Securing Cost Efficiency

Draft Determination Representations

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Representations within this document

Contents

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Introduction

Ofwat's view of our efficient costs is £3,177m at the draft determination – which is £304m lower than our IAP forecast (this includes the strategic enhancement solution investment). Following a robust challenge process, we have a revised forecast of £3,524m on the same basis. This is the result of identifying £42m of net efficiency gains. The diagram shows a number of additional double-sided and minor modelling error adjustments:

- £84m from our Strategic Enhancement Solutions (double-sided adjustment);
- Net £8m added to our plan costs as a result of Ofwat's reallocation of enhancement opex (update relates to the understatement of cost as noted in Table 3.3 of our draft determination). On Ofwat's side, the adjustment is net -£5m of Spill Frequency costs, plus £6.5m as a result of our P-removal costs being underfunded (these updates relate to minor modelling allowance errors); and
- The removal of -£0.5m of WRMP costs related to Havant Thicket (double-side adjustment).

Adjusting Ofwat's draft determination view for these double-sided adjustments, minor modelling error adjustments and inclusion of net efficiency gains results in a remaining difference of £262m between Ofwat's draft determination view of efficient costs and our revised plan.

	Southern Water IAP £m	Ofwat draft determination £m	Variance £m
Botex	2,461	2,337	
Enhancements	1,020	840	
Totex	3,481	3,177	304

Double-sided adjustments

Strategic Enhancement Solution)	84	84	
Ofwat understatements and modelling updates	8	1	
Havant Thicket	-0.5	-0.5	
Botex	2,470	2,337	
Enhancements	1,103	925	
Totex	3,573	3,263	311

Net changes to plan costs

	42		

	Southern Water revised plan	Ofwat draft determination	Variance
Botex	2,470	2,337	133
Enhancements	1,054	925	129
Totex	3,524	3,263	262

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WATER for LIFE from Southern Water

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Cost allowances for growth – water and waste

1. Issue

In our response to the IAP, we raised a number of concerns with the econometric models Ofwat uses to determine botex allowances in water and wastewater, including the level of frontier shift and Ofwat's forecasts of cost drivers. Ofwat has addressed some of these issues at the draft determination, for example by including allowance for labour real price effects (RPEs). However, there remain a number of issues, and we have further concerns with Ofwat's inclusion of growth within the botex models.

We focus here on the most material issue in relation to these botex models: the allowance for growth. Separately, we set out in Appendix A some of the remaining concerns we have with the botex models. We recognise, however, that Ofwat may consider that it would be difficult to make further changes to the econometric models at this late stage in the price review. For that reason, if our concerns about the allowance for growth are addressed in the final determination, in the terms set out in the proposed "Remedy" section below, then we would be prepared to accept the concerns identified in Appendix A.

For the draft determination Ofwat has changed the way in which it makes allowance for growth. Ofwat now includes growth in its 'botex' cost models, by adding it to the definition of modelled costs. However, the revised models do not make adequate allowances for the costs of growth. That is because Ofwat has not:

- included any specific growth related cost drivers in the botex model;
- used appropriate forecasts of cost drivers; or
- taken account of changes in the required level of expenditure to manage growth.

It is challenging to unpick the level of the cost allowance for growth from the models. We have tried to do so using two methods. Both suggest that the allowed level of growth expenditure is materially below the levels included in our business plan, which are necessary and efficient to address the forecast level of development in our region in AMP7. In the case of wastewater, the estimated draft determination cost allowance is also materially below Ofwat's own view of efficient costs at the IAP.

Table 1 below shows the change in Ofwat's growth allowance from the IAP to the draft determination, and the remaining gap with our view of efficient costs.

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Table 1. Change in growth allowance from IAP to draft determination

Water	Growth (£m)
Ofwat (IAP)	66
Southern Water (IAP)	103
Ofwat (DD)[1]	66
Change in Ofwat allowance	**0**
Gap with Southern Water view of efficient costs	**(37)**
Waste	**Growth (£m)**
Ofwat (IAP)	206
Southern Water (IAP)	240
Ofwat (DD)	130
Change in Ofwat allowance	**76**
Gap with Southern Water view of efficient costs	**(110)**
Total change in Ofwat's allowance	**(76)**
Total gap with Southern Water's view of efficient costs	**(147)**

Source: Southern Water analysis, Ofwat

The consequence of the shortcomings in the modelling approach is a material underfunding of our growth costs of £147m.

[1] Our highest estimate of Ofwat's implied growth allowance within botex

2. Our proposed remedy

At the IAP, Ofwat developed a set of enhancement models for Growth costs. However, the data on which they were based was inconsistent, both between companies and over time. Since the IAP, Ofwat has collected additional data on a more consistent basis from companies and is requiring further data to be provided as part of this draft determination response.

