and in the latter case, the volume of wet well storage.**
- e. **Any off-site, 'in consequence' foul sewer network reinforcement that is needed and which is to be funded by sewerage requisition charges.**
- f. **The water and sewerage infrastructure charges payable for each additional new home connected to existing water and sewerage infrastructure.**
- g. **The calculation of any bonding provision based on the cost of the infrastructure provided.**

As stated previously, for over thirty years, it has not been possible to obtain comparisons of associated data from Water and Sewerage Companies. To a certain extent, it has been a closely guarded secret, that is, until 1st January 2021, when as a consequence of the Water Act 2014, and the resultant requirement for Ofwat to produce an all-encompassing Code for Water Asset Adoption, resulted in each Company having to disclose this information.

Having abstracted the data from all nineteen versions of the DCS, it has been possible to undertake a comparison of how water demand for new residential development is being determined. What has come to light is a staggering variation in Company assessed demand profiles, as can be seen in the bar chart below.



Each value has been derived from three key elements, which in themselves have vast variations. These variations are readily identifiable in a more detailed schedule included as part of this Information Paper. That said, there is some value in highlighting the significant range/variation that occurs – see below:

- **Total daily water demand per property ranges from 307 litres to 1,200 litres**
- **Average demand per capita varies from 122 litres to 160 litres - (AD 'G' of the Building Regulations stipulates a maximum per capita usage of 125 litres/person/day but this has largely been ignored by all but two Water & Sewerage Companies, in addition to Water UK when creating a generic DCS)**
- **Average household occupancy rates of 2.04 to 2.68 persons/dwelling - (MHCLG data confirms an average occupancy between 2.15 and 2.20 persons per dwelling)**
- **The application of Peak Flow Factors ranging from 1.2 to 3 (A UKWIR Report issued in 2006 identified an average peaking factor of 1.37 for the period 2017 to 2029. This was accompanied by a statement that progressive metering penetration should result in lower peak flow factors being applied)**

(Chart 1 – Water Company Determined Water Demand for New Dwellings)

Against this background no Water & Sewerage Company has provided any justification and/or evidence-based verification for any of the criteria they have used. In many instances, it can be shown to contradict information previously published and/or disclosed to Ofwat.

For example, and just in relation to the peak flow factors currently being applied, earlier comments made by Water & Sewerage Companies have stated they have relied on established guidance, some dating back to 1992. However, based on this very same guidance, a peak flow factor of 1.75 to 2.0 is perhaps more representative for new residential development.

In addition, compulsory water metering in all new homes was imposed in 1990 - cumulatively, around 5.5 million homes are benefiting from this initiative and are providing real time water use data.

The qualitative and quantitative aspects associated with water metering means that this must be a material consideration when considering an appropriate peak flow factor. The UKWIR Report of 2006 and referred to earlier, made it

quite clear that increased water meter penetration would justify a continued reduction in peak flow factors, (e.g., in 2017, a value of 1.39 reducing to 1.36 in 2029, as advocated by UKWIR).

