C5

Cost and Efficiency

BRISTOL WATER

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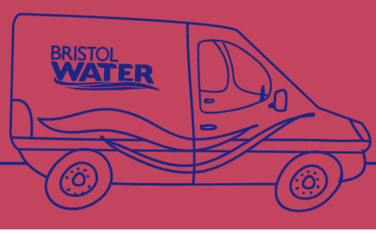

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1 EXECUTIVE SUMMARY

1.1 Summary of costs and efficiency

The total cost of delivering our plan for 2020-25 is £503m (this is 4% below expenditure in the period 2015-20) with the objective of delivering an ambitious plan for services at a cost affordable to customers which we believe represents an efficient position, within the upper quartile of the industry. Our customer research tells us that value for money is a key priority for our customers, particularly those in vulnerable circumstances[1]. Our draft business plan consultation[2], in particular, told us that customers expected us to deliver improvements in service as efficiently as possible, driving us to make efficiency central to our business plan. In order to deliver better outcomes at lower cost, we have taken a "Total Expenditure" (Totex) approach to planning our activities, resulting in a shift from capital intensive solutions to a focus on day-to-day operations. Capital expenditure is therefore c15% lower (c£32m) and operating expenditure c3% higher (c£10m) than for 2015-2020[3].

Delivering the plan will be challenging. Our past performance tells us that our capabilities need to improve quickly to provide confidence to all of our stakeholders on delivery in the short and long- term. We are therefore building on the significant efficiency improvements we have made since 2015, through a wide ranging transformation programme. This involves improving our operational performance, our asset management capability, our use of technology, and the way we collaborate with our supply chain and other partners. We are confident that this transformation will deliver our promises to our customers.

Our plan reflects the cost of delivering service improvements and fairly reflects the cost of the resources needed to deliver resilient services. Our efficiency assumptions also reflect that there are no major one-off capital interventions in our plan, as in 2018we have completed the most significant component of our resilience investment for AMP6, and our water resource plan can be delivered through demand management and leakage reduction. As our transformation programme is already underway, we can assume an initial efficiency saving at the start of AMP7, rather than a higher ongoing frontier shift efficiency assumption.

Our performance in the current period provides us with confidence that our plan to 2025 and beyond strikes the right balance in reducing bills overall, by ensuring our efficiency targets outweigh the cost pressures and the cost of service improvements. Bristol Water has delivered a step change reduction in the cost of its operations since 2015/16. This has been delivered through re-shaping both what we are aiming to deliver, and how we deliver it. We describe in the section on 'Our Efficiency Plans' how we will deliver further reductions in the cost while still delivering improvements to the service levels we provide.

This chapter also sets out how we intend to deliver our plans, the major investments that we plan to make, the limited nature of these and how our plan is dominated by on-going maintenance and operating costs, which will increase the presence of our customer-facing field-based operational staff.

In this Section we describe our costs and efficiencies in detail, including the evidence of our current efficiency position. We approached the development of the costs for our plan in two ways.

We looked "top-down" at the industry evidence for our efficiency position relative to others, at external forecasts of both input price pressures, and how the industry frontier of efficiency may change in the future.

We also considered cost needs and efficiency "bottom-up". This considered the business need for investment, driven by risk assessment with internal and external validation, to forecast the cost of the investment activities that make up our plan.

[1] A1: Customer Dashboard; B13: Customers in Vulnerable Circumstances Research
[2] B30: Draft Business Plan Consultation – Overall Consultation Report
[3] In 2017/18 CPIH prices

Operating costs include the whole life cost-benefit of the investment programme, in addition to a detailed review of our potential to make further efficiencies.

We discuss our approach to the transformation program, which informed the judgements the board considered in setting efficiency targets for a plan to deliver customer outcomes at a cost customers prefer. This considered both the top-down estimates of our efficiency position and our bottom up estimates of what the individual investments and initiative costings were expected to deliver.

We used both top-down and bottom-up estimates of efficiency to inform our business plan. We considered our actual costs against what the efficiency models available to us appeared to suggest in developing our cost adjustment claims. We have updated the claims since our early submission, for further work that we clarified we were undertaking to ensure the claims were consistent with the final assumptions in our evidence, and 2017/18 actual expenditure information. We have withdrawn our claim for the costs of traffic congestion as it does not meet the materiality threshold.

Total expenditure at £503.1m is forecast to be 6.3% below our PR14 CMA redetermination. Capital expenditure is 18% lower (£41.2m) and operating expenditure 2.4% higher (£7.4m), in 2017/18 CPIH prices.

		AMP6	AMP 7 - Appointee - Actual Spend						AMP6 Redetermination
Price Base 17/18 CPIH post efficiency	Unit	2015-20	2020-21	2021-22	2022-23	2023-24	2024-25	2020-25	2015-20
Wholesale Opex	£m	**258.7**	54.6	54.6	55.0	55.4	56.0	**275.6**	**260.2**
Maintaining asset capability ~ infra	£m	**68.4**	12.7	12.8	12.9	12.8	12.3	**63.5**	**57.9**
Maintaining asset capability ~ non-infra	£m	**66.0**	14.2	14.3	14.3	14.9	15.8	**73.5**	**64.2**
Enhancement Capex	£m	**99.1**	12.3	11.5	11.9	11.4	11.4	**58.5**	**130.6**
Grants and Contributions	£m	**(20.0)**	(2.8)	(2.7)	(2.8)	(2.8)	(2.9)	**(13.9)**	**(30.8)**
Wholesale Totex	£m	**472.2**	**91.0**	**90.6**	**91.4**	**91.6**	**92.7**	**457.2**	**482.1**
Retail Opex	£m	**50.3**	8.6	8.8	8.8	8.9	8.8	**44.0**	**52.1**
Retail Capex	£m	**2.5**	1.2	0.2	0.2	0.2	0.2	**1.9**	**2.8**
Totex	£m	**525.0**	**100.8**	**99.5**	**100.4**	**100.7**	**101.7**	**503.1**	**537.0**
Opex	£m	**308.9**	**63.2**	**63.4**	**63.8**	**64.3**	**64.9**	**319.6**	**312.2**
Capex	£m	**216.1**	**37.6**	**36.2**	**36.6**	**36.4**	**36.8**	**183.5**	**224.7**

Table 1-1 - Cost summary. Source: Bristol Water

The cost risks and opportunities are balanced at our proposed level of expenditure, after mitigating the risk associated with the cost of payments to the Canal and River Trust, with a central totex range of +2.3% outperformance to -2.4% underperformance of RORE. This level of cost is consistent with our detailed delivery plan, and we will have to deliver further efficiencies, particularly for opex, as cost risks emerge. Our performance in this period suggests our plan strikes the right balance in the context of reducing bills overall and we expect our costs to be efficient overall despite the increase in operating costs we forecast.

For wholesale capex our plan absorbs all of our forecast input price pressure above CPIH with a 0.9% p.a. frontier shift[4] as well as an 8.8% initial cost reduction. For residential retail, we include a 6.6% initial efficiency targeted at reducing bad debt and c.0.4% p.a. frontier shift[5], after input price pressure of c.2% p.a.[6]. Overall, the net cost increase is c.0.4% p.a., effectively a frontier shift of 1.6% p.a. when compared to CPIH inflation. For wholesale opex cost, input price pressure of 1.8% above CPIH[7] is offset by 0.7% p.a. frontier shift[8] of efficiency, as well as a 3.2% initial efficiency reduction. These figures are set out in Table 1-2. In all cases, in order to reduce customer bills quicker, we have assumed an immediate step change in efficiency from the start of the period followed by a smaller year on year frontier shift.

Our plan reflects the cost of delivering service improvements and fairly reflects the cost of the resources needed to deliver resilient services. Our efficiency targets also reflects that there are no major base or enhancement one-off capital

[4] NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. iii
[5] Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.9
[6] Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.11
[7] NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. iii
[8] NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. iv

interventions in our plan, as we have completed the most significant component of our resilience investment and our water resource plan can be delivered through demand management and leakage reduction. The transformation programme means we assume cost reduction at the start of AMP7, rather than a higher frontier shift efficiency assumption that may apply to the industry as a whole. We summarise the efficiency assumptions in Table 1-2 below:

	Initial efficiency from 2020	Efficiency p.a. after 2020 (Frontier shift)	Overall per annum 2020-25 "efficiency shift"	£m efficiencies	Annual real price effects above CPIH (except retail)
Wholesale water opex	-3.2%	-0.7%	-1.2%	£22m	1.8%
Wholesale water capex	-8.8%	-0.9%	-2.5%	£26m	0.9%
Residential retail opex	-6.6%	-0.4%	-1.6%	£4m	2.0%
Residential retail capex	-0.3%	-0.3%	-0.3%	£0.02m	0.7%

Table 1-2 – Efficiency parameters. Source: Bristol Water based on analysis by NERA and Economic Insight[9]

Through our continued transformation we have challenged our current and likely future costs and have identified £52m of new cost efficiencies by 2025 (around 9%), with around 80% delivered from 2020.

Our wholesale efficiency position

We have focussed our estimate of the current efficiency position on base maintenance and operations costs (known as BOTEX). Most of our areas of enhancement investment are investigations, or improvements such as our supply resilience expenditure that are similar activities to our maintenance expenditure. Industry information on unit costs, where available, were used to support our costing of other enhancement investments such as the water quality schemes, and this formed the basis for DWI support for these schemes, prior to us considering programme level efficiency challenges. We do not propose any investments of the scale that would qualify for Direct Procurement.

The most recent econometric cost benchmarking for the industry[10] suggests that overall, for water wholesale costs Bristol Water is at the upper quartile of cost efficiency in the industry. This is based on considering our water wholesale cost position as a whole, which is appropriate for our plan as it reflects the integrated nature of wholesale services and the interdependency between water treatment and water resources costs in particular. Our planning approach considers costs and efficiency challenges as a whole, which is particularly appropriate as we are not considering major new water resource schemes and therefore expect the balance between our Network plus and Water Resources expenditure to remain similar to the current position.

[9] Wholesale water frontier shift assumptions: NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. iv. We have challenged ourselves to have a frontier shift efficiency greater than that set out by NERA (0.7%).
Wholesale water real price effect assumptions: NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. iii
Residential retail frontier shift assumptions: Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.19
Residential retail real price effect assumptions: Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.11 and 13

[10] Ofwat (2018) A consultation on econometric cost modelling

Our business plan is based on efficient costs for wholesale, our evidence for this is in part informed through analysis by NERA[11] of the cost models proposed by Ofwat in the PR19 cost modelling consultation. When analysing these models (using 2011/12-2016/17 data), the improvement in our cost efficiency over the time series can be seen, as shown in Figure 1-1 below. Looking at average costs over the period, we are above the upper quartile of industry efficiency.[12] Overall we are c2% lower (more efficient)[13] than the industry upper quartile on 2016/17 costs. Therefore our costs in 2016/17 have been used as the basis for our bottom-up consideration of our cost base, in particular for operating and maintenance costs.

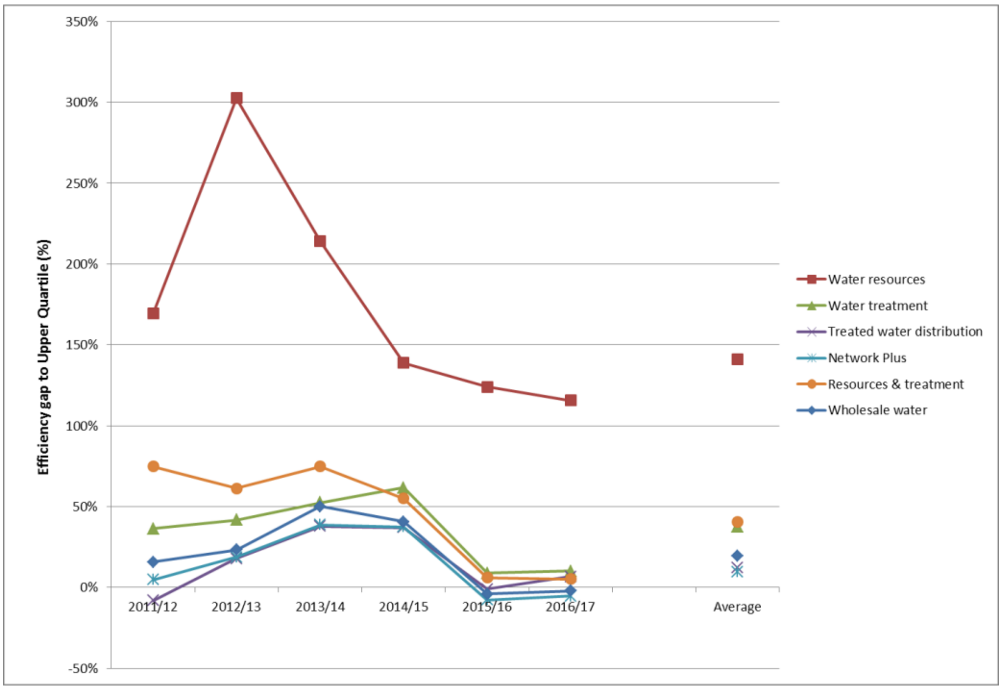

Figure 1-1 - Ofwat models: BRL wholesale efficiency gap to Upper Quartile (% of modelled costs). Source: Bristol Water, based on analysis by NERA (2018)[14]

We are an outlier compared to industry costs on water resources wholesale BOTEX. In our response to the Ofwat cost modelling consultation[15] we indicated that we are likely to remain an outlier on water resources expenditure, because of the costs we pay to the Canal & River Trust to abstract water from the Sharpness Canal, which provides 45% of our distribution input and c.60% of our deployable output. We propose that these costs could usefully be excluded from the cost modelling, or adjusted through our proposed cost adjustment claim.

We show below in Figure 1-2 the same graph of efficiency gaps with Water Resources removed. This illustrates the basis for our view that following the cost reductions implemented in 2015/16, our Wholesale water costs in 2016/17 are efficient.

[11] NERA (2018) Reproduction of Ofwat’s models published in the cost model consultation March 2018
[12] represented as 0% in the graph below, with a positive number representing higher costs
[13] NERA (2018) Reproduction of Ofwat's models published in the Cost Model Consultation March 2018
[14] Efficiency gap is the % of the efficient cost, not % of the actual costs. Therefore the percentage to reduce actual costs to the UQ is therefore (Efficiency gap / (1+ Efficiency gap)) i.e. 11% efficiency gap is a 10% cost reduction.
[15] Bristol Water (2018) Our response to the consultation on econometric cost modelling

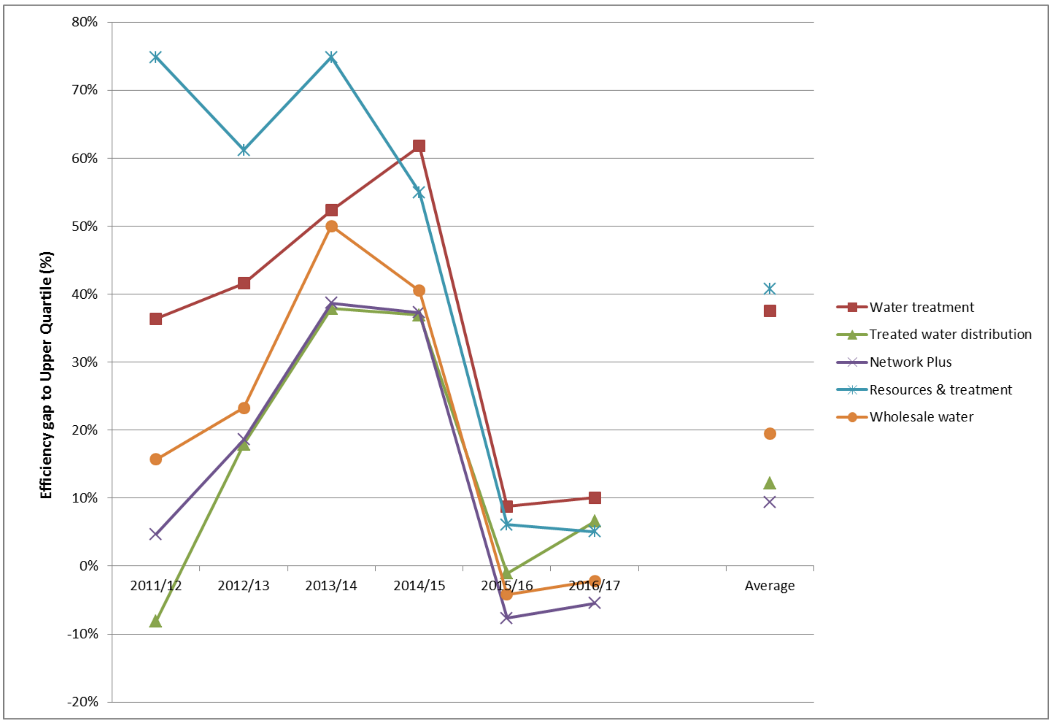

Figure 1-2 - Ofwat models: BRL wholesale efficiency gap to Upper Quartile - excluding Water Resources. Source: Bristol Water, based on analysis by NERA (2018)[16]

Our cost transformation from a position of being an outlier at PR14 has resulted from a transformation of operating performance and a move away from an "age-based" to "risk-based" approach to infrastructure maintenance. This has allowed a much more balanced set of outcomes and cost delivery appropriate for a totex framework. Accordingly, this change of approach means that cost expenditure before 2015, particularly on treated water distribution maintenance, has little relevance to the future investment programme. To a degree, additional mains replacements over 2011/12 - 2014/15 reflected a catch-up in investment on earlier periods and this volume of activity is not reflected in our future plans. Our network age and materials cost adjustment claim sets out this level of "atypical" historic expenditure[17]. Therefore we consider that our more recent efficiency modelling position is a better reflection of Bristol Water's relative efficiency than the average data over 2011/12 - 2016/17.

If we are assessed as more efficient than the upper quartile in Ofwat's cost assessment and our business plan costs are accepted as a package, our cost adjustment claims do not necessarily require consideration. Ultimately however, our need for our adjustment claims will depend on the specification and variables included in Ofwat's published PR19 models, which at the time of writing are unknown.

Our final cost adjustment claims are summarised in Table 1-3.

[16] Efficiency gap is the % of the efficient cost, not % of the actual costs. Therefore the percentage to reduce actual costs to the UQ is therefore (Efficiency gap / (1+ Efficiency gap)) i.e. 11% efficiency gap is a 10% cost reduction.
[17] C5.A – Cost Adjustment Claims

Cost adjustment claim	Price Control	Totex value over 2020/21-2024/25	Reason the claim is required
Payments to the Canal and River Trust	Wholesale Water Resources	+£9.420m	Payments to the Canal and River Trust for the purchase of water not made by other companies.
Water Treatment	Wholesale Water Network Plus	+£5.963m	Additional costs associated with operating a number of complex and costly treatment works.
Regional wages in the Bristol Water Supply Area	water wholesale network plus	+£0m - £8.716m	Additional costs associated with prevailing wages in the immediate area of Bristol being higher than in the South West. This claim depends on how Ofwat seeks to account for variations in wages in the cost assessment process.
Network Age and Materials	water wholesale network plus	+£12.282m	The age and associated material composition of our mains laid in certain historic cohorts requires higher levels of replacement and refurbishment.

Table 1-3 - Summary of PR19 cost adjustment claims. Source: C5A Technical Annex – Cost Adjustment Claims

We have not submitted any Residential Retail cost adjustment claims. This reflects our view that the PR19 Residential Retail econometric models will likely capture all factors relevant to our retail operations in the cost drivers selected[18]. We have also not submitted any enhancement cost adjustment claims. This is because we have not identified any large enhancement schemes within our capital investment programme that fulfil the cost adjustment claim criteria of being an atypically large investment.

Our submitted cost adjustment claims are well evidenced, efficient and challenging.

Our cost adjustment claims are well evidenced as can be demonstrated by our commitment to test econometric estimation approaches with bottom-up methods, test our shortlisted claims with our customers, undertake cross checks and iterative assessments of the evidence base against Ofwat's tests, utilise independent third-party expertise where their input added most value and going beyond regulatory requirements in terms of the level assurance this aspect of our plan has received. A number of claims were dismissed on the basis of the quantity and quality of the emerging evidence base.

Consistent with all cost forecasts presented in our business plan, our cost adjustment claims are demonstrably efficient and we have challenged ourselves to provide the same great service at lower cost. The claim valuations have been derived either using econometric methods, to which we are close to upper quartile efficient in the most recent years, or our latest available actual costs, which drive the upper quartile efficiency position identified by the econometric modelling. We are not relying on cost adjustment claims to meet the efficiency challenges we have set ourselves to deliver in AMP7 and this reflects that these costs are built into our day to day operational and maintenance activities, both now and in the future. Therefore the cost adjustment claims themselves do not form part of our strategy to bridge any efficiency gap identified directly per se and reinforces our view that if we are assessed to be more efficient than the upper quartile in Ofwat's cost assessment and our business plan costs are accepted, our claims do not require consideration.

As our response to the Ofwat cost modelling consultation in March 2018[19] identified, we prefer wholesale total cost modelling, as we think this is more robust than sub-service modelling. This reflects the integrated nature of wholesale services and the interdependency on water treatment with water resources costs in particular, and with the nature of water produced with the distribution network on the quality and reliability (and hence cost) of delivery to customers.

Triangulation of models

[18] We have not considered business retail cost adjustment claims as we have exited this market.
[19] Bristol Water (2018) Response to the Consultation on Econometric cost modelling, p.4

We have undertaken an extensive review of multiple different cost benchmarks in order to ascertain what we believe to be most applicable cost forecast. Our triangulated view is summarised in Table 1-4.

Our transformation has led to us to a much improved efficient cost base demonstrated in the financial year 2016/17 which we base our wholesale cost forecasts on; in particular for operating costs, the average efficiency over 2011/12 to 2016/17 provides the upper bound of the range of the upper quartile efficient position for Bristol Water.

	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[20]		
			Water Resources	Network Plus	Wholesale Water
Triangulated View	2011/12 to 2016/17	2014/15 to 2016/17	45%	12%	13%
	2011/12 to 2016/17	2016/17	20%	-2%	1%

Table 1-4 - Our Triangulated View of our Efficiency Gap to the Upper Quartile (%). Source: Bristol Water based on analysis by NERA (2018)[21]

Utilising triangulation of the figures set out above, we believe overall that an efficiency estimate of 1% for 2016-17 operating cost and c. 5 – 13% for capital costs (which, after cost adjustment claims are more likely to include an element of average expenditure) is appropriate as a top down assumption. We test this further against our bottom-up estimates of efficiency. This assumed range allowed us to test the basis of costs in our capital investment schemes, considered enhancement efficiency (given that much of our enhancement programme is similar in delivery nature to maintenance, or is environmental investigations) as well as allowing us to deliver as much efficiency early as part of our transformation and revised contracting arrangements.

Our retail efficiency position

Our residential retail costs benefit from our joint delivery of retail services with Wessex Water through Pelican Business Services, our Joint Venture billing company (formerly known as Bristol Wessex Billing Services Ltd, or BWBSL).

Our retail costs over AMP7 will be:

		Annual Retail						Annual Retail					
	Unit	2020-21	2021-22	2022-23	2023-24	2024-25	2020-25	2020-21	2021-22	2022-23	2023-24	2024-25	2020-25
		Notional Structure @ Nominal Values						Notional Structure @ 2017-18 FYA (CPIH deflated)					
Customer Services	£m	2.3	2.4	2.5	2.5	2.6	12.3	2.2	2.2	2.2	2.2	2.3	11.1
Debt Management	£m	0.5	0.6	0.6	0.6	0.6	2.9	0.5	0.5	0.5	0.5	0.5	2.6
Doubtful Debts	£m	2.7	2.8	2.8	2.9	3.0	14.2	2.6	2.6	2.6	2.6	2.6	12.9
Meter Reading	£m	0.4	0.4	0.4	0.4	0.4	2.0	0.3	0.4	0.4	0.4	0.4	1.8
Other operating expenditure	£m	2.7	2.7	2.8	2.8	2.8	13.8	2.5	2.5	2.5	2.5	2.5	12.5
Local authority and Cumulo rates	£m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Third party services	£m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total operating expenditure	£m	8.6	8.8	9.1	9.3	9.5	45.3	8.1	8.2	8.2	8.2	8.3	41.0
Recharge for Wholesale Assets	£m	0.5	0.7	0.7	0.7	0.7	3.3	0.5	0.6	0.6	0.6	0.6	3.0
Depreciation	£m	0.5	0.5	0.5	0.5	0.5	2.5	0.4	0.5	0.5	0.5	0.4	2.3
Retail Cost to Serve	£m	9.6	10.0	10.3	10.5	10.6	51.1	9.1	9.2	9.3	9.3	9.3	46.2
Allowable Retail Margin	£m	0.9	1.0	1.0	1.0	1.0	5.0	0.9	0.9	0.9	0.9	0.9	4.5
Allowed Revenue	£m	10.6	11.0	11.3	11.5	11.7	56.1	10.0	10.1	10.2	10.2	10.2	50.7
Total Operating Expenses & Recharges	£m	9.2	9.5	9.8	10.0	10.2	48.6	8.6	8.8	8.8	8.9	8.8	44.0
Total gross capital expenditure	£m	1.2	0.2	0.2	0.2	0.2	2.1	1.2	0.2	0.2	0.2	0.2	1.9
Total Expenditure Retail	£m	10.4	9.7	10.0	10.2	10.4	50.6	9.8	9.0	9.0	9.1	9.0	45.9

Table 1-5 – Retail cost summary. Source: Bristol Water

We show in the table above both nominal price retail inflation that is consistent with the business plan tables, as well as a deflated CPIH to 2017/18 prices that we show just for the purposes of describing the total appointee expenditure. The retail costs includes £3.7m efficiency and we have not made any cost adjustment claims. This leads to a real term reduction in cost per household:

[20] A negative (positive) gap indicates performance better (worse) than the Upper Quartile

[21] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p.48-50

	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Cost Per Household (nominal) £	18.65	18.95	19.97	16.95	17.19	17.42	17.66	17.91

Table 1-6 – Retail cost per household. Source: Bristol Water

We worked with Economic Insight to develop econometric models to understand our efficiency position. Economic insight identified a range for our efficiency position, depending on the model used, from 0% to 8.5%[22], and we adopted their central estimate of 5.4%[23]. In practice most of this efficiency applies to bad debt, and we are targeting a £2m saving over 2020-25 from an improvement in collection rates from 96.6% to 97.1%. The Ofwat efficiency modelling consultation also included a range of efficiency models, against which we reviewed our assumptions, and we have also carried out unit cost calculations. Overall, our costs set the frontier of efficiency for total retail costs and retail costs without bad debt, but depending on how deprivation is adjusted for there was a range of bad debt cost efficiency positions. As with wholesale costs, we believe that retail modelling should be on a whole business totex basis, rather than separating out individual cost elements. In particular, we do not think that bad debt and debt management modelling should be separate from the rest of the retail cost base (which for instance includes wider vulnerability and social tariff cost delivery). The latest unit costs for 2017/18 appear to confirm our retail efficiency position (based on the average basis used at PR14):

£/customer 2017/18	Bristol Water cost per customer	Industry average
Unmeasured: Debt & Debt management	£8.0	£9.0
Unmeasured: Other retail	£10.8	£12.8
Measured: Debt & Debt management	£6.3	£7.2
Measured: Meter reading	£1.2	£2.4
Measured: Other retail	£12.0	£15.5

Table 1-7 – Unit Cost comparison. Source: Bristol Water

Relative price effects

Our plan seeks to at least maintain our current industry leading position. In addition to this, for wholesale, NERA estimated for us a frontier shift for industry productivity of 0.6% for capex and 0.7% p.a. for opex[24]. The KPMG/Aqua work for Ofwat suggests a wider range for frontier shift of 0.4% - 1.2%[25]. We were not persuaded by the KPMG/Aqua analysis of a larger totex/outcomes frontier shift, although to a degree this challenge has been embedded in the bottom up efficiency estimates we describe earlier. Therefore we believe that our estimates for frontier shift are appropriate for adoption as targets in our plan.

With the advice of Economic Insight, we also set out an element of input price inflation on retail costs equivalent to 1.95% p.a.[26]. This is a gross input price pressure, which after frontier efficiency from current future innovations results in a net of 0.45% p.a. retail cost increase[27].

[22] Economic Insight (2018) Household Retail Cost Assessment for PR19, p.8
[23] Economic Insight (2018) Household Retail Cost Assessment for PR19, p.8
[24] NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. iv
[25] KPMG and Aqua (2017) PR19 - Innovation and Efficiency Gains from the TOTEX framework p. 19
[26] Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.11
[27] Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.11

Summary of cost changes

The table below explains our opex cost movements for wholesale water (excluding £3m principal use recharges from wholesale network plus to retail – average of £0.5m p.a. 2020-25).