Given the clear issues identified in this representation with the inclusion of growth costs within the botex models, we propose that Ofwat should use the additional data collected to develop a more robust set of growth enhancement models. We believe there may be merit in collaborative working between Ofwat and companies to do this. This will ensure that these models are consistent with company knowledge of the drivers of costs and are based on a consistent interpretation of the data.

We consider the use of this data would result in a cost allowance equivalent to our revised business plan costs of £103m for water and £240m for wastewater.

Given the limitations on time in the PR19 process, Ofwat may feel that developing new models at this stage is undesirable. If that is the case, given the materiality of the gap between our business plan forecast of growth costs and Ofwat's implied allowance, we suggest that Ofwat undertake a careful consideration of our evidence through a deep dive on our growth costs and accept our view of efficient growth costs.

As part of this review, and in order to address some of the specific issues we have identified, Ofwat should update its view of cost drivers to align with our plan view. Specifically, within water, Ofwat should use our forecasts for expected growth in the number of properties and new mains length. Within wastewater, Ofwat should use our forecasts for expected growth in sewer length and pumping capacity per sewer length. The use of these forecasts would, on its own, reduce the gap between our plan costs and Ofwat's cost allowance by £42m.

[redacted]

3. Supporting evidence

In this section, we provide supporting evidence relating to:

- Ofwat's modelling of growth (section 3.1)
- The use of incorrect growth-related cost drivers (section 3.2)
- Our approach to estimating Ofwat's growth allowance (section 3.3)
- Our AMP7 growth needs and expenditure (section 3.4)
- The basis of our proposed remedy (section 3.5)

3.1 Ofwat's modelling of growth

In moving from the IAP to the draft determination, Ofwat has revised its approach to assessing growth expenditure, both compared to the IAP and with previous price reviews. Growth expenditure, which was previously assessed as an enhancement cost, has now been incorporated into Ofwat's base econometric models. Ofwat has taken different approaches in water and wastewater. In the water base expenditure models, growth is modelled unsmoothed. In the wastewater base expenditure models, Ofwat takes the average growth expenditure over the historical period and replaces the unsmoothed value with this period average for the purpose of estimating its econometric models.

Ofwat says that including growth in modelled costs is appropriate because:

> *"growth-related expenditure is routine... can be explained with similar cost drivers to operational and capital maintenance (e.g. company scale), and [Ofwat] do not expect to see a significant step change in what drives growth enhancement expenditure during PR19."*[2]

While Ofwat has changed the scope of modelled base costs, it has not changed any cost drivers because it considers that the scale drivers within the model – namely, connected properties and length of mains within the water model, and sewer length in the wastewater model – capture the impact of growth.

We do not consider that the scale drivers capture growth and, as a result, Ofwat's approach at the draft determination results in an inadequate funding of our growth costs. We show here that:

- growth-related expenditure cannot be explained by the same cost drivers as botex;
- by only modelling historic costs, Ofwat's models do not take any account of clear evidence of projected increases in the unit costs of managing growth across the sector; and
- the implied marginal costs from Ofwat's models show that the allowance for growth in the model is inappropriate and materially understated.

[2] Ofwat, "PR19 draft determination: Securing cost efficiency", page 17

[redacted]

3.1.1 A comparison of a regression of botex and growth enhancement on Ofwat's botex cost drivers highlights that they do not properly model growth

Ofwat asserts that including growth in modelled costs is appropriate because growth-related expenditure can be explained by similar cost drivers to botex. To critically assess this statement, we split the revised definition of modelled costs into its component parts (i.e. botex and growth) and conducted two regressions:

- We regressed botex (i.e. Ofwat's definition of modelled costs at the IAP without growth) on the botex cost drivers (henceforth referred to as the "botex model"); and
- We regressed growth enhancement on the botex cost drivers (henceforth referred to as the "growth model").

If Ofwat's assertion holds true, the botex cost drivers should perform equally well at modelling the two components separately. In other words, the botex drivers should capture as much of the variability of the growth expenditure across the industry as it does of botex, with similar model performance. The growth models should therefore meet Ofwat's model development and assessment criteria. That is, the models should align with engineering and operational expectations; the coefficients should be of the right sign and of plausible magnitude; pass a range of statistical tests; and use an appropriate estimation method.[3]

Our analysis shows that the "growth" models perform comparatively worse than the "botex" models to the extent that the effectiveness of the "growth" models is undermined. Specifically, the model fit of growth models deteriorates and some coefficients become unintuitive. This is true across water and wastewater, with specific issues for each discussed below. The results of our analysis are presented in Tables 2 and 3 below, which compare the model performance for our "botex" and "growth" regressions across some key measures of model quality. The full set of coefficients for both sets of models is presented in Appendix C.

[3] Ofwat (2018), 'Cost assessment for PR19: a consultation on econometric cost modelling', page 8-10.