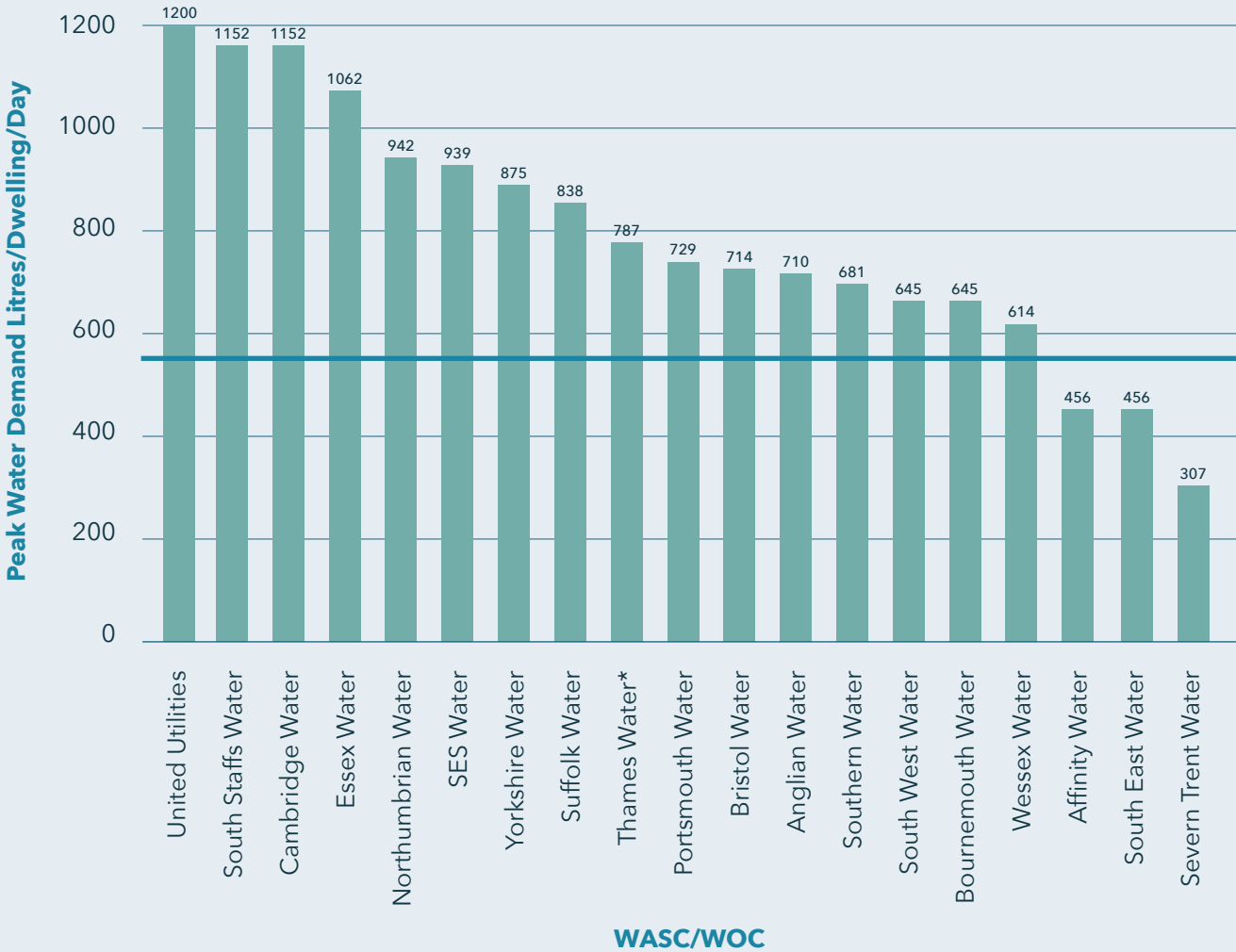
With over 55% water meter penetration confirmed by Water Companies in 2018/19, and with a rising trend, inclusive of ‘smart metering’, a corresponding reduction in peak flow factor would appear fully justified. **Therefore, what justification supports the application of a Peak Flow Factor of ‘3’?**

Relying on the factual evidence contained in this Information Paper, and applying established and accepted design guidance and/or practice relating to water supply infrastructure, a more representative and logical assessment of what would be a reasonable (and still conservative) total peak water demand per property would be in the region of **550 litres/dwelling** - see calculation below:

- 125 litres/p/d (AD ‘G’ - B Regs) x 2.2 (MHCLG household occupancy data) x 2.0 (A peak flow factor informed by the 2006 UKWIR Report and established design guidance).



COMPARISONS OF WATER DEMAND PER PROPERTY



As the chart identifies only three out of nineteen Companies are below this figure, with Severn Trent Water perhaps being the exemplar Company. Therefore, sixteen Companies can be considered to be overestimating the total daily water demand for a new dwelling. The consequences of this are far reaching for House Builders and Developers but why is this the case?

As previously identified, at least seven principal Water & Sewerage Company charges are either influenced or derived from Company assessed water demand criteria. Moreover, in terms of foul sewer design, there is a serious disconnect when one considers the hydraulic design requirements defined in the Design and Construction Guidance (DCG - Adoptable Sewerage Infrastructure) produced by Water UK as and when compared to actual water demand/usage.

Past editions of Sewers for Adoption and the more recently published DCG for on-site foul sewers impose a total discharge of **4,000 litres/dwelling** for hydraulic design purposes. There is an alternative approach using the hydraulic design methodology advocated in BS EN 16933-2, but this still over-compensates. That said, the BS EN in question refers to the importance of actual water use as a key component of foul sewer hydraulic design.

At a time when potable water consumption is reducing, due primarily to increased and enhanced metering, together with initiatives that are in place to introduce improved climate change asset ‘resilience’, what is the justification for continuing with outdated hydraulic design standards for adoptable foul sewers? Likewise, water use/discharge volumes that remain highly questionable, if not unrepresentative when modelling the hydraulic capacity of existing public foul sewers.