Item	Total 2020-25	Comment
2017/18 base operating costs	£266.2m	Based on the c£53m in 2017/18 as the base year of expenditure, before considering atypical and efficiencies compared to 2016/17 modelling
Impact of investment plan	£0.2m	Little net change from new investments including whole life cost. Ongoing operating cost of new schemes from some enhancements offset by others that reduce costs
Accounting transfer for 2015-20 leakage	£3.5m	Active leakage control to meet 12% reduction in 2015-20 becomes opex from 2020
New connections	£3.0m	Wholesale cost of serving new properties connected from 2017 – 2025, which includes cost of more staff needed to respond to customer enquiries, and cost of production
Business retail costs	£3.5m	Transfer of developer services costs and overheads from business retail
Input price pressure	£25m	1.8% above CPIH
Efficiencies	(£22m)	1.2% p.a. average
Total	£279m	

Table 1-8 – Summary of Movements in Wholesale costs. Source: Bristol Water

Comparing our AMP6 forecast against our AMP7 post efficiency forecast, infrastructure maintenance reduces from £68m to £64m, which reflects the efficiencies net of the leakage accounting transfer noted above; non-infrastructure maintenance increases from £66m to £74m; and enhancement has decreased from £79m to £45m.

Retail costs stay broadly stable at £45m opex and £2.5m of depreciation (£2.0m of capex), with input price pressure (with no indexation) of £4m offset by bad debt efficiencies of £2m and other efficiencies of £2m.

	Total 2020-25
2016/17 base operating costs	£45m
Input price pressure	+£4m
Bad debt reduction	-£2m
Other efficiencies	-£2m
Total	£45m

Table 1-9 – Retail Costs. Source: Bristol Water

Retail capex of £1.9m reflects ongoing costs (e.g. for vehicles) of c.£0.2m p.a. and the completion of the investment in a new billing system with Pelican in 2020/21 (£1m).

Risks and Opportunities

We have assessed a number of different factors and parameters for consideration by Ofwat when reviewing our cost position which leads to a 80% confidence interval for a potential increase in annual totex costs of £11.9m or reduction of £11.2m. The risks and opportunities are explored in section C6 of our business plan in the risk and return and RORE scenarios section.

Of most note is a water resource cost risk that we cannot mitigate as it is substantially outside of our control. The Canal and River Trust is seeking an increase in the amount we are charged for the water supplied from the Gloucester & Sharpness Canal from c£1.8m p.a. to £10m p.a., based on a "market value of water"[28]. We will defend this cost challenge robustly through arbitration initially and also consider other steps to mitigate this cost risk to customers. Any change in charges will be backdated to 1 April 2018, which in our view for any price legitimately based on the cost of supply may after the arbitration and challenge process see a decrease from current levels. In this situation, we believe notified item protection is

[28] Bristol Water (2017) correspondence with the Canal and River Trust charity

in customers' interests and is necessary for financial viability. We propose a specified sharing rate of 75% customer and 25% company as our customer research (PAYG research[29]) tells us that customers prefer us to limit variability in their bills, and to smooth changes over time. The cost risk range shown above includes £1.3m p.a. risk related to Canal & River Trust payments, as this reflects the modelling assumption of 80% probability at the point that this notified item protection would be triggered. Research on sharing mechanisms (ICS and Accent acceptability research) related to lower borrowing costs told us that customers do expect us to share the benefits of lower costs with them, as well as accepting that protection is required for cost risks outside our control to maintain services for the long term (more information in C1 Phase 5: Refining and acceptability). We do not propose any wholesale network plus specific risk mitigations or any enhancement cost adjustment claims.

1.2 Document structure

This Section and the supporting appendices are structured as follows:

Section	Brief	Supporting Appendix
1 Executive Summary	*Over view of key messages and mapping to IAP tests*	-
2 Introduction	*Document Summary*	-
3 Wholesale Water	*Our water resources and network plus costs*	-
3.1 Cost Evidence	*Our modelling and cost forecast methodlogies and outcomes*	-
3.1.1 Efficiency Modelling	*How we've understood our efficient cost position*	20, 11, 21, 13, 12, 23
3.1.2 Opex	*How we've developed our opex costs*	19
3.1.3 Capex	*How we've developed our capex costs*	2, 5, 6, 7, 8, 9, 10
3.2.1 Building an Efficient and Challenging Plan	*Outlines our 'top down' and 'bottom up' efficiency challenges*	
3.2.1 Modelling assumptions	*The efficiency assumptions included in our models*	3, 15, 27
3.2.2 Cost adjustment claims	*The wholesale cost adjustment claims we have made*	1
3.2.3 Our Efficiency Plan	*Our plans to achieve efficiency targets, with supporting evidence in the appendices*	22
4 Residential Retail	*Our Residential Retail costs*	-
4.1 Modelling	*The modelling our efficient cost position*	25, 14
4.2 Cost Forecasts	*The development of our cost forecasts*	-
4.3 Cost Adjustment Claims	*Our approach to cost adjustment claims*	1
4.4 Ofwat Retail Efficency Modelling	*Comparison of Ofwat modelling*	26
4.5 Our Efficiency Plans	*Our plans to achieve efficiency targets, with supporting evidence in the appendices*	22
5 Risks and opportunities	*Points the reader to where we have covered risk & opportunity*	
6 Sources and Reference	*Appendices*	-

Figure 1-3 - C5 Structure

1.3 IAP Tests

We believe we have met Ofwat's tests for a high quality business plan as follows:

Test	High quality plan test	Evidence in this document	Relevant section
CE1	How well evidenced, efficient and challenging are the company's forecasts of wholesale water expenditure, including water resources costs	**"Evidenced":** 1) We have shown our understanding of our costs position: a) Our view on the efficient level for the wholesale costs position as a whole based on econometric modelling carried out by expert third parties and compared against the approach consulted on by Ofwat	1a – See section 3.1.1

[29] B19: Company Financing and Bill Impacts Deliberative Event

Test	High quality plan test	Evidence in this document	Relevant section
		b) How our costs have changed over time to meet the efficiency challenge of PR14 c) Our benchmarking against companies in other countries d) Our triangulation of multiple cost models e) The composition of our capital expenditure 2) We have shown the best practice methodologies by which our costs are developed (Note: Section C8 outlines how these costs are assured) **"Efficient & Challenging":** 3) Our proposed costs are challenging in that they require us to achieve and maintain an efficiency level at the upper quartile of the industry 4) We have articulated the multiple efficiency challenges we have applied to the development of our cost models 5) We have shared our views on the extensive changes and innovations we will need to pursue to achieve our targeted efficient cost position 6) We have demonstrated how our adoption of the totex and outcomes framework has enabled our cost reduction 7) We have analysed our proposed level of costs against a number of risk scenarios	1b – See section 3.2.1.1 1c – see section 3.2.1.2 1d – see section 3.2.2 1e – see section 3.1.3 2 – See section 3.1 3 – see section 3.1 4 – see section 3.2.1 5 – see section 3.2.3 6 – see section 3.2.1.1 See section 5
CE3	How well evidenced, efficient and challenging are the company's forecasts of retail expenditure, including bad debt costs?	**"Evidenced"** 1) We have shown our understanding of our costs position: a) Our view on the efficient level for the costs position based on econometric modelling carried out by expert third parties b) We have shown the best practice methodologies by which our costs are developed **"Efficient and Challenging"** 1) Our proposed costs are challenging in that they require us to achieve and maintain an efficiency level at the upper quartile of the industry	1a – See section 4.1 1b - See section 4.2 1 – See section 4.1

Test	High quality plan test	Evidence in this document	Relevant section
		2) We have shared our views on the extensive changes and innovations we will need to pursue to achieve our targeted efficient cost position 3) We hold a leading efficiency position in the industry except for our bad debt costs where we have targeted specific efficiencies and outlined them in this document	2 – See section 4.5 3 – See section 4.1
CE4	To what extent are cost adjustment claims used only where prudent and appropriate, and where they are used, are cost adjustments well evidenced, efficient and challenging?	This was demonstrated in our initial cost adjustment claim submission, with further information updated in this case. We carried out a thorough, detailed process in order to limit the number and value of the claims proposed. The evidence supporting these claims has been subject to external assurance both from an economic and technical perspective. We do not require any enhancement special cost factors, emphasising the integrated nature of our plan proposals. Offsetting adjustments have been fully considered. We have dropped the Bristol congestion case due to materiality and continue to believe that the regional wage case will not be required, subject to Ofwat confirming the approach taken to econometric modelling.	See section 3.2.2 and 4.3
CA6	How consistent, accurate and assured are the company's PR19 business plan tables, including the allocation of costs between business units, information on corporation tax, and the assurance and commentary provided?	The allocation of cost between business units is covered in this commentary. We specifically refer to the principal use allocation between wholesale and retail, as well as the reallocation of developer services costs to wholesale network plus. Allocation between business units for totex is considered in the investment cases.	See section 3.1.2, 3.1.3 and 4.2

Table 1-10 - Summary of Evidence against Ofwat's Initial Assessment of Business Plan Cost and Efficiency Tests. Source: Bristol Water

2 Introduction

We set out in this Section of our business plan how we have developed our forecast costs for the period 2020/21 to 2024/25 and how we have challenged our current and future levels of efficiency, together with a summary of the investment cases and efficiency plans that support our business plan.

In each sub-section we set out the efficiency factors across the whole business as well as the assessment for each business unit and accounting category individually. Overall, our costs are driven by an assessment in the round reflecting the inter-dependencies of business units to our final service delivery.

We continuously review the efficiency of our operations, and have implemented a series of efficiency and innovation measures in recent years to reshape our cost base. We share our plans of how we intend to meet our efficiency targets moving forwards.

This work includes detailed bottom-up cost benchmarking within the water industry, external process and overhead reviews involving expertise from other sectors, as well as a range of top-down efficiency models.

Time-series analysis for the period 2011/12 to 2017/18 shows that we have made a step change that makes significant inroads on our efficiency gap and ultimately means that historic data may have less relevance to our future costs. This has been important in the shaping of our forecast cost base.

We use this evidence to demonstrate why we believe our plan is efficient, as well as exposing areas of risk and where we need to innovate further, particularly where we have evidence of current gaps to resolve.

Our cost adjustment claims are presented in light of this analysis. Our cost adjustment claims have been developed based on our assessment of why our plan is efficient, taking into account risk management and option values on timing of service and resilience investment.

Our costs, innovations and proposed investments seek to make significant progress towards delivering our long term ambition as set out in 'Bristol Water… Clearly'[30].

[30] Bristol Water (2018) Bristol Water Clearly

3 Wholesale Water

3.1 Cost Evidence

3.1.1 Efficiency Modelling

Efficiency is about making the most of limited resources, delivering more for less and driving performance improvements without compromising quality of service. Ofwat assesses efficiency as a relative concept, comparing the cost projections in our business plan to the costs implied by their econometric efficiency models which benchmark us to all the other water companies in the industry.

Given the importance of efficiency benchmarking to the cost assessment process we have sought to undertake econometric modelling to gather knowledge on how efficient we are compared to other companies in the industry. This has enabled us to develop an evidence base to inform, relatively-speaking, what efficiency improvements are achievable in the next five years and what we have to do in terms of transforming our cost-base to get there. We have worked with leading experts in the industry over the last two years to evidence, define and refine such a view of catch-up and frontier-shift of efficiency in order to inform our cost forecasts for the period 2020/21 to 2024/25.

We have focussed our estimates of our relative efficiency position on our operational and base maintenance costs (known as botex). This reflects our view that econometric modelling of enhancement expenditure is neither desirable nor robust.

The following sub-sections provide a brief chronological overview of this evidence base as we have developed it over time and the findings we have reached in terms of using this evidence base to inform our cost projections, along the three main lines of enquiry as summarised by Figure 3-1.

Figure 3-1 – Our approach to using econometric models to inform our efficiency benchmarking evidence base (Source: Bristol Water)

As a result of this efficiency modelling we have reached the conclusion that on average over the period 2011/12 to 2016/17 we are relatively inefficient, but when we consider the more recent past (2015/16 and 2016/17) our efficiency position has improved to be at or beyond the upper quartile position, even before taking into account any cost adjustment claims. Assessment of this evidence base suggests that at an aggregate level we have embraced a step-change in our costs and have therefore become more efficient. Whilst in relative efficiency terms we remain an outlier in the water resource price control compared to other companies, this is largely attributable to our unique arrangement with the Canal and River Trust which secures c45% of our daily distribution input and therefore justifies our need for a cost adjustment claim for these costs to explain the gap.

Our own initial triangulated view suggests that we have a 1% efficiency gap to the upper quartile for 2016/17[31], but based on the Ofwat cost models this was estimated at 2% beyond the upper quartile[32]. However, we applied efficiency

[31] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p. ii
[32] NERA (2018) Reproduction of Ofwat's models published in the Cost Model Consultation March 2018

assumptions to both wholesale and retail based on our bottom-up expectations of what efficiencies we could deliver, and this has therefore informed our catch-up efficiency assumptions for our wholesale opex business plan projections. We have applied an 8% efficiency to our capex projections.

We have decided to take forwards our 2016/17 efficiency position to inform our business plan cost forecasts and this reflects our view that in terms of our operational response costs, 2017/18 was an outlier. However, we reviewed our 2017/18 costs carefully and then applied efficiency assumptions, based on our bottom-up assessment and with further stretch. We believe we have delivered a step-change in costs and efficiency in recent years, meaning that our historic costs are less relevant to informing our future expenditure profile.

3.1.1.1 Updating the PR14 Efficiency Models

We commenced our evidence building through updating the PR14 models as these set the regulatory framework governing our cost allowance at present (AMP6).

We have worked with economic consultants, Oxera and NERA, to update and refresh Ofwat's PR14 models and the CMA models developed as part of our PR14 re-determination. These updates are each discussed in turn in the following sub-sections.

3.1.1.1.1 Oxera's updates of the PR14 models

We worked with Oxera during 2016/17 to analyse the impact of updating the Ofwat and CMA PR14 models for new data published since the models were developed, in particular the data from 2013/14 – 2015/16 that companies submitted to Ofwat in August 2016. This provided an updated view on our relative efficiency position, utilising data up to and including 2015/16 through adopting one of the following time periods to inform this position:

- **Standalone approach -** 2013/14 to 2015/16 (three year view); or
- **Shifted approach** - 2011/12 to 2015/16 (to provide a five year view as used at PR14); or
- **Extended approach** - 2008/09 to 2015/16 (to provide an eight year view, making use of all the industry data available, including the whole time series used at PR14 as well as the more recent years).

A summary of the results is presented in Table 3-1.

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[33]		
				Water Resources	Network Plus	Wholesale Water
Oxera Reproduction of Ofwat's PR14 models	Refined Botex, RE and OLS	2008/09 to 2012/13	2008/09 to 2012/13	Not assessed	Not assessed	20%
Oxera Reproduction of Ofwat's PR14 models	Refined Botex, RE and OLS	2013/14 to 2015/16; 2008/09 to 2015/16; and 2011/12 to 2015/16	2015/16	Not assessed	Not assessed	-11% to 6%

[33] A negative (positive) gap indicates performance better (worse) than the Upper Quartile

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[33]		
				Water Resources	Network Plus	Wholesale Water
Oxera Reproduction of Ofwat's PR14 models	Refined Botex, RE and OLS	2013/14 to 2015/16; 2008/09 to 2015/16; and 2011/12 to 2015/16	2013/14 to 2015/16	Not assessed	Not assessed	28% to 36%
Oxera Reproduction of CMA models	Smoothed and unsmoothed, logged and linear unit cost models	2013/14 to 2015/16; 2008/09 to 2015/16; and 2011/12 to 2015/16	2013/14 to 2015/16	Not assessed	Not assessed	33% to 35%
Oxera Reproduction of CMA models	Smoothed and unsmoothed, logged and linear unit cost models	2013/14 to 2015/16; 2008/09 to 2015/16; and 2011/12 to 2015/16	2015/16	Not assessed	Not assessed	-2% to 1%

Table 3-1 - Summary of Econometric Modelling Results showing our efficiency gap to Upper Quartile. Source: Oxera (2017)[34]

Oxera's analysis concluded that reproduction of the Ofwat PR14 models for the latest available data inferred an efficiency gap to upper quartile in the range 28%-36%[35], the lower end informed by the standalone approach and the upper end informed by the extended approach (compared to 20% at PR14[36]). The analysis also revealed that if the assessed period was limited to 2015/16 alone, our relative efficiency position improved considerably, to between 6% (taking the extended approach) to -11% (i.e. better than upper quartile, taking the standalone approach).

Oxera also analysed the effects of using the more recent data in the modelling approaches applied by the CMA in its re-determination of our PR14 price review. This analysis produced a similar output, in that the longer assessment period 2013/14 -2015/16 produced efficiency gaps in the range 33-35%, but using 2015/16 alone showed gaps in the range +1 to -2%[37].

3.1.1.1.2 NERA's update of the PR14 models

Subsequently, we have also worked with NERA to reproduce and update the PR14 and CMA models in order to undertake sensitivity analysis of the effect on our relative efficiency position by including an additional year of data following publication of companies' 2016/17 wholesale cost data.

These updates also took account of changes to the industry structure to account for the merger of South West and Bournemouth Water, removal of the regional wage variable as data was not available for more recent years, and updating the classification of water sources in line with the definitions used in the 2016/17 cost assessment submissions.

[34] Oxera (2017) Preliminary view on Bristol Water's efficient level of BOTEX, p.13-15
[35] Oxera (2017) Preliminary view on Bristol Water's efficient level of BOTEX, p.13
[36] Oxera (2017) Preliminary view on Bristol Water's efficient level of BOTEX, p.13
[37] Oxera (2017) Preliminary view on Bristol Water's efficient level of BOTEX, p.14

A summary of the results is presented in Table 3-2.

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[38]		
				Water Resources	Network Plus	Wholesale Water
NERA reproduction of Ofwat's PR14 models	Refined Totex, RE and OLS	2011/12 to 2016/17	2011/12 to 2016/17	Not assessed	Not assessed	27% to 32%
NERA reproduction of Ofwat's PR14 models	Refined Botex, RE and OLS	2011/12 to 2016/17	2011/12 to 2016/17	Not assessed	Not assessed	26% to 30%
NERA reproduction of CMA's PR14 unsmoothed models	Unit cost, Logged and Linear	2011/12 to 2016/17	2011/12 to 2016/17	Not assessed	Not assessed	32%
NERA reproduction of CMA's PR14 smoothed models	Unit cost, Logged and Linear	2011/12 to 2016/17	2011/12 to 2016/17	Not assessed	Not assessed	25% to 27%

Table 3-2 - Summary of Econometric Modelling Results showing our efficiency gap to Upper Quartile. Source: NERA (2017) based on NERA's Updates to the PR14 Regulatory and Oxera's models[39]

The implied efficiency gap from NERA's reproduction of Ofwat's PR14 and the CMA's re-determination models are broadly comparable, although slightly lower than that implied by Oxera's analysis. NERA's reproduction of Ofwat's PR14 botex models over the period 2011/12 to 2016/17 implied an efficiency gap of 26% to 30% compared to Oxera's of 28% to 36%, albeit the latter relating to a slightly older and shorter time period. NERA's reproduction of the CMA models (smoothed 32%, unsmoothed 25% to 27%) is similarly broadly comparable to, although slightly lower than that implied by the CMA's analysis (33% to 35%), again the latter relating to a slightly older and shorter time period.

3.1.1.2 Developing our own candidate PR19 models

We have worked with our econometric consultants, Oxera and more recently NERA, to develop models within the PR19 framework to inform our developing view of relative efficiency and hence an appropriate level of catch-up efficiency to set ourselves to deliver over the period 2020/21 to 2024/25.

Each is discussed in turn.

3.1.1.2.1 Oxera's PR19 models developed for a sub-set of water companies

We have worked with Oxera to identify the most appropriate cost drivers to use within PR19 Botex modelling, in aggregate and when separated into Network+ and Water Resources. The development of these models was collectively commissioned by a group of water companies, including ourselves. As such the model development process was informed by the respective views of the participating companies and therefore the resulting variables included in the models do not unfavourably represent the operations driving costs in one particular company more than the industry as a whole. These models included variables as shown in Table 3-3, Table 3-4 and Table 3-5.

[38] A negative (positive) gap indicates performance better (worse) than the Upper Quartile
[39] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p.17 and 19

Oxera Aggregate Botex Models		1	2	3	4	5	6	7	8
Dependent variable		Log aggregate	Log cost / properties	Log aggregate	Log aggregate	Log aggregate	Log aggregate	Log aggregate	Log aggregate
Cost Drivers	Connected properties (log)	✓		✓	✓				✓
	Population (log)					✓			
	Distribution input (log)						✓		
	Water delivered (log)							✓	
	Proportion of water treated at level 3 treatment plants	✓	✓	✓	✓	✓	✓	✓	
	Proportion of water treated at level 2 treatment plants								✓
	Average pumping head (log)	✓	✓	✓	✓	✓	✓	✓	✓
	Proportion of mains laid before 1980	✓	✓	✓	✓	✓		✓	
	Raw water mains and conveyors/DI (log)	✓	✓			✓	✓	✓	✓
	Number of sources over distribution input (log)			✓					
	Proportion of distribution input from boreholes				✓				
	2015 year dummy	✓	✓	✓	✓	✓	✓	✓	✓
	2016 year dummy	✓	✓	✓	✓	✓	✓	✓	✓
	Constant	✓	✓	✓	✓	✓	✓	✓	✓

Table 3-3 - Oxera's Industry Study Aggregate Botex models. Source: Oxera (2017)[40]

[40] Oxera (2017) Industry Study Summary of Botex Modelling Results

Oxera Water Resources Botex Models		1	2	3	4
Dependent variable		Log aggregate	Log cost / properties	Log aggregate	Log aggregate
Cost Drivers	Connected properties (log)	✓		✓	✓
	Length of raw water mains and conveyors over DI (log)	✓	✓		
	Average pumping head, resources (log)	✓	✓	✓	✓
	Number of sources over distribution input (log)			✓	
	Proportion of distribution input from boreholes				✓
	2015 year dummy	✓	✓	✓	✓
	2016 year dummy	✓	✓	✓	✓
	Constant	✓	✓	✓	✓

Table 3-4 - Oxera's Industry Study Water Resource Botex Models. Source: Oxera (2017)[41]

[41] Oxera (2017) Industry Study Summary of Botex Modelling Results

Oxera Network+ Botex Models		1	2	3	4	5	6	7	8	9	10	11
Dependent variable		**Log aggregate**	**Log cost / properties**	**Log aggregate**	**Log aggregate**	**Log aggregate**	**Log aggregate**	**Log aggregate**	**Log aggregate**	**Log aggregate**	**Log aggregate**	**Log aggregate**
Cost Drivers	Connected properties (log)	✓		✓	✓	✓	✓	✓	✓			
	Population (log)									✓		
	Distribution input (log)										✓	
	Water delivered (log)											✓
	Proportion of water treated at level 3 treatment plants	✓	✓	✓	✓				✓	✓	✓	✓
	Proportion of water treated at level 2 treatment plants					✓						
	Average pumping head, network+ (log)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Proportion of mains laid before 1980	✓	✓	✓	✓	✓	✓	✓				
	Properties over mains (log)			✓					✓			
	Proportion of distribution input from boreholes						✓					
	Proportion of surface water treated							✓				
	Mains/connected properties (log)								✓			
	2015 year dummy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2016 year dummy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Constant	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 3-5 - Oxera's Industry Study Network+ Botex Models. Source: Oxera (2017)[42]

[42] Oxera (2017) Industry Study Summary of Botex Modelling Results

Using the Oxera models, the implied wholesale water efficiency gap over 2013/14 – 2015/16 is in the range 23% – 31%. However for 2015/16 in isolation our efficiency position is between -4 and 12% ahead of the upper quartile. A summary of the models developed by Oxera for us as part of the industry group is provided in Table 3-6.

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[43]		
				Water Resources	Network Plus	Wholesale Water
Oxera's PR19 Industry Models for Bristol Water	OLS aggregate and unit cost models	2013/14 to 2015/16	2013/14 to 2015/16	37% to 56%	20% to 29%	23% to 31%
Oxera's PR19 Industry Models for Bristol Water	OLS aggregate and unit cost models	2013/14 to 2015/16	2015/16	21% to 47%	-12% to -26%	-4% to -12%

Table 3-6 - Efficiency gap (% to Upper Quartile) implied by Oxera's PR19 models. Source: Oxera (2017)[44]

3.1.1.2.2 NERA's PR19 models developed for Bristol Water

We have also worked with NERA to develop PR19 models which provide an industry-level perspective of what robust models, consistent with the emerging PR19 framework, could look like. NERA also reproduced the Oxera models to include the 2016/17 wholesale cost data published by companies, which was not available at the time Oxera developed their PR19 models.

NERA's reproductions of Oxera's models are presented in Table 3-7.

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[45]		
				Water Resources	Network Plus	Wholesale Water
NERA reproduction of Oxera's PR19 Industry Study models for Bristol Water	Unit cost log models	2011/12 to 2016/17	2011/12 to 2016/17	103% to 111%	15% to 38%	23% to 44%

Table 3-7 - Efficiency gap to Upper Quartile based on NERA's Updates to Oxera's models. Source: NERA (2017)[46]

Comparison of the implied efficiency gaps across the original and updated models suggests that the models are not particularly robust to changes in the time-series data informing them. At a wholesale water level the implied efficiency gap was 23% to 31% using the short time period (Oxera's analysis), compared to 23% to 44% when using the longer time period (NERA's analysis). The variance in implied efficiency gaps of changing the time period is even more distinguished at a more granular level of water resources and network plus as a comparison of Table 3-6 and Table 3-7 demonstrates.

NERA's own view of an appropriate form of benchmarking models to apply at PR19 was based on use of a Monte Carlo tool to help identify the most important cost drivers, and expert judgement as to which to include. The Monte Carlo approach involved running 4000 regressions for each value chain element, and then screening the results against the following criteria:

- Regressions should pass the Ramsey RESET test at the 5% significance level
- Regressions should have an adjusted R-squared of at least 20%; and

[43] A negative (positive) gap indicates performance better (worse) than the Upper Quartile
[44] Oxera (2017) Preliminary view on Bristol Water's efficient level of BOTEX, p.15
[45] A negative (positive) gap indicates performance better (worse) than the Upper Quartile
[46] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p.21-22

- Coefficients for a small number of variables (specifically DI per property, water delivered per property, share of water treated at or above level 4 and level 5 water treatment complexity) should have the expected sign.

This statistical approach identified cost drivers that are beneficial to the industry as whole, in terms of explaining differences in costs across companies, not just for Bristol Water. In particular, it removes the reliance on judgements to determine which variables to include and exclude from models and therefore represents a more balanced, industry level perspective of what good models could look like.

NERA developed a suite of Water Resource, Network Plus and Aggregate Wholesale botex models using this approach. A summary of the key explanatory variables identified by the Monte Carlo analysis are set out in Figure 3-2.

Figure 3-2 - NERA Assessment of Candidate Explanatory Variables - Total Botex. Source: NERA (2017)[47]

The key methodological choices made by NERA in the development of their models focused on:

- **Level of Aggregation –** Based on value chain elements, specifically Aggregate (across all value chain elements), Water Resources, Network plus, Raw Water Transport, Water Treatment and Treated Water distribution. However, NERA found that developing robust econometric disaggregate models for Raw Water Transport and Water Treatment was difficult; for example many of the models did not pass the Ramsey RESET test and of those that did, often exhibited counter-intuitive coefficients. Modelling at this level of disaggregation was therefore discontinued.
- **Functional Form -** Logarithmic models (also known as Cobb-Douglas) have been used, rather than the translog model specification used by Ofwat at PR14 (which was subsequently criticised by the CMA). Using Cobb-Douglas is considered preferable as it better captures relationships between costs and drivers, and provides practical examples for use of small sample sizes and a number of independent cost drivers.
- **Unit or Aggregate Costs -** Use of unit cost models, rather than aggregate cost models. Unit cost models explain the variation in costs per connected property, while aggregate cost models explain variation in the level of costs. NERA considered that unit cost models are more appropriate because they reduce the challenges associated with multicollinearity between various explanatory variables that control for differences in companies' scale. This approach is in line with that taken by the CMA.
- **Smoothing Approach to Capital Maintenance Costs -** NERA chose to 'smooth' capital maintenance costs over the time series for modelling. This approach was found to produce more robust outcomes from statistical analysis of the models, particularly using the Ramsey RESET test.

[47] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p. 32

- **Controlling for Effects over Time -** Use of time dummy variables, to control for changes in cost conditions which affect all companies, for example due to movements in input prices. This approach was recommended by the CMA at PR14.
- **Estimation Technique -** Use of Ordinary Least Squares (OLS) to estimate model coefficients and compute efficiency gaps. This is the most commonly used approach in UK regulation and was recently used by Ofgem at the RIIO-ED1 price control as well as by the CMA in the Bristol Water redetermination. NERA mirrored the approach taken in these examples by using a pooled OLS method.

The resulting model specifications developed by NERA as a result of the Monte Carlo and above modelling selection process are set out in Table 3-8.