Table 2: Comparison of model performance on water service

	"Botex"[1]	"Growth"[1]
Intuitive coefficients	Coefficients are generally of the expected sign. The models are sparsely specified, so the magnitude of the estimated coefficients would require further validation and cross-checks using alternative measures.	The coefficient on booster pumping stations per lengths of main is typically negative whilst the coefficient on the weighted average complexity measure is positive and large in magnitude. Both results are unintuitive. Furthermore, the coefficient on connected properties is larger than one, suggesting diseconomies of scale.
Statistical significance	Ofwat has given importance to alignment of the estimated coefficients with operational and economic rationale. Coefficients are generally significant. The U-shaped relationship between density and expenditure is statistically insignificant in the WRP2 model.	The coefficient on the proportion of water treated in complexity bands W3-6 and the number of booster pumping stations per lengths of main are statistically insignificant. The U-shaped relationship between density and expenditure is also statistically insignificant.
Diagnostic testing	WRP models typically "fail" the RESET test, indicating that alternative functional forms may improve model fit. TWD and WW models "pass" the RESET test and the Breusch-Pagan test suggests that a panel structure exists within the data in all models.	Models "pass" the RESET test and the Breusch-Pagan test suggests that a panel structure exists within the data
Range of estimated efficiency scores[2]	81–129%	Range of estimated efficiency scores are substantially larger: 44–179%
Model fit (R-square)[3]	0.921–0.975	0.754–0.763

Source: Oxera analysis

Notes: [1]The "botex" analysis presented covers all five econometric specifications (two WRP models, one TWD model and two WW models) whereas the "growth" analysis presented only covers the two WW models. [2] Efficiency is defined as triangulated predicted historical expenditure divided by outturn expenditure over the period 2014–2018. [3] The R-square is a measure of model quality. These cannot be directly compared when the dependent variables (i.e. modelled cost) are different.

[redacted]

Table 3: Comparison of model performance on wastewater service

	"Botex"[1]	"Growth"[1]
Intuitive coefficients	Coefficients are generally of the expected sign. The models are sparsely specified, so the magnitude of the estimated coefficients would require further validation and cross-checks using alternative measures.	The coefficient on pumping capacity per km sewer is negative. As this variable captures topography[4] and therefore the energy requirements for transporting or pumping wastewater, the expected sign should be positive. The coefficient on % of load treated with tight ammonia has a negative sign. This is unintuitive because it suggests that more complex treatment leads to lower costs.
Statistical significance	Ofwat has given importance to alignment of the estimated coefficients with operational and economic rationale. Coefficients are generally significant. The weighted average density measure is only marginally statistically insignificant for model SWC2, with a p-value of 0.109.	Pumping capacity per km sewer, % of load treated with tight ammonia consents and % of load treated at WTWs in size bands 1-3 and 6 are now statistically insignificant.
Diagnostic tests	All models "pass" the Breusch-Pagan test, suggesting a panel structure exists within the data. The BRP and SWC2 models "fail" WRP models typically "fail" the RESET test, indicating that alternative functional forms may improve model fit.	The SWC models "fail" the Breusch-Pagan test, suggesting that there is not a panel structure in the sewage collection models. This is unintuitive given the data are a panel of companies over time. The SWC, SWT1 and BRP2 models fail the RESET test, indicating that alternative functional forms may improve model fit.
Range of estimated efficiency scores[2]	64-140%	Range of estimated efficiency scores are substantially larger: 19–364%
Model fit (R-square)[3]	0.846-0.933	0.227-0.485

Source: Oxera analysis

Notes: It is not possible to apply the random effects model to Ofwat's average growth measure. For the purposes of this exercise, we have unsmoothed the growth expenditure to enable a comparison between botex and growth. [1]The "botex" and "growth" analysis presented covers all five econometric specifications (two SWC models, two SWT models and two BRP models) [2] Efficiency is defined as triangulated predicted historical expenditure divided by outturn expenditure over the period 2014–2018. [3] The R-square is a measure of model quality. These cannot be directly compared when the dependent variables (i.e. modelled cost) are different.

The above results show that the water and wastewater botex drivers are unable to robustly capture the variability in growth expenditure across the industry over the outturn period. As growth expenditure is a small

4 Ofwat (2019), 'Supplementary technical appendix: econometric approach', p.6.

[redacted]

proportion of botex, when modelled together with base expenditure, these issues are masked by the comparatively better model quality of botex.

Moreover, at the IAP, Ofwat recognised the step-increase in growth expenditure over AMP7. It is unlikely that the botex drivers and their forecasts would be able to reflect the expected structural change in the historical relationships over AMP7 (which are shown to be less reliable in the case of growth expenditure) as these are simply extrapolated. For example, the average forward-looking efficiency gap in these models grows substantially (and to an extent that does not appear plausible) when growth expenditure is modelled in isolation. In the water service area, the gap grows by 26% (excluding Severn Trent and Hafren Dyfrdwy) and only two companies are assessed to have efficient growth expenditure in AMP7. In the wastewater service area, the gap grows by 46%, with a minimum gap of 10%. A robust efficiency model, capable of isolating genuine differences in efficiency between companies, as opposed to other factors, should exhibit a relatively narrow range of efficiency scores.