Potentially, one of the most serious outcomes stemming from the Water & Sewerage Sector's identified approach to water demand assessment is how off-site requisitioned foul sewers have and continue to be designed and costed. Similarly, the likely impact of new development on existing public foul sewer networks using overly conservative, misaligned, and unrepresentative data. Likewise, the extent to which hydraulic modelling, using these values, has been skewed so as present an erroneous picture of reduced sewer capacity to bolster the network reinforcement element of the sewerage infrastructure charge.

Moreover, this applies equally to requisitioned water infrastructure. On both counts it has a significant impact on infrastructure construction cost. It could also mean that House Builders and Developers are actually funding asset betterment that favours Water & Sewerage Sector commercial interests, whilst subsidising existing customers.

Historically, we know that up to 31st March 2018, Ofwat did not reconcile infrastructure charge income against in-consequence infrastructure expenditure. **Following this latest evidence-based evaluation, it now appears that the total/peak water demand per property may well have been dramatically overestimated by the majority of Water and Sewerage Companies - a practice that appears to be continuing. It also has the propensity to seriously undermine**

fairness in charges/costs and therefore the overarching principle of cost-reflectivity.

The principle of infrastructure charges is one which seems fair and reasonable however their application appears to have evolved into a mechanism of discretely obtaining betterment. More importantly, it now raises serious questions as to whether House Builders have previously paid for unnecessary network reinforcement that has not been in direct consequence of their development. Likewise, is this a practice that is continuing given a lack of evidence underpinning infrastructure charges in general? In terms of assessing the quantum associated with the overpayments by House Builders and Developers, this is not so easy to determine but crude estimates taken across all Water & Sewerage Companies, together with the evidence gained to date, put this cumulative figure in the region of £0.5 billion.

The most alarming aspect is that unless Defra, or Ofwat, take a serious look at the data provided in this Information Paper, and how it is being applied by each Water & Sewerage Company, fairness and transparency within the sector will remain unfulfilled objectives. Moreover, if no steps are taken to delve into the detail, the objectives of creating trust and confidence will also remain unfulfilled.



WATER DCG SECTION 10.4

DOMESTIC HYDRAULIC DEMAND CALCULATIONS FOR WATER & SEWERAGE COMPANIES

Company	Average demand Per Capita (X)	Average Household Occupancy Rate (X)	Peak Flow Factor (Z)	Total Demand per property per day
Anglian Water	143	2.3	2.16	710
Southern Water	125	2.4	2.27	681
United Utilities	160	2.5	3	1200
South West	127.5	2.2	2.3	645
Wessex	130	2.1	2.25	614
Yorkshire	140	2.5	2.5	875
Northumbrian	144	2.18	3	942
Seven Trent	122	2.1	1.2	307
Thames Water	152	2.3	2.25	787

DOMESTIC HYDRAULIC DEMAND CALCULATIONS FOR WATER ONLY COMPANIES

Company	Average demand Per Capita (x)	Average Household Occupancy Rate (x)	Peak Flow Factor (Z)	Total Demand per property per day
South Staffs & Cambridge	160	2.4	3	1152
Essex	156	2.27	3	1062
SES	143	2.68	2.45	939
Portsmouth	135	2.4	2.25	729
Bristol	125	2.4	2.38	714
Affinity	152	2.4	1.25	456
South East	152	2.4	1.25	456
Suffolk	137	2.04	3	838
Bournemouth	127.5	2.2	2.3	645