Dependent variable	Total Botex			Water Resources Botex			Network Plus Botex		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Ln(total botex per connected property aggregate)	**Ln(total botex per connected property aggregate)**	**Ln(total botex per connected property aggregate)**	**Ln(water resource botex per connected property resources)**	**Ln(water resource botex per connected property resources)**	**Ln(water resource botex per connected property resources)**	**Ln(network plus botex per connected property resources)**	**Ln(networ k plus botex per connected property resources)**	**Ln(networ k plus botex per connected property resources)**
Ln(DI/connected property)	✓	✓	✓				✓	✓	✓
Ln(length of mains/ connected property)	✓	✓	✓				✓	✓	✓
Ln(length of raw mains and conveyors/DI)	✓				✓	✓			
Share of water treated at level 5 and above	✓		✓				✓	✓	
Length of mains laid pre-1940/Total length of mains	✓	✓	✓				✓	✓	✓
Length of renewed and relined mains/Total length of mains	✓	✓	✓				✓	✓	✓
Ln(average pumping head aggregate)	✓	✓	✓						
Year15	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year16	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year17	✓	✓	✓	✓	✓	✓	✓	✓	✓
Surface water treated / Total water treated		✓							✓
Share of water from reservoirs		✓	✓	✓	✓	✓		✓	
Ln(number of sources / DI)		✓		✓	✓	✓			✓
Share of water from boreholes				✓	✓				
Ln(average pumping head resources)					✓	✓			
Ln(average pumping head network)								✓	
Constant	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 3-8- NERA's Total, Network plus and Water Resource Botex model specifications. Source: Bristol Water (2018)[48]

[48] Bristol Water's submission of NERA's models to the PR19 consultation on econometric cost modelling (2018)

NERA's modelling shows an efficiency gap to the upper quartile for Bristol Water of approximately 13% over 2013/14 – 2016/17[49], which reduces to less than 1% when 2016/17 is assessed in isolation as Table 3-9 and Figure 3-3 demonstrate. These results are based on combining the implied efficiency results from each of their water resource, network plus and wholesale water models through adopting the triangulation approach illustrated in Figure 3-4.

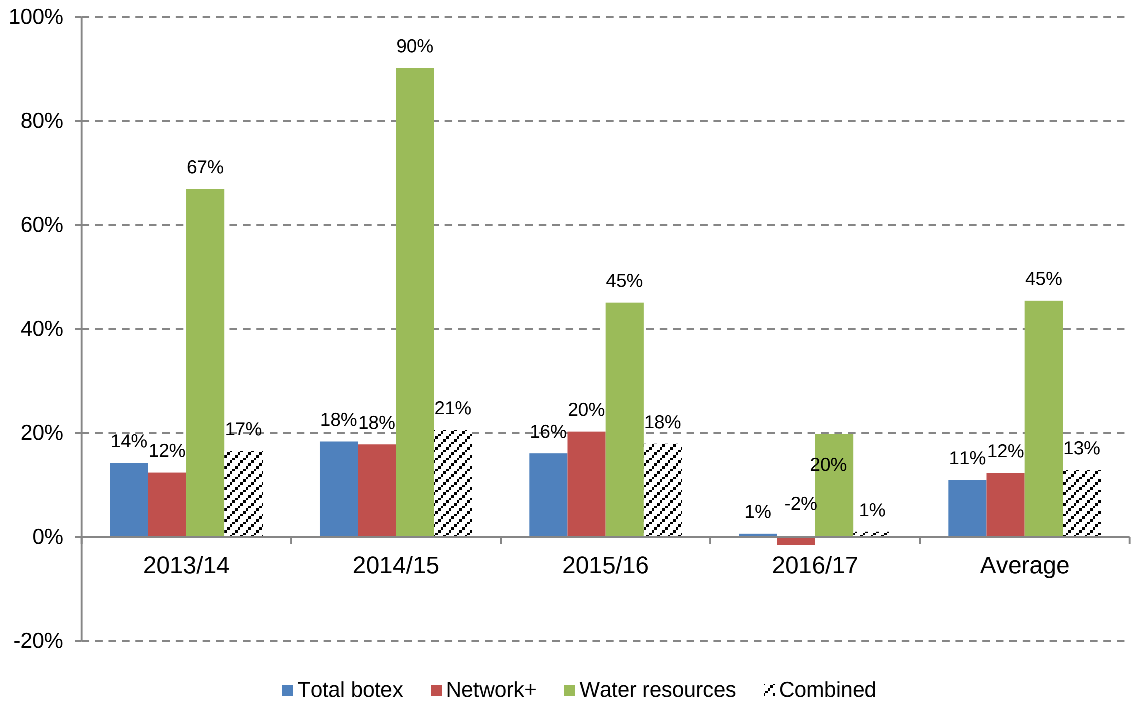

Figure 3-3 - NERA Models for Bristol Water: Annual Efficiency Gaps 2013/14 to 2016/17. Source: NERA (2017)[50]

The results set out in Figure 3-3 and Table 3-9 present a similar story to that set out in Oxera's reproduction of the Ofwat PR14 models and the CMA models developed for our PR14 re-determination, that the implied efficiency gap to the upper quartile is far smaller (more efficient) than if a longer historic period is used to inform the assessment.

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[51]		
				Water Resources	Network Plus	Wholesale Water
NERA's PR19 models for Bristol Water	Unit cost log models	2011/12 to 2016/17	2014/15 to 2016/17	45% (39% to 54%)	12% (10% to 13%)	11% (10% to 13%)
NERA's PR19 triangulated modelling	Unit cost log models	2011/12 to 2016/17	2014/15 to 2016/17	n/a[52]	n/a	13%
NERA's PR19 models for Bristol Water	Unit cost log models	2011/12 to 2016/17	2016/17	20%	-2%	1%

Table 3-9 - Efficiency gap (% to Upper Quartile) implied by NERA's PR19 models. Source: NERA (2017)[53]

[49] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p. 50
[50] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p. 50
[51] A negative (positive) gap indicates performance better (worse) than the Upper Quartile
[52] In providing a triangulated view, NERA have taken a weighted average of the implied efficiency gaps from their total botex and sum of network plus and water resource models. Therefore the triangulated view is for wholesale water only.

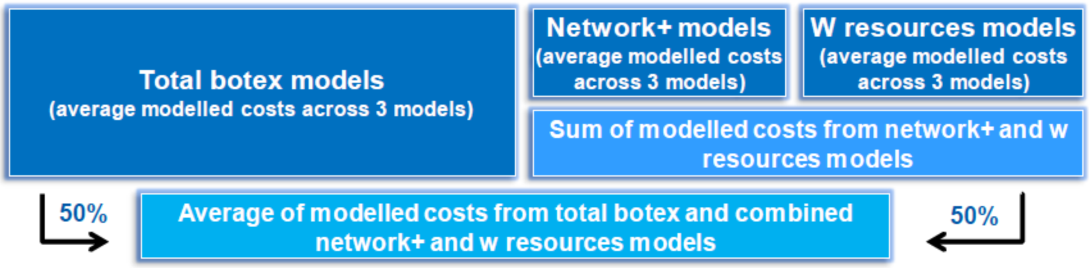

Figure 3-4 - NERA's approach to triangulating the implied results from aggregate and disaggregate value chain models. Source: NERA (2017)[54]

3.1.1.3 Regulatory insights from the PR19 modelling consultation

In March 2018, Ofwat published a consultation[55] on econometric cost modelling as a means of pooling industry ideas on modelling approaches to inform the PR19 cost assessment process. The consultation included 151 water models, 72 residential retail models and 12 enhancement models which were contributed by water companies and Ofwat. A separate report by CEPA, Ofwat's consultants, was also published as part of the consultation which presented a further 83 water models.

These models provide the best available insight into what the final PR19 models might look like, and have helped us in assessing the likelihood of whether the cost adjustment claims included in our business plan will be captured by Ofwat's published PR19 models. We briefly discuss the dependency of our cost adjustment claims on the final specification of the PR19 models in Section 3.1.1.3.3.

3.1.1.3.1 Ofwat's PR19 consultation models

In contribution to the cost model consultation, Ofwat published 48 models of varying aggregation and disaggregation[56]. These models capture base costs and are therefore comparable with the PR19-style botex models developed by Oxera and NERA set out in Section 3.1.1.2.1 and 3.1.1.2.2 in terms of the costs modelled. Efforts have been focused on developing simple models featuring key cost drivers.

We have reproduced Ofwat's consultation models with support from NERA and have assessed our position relative to the upper quartile implied by these models.

Table 3-10 summarises the implied efficiency gaps from these models.

[53] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p.48-50
[54] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p.49
[55] Ofwat (2018) A consultation on econometric cost modelling
[56] 2 water resource, 10 water treatment, 8 water resource plus, 8 treated water distribution, 8 network plus and 12 wholesale water models

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[57]		
				Water Resources	Network Plus	Wholesale Water
NERA Reproduction of Ofwat's PR19 consultation cost models	OLS aggregate models	2011/12 to 2016/17	2011/12 to 2016/17	141% (145%-150%)	9% (3%-25%)	20% (9%-32%)
NERA Reproduction of Ofwat's PR19 consultation cost models	OLS aggregate models	2011/12 to 2016/17	2016/17	115%	-5%	-2%

Table 3-10 - Efficiency gap (% to Upper Quartile) implied by Ofwat's PR19 consultation cost models. Source: NERA (2018)[58]

As expected, Table 3-10 suggests we perform very poorly in Water Resources as we are found to be the least efficient company for this value chain element. However, our efficiency performance is better across the other models, overall implying a 20% efficiency gap to the upper quartile when total costs are considered in the round across the period 2011/12 to 2016/17 (13th out of 17 companies as Figure 3-5 illustrates).

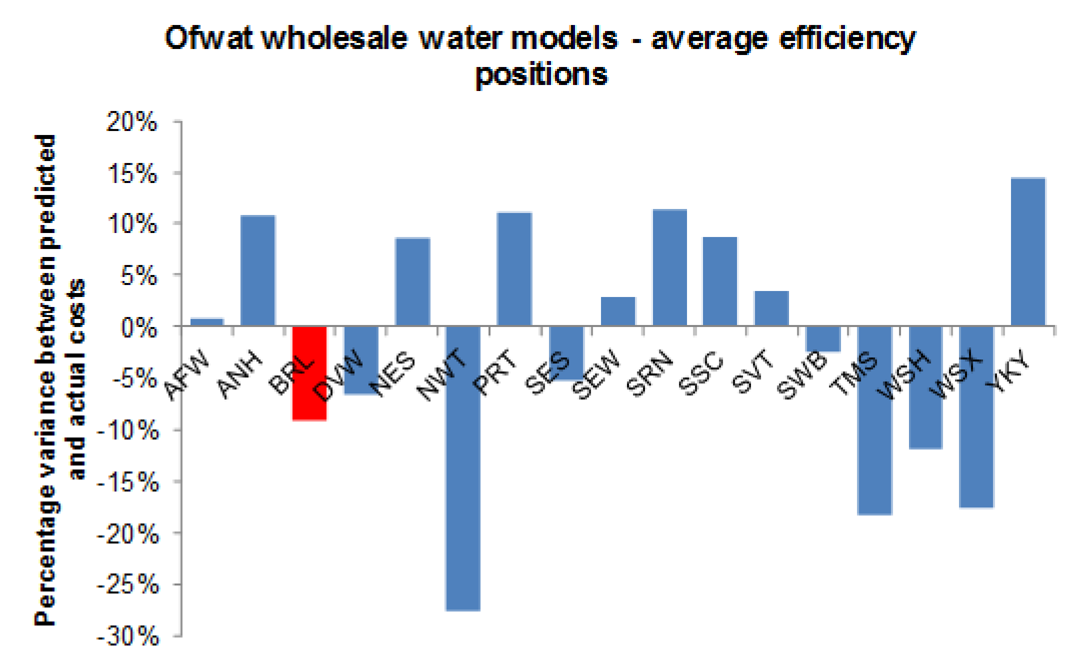

Figure 3-5 - Reproduction of Ofwat's wholesale water models. Source: NERA (2018)[59]

However, our implied efficiency gap when the year 2016/17 is considered in isolation, the results confirm the step-change in costs and efficiency hypothesis implied when we reproduced the PR14 regulatory models for our most recent costs.

Table 3-10 suggests that at an aggregate wholesale level our total costs in 2016/17 are 2% ahead of the upper quartile[60].

Figure 3-6 below presents our implied efficiency gap to upper quartile on an annual basis, based on the Ofwat consultation cost models. The analysis clearly confirms an improvement in our costs and efficiency profile over time and suggests that

[57] A negative (positive) gap indicates performance better (worse) than the Upper Quartile
[58] NERA (2018) Reproduction of Ofwat’s models published in the cost model consultation March 2018
[59] NERA (2018) Reproduction of Ofwat’s models published in consultation on econometric cost models
[60] NERA (2018) Reproduction of Ofwat's models published in the Cost Model Consultation March 2018

our historic costs will be less relevant to informing our future expenditure compared to more recent years (for example 2015/16 or 2016/17).

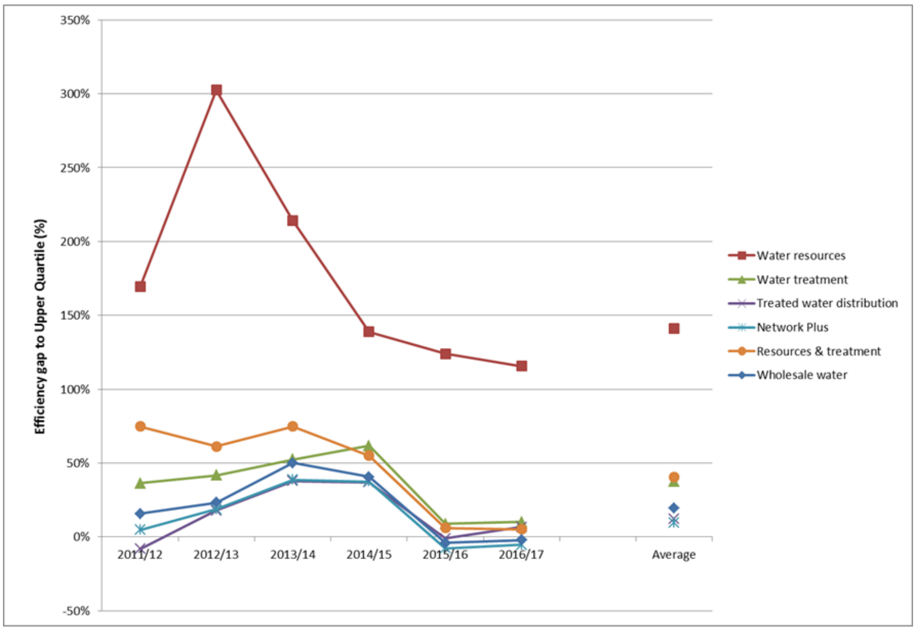

Figure 3-6 - Ofwat models: BRL wholesale efficiency gap to Upper Quartile (% of modelled costs). Source: Bristol Water, based on analysis by NERA (2018)[61]

We are an outlier compared to industry costs on water resources wholesale BOTEX costs. In part this reflects the additional water resource costs we incur for the purchase of water from the Canal and River Trust which represents 45% of our daily distribution input and 12% of our total water resource totex costs. This is 13% of our projected AMP7 water resources botex costs (£8.4m out of £74m botex).

In our response to the cost modelling consultation we indicated that Bristol Water is likely to remain an outlier in water resources investment, in part due to the cost adjustment claim and cost risk from the Canal & River Trust. We show in Figure 3-7 below the same graph with water resources removed.

[61] Efficiency gap is the % of the efficient cost, not % of the actual costs. Therefore the percentage to reduce actual costs to the UQ is therefore (Efficiency gap / (1+ Efficiency gap)) i.e. 11% efficiency gap is a 10% cost reduction.

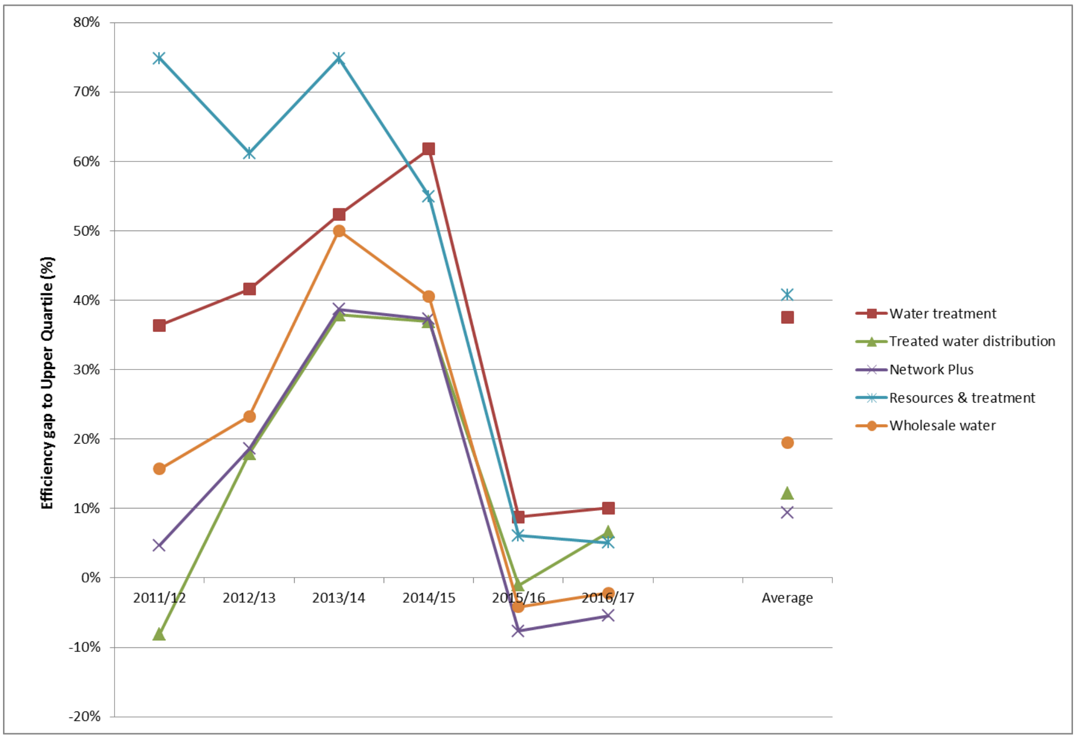

Figure 3-7 – Ofwat models: BRL wholesale efficiency gap to Upper Quartile - excluding Water Resources. Source: Bristol Water, based on analysis by NERA (2018)

3.1.1.3.2 CEPA's PR19 consultation cost models

In its contribution to the cost model consultation, CEPA published a total of 83 water models of varying aggregation and disaggregation[62].

CEPA published the average efficiency score implied by their models, by cost area, alongside their report as part of the cost model consultation[63]. Table 3-11 summarises the efficiency score and translates this into the implied efficiency gap.

	Water Resources	Raw Water Distribution	Water Treatment	Treated Water Distribution	Water Network Plus	Water Resources plus	Wholesale Water
Botex models							
Our efficiency score	54%	26%	50%	67%	73%	55%	75%
Implied upper quartile	86%	52%	63%	83%	86%	75%	88%
Implied Efficiency Gap	33%	26%	13%	15%	14%	20%	13%
Botex plus models							
Our efficiency score	50%	27%	48%	60%	65%	54%	64%
Implied upper quartile	82%	53%	61%	79%	79%	71%	79%
Implied Efficiency Gap	32%	27%	13%	20%	14%	17%	14%

Table 3-11 - Average Efficiency Score Implied by CEPA's cost model consultation models. Source: Bristol Water analysis of CEPA (2018)[64]

[62] 4 water resource, 8 water treatment, 8 water resource plus, 6 raw water distribution, 16 treated water distribution, 25 network plus and 16 wholesale water models
[63] CEPA (2018) Water Botex Baseline Results and CEPA (2018) Water Botex Plus Baseline Results
[64] CEPA (2018) Water Botex Baseline Results and CEPA (2018) Water Botex Plus Baseline Results

The CEPA botex models imply a wholesale water efficiency gap comparable to that set out in NERA's PR19 models, which suggests a 13%[65] cost reduction is required to achieve upper quartile efficiency, assuming all other things remain equal.

3.1.1.3.3 Modelling insights from the PR19 consultation

Both Ofwat and CEPA's models have excluded a number of costs[66] which are generally outside of management control and not indications of relative efficiency (or inefficiency) in their variation. The exclusion of costs associated with abstraction charges and discharge consent sets precedence for our view that our costs associated with the purchase of water from the Canal and River Trust should similarly be excluded from the modelling[67] as we set out in our cost adjustment claim for the case.

Ofwat and CEPA's water treatment models include the variable 'the proportion of water treated at Level 3-6' and 'the proportion of water treated at Level 4-6', respectively. These categories present a very broad or average view of the relationship between treatment complexity and cost, which may not fully control for the costs incurred by companies treating a high proportion of their water in the more extreme complexity categories. We believe inclusion of such a variable may therefore overlook the costs incurred by companies, including ourselves, who treat a high proportion of our water with high complexity processes and this rationale underpins our water treatment complexity cost adjustment claim.

CEPA's modelling generally found that a regional wage adjustment was not significant[68]. Given uncertainties as to what Ofwat's PR19 models will include, we have submitted a cost adjustment claim for regional wages[69] dependent on the scenario that Ofwat will seek to make an allowance for variations in regional wages as a driver of variations in regional costs in the cost assessment process, which could be within our outside of the model specifications.

Many of Ofwat's and CEPA's Treated water distribution, Network plus and Wholesale Water consultation models include the 'proportion mains installed post 1981'[70] in order to capture the relationship that these new mains should require less maintenance (a negative relationship). Whilst these models make allowance for younger mains driving lower costs, they make no allowance for older mains driving higher costs, for which all companies will have a proportion of each. This insight is relevant to our network age and materials cost adjustment claim[71], given the relatively old treated water distribution network that we operate.

3.1.1.4 Our triangulated view of catch-up efficiency

We have decided to place limited contribution on the PR14 models in informing our PR19 expenditure forecasts, due to changes in the modelling framework between the two price review planning periods, namely the transition to modelling costs of increased granularity at PR19 compared to PR14.

Oxera's reproduction of the PR14 regulatory models, NERA's candidate PR19 models and the Ofwat PR19 consultation models suggests that when a time-series of annual efficiency gaps is presented our efficiency gap to the upper quartile

[65] Bristol Water analysis of CEPA (2018) Water Botex Baseline Results
[66] Ofwat's models exclude: abstraction charges/discharge consent, business rates, third party costs, cost associated with the Traffic management Act and statutory water softening, enhancement capital expenditure (including infrastructure network reinforcement), pension deficit recovery payments and atypical costs. Ofwat (2018) A consultation on econometric cost modelling, p. 15. CEPA's models similarly exclude: abstraction charges/discharge consent, business rates, third party costs, cost associated with the Traffic management Act and statutory water softening and pension deficit recovery payments as well as other cash items and costs associated with Industrial Emission Directive. CEPA (2018) PR19 Econometric Benchmarking Models for Ofwat p. 12
[67] The majority of these costs are reported against the expenditure item 'Other operating expenditure excluding renewals'; the remainder of the costs are reported against the expenditure item 'Third Party Services' (approximately 5%)
[68] CEPA (2018) PR19 Econometric Benchmarking Models for Ofwat, p.118-121
[69] C5.A Cost Adjustment Claims
[70] Ofwat (2018) A consultation on econometric cost modelling, Appendix 1 Modelling results p. 12-13, 15-16 and 28-29. CEPA (2018) Water Botex Baseline Results
[71] See C5.A Cost Adjustment Claims

demonstrates a step-change in costs and efficiency over time. This is especially apparent when the years 2015/16 and 2016/17 are considered and we expect will also apply to our 2017/18 expenditure[72]. This suggests that our historic costs, or an average efficiency gap based on our historic costs, are less relevant in informing our future expenditure profile than the most recent past. Furthermore, the cost modelling evidence suggests that the recent transformation of our cost base has produced faster efficiency savings than other companies have delivered in recent years. This means that using our average efficiency gap (over the period 2011/12 to 2016/17) to inform our future expenditure profile based on current costs may not allow for a similar scale of reductions to be financially viable going forwards.

We have decided to take forwards our 2016/17 costs to inform our business plan forecasts and this reflects our view that in terms of our operational response costs, 2017/18 was as outlier, as we incurred significant additional operating costs due to exceptional operating incidents[73]. We have used our 2017/18 costs as a base, but then for wholesale operating costs identified offsetting efficiencies, which effectively go beyond the position that appears to be emerging from the 2016/17 cost modelling. These events caused increased cost of recovery associated with mains bursts and leakage[74] , and as such we have not forecast for these additional costs to reoccur regularly during the period 2020/21 to 2024/25. Therefore we have used 2016/17 as our baseline for considering future efficiency opportunities and cost challenges. On this basis we have sought to apply a one-off 1% efficiency challenge to our wholesale operating costs, which increases to 3.2% once the additional 2017/18 operating costs are considered. This is summarised in Table 1-2.

Our triangulated view of catch-up efficiency is presented in Table 3-12 and is largely based on the candidate PR19 models developed for us by NERA. We have taken the granular view to modelling of water resources and network plus and a triangulated view of wholesale water costs[75] from Table 3-9. We have adopted these models over others, or a combination of others, due to the use of the Monte Carlo tool to inform their development as a means of statistically identifying cost drivers that are good for the industry and which drive good model outcomes and this reflects our recommendation to Ofwat in our response to the cost model consultation[76].

	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[77]		
			Water Resources	Network Plus	Wholesale Water
Triangulated View	2011/12 to 2016/17	2014/15 to 2016/17	45%	12%	13%
	2011/12 to 2016/17	2016/17	20%	-2%	1%

Table 3-12 - Our Triangulated View of our Efficiency Gap to the Upper Quartile (%). Source: Bristol Water based on analysis by NERA (2018)[78]

We have taken the efficiency challenge implied by the modelling results set out in Table 3-12 into account in the development of our business plan by using 2016/17 as our "base" year for botex, and by assuming that the operating cost efficiency we have achieved in 2016/17 can be, at minimum, maintained at this level for the period 2020/21 to 2024/25. We have based our assumptions primarily on the efficiency challenge implied at a wholesale water level and this reflects our view that modelling in aggregate better captures the cost relationships, synergies and efficiencies between and across price controls which would be overlooked in more disaggregate modelling.

72 We have not updated the models for 2017/18 actuals given the timing of our business plan submission relative to receipt of published company level information for 2017/18
73 Including the Willsbridge burst, Clevedon precautionary boil water notice and the March 18 "Freeze Thaw" event.
74 Contributing to our missed performance target for leakage for 2017/18
75 To avoid a position where the sum of parts is greater than the whole, an outcome not uncommon in modelling efforts when undertaking both granular and aggregate modelling
76 Bristol Water (2018) Our response to the consultation on econometric cost modelling , p.1
77 A negative (positive) gap indicates performance better (worse) than the Upper Quartile
78 NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p.48-50

Therefore we believe overall that an efficiency estimate of 1% for 2016-17 operating cost and c.5 – 13% (with a central estimate of 8%) for capital costs (which are more likely after cost adjustment claims to include an element of average expenditure) is appropriate as a top-down assumption. We test this further against our bottom-up estimates of efficiency. This in part reflects that our cost adjustment claims, not considered in the efficiency gap, are focussed on operating and maintenance costs rather than enhancements.

Table 3-13 provides a full range of efficiency evidence that we have considered in developing our view of relative efficiency and our catch-up efficiency assumptions.