Scale drivers and growth

The evidence above shows that the model that scale drivers cannot be relied on to explain growth within the model. This is not surprising given the variability of growth rates between companies. Table 4 below shows that population growth is set to vary considerably by region, with the South East set to experience some of the strongest growth in the next two decades.

Table 4. Population growth by region in England

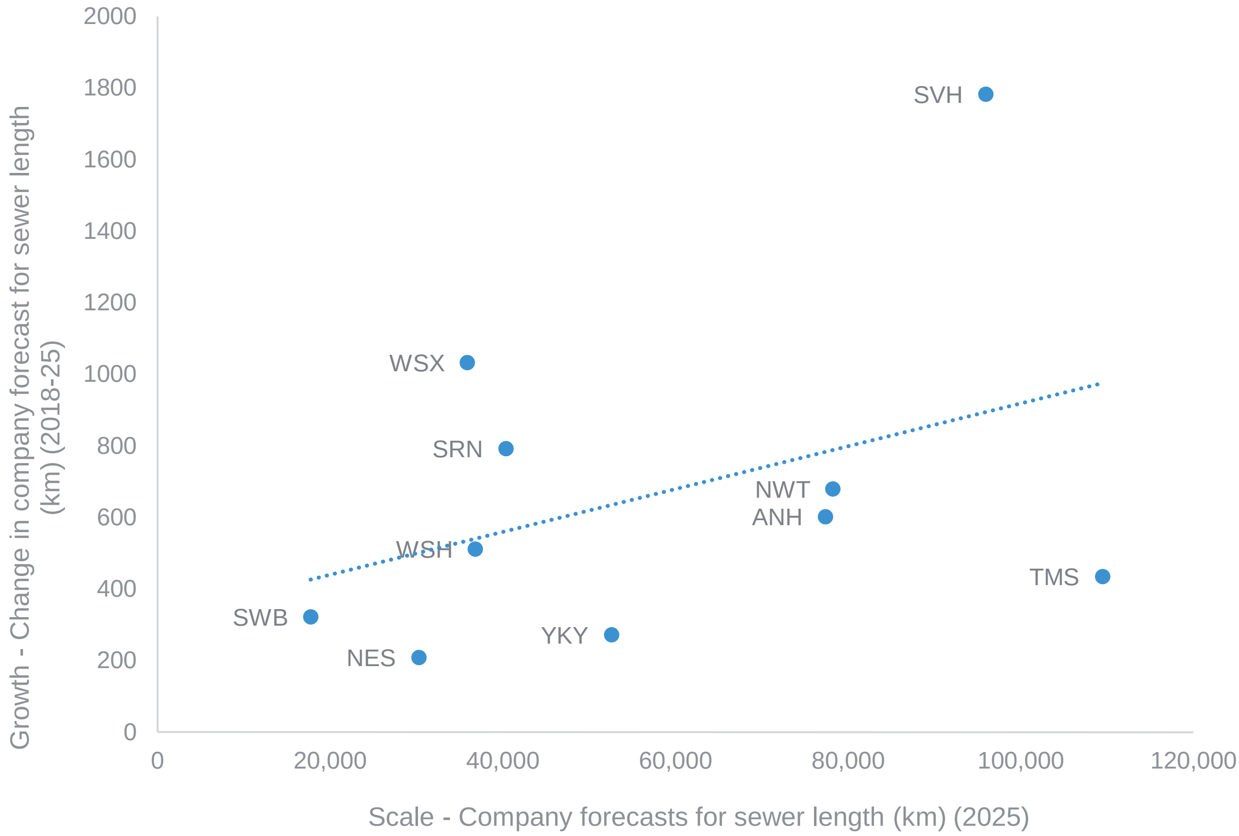
Region	Average annual growth rate (2020-40)	Population growth (2020-2040)
London	0.6%	12.6%
East	0.6%	11.4%
South West	0.5%	10.3%
South East	0.5%	9.9%
East Midlands	0.5%	9.2%
West Midlands	0.4%	8.8%
Yorkshire and The Humber	0.3%	5.1%
North West	0.2%	4.7%
North East	0.1%	2.2%
England	**0.4%**	**8.9%**

Source: Office for National Statistics

Figure 1 shows graphically that the relationship between Ofwat's key scale driver for wastewater (sewer length) and growth is a very weak one. There is a correlation coefficient of only 0.4. Ofwat's modelling takes no account of this. Companies, such as Southern Water, who are above the trend line, have stronger growth than would be suggested by our company size. This means, on average, we are disadvantaged by Ofwat's botex models and do not receive a sufficient allowance for our expected growth.

[redacted]

Figure 1. Relationship between scale and growth in wastewater (sewer length)



Source: Ofwat "FM_WWW3_ST_DD", Southern Water analysis

The evidence presented above leads us to conclude that the drivers of growth enhancement expenditure are indeed different to the drivers of base expenditure. As such, Ofwat's models at the draft determination are missing key cost drivers to appropriately capture growth.