Water Company	Water Demand L/D/D	Daily PCC L/P/D (WaSC/ WoC Applied)	Household Occupancy (Persons)	Peak Flow Factor (As Applied by WaSC/WoC)	Water Demand Litres/Day/ Dwelling	WaSC/WoC Actual Measured Usage (L/P/D) 2018/2019		Difference In Daily L/P/D	Current Building Regulations Water Use - L/P/D	2018/19 WaSC/ WoC Disclosed Actual Leakage (L/Dwelling)	% Leakage of WaSC/WoC Demand	Calculated Water Demand Based on Current Building Regs (c)	Difference in Demand	Difference in Demand as a %
	(d) x (e) x (f)	(d)	(e)	(f)	(a)					(b)	(b) ÷ (a) x 100%	(c)	(c- a)	
United Utilities	1200	160	2.5	3	1200	126		34	125	136	11	938	-263	22
South Staffs Water	1152	160	2.4	3	1152	128		32	125	119	10	900	-252	22
Cambridge Water	1152	160	2.4	3	1152	133		27	125	91	8	900	-252	22
Essex Water	1062	156	2.27	3	1062	157		-1	125	79	7	851	-211	20
Northumbrian Water	942	144	2.18	3	942	143		1	125	112	12	818	-124	13
SES Water	939	143	2.68	2.45	939	140		3	125	83	9	821	-118	13
Yorkshire Water	875	140	2.5	2.5	875	112		28	125	125	14	781	-94	11
Suffolk Water	838	137	2.04	3	838	157		-20	125	79	9	765	-73	9
Thames Water*	787	152	2.3	2.25	787	126		26	125	178	23	647	-140	18
Portsmouth Water	729	135	2.4	2.25	729	128		7	125	87	12	675	-54	7
Bristol Water	714	125	2.4	2.38	714	133		-8	125	77	11	714	0	0
Anglian Water	710	143	2.3	2.16	710	126		17	125	86	12	621	-89	13
Southern Water	681	125	2.4	2.27	681	124		1	125	91	13	681	0	0
South West Water	645	127.5	2.2	2.3	645	140		-12.5	125	101	16	633	-13	2
Bournemouth Water	645	127.5	2.2	2.3	645	144		-16.5	125	88	14	633	-13	2
Wessex Water	614	130	2.1	2.25	614	138		-8	125	107	17	591	-24	4
Affinity Water	456	152	2.4	1.25	456	136		16	125	130	29	375	-81	18
South East Water	456	152	2.4	1.25	456	141		11	125	85	19	375	-81	18
Severn Trent Water	307	122	2.1	1.2	307	117		5	125	117	38	315	8	-2

Notes & Comments

- * Thames Water provide a range of peak flow values - the value for a 150 dwelling development has been chosen for this evidential analysis
1.

Diversity in Company demand assessment is both significant and lacking in consistency (For example, UU is 4 times that of Severn Trent and with no explanation).
2.

There is no recognition of current water usage compliance as imposed through the Building Regulations, i.e., 125 litres/person/day
3.

MHCLG Household Occupancy data confirms an average occupancy of circa 2.15 persons/dwelling - 2.2 would therefore be an appropriate value in ant demand calculation
4.

Peak Flow factors above 2.5 do not apply in assessing water demand from new residential development - see Tworts “Water Supply” (Ratnayaka, Brant, & Johnson) A PFF of ‘2’ would be more representative.
5.

It is clear that excessive levels of leakage are being factored into the demand calculation - What night-time DMA data is available to justify incorporating such a high level in the demand calculation?
6.

Relying on the guidance advocated in Tworts “Water Supply”, i.e., a Pff of 2.0, MHCLG house occupancy data and compliance with Building Regulations, a more representative demand calculation results:
Demand = 125 x 2.20 x 2 = 550 litres/dwelling/day
7.

Water demand as calculated by each WaSC/WoC will be a derivative of the Water IC, especially the network reinforcement component - with such variation and inconsistency clearly evident
8.

WaSC/WoC water demand identified at column (a) will also be a component of costs for water supply infrastructure and off-site sewer requisitions - it therefore brings into question whether these costs,
9.

Hartlepool Water have been omitted from this analysis as their impact is too marginal to be of significance

130

9.1

Ave Leakage/
Dwelling From
Company
Measured Water
Supply

This Report is the product of research conducted by W A Consultancy and Technical Development Services. It relies on information disclosed under the Freedom of Information Act in addition to evidence that exists in the public domain. It is further informed by the outcome of related discussions over the last four years involving Defra, Ofwat, CCWater, Water UK, individual Water and Sewerage Companies, and Developers/House Builders.

This is not an official publication. The views expressed in this Report are those of respective authors, several peer group Consultants and Developer Clients.



Technical & Development
Services Holdings Ltd.
West End House,
60 Oxford Street,
Wellingborough,
Northants,
NN8 4JJ

Tel: 01933 423720
Mob: 07939 595778
Email: enquiries@t-d-s.com
Web: www.t-d-s.com



Stephen Wielebski
Principal Partner & Consultant
WA Consultancy Limited
3 Carmarthen Close
Callands
Warrington
Cheshire
WA5 9UT

Email: sew@waconsultancy.co.uk
Company Reg: 626981