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[79]		
				Water Resources	Network Plus	Wholesale Water
Oxera Reproduction of Ofwat's PR14 models[80]	Refined Botex, RE and OLS	2008/09 to 2012/13	2008/09 to 2012/13	Not assessed	Not assessed	20%
Oxera Reproduction of Ofwat's PR14 models	Refined Botex, RE and OLS	2013/14 to 2015/16; 2008/09 to 2015/16; and 2011/12 to 2015/16	2015/16	Not assessed	Not assessed	-11% to 1%
Oxera Reproduction of Ofwat's PR14 models	Refined Botex, RE and OLS	2013/14 to 2015/16; 2008/09 to 2015/16; and 2011/12 to 2015/16	2013/14 to 2015/16	Not assessed	Not assessed	28% to 36%
Oxera Reproduction of CMA models	Smoothed and unsmoothed, logged and linear unit cost models	2013/14 to 2015/16; 2008/09 to 2015/16; and 2011/12 to 2015/16	2013/14 to 2015/16	Not assessed	Not assessed	33% to 35%
Oxera Reproduction of CMA models	Smoothed and unsmoothed, logged and linear unit cost models	2013/14 to 2015/16; 2008/09 to 2015/16; and 2011/12 to 2015/16	2015/16	Not assessed	Not assessed	-2% to 1%
Oxera's PR19 Industry Models for Bristol Water	OLS aggregate and unit cost models	2013/14 to 2015/16	2013/14 to 2015/16	37% to 56%	20% to 29%	23% to 31%
Oxera's PR19 Industry Models for Bristol Water	OLS aggregate and unit cost models	2015/16	2015/16	21% to 47%	-12% to -26%	-4% to -12%
NERA reproduction of Ofwat's PR14 models[81]	Refined Totex, RE and OLS	2011/12 to 2016/17	2011/12 to 2016/17	Not assessed	Not assessed	27% to 32%
NERA reproduction of Ofwat's PR14 models	Refined Botex, RE and OLS	2011/12 to 2016/17	2011/12 to 2016/17	Not assessed	Not assessed	26% to 30%
NERA reproduction of CMA's PR14 unsmoothed models	Unit cost, Logged and Linear	2011/12 to 2016/17	2011/12 to 2016/17	Not assessed	Not assessed	32%

79 A negative (positive) gap indicates performance better (worse) than the Upper Quartile
80 Oxera (2017) Preliminary view on Bristol Water's efficient level of BOTEX, p.13-15
81 NERA (2017) Comparative Benchmarking Assessment to Support Preparation of Bristol Water's AMP7 Business Plan, p.17, 19, 21-22, 48-50

Models	Approach	Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)[79]		
				Water Resources	Network Plus	Wholesale Water
NERA reproduction of CMA's PR14 smoothed models	Unit cost, Logged and Linear	2011/12 to 2016/17	2011/12 to 2016/17	Not assessed	Not assessed	25% to 27%
NERA reproduction of Oxera's PR19 Industry Study models for Bristol Water	Unit cost log models	2011/12 to 2016/17	2011/12 to 2016/17	103% to 111%	15% to 38%	23% to 44%
NERA's PR19 models for Bristol Water[82]	Unit cost log models	2011/12 to 2016/17	2014/15 to 2016/17	45% (39% to 54%)	12% (10% to 13%)	11% (10% to 13%)
NERA PR19 triangulated modelling	Unit cost log models	2011/12 to 2016/17	2014/15 to 2016/17	n/a[83]	n/a	13%
NERA's PR19 models for Bristol Water	Unit cost log models	2011/12 to 2016/17	2016/17	20%	-2%	1%
NERA Reproduction of Ofwat's PR19 consultation cost models[84]	OLS aggregate models	2011/12 to 2016/17	2011/12 to 2016/17	141% (145%-150%)	9% (3%-25%)	20% (9%-32%)
NERA Reproduction of Ofwat's PR19 consultation cost models	OLS aggregate models	2011/12 to 2016/17	2016/17	115%	-5%	-2%

Table 3-13 - Summary of Econometric Modelling Results showing our efficiency gap to Upper Quartile

[82] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p. 48-50
[83] In providing a triangulated view, NERA have taken a weighted average of the implied efficiency gaps from their total botex and sum of network plus and water resource models. Therefore the triangulated view is for wholesale water only.
[84] NERA (2018) Reproduction of Ofwat's models published in the cost model consultation March 2018

		Time Series Informing Models	Assessed Period Informing Efficiency Gap	Implied Efficiency Gap to UQ (%)		
				Water Resources	Network Plus	Wholesale Water
Triangulated View[85]		2011/12 to 2016/17	2014/15 to 2016/17	45%	12%	13%
		2011/12 to 2016/17	2016/17	20%	-2%	1%
PR19 Business Plan Botex Costs – pre efficiency	£m	CPIH 2017/18 prices	2020/21 to 2024/25	81.0	371.9	452.9
Catch-up Efficiency to Upper Quartile	£m	CPIH 2017/18 prices	2020/21 to 2024/25	13.6	(7.4)	4.5
Adjusted for cost adjustment claims	£m	CPIH 2017/18 prices	2020/21 to 2024/25	(9.4)	(18.3)	(27.7)
Overall efficiency gap (negative is outperformance)	£m	CPIH 2017/18 prices	2020/21 to 2024/25	4.2	(25.7)	(23.2)
Plan efficiencies (Botex)	£m	CPIH 2017/18 prices	2020/21 to 2024/25	(6.8)	(33.5)	(40.3)
Post efficiency Plan Botex	£m	CPIH 2017/18 prices	2020/21 to 2024/25	74.2	338.4	412.6

Table 3-14 - Triangulated View of Our Efficiency Gap to Upper Quartile (%)

Effectively this table demonstrates that, depending on other companies' subsequent changes in Botex efficiencies, we have an expectation that the plan efficiencies of £40.3m build on a position of being above upper quartile by c£23m, depending on model aggregation and relative special factor differences. Our plan assumptions therefore assume a lower frontier shift than would otherwise be the case, consistent with our customer preferences for an early reduction in bills, as well as the stretching performance targets in the plan.

[85] NERA (2017) Comparative Benchmarking and Special Cost Factor Assessment, p.48-50

3.1.2 Opex

3.1.2.1 Introduction

This Section sets out the details behind our wholesale operating costs. It is presented as an aggregate of Water Resources and Network plus (referred to as Wholesale) which is the preferred approach for this document. We present the breakdown between the segments further below, although our cost changes largely apply at an aggregate wholesale level.

3.1.2.2 Key themes

We have challenged ourselves to evidence any adjustments we have identified in our forecast expenditure and only included items strictly necessary and which had strong evidence and support. Other areas where there is uncertainty are considered, either through the overall scope of efficiency we assume in our plan, or through the specific cost risks identified. There are relatively few specific cost risks, and these are set out as part of the RORE analysis in section C6.

The main cost risks, as noted below, relate to the cost of payments to the Canal & River Trust. We also have cost risks not included in our cost base related to highway permitting schemes of c£1.0m p.a., based on a recent Government recommendation to local authorities requiring implementation of such a scheme. Our only other specific wholesale cost risks relate to specific decisions we make, such as not including the full cost of a DWI-supported scheme at Cheddar Treatment Works, as the recent weather means we prefer to keep the investigation ongoing into AMP7. We then, with an appropriate (assumed 50%) cost sharing rate, carry the risk of the expenditure being required until 2025, rather than including in price limits and returning investment not required after the event.

3.1.2.3 Structure of the Section

This Section covers the details behind our wholesale operating cost model forecasts.

The calculation for our Wholesale opex is set out below, with each line in table then being explained in further detail in the following sections.

Wholesale - Amp7 Opex	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**AMP 7**
Base opex 17/18 actuals	53.2	53.2	53.2	53.2	53.2	266.2
Base Adjustments	0.1	0.1	0.1	0.1	0.1	0.3
Adjusted opex 17/18 actuals	**53.3**	**53.3**	**53.3**	**53.3**	**53.3**	**266.5**
Opex Impact of Amp7 Investment Plan	0.8	0.2	(0.0)	(0.3)	(0.5)	0.2
Amp6 Additional ALC	0.7	0.7	0.7	0.7	0.7	3.5
New Connections (17/18)	0.3	0.4	0.5	0.6	0.7	2.5
Business Retail Cost Moving to Wholesale	0.7	0.7	0.7	0.7	0.7	3.3
Input price pressure (above CPIH)	2.9	3.9	4.9	5.9	6.9	24.6
Efficiency	(3.6)	(4.0)	(4.4)	(4.8)	(5.2)	(22.0)
Sub Total	**55.1**	**55.2**	**55.6**	**56.0**	**56.6**	**278.6**
Princpal Use Recharge	(0.5)	(0.6)	(0.6)	(0.6)	(0.6)	(3.0)
Total	**54.6**	**54.6**	**55.0**	**55.4**	**56.0**	**275.6**

Table 3-15 Wholesale Opex. Source: Bristol Water

3.1.2.4 Base Opex

Our Base Opex is taken from 2017/18 actuals and represents our most recent financial figures to ensure the plan reflects our current cost levels. These figures are shown in a table similar to that of WS1 / 4D. All lines are included for completeness but are omitted from the breakdown tables in subsequent sections so that only rows with values are included.

Wholesale - Base Opex	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	8.7	8.7	8.7	8.7	8.7	43.6
Income treated as negative expenditure	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)
Abstraction Charges / Discharge consent	2.9	2.9	2.9	2.9	2.9	14.4
Bulk supply	0.1	0.1	0.1	0.1	0.1	0.7
~ Renewals expensed in year (Infrastructure)	2.2	2.2	2.2	2.2	2.2	10.8
~ Renewals expensed in year (Non-Infrastructure)	0.0	0.0	0.0	0.0	0.0	0.0
~ Other operating expenditure excluding renewals	33.0	33.0	33.0	33.0	33.0	165.0
Local authority and Cumulo rates	4.8	4.8	4.8	4.8	4.8	24.0
Total expenditure excluding third party services	51.7	51.7	51.7	51.7	51.7	258.4
Third party services Opex	1.6	1.6	1.6	1.6	1.6	7.8
Total Base Opex expenditure	53.2	53.2	53.2	53.2	53.2	266.2

Table 3-16 - Wholesale Base Opex. Source: Bristol Water

3.1.2.5 Adjustment to Base Opex

Wholesale - Base Opex Adjustment	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Income treated as negative expenditure	0.0	0.0	0.0	0.0	0.0	0.1
~ Renewals expensed in year (Infrastructure)	0.3	0.3	0.3	0.3	0.3	1.3
Total excluding third party services	0.3	0.3	0.3	0.3	0.3	1.4
Third party services Opex	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(1.0)
Total Base Opex Adjustments	0.1	0.1	0.1	0.1	0.1	0.3

Table 3-17 – Adjustment to Wholesale Base Opex. Source: Bristol Water

2017/18 actuals are used as the base for our forecast to ensure the plan reflects our current cost levels. This is adjusted to remove one off items which we would not expect to reoccur in future years. This removes the impact of one off credits and aligns our third party rechargeable costs to historic levels (consistent with related revenue assumptions). The net impact is a small uplift to the base of £0.06m per annum.

The water resources and water network plus equivalents are shown below:

Water resources

Water Resources Base Opex Adjustment	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Income treated as negative expenditure	0.0	0.0	0.0	0.0	0.0	0.0
Total Base Opex Adjustments	0.0	0.0	0.0	0.0	0.0	0.0

Table 3-18 - Adjustment to Water Resources Base Opex. Source: Bristol Water

Water network plus

Water Network Plus Base Opex Adjustment	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Income treated as negative expenditure	0.0	0.0	0.0	0.0	0.0	0.1
~ Renewals expensed in year (Infrastructure)	0.3	0.3	0.3	0.3	0.3	1.3
Total excluding third party services	0.3	0.3	0.3	0.3	0.3	1.4
Third party services Opex	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(1.0)
Total Base Opex Adjustments	0.1	0.1	0.1	0.1	0.1	0.3

Table 3-19 – Adjustment to Network plus Base Opex. Source: Bristol Water

3.1.2.6 Water Resources Opex summary

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Water Resources	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Base opex 17/18 actuals	12.0	12.0	12.0	12.0	12.0	59.8
Adjusted opex 17/18 actuals	**12.0**	**12.0**	**12.0**	**12.0**	**12.0**	**59.8**
Opex Impact of Amp7 Investment Plan	0.2	0.1	0.0	(0.0)	(0.1)	0.1
Total Opex Pre IPP and Efficiency	**12.1**	**12.0**	**12.0**	**11.9**	**11.9**	**59.9**
Input price pressure (above CPIH)	0.7	0.9	1.1	1.3	1.5	5.4
Efficiency	(0.8)	(0.9)	(0.9)	(1.0)	(1.1)	(4.7)
Sub Total	**12.0**	**12.1**	**12.1**	**12.2**	**12.3**	**60.7**
Principle Asset Usage Adjustment	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.4)
Total Post Adjustment	**11.9**	**12.0**	**12.0**	**12.1**	**12.2**	**60.2**

Table 3-20 - Water Resources Opex Summary. Source: Bristol Water

Other than from efficiency and general input price pressure there is very little change in water resources. Asset allocation is also modest, reflecting a small amount of net recharge to retail for shared wholesale systems, which are largely allocations from network plus as shown below. Base costs are included within wholesale and corporate cost allocations. This reflects a stable water resource plan (other than the specific canal cost risk), with investments and changes limited to recreation and amenity assets and WINEP environmental catchment management, biodiversity plans and abstraction investigations.

3.1.2.7 Water network plus summary

Water Network Plus	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Base opex 17/18 actuals	41.3	41.3	41.3	41.3	41.3	206.4
Base Adjustments	0.1	0.1	0.1	0.1	0.1	0.3
Adjusted opex 17/18 actuals	**41.3**	**41.3**	**41.3**	**41.3**	**41.3**	**206.7**
Opex Impact of Amp7 Investment Plan	0.7	0.2	(0.0)	(0.3)	(0.4)	0.1
Amp6 Additional ALC	0.7	0.7	0.7	0.7	0.7	3.5
New Connections (17/18)	0.3	0.4	0.5	0.6	0.7	2.5
Business Retail Cost Moving to Wholesale	0.7	0.7	0.7	0.7	0.7	3.3
Total Opex Pre IPP and Efficiency	**43.7**	**43.3**	**43.2**	**43.0**	**43.0**	**216.1**
Input price pressure (above CPIH)	2.3	3.1	3.8	4.6	5.4	19.2
Efficiency	(2.9)	(3.2)	(3.5)	(3.8)	(4.1)	(17.3)
Total	**43.1**	**43.2**	**43.5**	**43.9**	**44.3**	**218.0**
Principle Asset Usage Adjustment	(0.4)	(0.5)	(0.6)	(0.6)	(0.5)	(2.6)
Total Post Adjustment	42.7	42.6	43.0	43.3	43.8	215.4

Table 3-21 – Network plus Opex Summary. Source: Bristol Water

All of the main cost changes and principle use allocations are within water network plus.

3.1.2.8 Opex impact of AMP7 Investment Plan

Wholesale - Opex Impact of Amp7 Investment Plan	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	0.0	(0.0)	(0.0)	(0.1)	(0.1)	(0.2)
~ Other operating expenditure excluding renewals	0.8	0.3	(0.0)	(0.3)	(0.4)	0.4
Total Opex Impact of Amp7 Investment Plan expenditure	0.8	0.2	(0.0)	(0.3)	(0.5)	0.2

Table 3-22 – Impact of AMP7 Investment Plan on Wholesale Opex. Source: Bristol Water

We will be undertaking further investment in AMP7 in order to keep delivering an efficient and effective service. As a result there will be an impact on overall opex spend. These costs/credits have been added to our model. They are minor in nature for individual investment schemes, and are described in each investment case. They include additional costs from metering, savings in water from water efficiency and savings from catchment management on the cost of water treatment.

The main contributors to the overall AMP7 total are:

Wholesale - Opex impact of AMP7 Investment Plan	AMP 7 £m
Active leakage control to reduce leakage in AMP7	£1.9m
Water resource management plan actions	£0.8m
Customer side “leak stop” repairs	£0.6m
Network monitoring logger (e.g. batteries)	£0.6m
Reduction of customer minutes lost	£0.6m
Consolidation of resources	(£0.1m)
Water Resource Catchment management (NEP – Egford, Blagdon, Chew)	(£0.2m)
Customer analytics	(£0.2m)
Alderley cryptosporidium membrane – self cleaning	(£0.3m)
Environmental Performance	(£0.3m)
Other Items	(£0.5m)
Monitoring of Resource Usage	(£0.6m)
Internal Process Improvement	(£0.7m)
IT investment and upgrade benefits to existing services	(£1.5m)
Total	**£0.2m**

Table 3-23 – Breakdown of AMP7 Investment Plan Impacts on Wholesale Opex. Source: Bristol Water

3.1.2.8.1 Water Resources impact of AMP7 Investment

We will be undertaking further investment in AMP7 in order to continue delivering an efficient and effective service. As a result there will be an impact on overall opex spend. These costs/credits have been added to our forecast. They are minor in nature for individual investment schemes, and are described in each investment case. A summary of the schemes impacting on Water Resources opex is provided below.

Water Resources Opex Impact of Amp7 Investment Plan	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	0.0	0.0	0.0	(0.0)	(0.0)	(0.0)
~ Other operating expenditure excluding renewals	0.2	0.1	0.0	(0.0)	(0.1)	0.1
Total Opex Impact of Amp7 Investment Plan expenditure	0.2	0.1	0.0	(0.0)	(0.1)	0.1

Table 3-24 - Impact of AMP7 Investment Plan on Water Resource Opex. Source: Bristol Water

Water Resources - Opex impact of AMP7 Investment Plan	AMP 7 £m
Water resource management plan actions	£0.8m
Other Items	(£0.1m)
Internal Process Improvement	(£0.1m)
IT investment and upgrade benefits to existing services	(£0.1m)
Water Resource Catchment management (NEP – Egford, Blagdon, Chew)	(£0.2m)
Environmental Performance	(£0.2m)
Total	**£0.1m**

Table 3-25 - Breakdown of AMP7 Investment Plan Impacts on Water Resource Opex. Source: Bristol Water

3.1.2.8.2 Water Network plus impact of AMP7 investment

We will be undertaking further investment in AMP7 in order to continue delivering an efficient and effective service. As a result there will be an impact on overall opex spend. These costs/credits have been added to our forecast. They are minor in nature for individual investment schemes, and are described in each investment case. They include additional costs from metering, savings in water from water efficiency and savings from catchment management on the cost of water treatment. A summary of the schemes impacting on Water Network Plus opex is provided below.

Water Network Plus Opex Impact of Amp7 Investment Plan	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	0.0	(0.0)	(0.0)	(0.1)	(0.1)	(0.1)
~ Other operating expenditure excluding renewals	0.7	0.2	(0.0)	(0.2)	(0.3)	0.3
Total Opex Impact of Amp7 Investment Plan expenditure	0.7	0.2	(0.0)	(0.3)	(0.4)	0.1

Table 3-26 Impact of AMP7 Investment Plan on Network plus Opex. Source: Bristol Water

Water Network Plus - Opex impact of AMP7 Investment Plan	AMP 7 £m
Active leakage control to reduce leakage in AMP7	£1.9m
Customer side "leak stop" repairs	£0.6m
Network monitoring logger (e.g. batteries)	£0.6m
Reduction of customer minutes lost	£0.6m
Environmental Performance	(£0.1m)
Consolidation of resources	(£0.1m)
Customer analytics	(£0.2m)
Alderley cryptosporidium membrane – self cleaning	(£0.3m)
Other Items	(£0.5m)
Monitoring of Resource Usage	(£0.5m)
Internal Process Improvement	(£0.6m)
IT investment and upgrade benefits to existing services	(£1.4m)
Total	**£0.1m**

Table 3-27 - Breakdown of AMP7 Investment Plan Impacts on Network plus Opex. Source: Bristol Water

3.1.2.8.3 AMP6 Additional Opex Spend - Active Leakage Control (Water network plus)

The opex impact of any capital schemes delivered in AMP6 which are not captured in our base year will not be fully reflected in the calculated base opex. The amounts shown above reflect the ongoing active leakage control cost having reduced leakage by 12% over 2015/20.

Our Active Leakage Control scheme from AMP6 was identified as the only material addition. This AMP, we have made capital investments in our leakage management to raise performance. Once AMP7 commences, the leakage performance level and associated resources will be considered business as usual. This resource cost will become opex as it maintains the performance level reached (note for further improvements to meet our AMP7 leakage targets, we have a complementary investment scheme).

Wholesale - AMP6 Additional ALC	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
~ Renewals expensed in year (Infrastructure)	0.7	0.7	0.7	0.7	0.7	3.5
Total AMP6 Additional ALC expenditure	0.7	0.7	0.7	0.7	0.7	3.5

Table 3-28 – AMP6 Additional Opex Spend on Activity Leakage Control (Network plus). Source: Bristol Water

3.1.2.8.4 Additional Wholesale Opex from New Connections (Water network plus)

As our customer base grows so will our cost base. Therefore by taking easily identifiable costs (from 2017/18) which have a strong correlation to the number of water services provided we have generated a unit cost per population (based on 2017/18 figures). This figure excludes labour and infrastructure enhancements. This figure was then multiplied by the forecast population increase as per WS3 and generated our new connection opex. The benefits of metering and water efficiency are included within the overall investment programme (impact shown separately) which helps to offset these costs.

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Wholesale - New Connections	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	0.2	0.3	0.3	0.4	0.5	1.7
~ Other operating expenditure excluding renewals	0.1	0.1	0.2	0.2	0.2	0.8
Total New Connections expenditure	0.3	0.4	0.5	0.6	0.7	2.5

Table 3-29 - AMP6 Additional Opex Spend on New Connections (Network plus). Source: Bristol Water

3.1.2.8.5 Business Retail Costs (wholesale network plus)

With effect from 1st April 2017 we exited the Business retail market. However an element of these costs remained in the business. These have been allocated by two different approaches

- AMP 6 Approach - Retail Non-Household costs to be excluded from Retail Household Reporting. These costs are also not included in Wholesale opex.
- AMP 7 Approach - Retail Non Household costs are no longer shown in retail and therefore must be reflected in Wholesale for the AMP. Based on 2017/18 numbers these costs were then posted to WS1 Line 7 and Line 8 Treated water distribution lines. This reflects developer services as well as other allocations including overheads. Therefore the costs are all adjustments to wholesale network plus.

Wholesale - Business Retail Cost Moving to Wholesale	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
~ Other operating expenditure excluding renewals	0.7	0.7	0.7	0.7	0.7	3.3
Total Business Retail Cost Moving to Wholesale	0.7	0.7	0.7	0.7	0.7	3.3

Table 3-30 – Wholesale Opex from Business Retail. Source: Bristol Water

3.1.2.9 Input Price Pressure (IPP)

We commissioned NERA Economic Consulting (NERA) to produce a forecast of Real Price Effects (RPEs)[86] ensuring our real input price inflation is built on cost pressures that comparable companies face.

This means our input price pressure is therefore based on published price and cost indices that are most relevant to explaining changes in the input prices we faces for labour, materials, plant and equipment, energy and other costs.

An adjustment for Input price pressures is applied based upon the forecast in the NERA report[87], which showed an average yearly uplift of 3.8%. This value is applied equally across all cost lines (adjustments made for CPIH as required in AMP7). This is reflected in App24.

The calculation of input price pressures is summarised below, small differences reflect the interaction with efficiency:

		2018-19	2019-20	2021-21	2021-22	2022-23	2023-24	2024-25	AMP7
Opex - Pre IPP / Efficiency		53.4	53.5	55.8	55.3	55.1	54.9	54.9	276.043
IPP % - p.a. (above CPIH)		**1.56%**	**1.93%**	**1.81%**	**1.75%**	**1.76%**	**1.76%**	**1.78%**	
IPP % - cumulative (above CPIH)		1.56%	3.52%	5.40%	7.25%	9.13%	11.05%	13.02%	
Opex with IPP		54.2	55.4	58.8	59.3	60.2	61.0	62.0	301.314
		0.8	1.9	3.0	4.0	5.0	6.1	7.1	

Table 3-31 - Opex Adjustment for Input Price Pressures. Source: Bristol Water

86 NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19
87 NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. iii

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Wholesale - Input cost pressure (above CPIH)	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	0.5	0.6	0.7	0.9	1.0	3.7
Abstraction Charges / Discharge consent	0.2	0.2	0.3	0.3	0.4	1.3
Bulk supply	0.0	0.0	0.0	0.0	0.0	0.1
~ Renewals expensed in year (Infrastructure)	0.1	0.2	0.3	0.3	0.4	1.3
~ Other operating expenditure excluding renewals	1.8	2.5	3.1	3.7	4.3	15.4
Local authority and Cumulo rates	0.3	0.4	0.4	0.5	0.6	2.2
Total operating expenditure excluding third party services	2.9	3.8	4.8	5.8	6.7	24.0
Third party services Opex	0.1	0.1	0.1	0.1	0.2	0.6
Total Input cost pressure (above CPIH)	2.9	3.9	4.9	5.9	6.9	24.6

Table 3-32 – Wholesale Water Input Price Pressure. Source: Bristol Water

3.1.2.9.1 Water resources Input Price Pressure

Water Resources Input cost pressure (above CPIH)	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	0.1	0.1	0.2	0.2	0.2	0.8
Abstraction Charges / Discharge consent	0.2	0.2	0.3	0.3	0.4	1.3
Bulk supply	0.0	0.0	0.0	0.0	0.0	0.0
~ Renewals expensed in year (Infrastructure)	0.0	0.0	0.0	0.0	0.0	0.1
~ Other operating expenditure excluding renewals	0.3	0.4	0.5	0.6	0.7	2.5
Local authority and Cumulo rates	0.1	0.1	0.1	0.1	0.2	0.6
Total operating expenditure excluding third party services	0.6	0.8	1.1	1.3	1.5	5.3
Third party services Opex	0.0	0.0	0.0	0.0	0.0	0.1
Total Input cost pressure (above CPIH)	0.7	0.9	1.1	1.3	1.5	5.4

Table 3-33 – Water Resources Input Price Pressure. Source: Bristol Water

3.1.2.9.2 Water network plus Input Price Pressure

Water Network Plus Input cost pressure (above CPIH)	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	0.4	0.5	0.6	0.7	0.8	2.9
Abstraction Charges / Discharge consent	0.0	0.0	0.0	0.0	0.0	0.0
Bulk supply	0.0	0.0	0.0	0.0	0.0	0.0
~ Renewals expensed in year (Infrastructure)	0.1	0.2	0.2	0.3	0.3	1.2
~ Other operating expenditure excluding renewals	1.5	2.1	2.6	3.1	3.6	12.9
Local authority and Cumulo rates	0.2	0.3	0.3	0.4	0.5	1.6
Total operating expenditure excluding third party services	2.2	3.0	3.7	4.5	5.3	18.7
Third party services Opex	0.1	0.1	0.1	0.1	0.1	0.5
Total Input cost pressure (above CPIH)	2.3	3.1	3.8	4.6	5.4	19.2

Table 3-34 Water Network plus Input Price Pressure. Source: Bristol Water

3.1.2.10 Efficiency

Wholesale - Efficiency	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	(1.8)	(1.9)	(2.0)	(2.1)	(2.3)	(10.1)
Abstraction Charges / Discharge consent	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.5)
Bulk supply	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)
~ Renewals expensed in year (Infrastructure)	(0.1)	(0.2)	(0.2)	(0.3)	(0.4)	(1.2)
~ Other operating expenditure excluding renewals	(1.4)	(1.7)	(1.9)	(2.1)	(2.2)	(9.3)
Local authority and Cumulo rates	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.5)
Total operating expenditure excluding third party services	(3.6)	(3.9)	(4.3)	(4.7)	(5.1)	(21.7)
Third party services Opex	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.3)
Total Efficiency	(3.6)	(4.0)	(4.4)	(4.8)	(5.2)	(22.0)

Table 3-35 – Wholesale Efficiency. Source: Bristol Water

Knowing our efficient opex targets, we looked within the business at how we could best optimise our current operation. This provided us with areas from which we could then allocate our efficiency target to best reflect potential efficiency projects. This targets areas such as power, other operating expenditure excluding renewals and renewals expensed in year (infrastructure). We describe how these efficiencies will be delivered through the bottom up transformation analysis later in this document.

The efficiencies break down into two components. We do not make a distinction in our bottom up planning between catch up and frontier shift efficiency. Instead we use an integrated approach, identifying specific initiatives and then with a remaining cost challenge which reflects our frontier shift. The opex outcome which applies to both water resources and water network plus is summarised below:

	Initial efficiency from 2020	Efficiency p.a. after 2020	Overall per annum 2020-25 "efficiency shift"	£m efficiencies	Annual real price effects above CPIH (except retail)
Wholesale water opex	-3.2%	-0.7%	-1.2%	£22m	1.8%

Table 3-36 – Wholesale Water Opex Efficiency parameters. Source: Bristol Water

3.1.2.10.1 Water resources Efficiency

Water Resources Efficiency	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	(0.4)	(0.4)	(0.4)	(0.5)	(0.5)	(2.1)
Abstraction Charges / Discharge consent	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.4)
Bulk supply	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
~ Renewals expensed in year (Infrastructure)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.2)
~ Other operating expenditure excluding renewals	(0.2)	(0.3)	(0.4)	(0.4)	(0.4)	(1.7)
Local authority and Cumulo rates	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)
Total operating expenditure excluding third party services	(0.8)	(0.8)	(0.9)	(1.0)	(1.1)	(4.6)
Third party services Opex	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Total Efficiency	(0.8)	(0.9)	(0.9)	(1.0)	(1.1)	(4.7)

Table 3-37 Water Resources Efficiency. Source: Bristol Water

3.1.2.10.2 Water network plus Efficiency

Water Network Plus Efficiency	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
Power	(1.4)	(1.5)	(1.6)	(1.7)	(1.8)	(8.0)
Abstraction Charges / Discharge consent	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Bulk supply	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)
~ Renewals expensed in year (Infrastructure)	(0.1)	(0.2)	(0.2)	(0.2)	(0.3)	(1.0)
~ Other operating expenditure excluding renewals	(1.2)	(1.4)	(1.5)	(1.7)	(1.8)	(7.5)
Local authority and Cumulo rates	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.4)
Total operating expenditure excluding third party services	(2.8)	(3.1)	(3.4)	(3.7)	(4.0)	(17.0)
Third party services Opex	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.3)
Total Efficiency	(2.9)	(3.2)	(3.5)	(3.8)	(4.1)	(17.3)

Table 3-38 Water Network Plus Efficiency. Source: Bristol Water

3.1.2.11 Principal Asset Usage Adjustment

A final adjustment was made for recharging of asset usage between wholesale and retail.

This is where assets principally used by wholesale, (which therefore have their capex cost and depreciation recorded against wholesale) will recharge part of this depreciation to reflect the proportion used by retail. Typical retail asset usage will include shared central IT systems, office and office equipment .

This cost which is also shown on the recharge lines in table R1 is removed from WS1 - Line 7 - Other operating expenditure excluding renewals (in CPIH deflated terms).