3.1.2 Failure to account for projected increases in the costs of managing growth

Ofwat's botex models are developed using historic data, including that for managing the impact of growth, from the period 2011 to 2017. The models take no account of projected changes in future costs. While this may be appropriate for some aspects of the model, it is not so for modelling capital investment for accommodating growth.

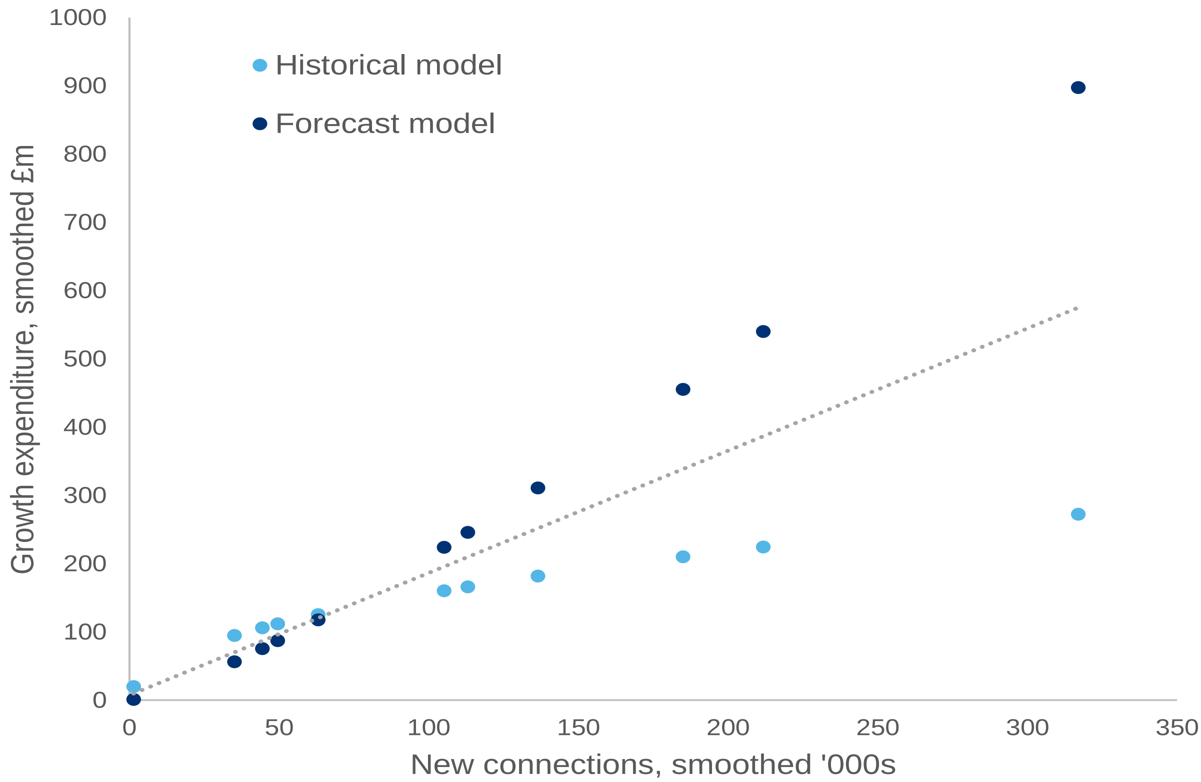
For costs such as labour or materials, it may be a reasonable starting assumption that future costs should not diverge markedly from historic costs. Ofwat also closely examines the evidence on whether this assumption holds through its work on RPEs and frontier efficiency scope.

With respect to the required capital investment for accommodating growth in networks and treatment the starting assumption that future costs should equal historic costs is flawed. Indeed, a priori, one might expect that the marginal costs of growth would increase over time, as spare network and treatment capacity becomes increasingly scarce and expansion to treatment works and upsizing of networks is required.

The business plan submissions of the various water companies appear to be consistent with this hypothesis of increasing marginal costs. In the IAP unit costs, there is clear evidence of a step change in the relationship between cost and cost drivers on historical vs forecast data. This is demonstrated in Figure 2 below, which shows the considerable difference in Ofwat's predicted allowance based on historical or forecast data in IAP wastewater growth models.

[redacted]

Figure 2. Ofwat's prediction across wastewater growth models



Source: Oxera analysis of IAP and draft determinations

In the process of incorporating growth expenditure within the backward looking botex models, Ofwat does not appear to have examined this evidence of increasing unit costs. This is in contrast to its approach at the IAP where Ofwat's assessment of growth took account of both forward-looking and historical data, giving a 50:50 weighting to each. In the presence of rising marginal costs, the failure to take account of forward-looking data in Ofwat's draft determination models will result in a systematic underfunding of the whole sector, with the impact being greatest for companies such as Southern Water, that expect to see some of the highest levels of growth in AMP7.

3.1.3 Implied marginal costs from Ofwat's models show that the allowance for growth is inappropriate, erroneous and materially understated

Ofwat contends that the impact of growth will be adequately captured by the scale drivers in its models. As discussed above, this is not supported by the evidence. This can be further demonstrated by reference to the implied marginal costs of growth from the model, which show that the allowance for growth is inappropriate and materially understated.

We have assessed the implied marginal cost by flexing the value of each of the model scale drivers, by one unit and calculating the resulting impact on allowed botex. The results clearly demonstrate that the models scale drivers do not adequately capture the costs of growth.

(i) Water service new connections

Increasing the number of connections in Ofwat's botex model by one, results in an increase in the allowed costs of just £79. This is significantly below the industry upper quartile value of £764 per connection (based

[redacted]

on data supplied by Ofwat at the IAP in January 2019) and our current AMP6 unit cost of £692 per connection. Ofwat's implied marginal cost is significantly beyond any reasonable frontier shift.

(ii) New water mains

Applying the same approach to water mains gives an implied marginal cost of £3 per metre for the installation of new water mains on new developments. This is far below the basic materials costs for a new main, before consideration of installation costs. For comparison, our average AMP6 installation cost is £266 per metre for new development sites.[5]

(iii) New sewers

For new sewers, this approach gives an implied marginal cost of £3 per metre for the construction and installation of new sewers to serve new developments. Again this is well below the basic materials costs. Our charging arrangements for new sewers, published in January 2019, have an average cost of £947[6] per metre[7].

These implied marginal costs demonstrate that the botex models, as specified, are unable to make appropriate allowance for the marginal costs of new growth and will systematically and materially understate the costs.

3.2 The growth-related cost drivers

For the draft determination, Ofwat has replaced our forecasts of a number of growth-related cost drivers with forecasts from other sources. Taken together, these materially reduce the cost allowance from the botex models, when compared with our business plan forecasts.

While we welcome Ofwat's recognition at the draft determination that a number of its forecasting approaches were inappropriate, namely using historical time trends, we believe that its approach at the draft determination remains inappropriate.

The draft determination uses Office of National Statistics (ONS) projections to set a revised connected properties forecast. This forecast underestimates the number of new properties by 12,412 properties versus our business plan forecast (a 24% reduction). For length of water mains, Ofwat places a 50% weight on the historical average and a 50% weight on company forecasts. This 50% weighting of historical data results in an 11% reduction in our forecast growth from 168km to Ofwat's forecast of 150km.

For wastewater, Ofwat has used a similar approach. This results in a reduction in forecast growth of 94km, or 17%. In the case of pumping station capacity / sewer length, Ofwat takes an average of the last three years of data and therefore assumes no growth. This is a 100% undercut of our forecast growth.

5 FM_E_WW_growth_IAP (Ofwat)
6. Average of pipes >1.5-2.5m and >2.5-3.5m
7. "New Connections Services: Charging Arrangements 2019-20", January 2019 - available here: https://www.southernwater.co.uk/media/2282/ds-charging-arrangements-19-20.pdf

[redacted]

3.2.1 Impact of Ofwat's cost driver forecasts

In the water botex model, when our Business Plan forecasts for connections and mains, with expected growth, are applied to Ofwat's model coefficients, Southern Water's modelled allowance increases by £4m.

In the wastewater model, the impact of Ofwat's forecasts is considerably more material. As well as sewer lengths, growth will also increase the pumping capacity per sewer length, which is a key cost driver in the model. Taken together, the use of Ofwat's forecast reduces the allowed expenditure by £38m. While Southern Water is an outlier compared with some other companies in terms of our expected pumping station capacity growth, this is entirely expected and our forecasts are robust and reasonable. This is set out in Appendix B.

Tables 5 to 8 below set out the difference between our business plan and Ofwat's forecasts in the water and wastewater models and the impact on the modelled allowance.[8]

Table 5. Number of properties (water)

	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Growth
SRN forecast	1,121,889	1,129,319	1,143,215	1,156,473	1,169,369	1,182,151	1,194,283	72,394
Ofwat forecast	1,123,696	1,132,854	1,141,614	1,150,078	1,160,253	1,170,237	1,180,270	56,574
Difference								-22%
Impact on SRN cost allowance								£4m

Source: Southern Water Wn2

Table 6. Length of mains (water)

	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Growth
SRN forecast	13,929	13,975	14,017	14,059	14,107	14,143	14,185	256
Ofwat forecast	13,956	13,990	14,027	14,065	14,102	14,140	14,177	222
Difference								-13%
Impact on SRN cost allowance								£0.3m

Source: Southern Water Wn2

Note: there is a discrepancy between our length of mains forecast as submitted in Wn2, and those which Ofwat has included in its feeder model 3 for water as our company forecasts.