Wholesale - Principal Use Recharge	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
~ Other operating expenditure excluding renewals	(0.5)	(0.6)	(0.6)	(0.6)	(0.6)	(3.0)
Total Principle Asset Usage Adjustment	(0.5)	(0.6)	(0.6)	(0.6)	(0.6)	(3.0)

Table 3-39 – Wholesale Principal Asset Usage Adjustment. Source: Bristol Water

3.1.2.11.1 Water resources principal asset usage adjustment

Water Resources Principle Principal Use Recharge	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
~ Other operating expenditure excluding renewals	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.4)
Total Principle Asset Usage Adjustment	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.4)

Table 3-40 Water Resources Principal Asset Usage Adjustment. Source: Bristol Water

3.1.2.11.2 Water network plus principal asset usage adjustment

Water Network Plus Principal Use Recharge	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7
~ Other operating expenditure excluding renewals	(0.4)	(0.5)	(0.6)	(0.6)	(0.5)	(2.6)
Total Principle Asset Usage Adjustment	(0.4)	(0.5)	(0.6)	(0.6)	(0.5)	(2.6)

Table 3-41 Water Network plus Principal Asset Usage Adjustment. Source: Bristol Water

Conclusions on wholesale operating costs

The graph below sets out the components of our proposed opex movement from AMP6 to AMP7.

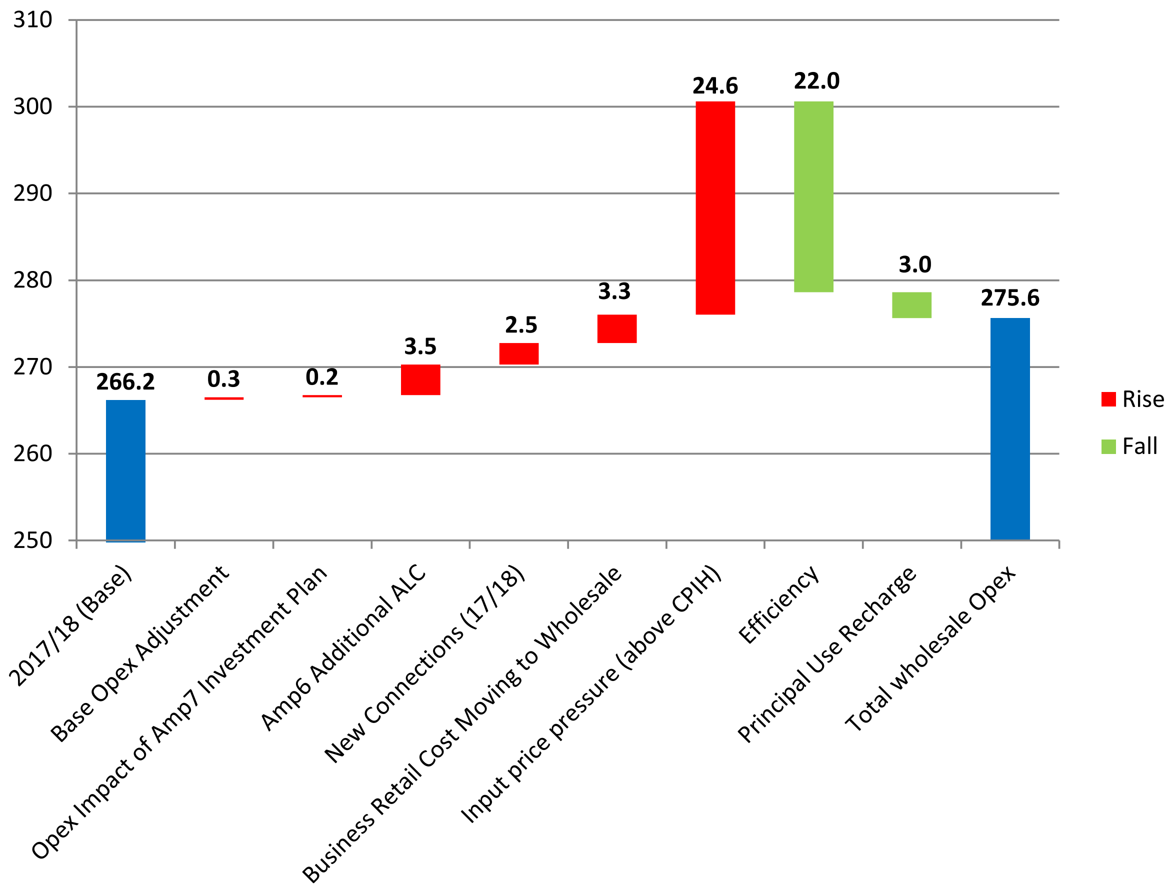

Figure 3-8 - Movement from 2017/18 Base Opex. Source: Bristol Water

The expenditure that we have included in our plan is realistic, evidence-based and provides a challenge based upon an externally assessed target, but built on an understanding of how the plan will be delivered.

3.1.3 Capex

The starting point for our investment case development was to understand our customers' priorities and determine associated performance commitments. Our customer research have considered both the next planning period and further ahead. Our long term ambition, as presented in "Bristol Water… Clearly"[88], commits to maintaining the long-term health of our assets and sets out how we will deliver the service improvements that customers value, in AMP7 and beyond.

We have adopted totex principles to determine how we should invest in order to deliver these priorities and associated performance commitments. The totex approach we have adopted considers which the best solution is because it is the lowest cost over the whole life of the asset, regardless of whether it is operational or capital expenditure.

As a result of our approach, we have put forward a low-cost plan aimed at meeting customer priorities and have challenged ourselves to become more efficient and innovative by applying an 8% cost efficiency challenge to its delivery.

At £208m pre-efficiency and £182m post-efficiency over the period, our AMP7 plan is lower cost that AMP4, 5 and 6, as we are pursuing only "botex" like enhancements which reflects our intention to operate in the top quartile of the industry and meet customer expectations with an enhancement program that is either environmental investigations or "botex-like" resilience investments. These have been fully integrated with our maintenance plans for PR19.

We will measure progress via twenty six performance commitments for which we have set stretching delivery targets (see section C3). The investment programme, its relationship to performance commitments and customers' priorities is illustrated below.

Figure 3-9 below demonstrates how our investment programme contributes to our performance commitments and customer priorities.

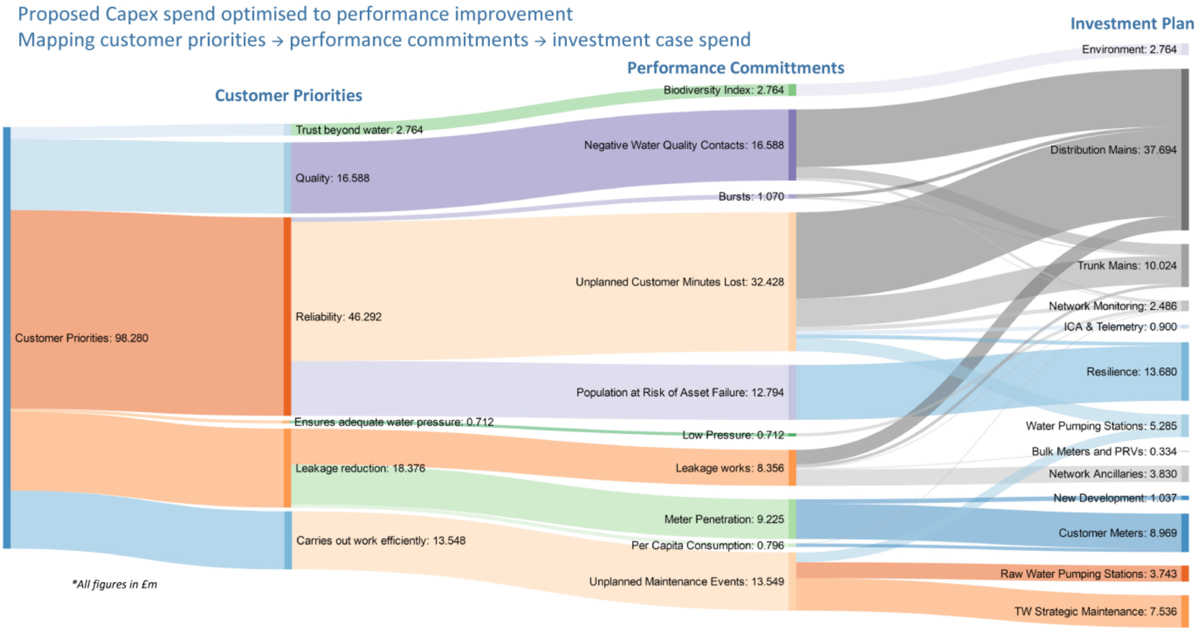

Figure 3-9 – Investment line of sight to customer priorities. Source: Bristol Water

[88] Bristol Water (2018) Bristol Water Clearly

An overall summary of the wholesale capex costs is set out in Figure 3-10 below:

	Pre-efficiency	Post-efficiency	Efficiency
Capital maintenance - infra	72.0	63.5	8.5
Capital maintenance - non-infra	83.4	73.5	9.9
Capital enhancements (net)	52.5	44.6	7.9

Figure 3-10 – Wholesale capex summary. Source: Bristol Water

The optimised investment cases have an 8% (£15.8m) efficiency challenge applied, based on an assessment of the bottom-up programme level optimisation of the investment cases as a whole, compared to the potential top-down efficiencies being delivered.

On capital frontier efficiencies, we have effectively absorbed the 0.9% above CPIH capex input price inflation identified by NERA with the 0.6% capex frontier shift assumption[89], plus an additional 0.3% frontier shift efficiency challenge in order to maintain upper quartile efficiency. Effectively after the 8% efficiency adjustment, we assume that wholesale costs are in line with CPIH inflation. This produces an 8.8% efficiency challenge from 2020.

	Initial efficiency from 2020	Efficiency p.a. after 2020	Overall per annum 2020-25 “efficiency shift”	£m efficiencies	Annual real price effects above CPIH (except retail)
Wholesale water capex	-8.8%	-0.9%	-2.5%	£26m	0.9%

Table 3-42 – Wholesale Water Opex Efficiency parameters. Source: Bristol Water

The Investment plan is made up of twenty one investment cases and an overarching summary document (See Technical Annex C5.B) A summary is outlined in Figure 3-11:

[89] NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. iv

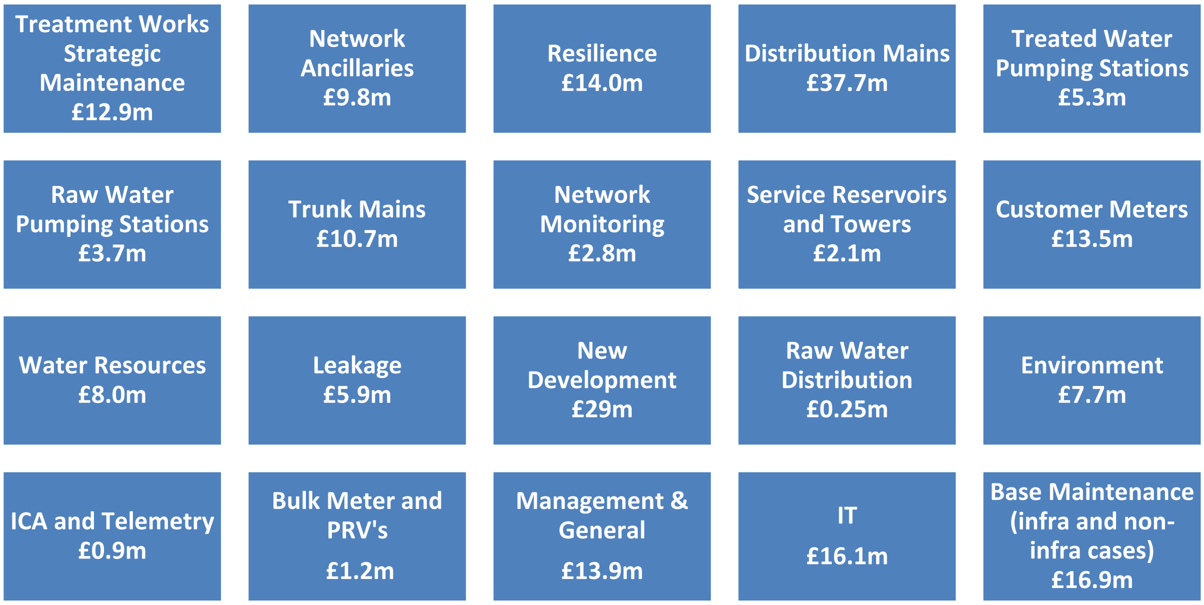

Figure 3-11 - Investment plan summary. Source: Bristol Water

Where we are building our cost profiles and interventions, we have done this through recognised industry practice. We have developed the following methodologies which have been used to ensure we effectively identify asset risks, interventions and costs:

- Data Assurance;
- Risk Identification, Verification and Needs Identification;
- Optioneering and Intervention Development;
- Costing;
- Benefits Quantification; and
- Investment Optimisation (which balances ODI performance against intervention cost);

which are explained in full in Technical Annex C5.B PR19 Investment Cases: Summary Document.

The investment optimisation of our investment schemes is undertaken using industry best practice from a proven third party: Servelec. Given that the volume of activity in AMP7 is lower than for AMP6, we are confident in our ability to deliver the proposed interventions.

All the data in our investment programme has been subject to our data assurance methodology in order to ensure that it is accurate and reliable. Improving the integrity of our data has been of critical importance to us throughout AMP6; as a key aspect of our focus in preparing this plan, we appointed a dedicated Asset Information Manager.

In order to provide assurance of our investment costs and to ensure standardisation, we engaged ChandlerKBS as our costing partner. They were selected in part due to their ability to provide us with industry comparable cost data, often at intervention level. They have supported us in several ways:

- analysis of intervention costs;
- in some instances development of intervention costs; and
- support to build our cost database,

Direct costs, indirect overheads, such as contractor costs, design costs, contract management, and our overheads have been developed at intervention level. Wherever possible we used our data, or if unavailable, we used industry average costs sourced by ChandlerKBS.

In summary, we have adopted a sound, risk based totex approach to determine how best to deliver our customer priorities and look after the long term health of our assets.

Our investment plans

Our plan is focussed on operating cost and maintenance expenditure. The investment plans are in general for a smooth level of investment each year, which is an efficient way of delivering our investments and emphasises that even the enhancement expenditure is mostly “maintenance-like” in our delivery approach. We describe key areas of expenditure in this section, however these do not deliver our performance commitments in isolation as operational and service changes are just as important.

Key areas of expenditure are shown below.

Water resources infrastructure maintenance (£3m, 0.7% of Totex)

The only significant activity is reservoir safety inspections – an ongoing programme at £1.2m.

Water network plus IRE expenditure (£60m, 12% of Totex)

Other than trunk and distribution mains planned refurbishment and replacement, key areas are:

- Customer stop taps and pipes - £10m
- Changes to hydrants to reduce supply interruptions - £3m
- Leakage control and pressure management - £4m

Non-infrastructure maintenance costs (MNI)

These costs increase to reflect the timing of expenditure at our pumping stations and treatment works. MNI also delivers more network monitoring technology and IT integration to deliver field force and supply chain information – essential for new services, vulnerable customer support ambitions and a single view of customer rather than just asset impacts. Expenditure for high level pumps at Purton and water quality maintenance at Banwell contribute to this increase.

The key **water resources** MNI expenditure (£11m, 2% of totex) is on:

- Major raw water pump replacements - £3m
- Improving reservoir amenity - £2m
- Water resource plan actions - £2m

Network plus maintenance (MNI) costs (£63m, 13% of totex)

Other than day to day works and equipment maintenance, the key areas of expenditure are:

- Replacing customer meters - £4m
- Stowey ozone plant replacement - £3m
- Banwell membrane and UV plant - £3m
- Network monitors and pressure logger - 4m
- Purton High Lift Pumps - £4m
- Crypto membrane plant refurbishments - £2m
- Integrated applications – API enables us to connect data across systems to delivery partners (e.g. water efficiency platform) - £4m

Enhancement capital expenditure (£45m, 9% of totex)

The amount of enhancement capital expenditure falls from £79m in 2015-20 to £45m in 2020/25. Major enhancements are:

- Water resource – abstraction and WINEP programme - £7m
- Optional and selective metering -£9m
- SEMD (infrastructure security) - £0.5m

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- 10,000 population centre resilience - £12m
- New developments (net of developer contributions) - £14m

DWI quality programme:

The Key components are:

- Alderley TW plumbosolvency - £0.5m
- Cheddar TW algal bloom trial extension -£0.5m
- Lead pipe – nurseries and quality - £0.5m
- Catchment management – metaldehyde -£1m

The enhancement programme reflects current efficient costs and have been benchmarked externally. Detail is provided for each investment case within C5B Technical Annex.

The resilience investment is the only "optional" enhancement component that is service driven. This is reflected in a specific outcome performance commitment for the Population at Risk from Asset Failure, as set out in Section C3. The metering programme is also cost beneficial and is reflected in its own outcome performance commitment on Meter Penetration, again set out in Section C3. The DWI quality programme is reflected in the Compliance Risk Index performance commitment. The WINEP programme is reflected in the WINEP performance commitment, with the environmental impact on a cost-beneficial basis reflecting customers support, which is also incentivised through the innovative raw water quality and biodiversity index ODIs.

How the investment plans deliver long term asset health

The main bulk of wholesale expenditure delivers on-going asset health. We plan to replace or renovate around 20km of our mains each year, which is c.0.3% of our network.

In our detailed evidence as part of our plan we demonstrate that this level of network replacement is appropriate for the long-term, and remains sufficient to deliver stable network asset health, as well as our supply interruptions, leakage and mains burst planned performance improvements. This is below the level of additional mains we restored over 2012-2015, which amounted to c.1% of our network p.a.

Our recent experience suggests that this level of replacement represented a backlog of expenditure which is not required in the future to deliver the targets we have set.

We have checked our approach based on benchmarking against water companies in the UK and around Europe. This benchmarking[90] suggests we have the oldest average age of network in Europe (as also explained in our Network Age and Materials cost adjustment claim in C5A Technical Annex) reflecting the long history of Bristol Water, but we also deliver upper quartile leakage performance and on recent data are upper quartile on network cost efficiency. We are confident therefore that our proposed network expenditure is both efficient and will be effective. We have identified 8% efficiencies for all capital expenditure, and will also absorb 0.9% of above CPIH inflation cost pressures, offsetting these through future efficiencies.

[90] European Benchmarking Co-operation (2017) International Benchmark 2016 Water Supply, p.33

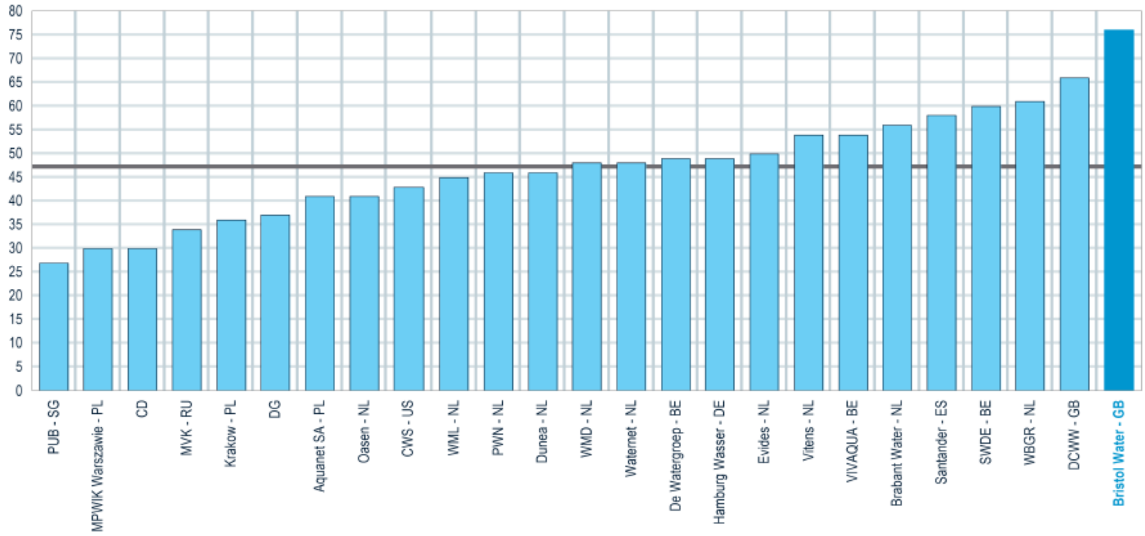

Figure 3-12- Standardised Average Network Age Index (SNAX) for participant companies in a European Benchmarking Exercise of the Water Sector. Source: European Benchmarking Co-operation (2017)[91]

Therefore, infrastructure renewals capital expenditure falls from £68m in AMP6 to £62m in AMP7. This is in part due to additional one-off expenditure incurred as a result of the exceptional weather in 2017 and early 2018, but also reflects our efficiency target, and reallocation of leakage expenditure to operating cost as our 12% reduction in 2015-20 is completed (which is a regulatory presentation as the IAS accounting treatment is the same).

3.2 Building an Efficient and Challenging Plan

Through transformation and challenging ourselves we have delivered significant efficiency improvements since PR14. At PR14, Ofwat assessed our business plan to represent less than efficient costs compared to other companies and this meant we have faced a significant degree of catch-up during AMP6. We have challenged and continue to challenge ourselves to transform our cost base and deliver a business plan that pushes us on all fronts and this ambition is reflected in our business plan proposals for PR19.

Comparison of the efficiency gaps[92] of different companies enables a relative assessment of efficiency performance across the industry to be made by Ofwat and this informs their overall assessment of the revenues set in the price planning process for the period. The lower the (positive) efficiency gap the more efficient the company is, according to the models.

At PR14 our cost assessment determination by Ofwat showed the largest gap in the industry. As set out in Table 3-43 below, our business plan proposals came in at a cost above Ofwat's view of how much it should efficiently cost us to deliver the services and investments we had set out in our plan. We have shown the difference against our representation on the PR14 Draft Determination, as following further review after our initial and revised business plan submissions, that was the final cost proposal we submitted ahead of the PR14 Final Determination.

[91] European Benchmarking Co-operation (2017) International Benchmark 2016 Water Supply, p.33
[92] Efficiency gap is defined as actual costs expressed as a percentage of efficient costs (actual costs / efficient costs *100%)

Business Plan (Planning period 2015-20)	Price base	Proposed Totex (£m)	Assessment (£m)	Gap (£m)	Gap (%) [gap / assessment]
PR14 Representation on Draft Determination (Final Plan)	2012/13 RPI	541.1	409.2	131.9	32%

Table 3-43 PR14 efficiency gap. Source: Ofwat (2014)[93]

Ofwat's assessment was such that our efficiency gap placed us at the bottom of the efficiency league table compared to the 17 other companies providing water services at the time[94]. We are confident that we are in a far better relative efficiency position now compared to at PR14.

Driving efficiency is not just our ambition for the business planning period; to be an efficient leader in the sector is one our long-term strategic goals. This reflects our commitment to deliver the services that customers need at the lowest possible cost and by that we mean that customers should not be paying more than they really need to, both now and in the future. Our long term strategy, 'Bristol Water… Clearly'[95] sets out how we intend to deliver this.

We are committed to delivering further efficiency in our cost base through continuous improvement, transformation and innovation. By concentrating our efforts on driving positive change, we can deliver and distribute benefits to our customers, such as our outcomes of excellent customer experiences, local community resilience, safe and reliable supply of water, corporate and financial leadership.

Being an industry leader in efficiency is not just about driving down costs and ensuring the service we supply meets customers demand, it is a far more wide reaching concept. It is about making the most out of our resources, optimising the use of our water resources and harnessing smart technologies to deliver gains in renewable energies, adopting best practice in asset management to deliver performance and cost efficiencies both now and in the future and securing low and efficient costs of finance.

We consider that we have put forward an efficient and challenging plan that sees us continue our journey of significant transformation to maintain an efficient position with the industry upper quartile.

We have assessed our efficiencies from top down modelling against bottom up identified opportunity.

[93] Ofwat (2014) Bristol Water PR14 Final Determination p. 82
[94] Ofwat (2014) Calculation of efficiency scores and efficiency adjustment factors
[95] Bristol Water (2018) Bristol Water Clearly

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	Pre-efficiency (£m)	Post-efficiency (£m)	Efficiency (£m)	
Wholesale opex	301	279	22	7.31%
Capital maintenance - infra	69	63.5	6	8.00%
Capital maintenance - non-infra	80	73.5	6	8.00%
Capital enhancements (net)	48	44.6	4	8.00%
Capex frontier efficiency			10	5.3%
Retail opex - net efficiency	49	45	4	7.63%
TOTAL EFFICIENCY	**547**	**505**	**52**	
		Low £m	**Medium £m**	**High £m**
Range identified from transformation savings		24	34	46
Frontier shift and innovations		15	18	20
Total potential		**39**	**52**	**66**

Table 3-44 - Efficiency parameters – top-down and bottom-up. Source: Bristol Water

We applied an 8% programme level efficiency target to the capital expenditure elements of the optimised investment cases in order to reflect the programme level efficiency potential from the cost estimates used. The evidence available suggests that this cost level should at least match the industry upper quartile efficiency.

For opex, we assessed our catch-up efficiency, frontier shift and further challenges according to the difference between bottom-up cost forecasts and target efficiency positions.

This leads to an overall efficiency challenge of £52m over the AMP, as shown in Table 3-44.

We have assessed this against bottom up potential from the continuation of our transformation anticipated frontier shift. The transformation project provides confidence in the central estimate. Other business efficiencies and delivery risks produce a bottom up range of efficiencies as shown above, however the level indicated below has been validated with the business as part of the control process over the transformation project. Business as usual projects, including absorption of input price pressure, also affects the efficiency range. For instance, there is clear cost pressure from the development of the new power station at Hinkley Point in this region and from other major infrastructure projects, that the transformation programme and delivery model help to mitigate. This judgement is reflected in the overall balance of risk and reward we propose in our plan.

Efficiency Challenge	Modelling Parameter	Gross value over AMP7 (£m CPIH prices)
Savings identified through business transformation program	Network Delivery model	8.7
	Commercial reductions	3.1
	Energy management	7.8
	Customers, billing & collections (including bad debt)	6.3
	Project Delivery	2.3
	Continuous Improvement & automation	3.3
	Production optimisation	2.7
Frontier shift and innovations	Further improvements to be identified	17.8
Total		**52.0m**

Table 3-45 Our plans for delivering efficiencies. Source: Bristol Water (2018)[96]

The efficiency savings identified in our transformation programme and from frontier shift and further innovations leads to a potential £52m saving over the AMP, which compares favourably with the £34m assessed, and recognises that there will continue to be further efficiencies that we can find which are not specifically part of the transformation project, as they will be identified through business-as-usual improvements. This is also supported by innovation and our approach to markets, through our Bid Assessment Framework. The breadth of this transformation program, on top of our previous achievements, demonstrates the challenge we have set ourselves in pursuing our efficiency targets.

3.2.1 Modelling Assumptions and Challenges

This section elaborates on the key efficiency assumptions applied to our cost modelling:

- Our capex efficiency challenge - 8% capex cost reductions;
- Our chosen baseline year for forecasting - utilising our most efficient year as the baseline of our transformed cost base; and
- Our frontier efficiency challenge - frontier catch up.

3.2.1.1 Capex Efficiency Challenge

We applied an 8% programme level efficiency target to the capital expenditure elements of the optimised investment cases in order to reflect the programme level efficiencies from the cost estimates used. This was based on an efficiency range c. 5 – 13% (with a central estimate of 8%). The evidence suggests that this cost level should at least match the upper quartile, based on available information. This is explained further in 'Application of Efficiency Challenge' section. It was then validated through the programme level judgements and the work in developing the transformation programme.

The impact of the 8% on our capex components is shown below:

[96] Bristol Water (2018) Efficiency Initiative Assessments

Efficiency Challenge	Modelling Parameter	Value over AMP7 (£m 17/18 CPIH prices)
8% cost reduction to capital expenditure	IRE Capex	5.5
	MNI Capex	6.4
	Capex enhancements	3.9

Table 3-46 Capex efficiency parameters. Source: Bristol Water

3.2.1.2 Our Chosen Baseline Year for Forecasting

We have delivered a step change in the cost of our operations since 2015/16 and set out on a trajectory of further reductions by embracing Totex and outcomes delivery, seeking more efficient operational solutions over enhancements and innovating in the way we deliver our services.

Examination of our cost performance over the period 2011/12 to 2017/18 shows a step change that makes significant inroads on our efficiency gap, meaning that from a planning perspective, historical data may have less relevance to our future costs.

This step change needs to be taken into account to ensure that the efficiency challenge we set ourselves is sufficiently stretching and is therefore in the interests of customers. This reflects our commitment to deliver a business plan that is based on efficient cost, meaning that customers should not be paying more than they should need to, both now and in the future.

Figure 3-3 illustrates this with respect to econometric models developed by NERA for Bristol Water to inform our efficiency position from a top-down perspective, showing that from 2015/16 our efficiency performance relative to the upper quartile benchmark has been improving.

A similar trend is also apparent in the efficiency gaps implied by Ofwat's models as published in the cost model consultation (see Figure 3-6). We feel this is a strong story given the alignment of two separate and independent sources.

The most recent econometric cost benchmarking for the industry suggests that overall Bristol Water is at upper quartile of cost efficiency for the industry. This is based on considering our wholesale cost position as a whole. As our response to the Ofwat cost modelling consultation in March identified, we prefer wholesale total cost modelling, as we think this is more robust than sub-service modelling. This reflects our 'Systems Thinking' and the integrated nature of wholesale services; the interdependency between water treatment and water resources costs in particular; and also the interdependency between the nature of water produced and the distribution network on the quality and reliability (and hence cost) of delivery to customers.