[8] Note that in calculating the change in Ofwat's modelled allowance, we override Ofwat forecasts with company forecasts for 2021-25, as these are the only years Ofwat's model coefficients are applied to.

[redacted]

Table 7. Length of sewer (wastewater)

	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Growth
SRN forecast	39,656	39,767	39,886	40,036	40,166	40,308	40,448	792
Ofwat forecast	39,667	39,769	39,875	39,997	40,108	40,226	40,343	676
Difference								-15%
Impact on SRN cost allowance								£1m

Source: Southern Water WWn3

Table 8. Pumping capacity per sewer length (wastewater)

	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Growth
SRN forecast	3.28	3.34	3.40	3.45	3.51	3.56	3.62	0.33
Ofwat forecast	3.16	3.16	3.16	3.16	3.16	3.16	3.16	0.00
Difference								-100%
Impact on SRN cost allowance								£37m

Source: Southern Water WWn3

3.2.2 Robustness of Southern Water forecasts

Our bottom-up forecast approach is rooted in a clear understanding of the quantum, nature and location of development in our region, and is in accordance with methodologies established and endorsed by all regulators. It therefore provides the most appropriate basis for modelling cost allowances in this critical area, and is more robust than top-down forecasts and extrapolation of historic data.

We describe below our approach to forecasting each of the key growth-related variables in Ofwat's models and why it is appropriate and more robust than the forecasts used in the draft determination.

(i) Water: connected properties

Our forecasts for property/household growth were generated by an expert third party organisation, Experian. The forecasts were produced in accordance with the guidelines issued by the Environment Agency in collaboration with Defra, the Welsh Government and Ofwat (Water Resources Planning Guideline, May 2016).

The recommended approach referred to in the guideline is in line with the following methodologies:

- UK Water Industry Research (UKWIR) and Environment Agency's new guidance on population, household, property and occupancy forecasting for WRMP (UKWIR Report Ref No. 15/WR/02/8 – Feb 2016); and
- Water Resources Planning Guideline from the EA and Natural Resources Wales (Final Water Resources Planning Guideline, May 2016). Produced in collaboration with Defra, the Welsh Government, and Ofwat.

Section 5.3 (Forecast population, properties and occupancy) of the planning guideline states:

[redacted]

> *"….you will need to base your forecast population and property figures on local plans published by the local council…"*[9]

Accordingly, the forecast property figures in our plan are based on data from local plans.

This was recognised by Ofwat in response to our draft Water Resource Management Plan (WRMP) with the following statement:

> *"The demand forecast is well documented, reference to the industry guidance has been made and it appears to have been followed. This includes the use of local authority plan-based projections."*[10]

The use of any alternative approach for forecasting growth is inconsistent with Ofwat's own recommended methodology and their acceptance of our approach for the WRMP. It is not appropriate to use or endorse different forecasts for the same variable in different places.

Additionally, the ONS projections are accompanied by warnings about their quality and robustness, which undermine their appropriateness for use in these particular models. As stated in the ONS' official methodology:

> *"Household projections are not forecasts and generally take no account of policy or development aims that have not yet had an impact on observed trends. Rather, household projections should be thought of as a trend-based starting point for analysis, providing data produced on a consistent basis for England, its regions and local authorities. Further analysis can be taken forward using these data, including the assessment of future housing need."*[11]

By the ONS' own admission, these projections should be used as a starting point, augmented by more in-depth local knowledge about a region's specific characteristics, policies and pressures. Our company-specific forecasts, based on granular and deep knowledge of the South East, therefore add this additional layer of analysis. They therefore provide a more robust basis for the modelling.

(ii) Water: mains length

Our forecasts for new mains are based on the average amount of new mains required to connect each additional property. This average is derived from the evidence of our AMP6 actuals in the period 2015-16 to 2017-18. The average length of new main per new connection for 2015-16 to 2017-18 is then multiplied by our new connections forecast for AMP7 to give our forecast for length of new mains for AMP7.

We believe that this is a robust approach to forecasting, which better takes account of expected growth in AMP7, compared with the draft determination approach, which applies a linear trend to historical data. This

[9] "Final Water Resources Planning Guideline", Natural Resources Wales and Environment Agency (May 2016) - page 21
[10] "Southern-Water-draft-WRMP19-consultation-response.pdf", Ofwat (May 2018) - page 21
[11] "Methodology used to produce household projections for England: 2016-based", ONS (Dec 2018) - available here: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/methodologies/methodologyusedtoproducehouseholdprojectionsforengland2016based

[redacted]

linear time trend results in estimating our growth over the period 2018-19 to 2024-25 at 1.4%, compared to our forecast of 1.8%.

Our mains length forecast is internally consistent with our connected properties forecast; the draft determination forecasts are inconsistent. Ofwat should ensure consistency between its connected properties and mains length forecasts (as well as sewer length – see below). Adopting our remedies in this representation and using our company forecasts will provide this consistency.