We have tested our efficiency position top down against a detailed development of a plan that continues our transformation. The speed in transformation of the Bristol Water efficiency position is of particular note, as demonstrated in NERA's analysis of Ofwat's proposed cost models for PR19.

Based on NERA analysis of the Ofwat form of cost models in the PR19 cost modelling consultation (based on 2011-2017 data), Bristol Water can be seen to be improving substantially over the period (see Figure 3-6). Looking at the average cost over the period, Bristol Water does not form the efficiency frontier, however, we do on more recent (and we anticipate, based on the efficiency assumptions in our plan) projected data.

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In our response to the cost modelling consultation we indicated that we are likely to remain an outlier in water resources expenditure, in part due to the cost of payments to the Canal and River Trust.

This reflects the percentage of the predicted cost that we are above or below the upper quartile position. For 2016/17 we were 2.2% below the upper quartile, using wholesale water costs as a whole. We consider using the higher 5.4% for network plus costs, noting this is inconsistent with our view of the appropriate form of cost modelling.

At the start of AMP6 we launched a change program called Project Channel. The objectives of this program were to:

- Adapt Bristol Water to the requirements and opportunities of working in a totex environment, focused on delivering outcomes
- Deliver the efficiencies needed in AMP6

This program delivered much of the step change in cost required to meet our PR14 Final Determination (post-CMA redetermination) in a sustainable fashion that we have been able to maintain. This was achieved through a range of business change initiatives such as:

- Organisation re-design and headcount reduction
- Improved commercial management
- Improved energy management
- Improved asset management to re-profile our capital investments
- Consolidation of business premises to reduce rates
- Innovation – engaging the business as part of a cultural change to transformation and continuous improvement.

Much of the sustained improvement, particularly to asset management, can be seen where we have built a bottom up view of the schemes and interventions to meet the needs of our customers through industry leading practice. The schemes we anticipate in AMP7 lead to a lower cost profile than that targeted in AMP6 (see Figure 3-13 below), thereby maintaining our trajectory of lower costs.

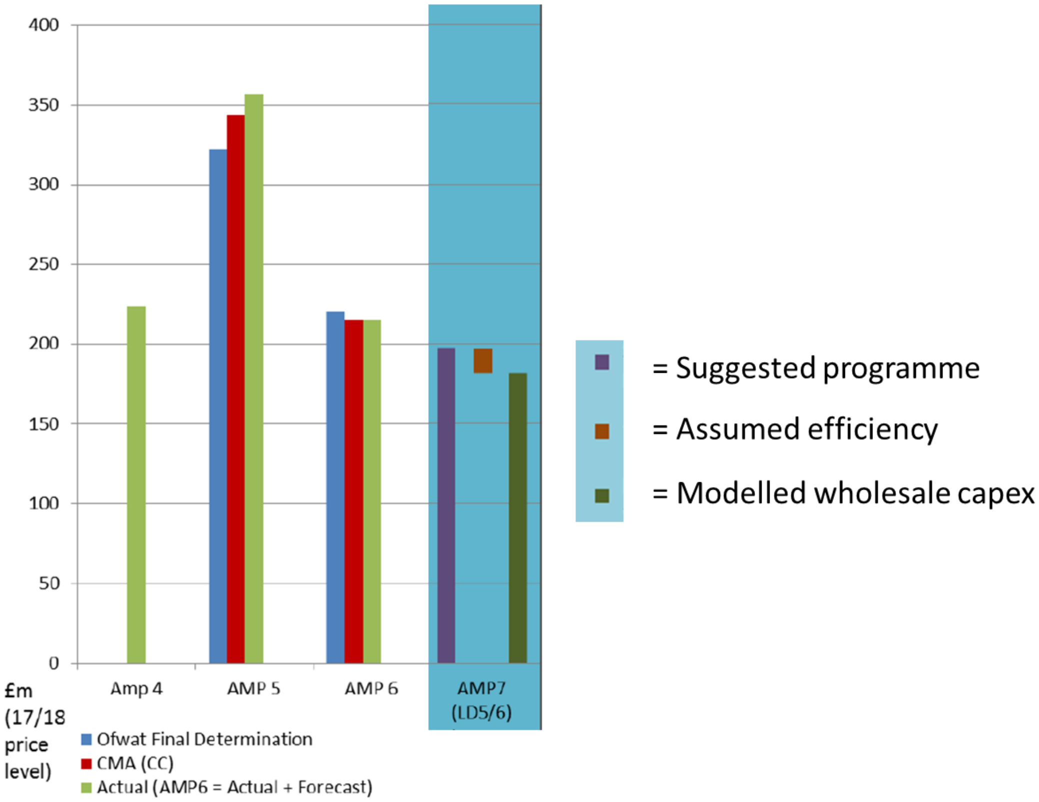

Figure 3-13 – Capex investment over Price Reviews. Source: Bristol Water

Our cost transformation from a position of being an outlier at PR14 has resulted from a transformation of operating performance and a move away from an "age-based" to "risk-based" approach to infrastructure maintenance. This has allowed a much more balanced set of outcomes and cost delivery appropriate for the totex framework. Accordingly, this change of strategy means that cost expenditure before 2015, particularly on treated water distribution maintenance, has little relevance to the future investment programme. To a degree, additional mains replacements over 2011/12-2014/15 reflected a catch-up in investment on earlier periods and this volume of activity is not reflected in our future plans. Our network age and materials special cost factor case sets out this level of "atypical" historic expenditure. Therefore we consider that our more recent efficiency modelling position is a better reflection of our relative efficiency than the average data over 2011/17.

The Asset Management workstream within Project Channel directly sought to improve how we respond to our asset risks by including a full assessment of all options available across capital and operational dimensions in keeping with Totex ways of working. This, coupled with a prioritisation of our risks according to their impact on our ODIs (which were developed from our customers' feedback) ensured that we only respond to those asset risks where required and that we deploy the full range of options available to us to ensure we select the solution of least whole-life cost for our customers. The efficiency delivered from employing this approach is monitored by comparing the running cost of the emerging capital program compared to that proposed in the original business plan (currently forecasting a saving of £54.2m over AMP6). These benefits are tracked through a central change programme and reported to the executive on a quarterly basis.

The broad assessment of options is undertaken by our asset planning teams; not only do we ensure that these teams review all capital and operational solutions, but we work to ensure that they select innovative solutions where that is beneficial. A significant component of our Innovation Framework feeds into our asset planning teams: in order to ensure that we bring leading thinking to our asset risks we undertake:

- **Knowledge sharing**: we run a regular session with third parties to review our technology needs and understand what new solutions are available to meet these needs. We also participate in a number of research and “innovation brokerage” services such as UKWIR, Technology Approval Group, and the Pipeline Innovation Research Club.
- **Open innovation**: we run events such as the innovation exchange which seeks to invite a number of suppliers to pitch solutions to some of our strategic needs. We also publish our “innovation challenges” on our websites so that entrepreneurs, academics and suppliers can bring their solutions to our asset planning teams.
- **Market scanning:** part of the role of a number of individuals within our asset teams is dedicated to maintaining a current view on leading technologies that we could bring to bear in responding to our asset risks.
- **Research partnerships:** we are members of UKWIR and have a number of partnerships to undertake leading research into areas of interest, for example Dynamic DMAs and Behavioural studies on water use

This recent step change needs to be considered when setting ourselves an efficiency target to ensure that our target is sufficiently stretching. In this respect taking a more long term average of our efficiency performance over the period 2011/12 to 2016/17 may mean we set ourselves a target which is not sufficiently challenging by recent performance standards. Therefore applying greater weight to the most recent past performance over older evidence will ensure a level of challenge is set appropriate to our current cost performance which is in the interests of customers. Ofwat may wish to consider the impact of adjusting our historic inefficient performance from the overall industry efficiency modelling given the transformation we have delivered and step change in cost from 2015/16 compared to the earlier period.

This reflects our commitment to deliver a business plan that is based on efficient costs and by that we mean that customers should not be paying more than they should need to, both now and in the future.

3.2.1.3 Our Frontier Efficiency challenge

In addition to closing the gap to the top quartile of the industry, in developing our efficiency challenge we also need to acknowledge that the frontier is also moving, due to industry-wide productivity improvements. In addition to this, NERA estimated a frontier shift for industry productivity of 0.6% for capex and 0.7% p.a. for opex. The KPMG/Aqua work for Ofwat suggests a wider range for frontier shift of 0.4% - 1.2%[97]. We were not persuaded by the KPMG/Aqua analysis of a larger totex/outcomes frontier shift, although to a degree this challenge has been embedded in the bottom up efficiency estimates we describe further below. Therefore we believe that NERA’s estimates for frontier shift are appropriate for adoption in our business plan.

[97] KPMG and Aqua (2017) PR19 - Innovation and Efficiency Gains from the TOTEX framework p. 19

RPE Forecasts (Real Growth, ie. above CPIH)

	2020/21	2021/22	2022/23	2023/24	2024/25	Avg
Labour	1.9%	1.8%	1.4%	1.4%	1.4%	**1.6%**
Materials	1.2%	1.2%	1.2%	1.2%	1.2%	**1.2%**
P&E	0.5%	0.5%	0.5%	0.5%	0.5%	**0.5%**
Energy	5.3%	9.0%	-0.7%	3.0%	3.9%	**4.0%**
Other	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**

Bristol Water's Forecast RPEs and Tender Price Inflation (Real Growth, ie. above CPIH)

	2020/21	2021/22	2022/23	2023/24	2024/25	Avg
Combined Opex	2.1%	2.8%	0.8%	1.5%	1.6%	**1.8%**
Combined Capex	1.1%	1.0%	0.8%	0.8%	0.8%	**0.9%**
Combined Totex	1.5%	1.8%	0.8%	1.1%	1.2%	**1.3%**
Tender Price Inflation	1.3%	1.3%	1.3%	1.3%	1.3%	**1.3%**

Figure 3-14 - Forecasts of Real Price Effects, 2020/21 to 2024/25. Source: NERA (2017)[98]

The RPE assumptions within our plan are shown in table App24a:

App24a - Real price effects (RPEs) and efficiency gains — **Bristol Water**

	Line description	Item reference	Units	DPs	Weightings	2020-21	2021-22	2022-23	2023-24	2024-25
A	CPIH assumptions used for RPE calculations									
1	CPIH: Financial year average indices year on year %	APP23005_CPY	%	2		1.95%	2.01%	2.01%	2.01%	1.99%
B	Real price effects included in wholesale water resources									
2	Operating expenditure (RPEs in water resources)	APPA240001	%	2	74.50%	1.81%	1.75%	1.76%	1.76%	1.78%
3	Maintaining the long-term capability of the assets infrastructure (RPEs in water resources)	APPA240002	%	2	4.12%	0.90%	0.90%	0.90%	0.90%	0.90%
4	Maintaining the long-term capability of the assets non-infrastructure (RPEs in water resources)	APPA240003	%	2	12.59%	0.90%	0.90%	0.90%	0.90%	0.90%
5	Other capital expenditure ~ infra (RPEs in water resources)	APPA240004	%	2	3.15%	0.90%	0.90%	0.90%	0.90%	0.90%
6	Other capital expenditure ~ non infra (RPEs in water resources)	APPA240005	%	2	5.64%	0.90%	0.90%	0.90%	0.90%	0.90%
C	Real price effects included in wholesale water network plus									
7	Operating expenditure (RPEs in water network plus)	APPA240006	%	2	57.33%	1.81%	1.75%	1.76%	1.76%	1.78%
8	Maintaining the long-term capability of the assets infrastructure (RPEs in water network plus)	APPA240007	%	2	16.02%	0.90%	0.90%	0.90%	0.90%	0.90%
9	Maintaining the long-term capability of the assets non-infrastructure (RPEs in water network plus)	APPA240008	%	2	16.67%	0.90%	0.90%	0.90%	0.90%	0.90%
10	Other capital expenditure ~ infra (RPEs in water network plus)	APPA240009	%	2	9.72%	0.90%	0.90%	0.90%	0.90%	0.90%
11	Other capital expenditure ~ non infra (RPEs in water network plus)	APPA240010	%	2	2.89%	0.90%	0.90%	0.90%	0.90%	0.90%

Figure 3-15 - Our Assumptions of Real Price Effects. Source: App24a, Bristol Water

During AMP7 NERA expect industry base costs (weighted to reflect the Bristol Water cost base) to increase above CPIH inflation by 1.3% of totex, split 1.8% opex and 0.9% capex.

Furthermore, we have utilised risk-adjusted cost benefit analysis to ensure that we are achieving productive efficiency, i.e. the most effective solution for least cost that maximises customer benefits (using WTP and other valuations). To do this, in developing our investment plan for 2020/21 to 2024/25 we have used an optimiser tool. This has been achieved through working with a specialist costing partner, ChandlerKBS, to inform cost estimates that are benchmarked to comparable projects completed elsewhere in the sector so that we and therefore customers are not paying more than necessary to ensure the long term capabilities of our assets. We applied an 8% programme level efficiency target to the capital expenditure elements of the optimised investment cases in order to reflect the programme level efficiencies from the cost estimates used. The evidence suggests that this cost level should at least match the upper quartile, based on available information.

Finally, through participation in the European Benchmarking exercise we have sought to understand how our efficiency compares against a group of 47 companies from across the continent and further afield.

Analysis of unit cost rates, both in aggregate and by process shows that our unit costs per m3 of treated water compare favourably to the average, although we note that our distribution costs are higher than average. Interest costs are also higher than average, which is explained by the different financing structure of UK companies compared to those in continental Europe.

[98] NERA (2017) Forecasts of Real Price Effects and Ongoing Productivity Improvements During PR19, p. ii-iii

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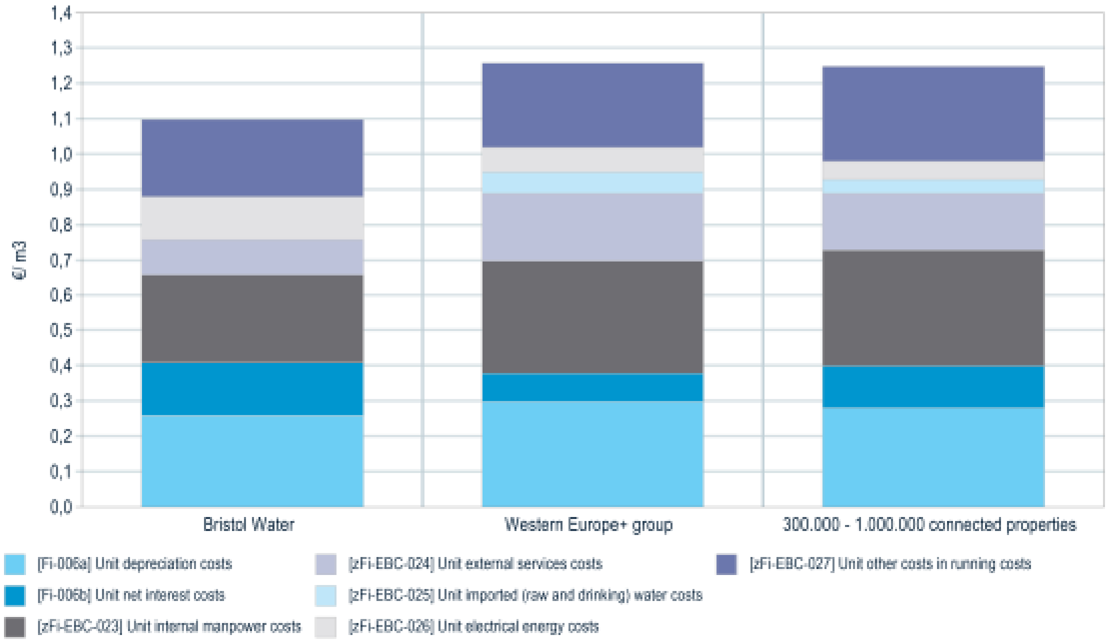

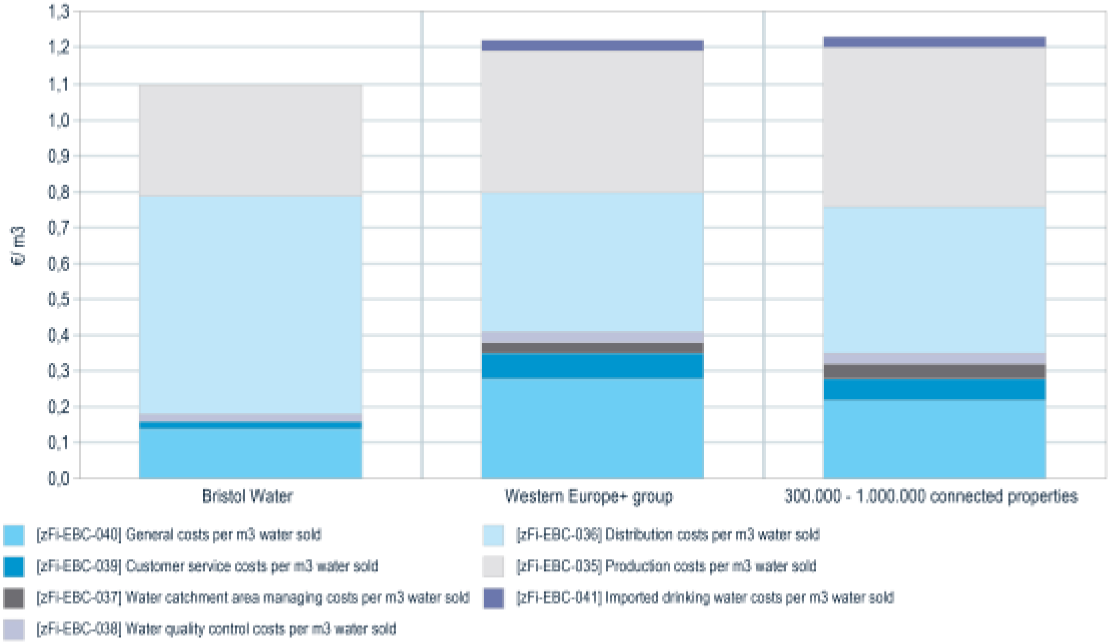

Unit and Total Costs Benchmarking per Business Area. Source: European Benchmarking Co-operation (2016)[99]

3.2.2 Cost Adjustment Claims

Econometric efficiency modelling (see Section 3.1.1) makes assumptions on the level of costs incurred by companies based on a number of cost drivers, reflecting the scope and nature of company operations and the circumstances in which they operate.

There are some areas where an econometric approach will not fully reflect a company's costs if they are not directly correlated to a cost driver included within the models. Where these costs cannot be driven down further, due to factors beyond a company's control, and they cannot be overcome or mitigated within the period 2020/21 to 2024/25, then an adjustment to the modelled cost allowance may be claimed for. Similarly

[99] European Benchmarking Co-operation (2017) International Benchmark 2016 Water Supply, p.5

where there are areas where a company's costs are naturally lower due to factors not included within the models, an adjustment may be made.

The regulatory framework acknowledges these areas and makes a separate assessment through the cost adjustment claim process as part of Ofwat's cost assessment. In this instance higher or lower customer bills are not due to inefficiency or efficiency of our operations but rather due to circumstances over which we have no influence.

Making this distinction is important in order to ensure that customers are not paying for inefficient levels of cost, given our performance, our work delivery and our risk appetite. Making this distinction is also important, as otherwise uncontrollable factors that make our costs higher may be wrongly labelled as inefficiency and uncontrollable factors that make our costs lower may be wrongly labelled as efficiency, neither of which are in the long term interests of customers.

We have embraced a methodical approach to identifying, shortlisting and developing cost adjustment claims, such that only those most relevant and robustly evidenced have been included in our business plan. Our approach is summarised in Figure 3-16.

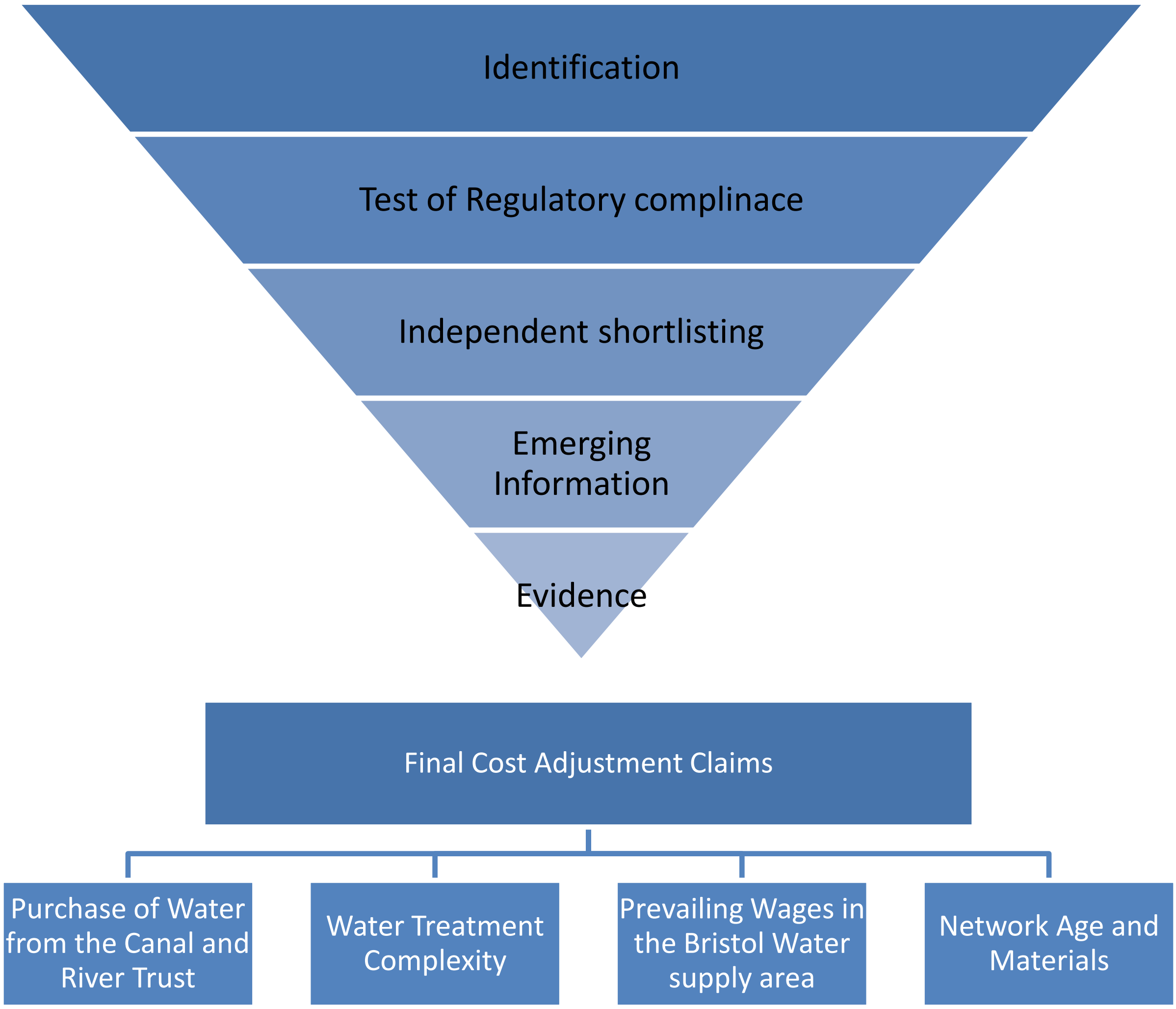

Figure 3-16 - Our approach to submitting cost adjustment claims. Source: C5A Technical Annex – Cost Adjustment Claims (Bristol Water)

Identification: We sought to cast a wide net to identify possible cost adjustment claims. This initial identification process involved firstly:

- reviewing our own PR14 cost adjustment claims;

- undertaking an industry review of the cost adjustment claims submitted by other companies at PR14;
- econometric insights through work with both Oxera and NERA to understand cost areas that may not be captured by their own models developed in the PR19 framework; and
- internal conversations.

This information gathering stage enabled greater appreciation of areas where our activities differ to those of other companies, due to factors beyond our control from an operational perspective. This process has provided a wealth of knowledge into the cost make-up of our operations and was formally concluded by a Bristol Water workshop, led by NERA, on the identification of cost adjustment claims.

Downward adjustments: We actively sought to identify cost adjustment claims which may require a downward adjustment to our cost baseline.

Regional wages is one area in particular where a downward (or upward) adjustment may be appropriate, although the direction and magnitude ultimately remains dependent upon the final form of Ofwat's PR19 models and how Ofwat intends to account for variations in wages across companies. In C5A we present a plausible uplift to the case of wages with the acknowledgement, as with all cases we have submitted, that the claim is 'model dependent'.

Two further downward cost adjustment claims are also worth acknowledgement; preferential sludge disposal arrangements and cost savings associated with operating in local authority areas where permits to work are not required. These adjustments were however ultimately dismissed as they did not meet the second test of regulatory compliance in terms of materiality when it came to the evidence building stage.

Test of Regulatory Compliance: Shortlisting commenced against two initial tests. The first was the likelihood of the claim to pass a materiality assessment of £1m[100] and dependent on this outcome an assessment was made against whether the claims truly fulfilled the regulatory requirements of what a cost adjustment claim constitutes, namely either an atypically large investment, a regional operating circumstance, a new requirement or a disproportionate cost.

Independent Shortlisting: We commissioned NERA to undertake a shortlisting exercise to further refine the list of candidate claims and to provide an independent view on each of the claims with respect to economic rationale, uniqueness of the claim to Bristol Water, ability to quantify the claim, regulatory precedence and materiality. This exercise informed internal decision making and demonstrates our commitment to only take forward cost adjustment claims that are prudent and appropriate. The Bristol Water PR19 Board Sub-Committee was involved throughout this shortlisting process, providing recommendations on the claims to be included.

Emerging Information: Throughout the process, continuous review took place against emerging information inclusive of the draft and final PR19 methodologies, business decisions and more recently the cost model consultation, to ensure that our candidate claims remained prudent and appropriate. This reassessment led to a number of claims ultimately being dismissed.

Evidence: With a handful of claims remaining, development of the evidence base commenced which involved continuous review of the quantity and quality of the evidence being collated, alongside a reassessment of each claim against the four stages of screening set out above to ensure that each case remained compliant with the regulatory tests and emerging information. A number of claims were dismissed at this stage in the process. These dismissed claims are summarised in Table 3-47:

[100] This test took place prior to publication of materiality thresholds in the PR19 Final Methodology (December 2018). Materiality was subsequently re-assessed against the PR19 business unit thresholds as part of the independent shortlisting exercise.

Candidate Claim	Direction of claim	Price control	Rationale for dismissal
Pumping Costs	Upwards	Network plus	• Higher costs in the Network plus control were largely netted out by lower costs in the Water Resources control. On balance a claim was not considered prudent; and • Improved reporting requirements for the average pumping head variable provided assurance of greater consistency in reporting methodology across companies if the variable is included in Ofwat's PR19 cost assessment econometric models.
Permits to work on the roads	Downwards	Network plus	Since claim identification, the government has announced its intention to roll out lane rental nationwide (currently only London / Kent), with further guidance to be issued Autumn 2018. Therefore it is likely that during AMP7 Bristol Water will face costs on a similar basis to other companies who currently have to pay lane rental charges (e.g. Thames) and that this claim is no longer appropriate.
Preferential sludge disposal costs	Downwards	Network plus	Upon assessment of the costs, this claim did not meet Ofwat's materiality threshold for the control.
Congestion in the City of Bristol	Upwards	Network plus	This claim informed our early submission where we identified a risk that the claim upon revision for 2017/18 actuals may not be material. Updates to the analysis have confirmed that the claim does not meet Ofwat's materiality threshold for the control.

Table 3-47 - Summary of cost adjustment claims dismissed during the evidence development stage

Further information can be found in C5B Technical Annex - Cost Adjustment Claims.

Final Cost Adjustment Claims: We have submitted four cost adjustment claims as part of business plan, this is one less than at early submission and reflects our omission of the congestion cost adjustment claim on the grounds of materiality. One claim relates to the Water Resources price control and three relate to the Network plus control. These are summarised below. We have not submitted any capital enhancement schemes as cost adjustment claims.

Cost Adjustment	Price control	Estimated value 2020/21 to 2024/25 (£m,17/18 CPIH prices)	
		Lower estimate	Upper estimate
Purchase of Water from the Canal and River Trust	Water Resources	9.420	
Water Treatment Complexity	Network plus	5.963	55.608
Prevailing Wages in the Bristol Water Supply Area	Network plus	0	8.716
Network Age and Materials	Network plus	12.282	
Total (Range)		**27.665**	**86.026**

Table 3-48 - Summary of PR19 Cost Adjustment Claims. Source: C5A Technical Annex – Cost Adjustment Claims (Bristol Water)

Our submission reflects the low end of the range shown in the table above. The total value of the cost adjustments is £27.665m (£36.381m with the prevailing wage claim that depends on the modelling approach taken). Further information on these claims and the evidence base underpinning them can be found in C5.B Technical Annex: Cost Adjustment Claims.

As well as embracing a rigorous approach to the identification and shortlisting process, we have also been rigorous in our development of the supporting evidence base and challenging in the commitments we have set ourselves. This is set out in more detail below.

Demonstrating that our cost adjustments are well evidenced: C5B Technical Annex- Cost Adjustment Claims sets out the evidence base for each cost adjustment claim in turn.

Our cost adjustment claims are well evidenced as can be demonstrated by our commitment to:

- **Testing econometric estimates with bottom-up approaches.** Whilst an econometric framework will provide the basis for Ofwat's cost assessment, implied revenue allowances are most robust when interpreted in the round and in aggregate.[101] This reflects the limited number of cost drivers that can be included in a model, limitations on the granularity of modelling that can be developed and inevitable correlations between cost drivers and their statistical relationship with costs. In light of this assessment we have sought to ensure that econometric estimates used to inform our cost adjustments have been linked back to and cross-referenced with real costs and real operational experiences at Bristol Water. For each case, such bottom-up approaches drive the overall monetary value of the claim.
- **Cross-checks on the validity of the assumptions and valuations.** A number of cross-checks have been undertaken to ensure that the valuation of each claim and the method used to derive it are robust and intuitive to other aspects of the plan, in particular the overall botex and totex forecasts.
- **Iterative assessment against Ofwat's evidence tests**. Ofwat have made clear they will set a higher evidence bar to inform their assessment of companies cost adjustment claims. We have undertaken an iterative assessment of our responses to each of the Ofwat tests to ensure compliance and maximise value added. We have undertaken a comprehensive review of both Ofwat and the CMA's assessment of our claims at PR14, where these are relevant to our PR19 claims, taking into account receipt of new information and the current regulatory framework. This has informed our evidence base and we have responded to gaps identified where it has been prudent to do so.
- **Independent contributions to our evidence base.** We have commissioned independent contributions to our evidence base in areas where we considered this will add most value. In particular we commissioned Aqua to undertake benchmarking analysis of our treatment work costs against comparable sites of other companies. Their findings not only concurred with the presentation of our treatment complexity case at early submission but also provide additional rigour to the case in principal through their third party perspective.
- **Customer Research.** In light of our holistic view of customer engagement in the business planning process, we have sought to evaluate customer priorities and views as part of our evidence base. We carried out a specific customer research event (January 2018) in order to explore customers' views on the specific challenges and opportunities provided by being served by a small local water company and those unique to our supply area. These views helped to inform our decisions on the claims to include within this submission, of which further information can be found in C5.B Technical Annex: Cost Adjustment Claims.
- **Assurance.** We have gone beyond regulatory requirements through undertaking two rounds of technical third party assurance, prior to early and final submission. Through adopting this approach we have been able to demonstrate improvements in the quantity and quality of the evidence base and this follows from our strategy to prepare our early submission on the basis of fully-evidenced claims, although again this was not a regulatory requirement. An assurance statement on the quality

[101] As we set out in our response to the cost model consultation

of the evidence base informing our cost adjustment claim submission is included within C5.B Technical Annex: Cost Adjustment Claims.

Demonstrating that our cost adjustments are efficient and challenging:

Summary: We are not relying on cost adjustment claims to meet the efficiency challenges we have set ourselves to deliver in AMP7.

From a Botex perspective, to which all of our claims relate, the efficiency challenge we have set ourselves has been developed from a financial perspective of comparing what we have modelled our efficient costs to be against our actual costs going forwards, with the gap to be made up through innovations and improvements that deliver cost savings (see Section 3.2.3).

Our cost adjustment claims are present both in our historic and forecast baselines and therefore the associated expenditure is explicitly included in our business plan botex costs. That is to say, the following are all costs built into our day-to-day operational and maintenance activities, both now and in the future:

- securing 45% of our distribution input through the purchase of water from the Canal and River Trust;
- operating our treatment works to the required level of complexity given the nature of our raw water sources;
- paying staff salaries that at minimum encourage them to not look elsewhere in the South West; and
- maintaining our network in light of its age and material composition.

Therefore the cost adjustment claims themselves do not form part of our strategy to bridge any efficiency gap identified directly per se; rejection of our claims by Ofwat would effectively lead to a reduction in the revenue allowed and in turn therefore a larger efficiency gap to close through innovations and improvements. Any downward cost adjustment claims posed to us through the symmetric process post Ofwat's initial assessment of business plans will in parallel also lead to a reduction in the revenue allowed and in turn therefore a larger efficiency gap.

To conclude, as we believe our plan to be efficient as a whole, our cost adjustments claims depend on the form of modelling that Ofwat ultimately undertake. If the costs in our plan are accepted as a package, we would not require detailed review of the cost adjustment claims to improve our relative efficiency position.

Summary: Consistent with all cost forecasts presented in our business plan, our cost adjustment claims are demonstrably efficient and we have challenged ourselves to provide the same great service at lower cost. The claim valuations have been derived either using econometric methods, to which we are close to upper quartile efficient in the most recent years, or our latest available actual costs, which drive the upper quartile efficiency position identified by econometric modelling. In our business plan we have not sought to make any explicit efficiency challenge for our purchases of water from the Canal and River Trust claim as we consider such challenges arbitrary in the face of current contractual re-negotiations of price. Our preference is for these costs to be treated as 'pass through'.

The claims in our business plan relate to cost areas present both in our historic and forecast cost baselines. We therefore expect that the costs underpinning the claims will to a large extent[102] be included in the costs Ofwat models using econometrics. As set out in the 'Modelling' section, we believe in our own modelling efforts and our reproduction of Ofwat's cost model consultation models that we are efficient at the upper quartile benchmark when our most recent costs (2016/17[103]) are assessed.

Consistent with this conclusion we believe that,

[102] This depends on the precise costs Ofwat chooses to model through the PR19 econometric cost assessment models

[103] Reflecting that the 2017/18 company actuals informing the cost assessment process have not yet been published by Ofwat

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- where our cost adjustment claims have been valued using an econometric approach, the forward looking estimates are efficient; and
- where our cost adjustment claims have been valued using actual costs, the forward looking estimates are efficient as we have sought to develop the estimates on the latest available information (2017/18)[104], reflecting our view that historic costs are less relevant given the step-change in costs evidenced in Section 3.1.1.

Furthermore, we have not explicitly sought to drive a standalone efficiency challenge in our cost adjustment claims for the following legitimate reasons:

- The costs associated with our claims are already built into our business plan estimates and as such they have already been subject to adjustments for frontier and catch-up efficiency[105];
- The cost adjustments seek an allowance for areas of expenditure which are unavoidable; our ability to influence their costs is therefore limited; and
- We expect that efficiency adjustments for frontier and catch-up will form part of Ofwat's econometric modelling assessment, not the post-modelling cost adjustment claim assessment.

As a result of this assessment, we have not included any adjustments to the claims to reflect improvements across the industry that deliver cost-savings (frontier efficiency) or a challenge to ourselves to be upper-quartile in the industry (catch-up efficiency), upon the understanding that these are already accommodated elsewhere both in our business plan and in Ofwat's framework for assessing our plan.

Cost adjustment claims represent areas of expenditure not likely to be captured by the econometric models, fully or in part. We anticipate that the costs underpinning our adjustment claims will to a large extent[106] be included in the costs Ofwat models using econometrics; what we are currently uncertain about is whether Ofwat will include cost drivers in the econometric analysis which sufficiently account for the activities set out in our claims. The cost adjustment claims themselves therefore seek to ensure that the allowance ultimately set out by Ofwat for Bristol Water is reflective of our actual operations and associated unavoidable costs and are not mis-interpreted as 'inefficiency'.

The exclusion to this efficiency assessment[107] is our arrangement with the Canal and River Trust which permits the purchase of water from the canal system in South Gloucestershire. This reflects our current engagement at the time of business plan submission on a contractual price re-negotiation. Given the outcome of such a negotiation could either result in an upward or downward movement in prices, application of an efficiency challenge to a currently unknown future cost and cost-profile is arbitrary. We are, however, committed through this process to securing a price that represents value for money for our customers both now and for the foreseeable future. Ultimately the main factor influencing the future cost profile of this claim is the contractual arrangement, which is a risk we cannot mitigate[108] within the period 2020/21 to 2024/25.

Summary: We have one significant water resources cost risk which we cannot mitigate as it is substantially outside of our control. This refers to our payments to the Canal and River Trust for the purchase of water from the Sharpness Canal and current uncertainties regarding the outcome of the price negotiation process which has gone to arbitration.

[104] This justifies our approach in comparison to, for example, taking a three year average of historic costs to inform forecasts, as such estimates may be higher than they otherwise need to be
[105] With the exception of our case for the purchase of water from the Canal and River Trust
[106] This depends on the precise costs Ofwat chooses to model through the PR19 econometric cost assessment models
[107] Both in terms of a frontier adjustment and challenge to ourselves and to deliver more for less
[108] For example through alternative water resource options

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The Canal & River Trust are seeking an increase in the amount we are charged for the water supplied from the Gloucester & Sharpness Canal from c£1.8m p.a. to £10m p.a., based on a "market value of water"[109]. We will defend this cost challenge robustly through arbitration initially and also consider other steps to mitigate this cost risk to customers. Any change in charges will be backdated to 1 April 2018, which in our view for any price legitimately based on the cost of supply, may after the arbitration and challenge process, see a decrease from current levels. In this situation, we believe notified item protection is in customer interests and is necessary for financial viability. We propose a specified sharing rate of 75% customer and 25% company as our customer research tells us that customers prefer us to limit variability in their bills, and to smooth changes over time. Further details of this proposal are set out in Section C6.

We have no enhancement cost adjustment claims, reflecting a small and low-risk enhancement programme where the expenditure is either investigations or "maintenance-like" enhancement activity such as resilience. The net cost of network reinforcement reflects the income offset received from developers, which therefore does not lend itself to efficiency modelling.

3.2.3 Our Efficiency Plans

We challenged our 'top down' efficiency targets by undertaking a thorough review of our business to understand where we can achieve efficiencies. The review is undertaken by engaging suitable representatives (both team members and senior leaders) from all of our business, to understand where there might be opportunities for efficiency. We ensure that we are suitably challenging of ourselves in this assessment by engaging reputable third parties to guide and review our activities, against their view of potential efficiencies and innovations available.

This activity has been undertaken as part of how we deliver change and transformation at Bristol Water:

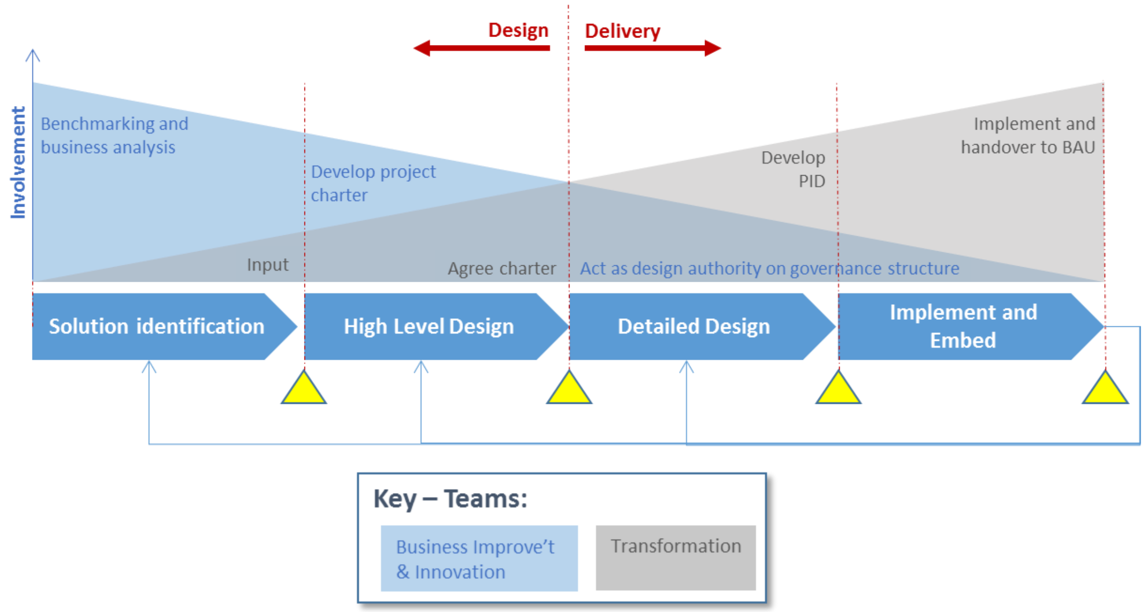

Figure 3-17 – Transformation process. Source: Bristol Water

The process moves through four phases of solution identification, high level design, detailed design and implementation. At each stage an appropriate steering group reviews the output and provides the approval to continue. Our Business Improvement and Innovation (BI&I) team undertake a phase of solution identification in order to identify where the business can make improvements. Projects that require a major change for implementation are undertaken by our permanent Transformation function which operates under the steer of an executive steering group. Smaller items continue through to implementation with the BI&I team. For those

[109] Bristol Water (2017) correspondence with the Canal and River Trust charity

items implemented by the Transformation team BI&I operate as a design authority to ensure effective delivery. This model allows us to constantly challenge and improve our operation.

For AMP7, the BI&I team have begun the solution identification stage on initiatives aimed at delivering our efficiency position. This 'bottom up' work provides a guide on how much business change will be required to meet our top-down targets, thereby giving an indication on whether these targets are sufficiently stretching (without requiring our customers and shareholders to tolerate excessive operational risk).

There are five distinct stages that have led us to our efficiency position:

1. **Benchmarking Activity**: We employed third parties (Enzen and Hackett) to review our business and benchmark our position. This gives us some high-level areas of focus and challenge as we moved into our efficiency review.
2. **Efficiency Assessment**: We conducted subject matter expert (SME) interviews across all areas of our business and this gave us an initial view of where we could seek efficiency. 65 initiatives were initially identified, and these were grouped into high-level themes/benefit drivers.
3. **External review and prioritisation**: To ensure sufficient ambition, we brought in an external consultancy, Baringa, to review these initiatives, and prioritise them based on value and maturity. This work was split into two review phases (forming our external assurance). The first phase identified a large number of initiatives to remove, due to low value and scope. The second phase identified additional opportunities, and grouped the remaining initiatives based on key themes, such as Energy Management, and Continuous Improvement.
4. **Internal review**: Following the external review, the remaining initiatives were reviewed internally by business SMEs, to highlight any limitations (operational or other), and to verify the underlying assumptions and calculations. SMEs provided consensus on the remaining initiatives, and give us confidence that we have sought out appropriate efficiency areas.
5. **Innovation challenge:** For the specific investment cases within our Business Plan we engaged a third party, Isle Utilities, to undertake a market scanning exercise and identify where we can pursue likely future benefits. These activities ensure we continue to push the industry frontier forward. Isle Utilities undertook a review of our investment cases, prioritising focus areas according to the impact on outcomes, expenditure and the long term ambition of the company. Within these focus areas Isle undertook a market scanning exercise of technologies that we should aim to exploit in the next AMP, in order to deliver the investment cases as effectively and efficiently as possible.

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This process begins to mobilise an ambitious programme of change, building on the success of our previous transformation programme, Project Channel. The breadth and transformational nature of this programme firmly indicates that the efficiency targets put forward in our plan are ambitious. These plans are summarised below. The specific initiatives are presented alongside C5[110].

Area	Description	Gross Efficiency Target (over AMP7)
Energy Management	A suite of low-carbon initiatives and innovations to reduce the volume and cost of energy used such as: • Solar generation • Gas generation • Pump schedule optimisation	£7.8m
Commercial and Operations	A root and branch review of how we deliver our key operations including transformation of: • Our sourcing strategy for maintenance activities • Productivity improvements of operational activities • Targeted focus on contractual efficiencies • Upgrade of our core IT operational platforms	£11.8m
Continuous improvement	A series of process improvements to drive higher output at reduced cost such as: • Improved reporting, control and systems for project delivery • Automation of high-effort manual processes	£5.0m
Production optimisation	A range of initiatives focussing on driving cost improvements across system, site and process levels, for example: • Whole-system optimisation to ensure least cost works are used at maximum output • Optimised maintenance plans for least whole life cost, including a shift further towards planned work • Chemical optimisation to reduce spend	£2.7m

Figure 3-18 – Efficiency Initiatives. Source: Bristol Water[111]

By using independent third parties to set quantitative targets against which initiatives were developed, we were able to challenge ourselves to be ambitious in the transformations we sought.

These plans are already being taken through our change process (explained above), refined, reviewed and prepared for implementation within the business ahead of AMP7 in order to put us in a strong position for the next AMP.

These plans are highly ambitious, impacting all areas of the company, with ambitious change and targets underpinned by continued capability growth and service improvements.

This exercise also included a review of the potential Retail efficiencies and a summary of this can be found in the following retail section.

The summary of how our transformation plan components deliver against cost and service objectives (our "customer promises") is shown below:

[110] Bristol Water (2018) Efficiency Initiative Assessments
[111] Bristol Water (2018) Efficiency Initiative Assessments

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Customer priorities	Customer promises	Production	Network	Customer 360 view	Knowledge & Asset Management	Supply Chain	Systems	People	Transformation Function
We give you a bill which you can afford	Lower bills for customers - affordable for all	H	H	L	M	M	L		M
You get the best possible experience every time you need us	Achieving customer excellence	L	H	H	L	H	H	H	H
	Inclusive services that meets customers individual needs, especially when they are most vulnerable. Aiming for zero water poverty		M	H	M	M	H	M	M
Saving water before developing new supplies	15% leakage reduction	H	H	H	H	H	H	M	H
	Metering and water efficiency promotion and support		H	H	M	H	H	M	M
Trust beyond water – helping you to improve your communities and the local environment	Accountable to the community partners we work with for the wellbeing of society – 'Bristol Water For All'		H	H		M	H	H	L
	Building biodiversity and protecting our environment	H	M		H	L			L
Keeping top quality water flowing to your tap	Improving water quality (including contacts for discolouration and taste)	H	H	H	H	M	H	L	M
	Reducing supply interruptions to 1.8 minutes per customer (our forecast of industry top quartile)	M	H	H	H	H	H	M	
	Resilience – boosting protection for population centres of more than 10,000	H	H		H	L			L

H	High contribution
M	Medium contribution
L	Low contribution

Figure 3-19 – Customer Promises. Source: Bristol Water

4 Residential Retail

Our residential retail costs benefit from our joint delivery of retail services with Wessex Water through Pelican Business Services, our joint venture billing company (formerly known as Bristol Wessex Billing Services Ltd, or BWBSL).

Our retail costs over AMP7 will be:

	Unit	Annual Retail – Notional Structure @ Nominal Values: 2020-21	2021-22	2022-23	2023-24	2024-25	2020-25
Customer Services	£m	2.3	2.4	2.5	2.5	2.6	12.3
Debt Management	£m	0.5	0.6	0.6	0.6	0.6	2.9
Doubtful Debts	£m	2.7	2.8	2.8	2.9	3.0	14.2
Meter Reading	£m	0.4	0.4	0.4	0.4	0.4	2.0
Other operating expenditure	£m	2.7	2.7	2.8	2.8	2.8	13.8
Local authority and Cumulo rates	£m	0.0	0.0	0.0	0.0	0.0	0.0
Third party services	£m	0.0	0.0	0.0	0.0	0.0	0.0
Total operating expenditure	£m	8.6	8.8	9.1	9.3	9.5	45.3
Recharge for Wholesale Assets	£m	0.5	0.7	0.7	0.7	0.7	3.3
Depreciation	£m	0.5	0.5	0.5	0.5	0.5	2.5
Retail Cost to Serve	£m	9.6	10.0	10.3	10.5	10.6	51.1
Allowable Retail Margin	£m	0.9	1.0	1.0	1.0	1.0	5.0
Allowed Revenue	£m	10.6	11.0	11.3	11.5	11.7	56.1
Total Operating Expenses & Recharges	£m	9.2	9.5	9.8	10.0	10.2	48.6
Total gross capital expenditure	£m	1.2	0.2	0.2	0.2	0.2	2.1
Total Expenditure Retail	£m	10.4	9.7	10.0	10.2	10.4	50.6

	Unit	Annual Retail – Notional Structure @ 2017-18 FYA (CPIH deflated): 2020-21	2021-22	2022-23	2023-24	2024-25	2020-25
Customer Services	£m	2.2	2.2	2.2	2.2	2.3	11.1
Debt Management	£m	0.5	0.5	0.5	0.5	0.5	2.6
Doubtful Debts	£m	2.6	2.6	2.6	2.6	2.6	12.9
Meter Reading	£m	0.3	0.4	0.4	0.4	0.4	1.8
Other operating expenditure	£m	2.5	2.5	2.5	2.5	2.5	12.5
Local authority and Cumulo rates	£m	0.0	0.0	0.0	0.0	0.0	0.0
Third party services	£m	0.0	0.0	0.0	0.0	0.0	0.0
Total operating expenditure	£m	8.1	8.2	8.2	8.2	8.3	41.0
Recharge for Wholesale Assets	£m	0.5	0.6	0.6	0.6	0.6	3.0
Depreciation	£m	0.4	0.5	0.5	0.5	0.4	2.3
Retail Cost to Serve	£m	9.1	9.2	9.3	9.3	9.3	46.2
Allowable Retail Margin	£m	0.9	0.9	0.9	0.9	0.9	4.5
Allowed Revenue	£m	10.0	10.1	10.2	10.2	10.2	50.7
Total Operating Expenses & Recharges	£m	8.6	8.8	8.8	8.9	8.8	44.0
Total gross capital expenditure	£m	1.2	0.2	0.2	0.2	0.2	1.9
Total Expenditure Retail	£m	9.8	9.0	9.0	9.1	9.0	45.9

Table 4-1: Retail cost summary. Source: Bristol Water

We show in the table above both nominal price retail inflation that is consistent with the business plan tables, as well as a deflated CPIH to 2017/18 prices that we show just for the purposes of describing the total appointee expenditure. The retail costs include £3.7m efficiency (7.6%) and we have not made any cost adjustment claims. This leads to a real-term reduction in cost per household:

	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Cost Per Household (nominal) £m	18.65	18.95	19.97	16.95	17.19	17.42	17.66	17.91

Table 4-2 – Cost per household. Source: Bristol Water

These costs have been determined through a pattern of:

1. Econometric benchmarking of our target costs
2. Bottom-up development of cost forecasts
3. Comparison and iteration of steps 1 and 2 to reach appropriate and efficient expenditure forecasts.

The sections that follow outline this approach and analysis.

4.1 Modelling

We have worked with a leading economic consultancy, Economic Insight, to develop household retail econometric models[112] that reflect our understanding of the modelling approaches Ofwat are likely to adopt at PR19 on retail costs, including separate analysis of bad debt and other retail costs. This analysis has focused on botex (Base expenditure, the sum of operational costs and capital maintenance costs, excluding capital enhancement costs) and is based on our ambition to maintain our position in the top quartile of the industry, as we were on the Average Cost to Serve approach used at PR14.

Economic Insight developed three modelling scenarios to inform plausible ranges of our efficiency gap to maintain our position as a leading company, that is the percentage variation between our actual costs and efficient costs, as informed by econometric analysis.

[112] Economic Insight (2018) Household Retail Cost Assessment for PR19

C5 – Cost and efficiency

Annual Retail Cost Efficiency Gap (%)		
Low	Central	High
Average [range]	Average [range]	Average [range]
0.0% [0.0%-0.0%]	5.4% [0.0%-10.8%]	8.5% [1.3%-14.8%]

Note: These three modelling scenarios vary in the efficiency assumptions taken, e.g. gap to average, top quartile and top quintile.

Table 4-3 – Annual retail cost efficiency gap. Source: Economic Insight (2018)[113]

Reflecting our ambition to maintain our position in the top quartile of the industry, we have based our plan on achieving the central efficiency challenge.

In addition to maintaining our position at the frontier of the industry on retail costs, in developing our efficiency challenge we also need to acknowledge that the frontier of efficiency is also moving, due to industry-wide productivity improvements. In addition to an estimation of our retail efficiency gap (catch-up efficiency), we have also calculated the gross input price pressures (IPP) and forecasted frontier shift for the period (productivity gain) with support from Economic Insight.

Modelled Element	High relative efficiency / low frontier shift / high cost pressure	Central Case	Low relative efficiency / high frontier shift / low cost pressure
Catch up% - one off	0%	**-5.4%**	-8%
Frontier (p.a.):			
Gross IPP	2.43%	**1.95%**	1.89%
Frontier shift	0.42%	**-0.42%**	-1.1%
Catch up	0%	**-1.08%**	-1.6%
Net % p.a. cost shift	**+0.93%**	**+0.45%**	**-0.39%**

Table 4-4 - Low, central and high scenarios to generate efficiency gap estimates. Source: Economic Insight (2018)[114]

[113] Economic Insight (2018) Household Retail Cost Assessment for PR19, p.8

[114] Economic Insight (2018) Household Retail Cost Assessment for PR19, p.8. Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.8-9, 11

C5 – Cost and efficiency

In summary the IPP analysis and evidence finds that:

- Input Price Pressure (IPP) for HH retail was found to range from -0.39% to 2.43%, broadly 0.93% over the period 2020/21 to 2024/25. Effectively, this is 1.95% less catch-up efficiency equivalent of c.1% p.a;
- Retail frontier shift in efficiency was found to be -0.42% for the years 2007-2015 and 1.1% between 1999 - 2008, with a long-term average of 0.42% for the 1999-2015 period; and
- Bringing all of the evidence together, we could face net IPP in our retail business of between 0.39% and 0.93% per annum on average over the period 2020/21 to 2024/25, with a central case of 0.45% pa.

These factors have been built into our cost models and shows that the efficient level of cost for Bristol Water Retail household opex is £45.3m over AMP7 (excluding wholesale recharge).

	2018/19	*2019/20*	*2020/21*	*2021/22*	*2022/23*	*2023/24*	*2024/25*	*AMP7 Total*
Base OPEX (2017/18)	9.14	9.14	9.14	9.14	9.14	9.14	9.14	45.7
Additional Cost of New Properties	0.15	0.22	0.30	0.38	0.45	0.52	0.59	2.2
Additional cost of Optants/Selectives	0.06	0.13	0.18	0.20	0.22	0.23	0.25	1.1
Total pre IPP & Efficiency	9.35	9.49	9.62	9.71	9.80	9.89	9.98	**49.0**
One Off Efficiency Catch Up	-1.48	-1.50	-1.50	-1.51	-1.52	-1.52	-1.53	-7.6
Efficient OPEX pre IPP & frontier shift	7.9	8.0	8.1	8.2	8.3	8.4	8.4	**41.4**
Frontier Efficiency	-0.07	-0.10	-0.14	-0.17	-0.21	-0.25	-0.29	-1.1
IPP	0.31	0.47	0.63	0.80	0.98	1.15	1.34	4.9
Efficient OPEX post IPP & frontier shift	8.10	8.36	8.61	8.83	9.05	9.27	9.49	**45.3**

Table 4-5 – Cost summary. Source: Bristol Water

4.1.1 Gross Input Price Pressure

Economic Insight calculated gross inflation forecasts based on bespoke inflation indices derived from a detailed mapping of the key categories of retail costs incurred to independent inflation data. The central case gives an average IPP of 1.95% per annum.

	2020/21	2021/22	2022/23	2023/24	2024/25	Average
High	2.30%	2.48%	2.46%	2.46%	2.46%	2.43%
Medium	1.74%	2.09%	1.94%	1.97%	1.99%	1.95%
Low	1.68%	2.03%	1.87%	1.91%	1.93%	1.89%

Table 4-6 – Gross input price pressure. Source: Economic Insight (2018)[115]

4.1.2 Frontier Shift

Economic Insight calculated the productivity gains that even an efficient company could expect to make. The analysis was primarily based on EU KLEMS data (which gives productivity values over time).

[115] Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.8

Calculation step	Scenario	2020 / 21	2021 / 22	2022 / 23	2023 / 24	2024 / 25	Average over PR19
Productivity savings (%)	High	1.10%	1.10%	1.10%	1.10%	1.10%	1.10%
	Medium	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%
	Low	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%

Table 4-7 – Frontier Shift. Source: Economic Insight (2018)[116]

The central estimate of frontier shift efficiency is 0.42% per annum.

The range in estimates is based on different time periods for the base data analysis.

The low case is based on the average from 2007 to 2015, which gives negative productivity gains, reflecting the UK's poor productivity performance since the 2008 financial crisis. Economic Insight considers this scenario to be plausible given recent UK financial performance and the possible impact of Brexit.

4.1.3 Catch Up

Economic Insight calculated gross catch up efficiency based on econometric modelling of company costs. For catch-up efficiency, the central case gives 5.4% efficiency challenge in Year 1 of AMP7, to take Bristol Water to the upper quartile in Retail Service Efficiency within the water sector.

Calculation step	Scenario	2020 / 21	2021 / 22	2022 / 23	2023 / 24	2024 / 25	Average over PR19
Catch-up efficiency savings (%)	High	8.00%	0.00%	0.00%	0.00%	0.00%	1.60%
	Medium	5.40%	0.00%	0.00%	0.00%	0.00%	1.08%
	Low	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 4-8 – Catch up efficiency. Source: Economic Insight (2018)[117]

Economic Insight has modelled efficiency using two different approaches to account for single and dual serve properties:

[116] Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.11
[117] Economic Insight (2018) PR19 Retail Household IPP Analysis and Evidence, p.11

Approach	Model set A Separate dual & single service customer variables	Model set B Separate total & single service customer variables
Advantages	More flexible specification Larger number of relevant cost drivers Reduced risk of omitted variable bias	More parsimonious regression specifications Estimated coefficients easier to interpret Appears to fit data better
Disadvantages	Many companies have no dual customers Marginal effects are difficult to interpret Gaps sensitive to benchmark choice	Less flexible specification Fewer relevant cost drivers included (potential omitted variable bias)

Table 4-9 – Model description. Source: Economic Insight (2018)[118]

The Central case assumes an upper quartile benchmark, with no glide path (all efficiency applied in year 1).

Parameter	Low (less challenging)		Central		High (more challenging)	
	Original	Updated	Original	Updated	Original	Updated
Model weights	*Equal*	Equal	*Equal*	Equal	*Equal*	Equal
Residual adjustment	*25%*	None	*10%*	None	*10%*	None
Benchmark	*Upper quartile*	Average	*Upper quartile*	Upper quartile	*Minimum*	Upper quintile
Glide path	*Three years*	Five years	*Three years*	None	*None*	None

Table 4-10 – Modelling cases. Source: Economic Insight (2018)[119]

Under model set A (separate dual and single serve variables) the central case modelled catch up efficiency is 10.8%.

[118] Economic Insight (2018) Household Retail Cost Assessment for PR19, p. 59
[119] Economic Insight (2018) Household Retail Cost Assessment for PR19, p. 69

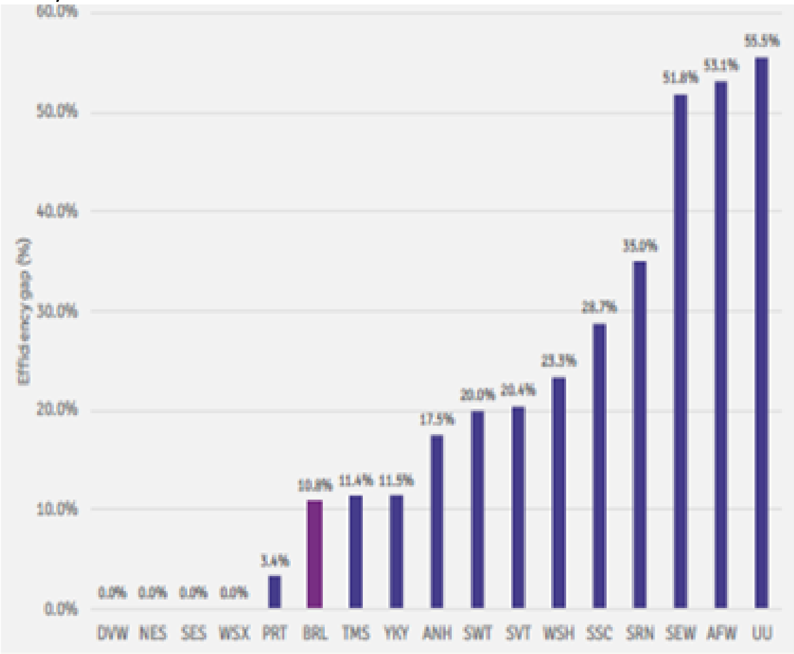

Figure 4-1: Model A results. Source: Economic Insight (2018)[120]

Under model set B (separate total and single serve variables) the central case modelled catch up efficiency is 0%, as BW is already at the UQ.

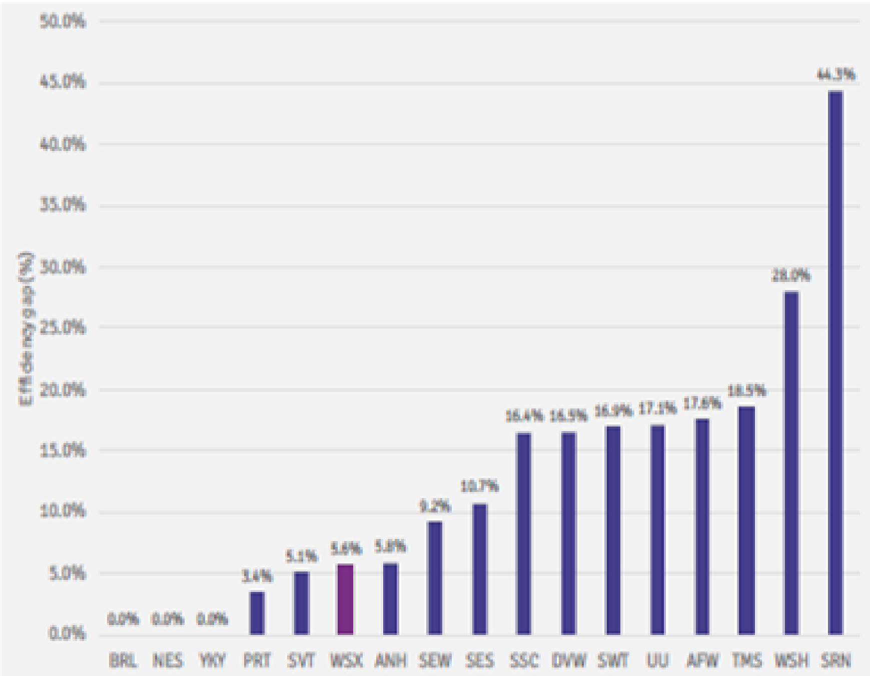

Figure 4-2 Model B results. Source: Economic Insight (2018)[121]

Overall, both approaches have advantages and disadvantages. We do not think that there are strong reasons to consider either approach more credible than the other. The average of both model sets has been used to derive a central efficiency estimate of 5.4% (with a range of 0% to 8.0%).

[120] Economic Insight (2018) Household Retail Cost Assessment for PR19, p. 70
[121] Economic Insight (2018) Household Retail Cost Assessment for PR19, p. 70

4.1.4 Net Cost Shift

Economic Insight has presented the results of its work as net IPP values. These can be based on either annually variable IPP values, or annual average IPP values. The choice of method does not have a material impact on cost.

Central case Using annual IPP value	2020/21	2021/22	2022/23	2023/24	2024/25	Average over AMP
Gross IPP	1.74%	2.09%	1.94%	1.97%	1.99%	1.95%
Catch up efficiency	-5.40%	0.00%	0.00%	0.00%	0.00%	
Productivity savings	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%
Net IPP	-4.08%	1.67%	1.52%	1.55%	1.57%	

Using average IPP value per annum	2020/21	2021/22	2022/23	2023/24	2024/25	Average over AMP
Gross IPP	1.95%	1.95%	1.95%	1.95%	1.95%	1.95%
Catch up efficiency	-5.40%	0.00%	0.00%	0.00%	0.00%	
Productivity savings	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%
Net IPP	-3.87%	1.53%	1.53%	1.53%	1.53%	

Table 4-11: IPP values. Source: Bristol Water

Gross IPP values of 1.95% are assumed across years 1 to 5 of AMP7.

This means that we forecast that the net impact of upward price pressures and efficiency gains is a small increase in base cost. The net IPP includes an assumption of catch-up efficiency which, given the uncertainty associated with the efficiency position, is effectively an additional frontier shift.

Additional cost will also occur due to the cost of serving new customers and increasing meter reading costs due to increased meter penetration (in line with our performance commitment to reach 75% by 2024/25, as set out in Section C3); these have been included and lead to opex of £45.3m over AMP7 (excluding wholesale recharge).

In practice, most of this efficiency applies to bad debt, and we are targeting a £2m saving over 2020-25, delivered by an improvement in collection rates from 96.6% to 97.1%. The Ofwat efficiency modelling consultation also included a range of retail efficiency models, and we have also carried out unit cost calculations. Overall, our costs set the frontier of efficiency for total retail costs and retail costs without bad debt, but depending on how deprivation is adjusted for there was a range of bad debt cost efficiency positions. As with wholesale costs, we believe that retail modelling should be on a whole business totex basis, rather than separating out individual cost elements, in particular by modelling bad debt and debt management separately from the rest of the retail cost base (which for instance includes wider vulnerability and social tariff cost delivery). The latest unit costs for 2017/18 appear to confirm our retail efficiency position (based on the average basis used at PR14):

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£/customer 2017/18	Bristol Water cost per customer	Industry average
Unmeasured: Debt & Debt management	£8.0	£9.0
Unmeasured: Other retail	£10.8	£12.8
Measured: Debt & Debt management	£6.3	£7.2
Measured: Meter reading	£1.2	£2.4
Measured: Other retail	£12.0	£15.5

Table 4-12 – Unit Cost comparison. Source: Bristol Water

The overall efficiency assumptions are shown below:

	Initial efficiency from 2020	Efficiency p.a. after 2020	Overall per annum 2020-25 "efficiency shift"	£m efficiencies	Annual real price effects
Residential retail opex	-6.6%	-0.4%	-1.6%	£4m	2.0%
Residential retail capex	-0.3%	-0.3%	-0.3%	£0.02m	0.7%

Table 4-13 – Overall Efficiency Assumptions. Source: Bristol Water

4.2 Cost Forecasts

The sections below outline how our Household Retail opex and capex costs were developed.

4.2.1 Opex

We model our efficient opex costs over the following activities:

	Unit	Annual Retail 2020-21	2021-22	2022-23	2023-24	2024-25	2020-25
		Notional Structure @ Nominal Values					
Customer Services	£m	2.3	2.4	2.5	2.5	2.6	12.3
Debt Management	£m	0.5	0.6	0.6	0.6	0.6	2.9
Doubtful Debts	£m	2.7	2.8	2.8	2.9	3.0	14.2
Meter Reading	£m	0.4	0.4	0.4	0.4	0.4	2.0
Other operating expenditure	£m	2.7	2.7	2.8	2.8	2.8	13.8
Local authority and Cumulo rates	£m	0.0	0.0	0.0	0.0	0.0	0.0
Third party services	£m	0.0	0.0	0.0	0.0	0.0	0.0
Total operating expenditure	£m	8.6	8.8	9.1	9.3	9.5	45.3
Recharge for Wholesale Assets	£m	0.5	0.7	0.7	0.7	0.7	3.3
Depreciation	£m	0.5	0.5	0.5	0.5	0.5	2.5
Retail Cost to Serve	£m	9.6	10.0	10.3	10.5	10.6	51.1
Allowable Retail Margin	£m	0.9	1.0	1.0	1.0	1.0	5.0
Allowed Revenue	£m	10.6	11.0	11.3	11.5	11.7	56.1

Table 4-14 Retail opex costs. Source: Bristol Water

The split of future opex across the cost lines above is based on the actual split in 2017/18. This split is broadly reflective of the historical cost mix and as the most recently published figure is the best indicator of future cost split. Economic Insight's assumptions on input prices have been applied on a weighted pro rata basis across all lines.

The cost forecasts include the effect of new customers and meter switching as outlined below.

New Customers

Our costs will increase as the underlying customer base changes; therefore costs in relation to serving an increased number of customers and an increase in the proportion of metered properties have been added.

The methodology for calculating these costs are as follows:

C5 – Cost and efficiency

- The number of households (measured and unmeasured) is taken from table WS3 which is aligned to the property forecasts within our Water Resources Plan; and.
- The marginal cost consists of Total Operating Expenditure for metered households with the exception of Other Operating Expenditure (OOE) as this is made up of mostly fixed costs – such as Local Authority Rates, Salaries and General & Support Costs.

Converting Unmeasured Households to Measured

Included within the PR19 data table forecast is the conversion of unmeasured households to measured households through meter optants and selective metering, in line with our performance commitment on meter penetration as explained in Section C3. The forecasts reflect the higher overhead retail costs for serving our measured customer base.

The relevant costs include:

- Meter Reading;
- Billing;
- Payments handling; and
- Debt Management

These are the costs that would be impacted by the increase in the number of measured properties.

A cost per household is then calculated for metered and unmetered, with the difference coming out as £2.24. This is then applied to the number of converted households on an annual basis. See below breakdown:

	2020/21	*2021/22*	*2022/23*	*2023/24*	*2024/25*	*Total*
New Connections	0.30	0.38	0.45	0.52	0.59	2.23
Customer services	0.13	0.16	0.19	0.22	0.25	0.94
Debt management	0.03	0.04	0.04	0.05	0.06	0.22
Doubtful debts	0.12	0.15	0.17	0.20	0.23	0.87
Metering	0.03	0.03	0.04	0.05	0.05	0.20
Other operating expenditure	0.00	0.00	0.00	0.00	0.00	0.00
Local authority and Cumulo rates	0.00	0.00	0.00	0.00	0.00	0.00
Pension deficit repair costs	0.00	0.00	0.00	0.00	0.00	0.00
Metering	0.18	0.20	0.22	0.23	0.25	1.09
Customer services	0.07	0.08	0.08	0.09	0.10	0.41
Debt management	0.02	0.02	0.02	0.03	0.03	0.12
Doubtful debts	0.00	0.00	0.00	0.00	0.00	0.00
Metering	0.09	0.10	0.11	0.12	0.13	0.55
Other operating expenditure	0.00	0.00	0.00	0.00	0.00	0.00
Local authority and Cumulo rates	0.00	0.00	0.00	0.00	0.00	0.00
Pension deficit repair costs	0.00	0.00	0.00	0.00	0.00	0.00

Table 4-15 Cost per household breakdown. Source: Bristol Water

Joint Venture, Pelican

Our joint venture with Wessex Water, Pelican, makes up a significant proportion of our Retail costs. The costs below are pro-rata based on Pelican's share of our 2017/18 actuals.

	2020/21	*2021/22*	*2022/23*	*2023/24*	*2024/25*	*Total*
Total (£m)	5.48	5.63	5.79	5.94	6.10	28.94
Customer services (£m)	1.25	1.29	1.33	1.37	1.40	6.63
Debt management (£m)	0.54	0.56	0.58	0.59	0.61	2.89
Doubtful debts (£m)	2.71	2.78	2.85	2.92	2.99	14.25
Metering (£m)	0.37	0.39	0.41	0.43	0.45	2.03
Other operating expenditure (£m)	0.61	0.62	0.63	0.64	0.65	3.13

Table 4-16 Pelican modelled costs. Source: Bristol Water

Pelican then built a bottom cost model to ensure deliverability as follows:

	2020/21	*2021/22*	*2022/23*	*2023/24*	*2024/25*	*Total*
Total (£m)	5.77	5.64	5.79	5.96	6.11	29.26
Customer services (£m)	1.27	1.28	1.32	1.36	1.40	6.63
Debt management (£m)	0.55	0.55	0.57	0.59	0.60	2.85
Doubtful debts (£m)	3.00	2.84	2.91	2.99	3.06	14.81
Metering (£m)	0.29	0.29	0.30	0.31	0.31	1.49
Other operating expenditure (£m)	0.67	0.67	0.69	0.71	0.73	3.48

Table 4-17 Pelican cost forecast. Source: Bristol Water

This compares favourably with the efficient position and is based on the following factors:

Cost Adjustment Claims: we have not proposed any cost adjustment claims (this is explained further in the section that follows).

Bad debt: improving collection rates from 96.6% to 97.1% by 2025 (see document B3 for a full explanation of our plans to manage our debt costs). We anticipate the following costs:

Bad debt information	2020-21	2021-22	2022-23	2023-24	2024-25
Debt written off ~ residential (£m)	3.005	2.838	2.912	2.991	3.061

Table 4-18 Bad debt. Source: Bristol Water

These figures are modelled based on the following billing and collection rates

	2020-21	2021-22	2022-23	2023-24	2024-25
Billing – total revenue, incl. wholesale charge (£m)	94.19	96.87	99.37	102.09	104.47
Collection rate	3.19%	2.93%	2.93%	2.93%	2.93%

Table 4-19 Billing and collection. Source: Bristol Water

Voids and Gap Sites: we improve our percentage of Voids from a 2% average to a 1.8% average (explained further below).

C5 – Cost and efficiency

	2020/21	2021/22	2022/23	2023/24	2024/25
Total Properties	517,804	523,709	529,117	534,435	539,628
Household Voids	9,735	9,689	9,631	9,575	9,518
Percentage of voids	1.9%	1.9%	1.8%	1.8%	1.8%

Table 4-20 Performance Commitments Voids. Source: Bristol Water

Our performance to date (as shown in Table 4-21) demonstrates that over time (5 years) we have experienced an average void rate of 2%, noting a reduction in actual void properties over the period despite property numbers increasing. In percentage terms connected properties have increased by 2% while void rates declined by 8.5% overall within that same time period.

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Total Properties	489,168	483,212	486,461	490,171	494,270	509,927
Household Voids	10,576	10,063	9,737	9,033	9,680	10,291
Percentage of voids	2.2%	2.1%	2.0%	1.8%	2.0%	1.9%

Table 4-21 Percentage Voids. Source: Bristol Water

Over those years we have an average 2.0% void rate of the total residential properties we serve.

The void rate is impacted by metering activity, and can fluctuate within years particularly in response to unmeasured annual billing.

However, we are also aware that there are external drivers for voids, which we cannot directly influence. For example, economic and housing factors which may impact on different companies' areas in different ways and at different times.

Social factors	Higher levels of transience would make it more difficult to keep track of change of occupancy and manage voids. This could particularly include areas with high student populations, where properties often change occupier annually and may be unoccupied during the summer break.
Changes in development / housing / land use	For example, a residence that once received a single bill may be turned into multiple self-contained apartments thus resulting in the property having multiple new occupiers, potentially with separate bills. If one of these individually-billed apartments is vacant it would be reported as a void, whereas if it were part of a jointly-billed property it would not.
Economic factors	Deprivation levels are likely to affect whether the customer decides to provide accurate information on the occupancy status of a property – customers may attempt to avoid paying bills by not disclosing to water companies that the property is occupied.

Figure 4-3 - External drivers of void rates

We already have one of the lowest void rates relative to other water industry companies as shown in Figure 4-4.

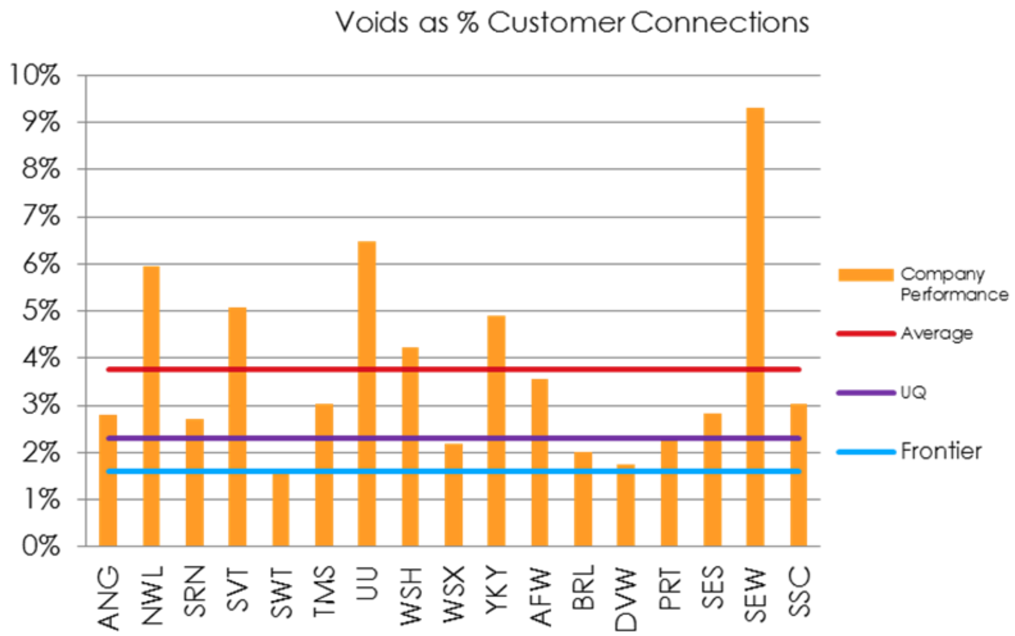

Figure 4-4 - Company Void rates. Source: Bristol Water analysis of Company APRs 2017/18

Based on our analysis we do not see there to be significant outliers (i.e. voids that could potentially be gap sites).

As a percentage of our total connections, we have a current void rate of 2.0% on average over past five years. In comparison and as shown in the graph opposite the Water Industry Upper Quartile is 2.3%.

We set out in Section C3 our performance commitment on reducing the percentage of void properties, targeting a level of 1.8% by 2025.

4.2.2 Capex

Capex: a small amount of capital expenditure that peaks in 2021 due to the installation of a new billing system, which will act as a strong enabler to many of the efficiencies listed in the efficiency section below. For AMP7, the capex forecast is based on our 25% share of Pelican capex spend. As per Economic Insight guidance this then has IPP and Frontier Efficiency applied to it (Net impact of 0.46% pa) to generate the figures below

		Annual Retail					
	Unit	2020-21	2021-22	2022-23	2023-24	2024-25	2020-25
		Notional Structure @ Nominal Values					
Total Operating Expenses & Recharges	£m	9.2	9.5	9.8	10.0	10.2	48.6
Total gross capital expenditure	£m	1.2	0.2	0.2	0.2	0.2	2.1
Total Expenditure Retail	£m	10.4	9.7	10.0	10.2	10.4	50.6

Table 4-22 Capex costs. Source: Bristol Water

4.3 Cost Adjustment Claims

We have adopted a methodical and rigorous approach to identifying and filtering out candidate cost adjustment claims so that only those which are economically intuitive and well evidenced have been presented in our business plan. We have been mindful of the need to present a small number of well evidenced claims and this draws as much from the PR19 regulatory framework as it does from our own evaluation of PR14 when we submitted a far higher number of cost adjustment claims.

C5 – Cost and efficiency

We have actively sought to identify areas where our operations naturally provide us with cost-preferential options compared to those available at other companies in order to aid transparency in the symmetrical assessment of claims which Ofwat will undertake. None of these, as set out in C5A Technical Annex – Cost Adjustment Claims, were material.

We have chosen not to submit any retail cost adjustment claims. This reflects our belief that Ofwat's PR19 models will capture the key drivers of retail costs, including those which may be due to regional differences and could otherwise be considered cost adjustment claims, such as deprivation.

Despite our economic consultant, Economic Insight, identifying deprivation in Bristol city centre as a plausible cost adjustment claim, we challenged and rejected it because variations in deprivation across the country as a driver of bad debt will likely be captured by Ofwat's retail models, reflecting the fact that Ofwat has a smaller pool of candidate cost drivers available to it in the retail control compared to wholesale.

Input price pressures in the retail price control were also considered as a candidate cost adjustment claim. In Ofwat's assessment of our PR14 business plan it was acknowledged that as our retail costs are efficient we had little scope to absorb any increases in prices due to input price pressures. However, in light of the fact that Ofwat is collating information on input price inflation assumptions from companies in App24a, a cost adjustment claim was not considered appropriate as there is now an alternative mechanism to evaluate this. We confirmed that this approach was correct through the PR19 query process.

Overall therefore, no retail cost adjustment claims were submitted to Ofwat for the early submission and this evidences our prudent approach to cost adjustment claims in the retail price control.

More detail on our Cost Adjustment Claims is provided in Section 3.2.2 and C5A Technical Annex – Cost Adjustment Claims.

4.4 Ofwat Retail Efficiency Modelling

Ofwat's retail models are also relatively simple and contain few variables. Ofwat has modelled bad debt separately to totex (including bad debt) and totex (without bad debt) models. Excluding bad debt costs we are beyond the upper quartile, and are close to the upper quartile on totex. There is an efficiency gap of 27% to 49% on bad debt to the upper quartile (we are ranked between 11th and 16th out of 17 companies). We prefer total retail cost models as developed by Economic Insight rather than disaggregated models as this reflects the whole cost base.

The Ofwat models rely on scale, but our efficiency position depends on how water-only customers are included – whether as a separate variable or within total connected properties. We prefer the former. The bad debt position depends on whether Ofwat accepts United Utilities' suggested use of a "default propensity" within debt rather than the standard "Index of Multiple Deprivation". Economic Insight suggest the former is partially within management control as a variable, it is a proxy for deprivation rather than measuring deprivation itself, which is perhaps particularly evident for Bristol Water given our performance commitment of maintaining zero customers in water poverty (as set out in Section C3). The mix of credit policies between companies is another argument against the Ofwat approach. As shown in Figure 4-5 below this metric chosen by Ofwat particularly affects Welsh Water, Dee Valley and Bristol Water.

Ofwat's models include often insignificant time dummy variables, which does not sit with making an allowance for future cost/efficiency frontier changes. Ofwat's modelling also suggests that an average cost to serve for totex (other than bad debt) may be taken. We are 1st or 2nd most efficient on these models. The efficiency gap is 0 – 6% on total totex. Therefore the 5.4% we include from our own modelling, and our application of it towards bad debt in the detailed cost build up, means we believe that our retail costs will remain in total at or near the frontier of efficiency.

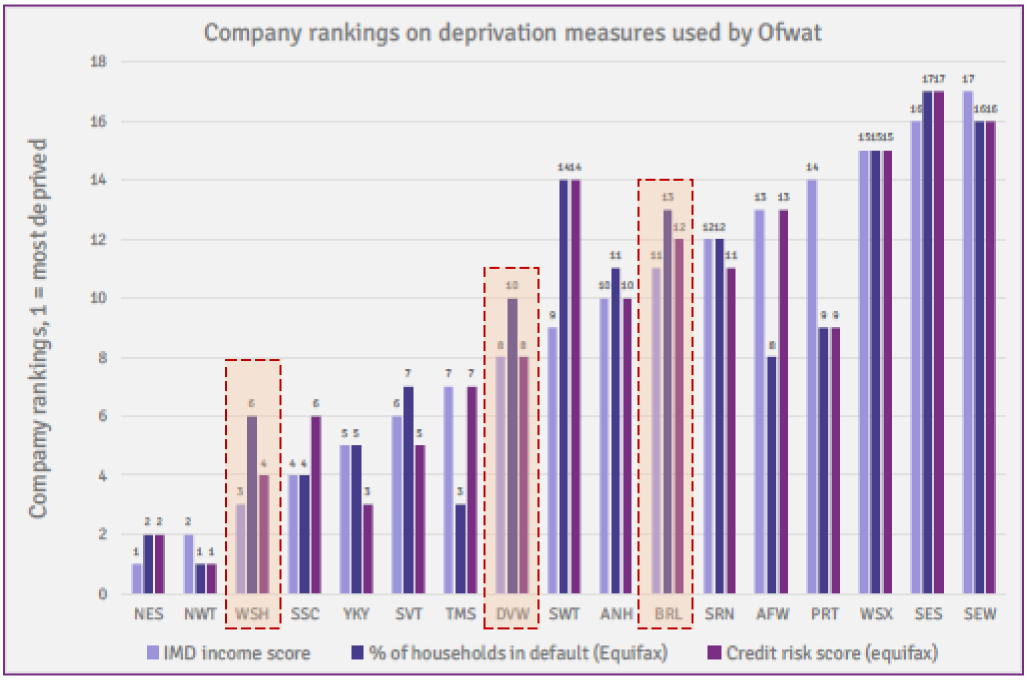

Figure 4-5 Deprivation measures. Source: Economic Insight, 2018[122]

4.5 Our Efficiency Plans

Following the econometric analysis, we built a bottom-up model of the potential efficiencies we feel are available by identifying specific initiatives to deliver them. To do this we engaged an independent third party to ensure that we were being challenging enough and to ensure that we considered as broad a range of potential initiatives based on their external perspective. The detail of this process is explained in the 'Our Efficiency Plans' section of the Wholesale Water section.

The outcome of the exercise was a range of potential initiatives (listed below) that were estimated to offer a net efficiency of £3.3m (£6.3m gross) over AMP7 in real terms (including bad debt improvements).

[122] Economic Insight (2018) Analysis of Ofwat's Retail Cost Assessment Models published in the Cost Model Consultation, p.7

Initiative	Description
IT cost impact of billing system	Reduced system license and support costs.
Pelican customer portal self-serve upgrades	Higher first time resolution reducing repeat calls and high-cost prolonged journeys. Use of on-line self-serve reducing contact effort. Assuming up to 10% reduction in contact effort.
Chat-bots to reduce contact costs.	Reduced contact volume by 15% (no voice) to 30% (Inc. voice).
Robotic Process Automation (back-office)	Automation, reducing manual effort through RBA. Typical 4% time saving, 6 processes p.a.
Targeted debt analytics	Targeted analytics for poor payers, reducing debt costs & bad debt. Based on case studies saving c.5% BDC through this approach.
Higher direct debit penetration	Higher direct debit reducing debt management costs & bad debt. Increase from c.60% to c.70%, reducing bad debt charge.
Bill redesign/clearer calls to payment	c.10% reduction in bad debt seen in other case studies.
E-billing	Higher use of e-billing reducing print & postage. Move from 5% e-billing to 30% (bills only) to 45% (all mail).
Simplification programme	Process rationalisation reducing un-needed activity. Achieve similar savings seen 2017 YTD, for three years only.
Meter read frequency	Higher proportion of metered customers impacting costs & debt. “Smart” to lever savings (at a cost). Reduce to annual reads (or biannual in high case).

Table 4-23 Efficiency initiatives. Source: Bristol Water

This assessment puts us on track to deliver the efficiency of £3.7m over AMP7 and the breadth of initiatives pursued demonstrates the ambition sought in meeting efficiency targets.