(iii) Wastewater: sewer length

Our sewer forecasts have been developed based on a deep understanding of the growth expected in our region, as well as our analysis of historical growth. Our sewer length forecasts, along with our forecasts for length of main, therefore are internally consistent with our forecasts of new connections and growth in our region.

The draft determination forecasts are based on historical growth and do not reflect the same depth of information regarding our expected growth (i.e. population and new developments). In addition, they are inconsistent as they do not reflect the forecast of connected properties growth. Ofwat should ensure consistency between its connected properties and sewer length (as well as mains length). Adopting our remedies in this representation and using our company forecasts will provide this consistency.

(iv) Wastewater: pumping station / sewer length

Given its materiality to our modelled allowance, and the extent of the variance between our own and the draft determination forecast for this variable we consider our forecasts in detail in Appendix B. In Appendix B, we set out our robust methodology for forecasting this variable, as well as evidencing why we have pumping station capacity / sewer lengths that are considerably above the industry norm and therefore require a company-specific adjustment.

We show that we have a higher number of pumping stations per length of sewer because of strong growth (both historically and in the future), that occurred in new development in less favourable land due to restrictions of building on the South Downs and the coast. As a result, growth in our region is high but in smaller pockets, often on the edges of the South Downs, which is more likely to require a pumping station and a reasonably large pump. These economic and topological factors are outside of our control.

3.3 Our approach to estimating Ofwat's growth allowance

In Sections 3.1 and 3.2 above we described a number of shortcomings in the draft determination approach, which would result in a materially lower cost allowance than is appropriate. In order to assess the overall impact of these issues, it is necessary to understand how Ofwat's view of efficient growth expenditure differs from our own business plan forecasts.

The revised approach to assessing growth-related expenditure within botex, leads to a lack of transparency and means that identifying just how much allowance has been made for the costs of managing growth is difficult. Nonetheless, to effectively make representations on the draft determination it is important that we are able to estimate the level of the allowance that has been made. Therefore, a key aspect of our assessment has involved attempting to calculate the implied allowance for growth within the botex model.

We set out below two separate approaches that we have tested to isolate the implied growth allowance. These are:

- **Calculating Ofwat's allowance for new connections, new mains, and new sewers:** we calculated the difference between: (a) Ofwat's modelled allowance using their forecasts; and (b) Ofwat's modelled allowance assuming no growth in Ofwat's forecast from 2020.
- **Re-running Ofwat's models to isolate the change to modelled costs:** by re-running Ofwat's draft determination models using the definition of modelled costs at the IAP, we isolated the impact of the change of the modelled cost definition and therefore calculated Ofwat's implied allowance for growth. We explain this approach in Appendix C.

Table 9 below shows our estimates of the implied growth allowance from each of these approaches.

Table 9. Our range of estimates of the implied growth allowance

Approach	Implied growth allowance for water (£m)	Implied growth allowance for wastewater (£m)
(i) Calculating Ofwat's allowance for new connections and new mains / sewers	8.6	3.8
(ii) Re-running Ofwat's models to isolate the change to modelled costs	66.5	130.3

Source: Southern Water analysis, Oxera analysis

Even at our highest estimate, our analysis suggests that the implied growth allowance is materially lower than our view of efficient costs at the IAP. And in the case of wastewater, it is also materially lower than Ofwat's own view of efficient costs at the IAP (£76m).

We provide more details on each of our approaches below.

3.3.1 Calculating Ofwat's allowance for new connections and new mains/sewers

Building on the analysis presented in section 3.1.3 of the marginal costs of growth implied by Ofwat's botex models, we explored the implied total allowance for growth within the models by flexing the cost drivers that are said to capture the impact of growth.

We did this by comparing the difference in cost allowances derived from the draft determination botex models using Ofwat's forecast of growth (i.e. properties and length of mains/sewers) and when these cost drivers are held constant (i.e. there is no growth). The difference represents one estimate of the modelled allowance for growth.

Table 10 below sets out the results of our analysis. This approach suggests an implied allowance for growth of £8.6m in water and £3.8m in wastewater.

[redacted]

Table 10. Comparison of cost allowances with and without growth

Cost driver	Difference between Ofwat forecasts for 2021 and 2025	Ofwat modelled cost allowance (£m)	Ofwat modelled allowance assuming no growth in cost driver in AMP7 (£m)	Difference in modelled allowance, i.e. implicit growth allowance (£m)
Number of properties	38,656	653.0	645.5	7.5
Length of mains	150	653.0	651.9	1.1
Sewer length	468	1526.4	1522.5	3.8
Total				**12.4**

Source: Southern Water analysis, Ofwat (FM_WW4_ST_DD, FM_WWW4_ST_DD)

3.3.2 Re-running Ofwat's models to isolate the change to modelled costs

The key change between the IAP and draft determination botex allowances is the inclusion of growth within the botex models. Comparing the allowances at the IAP stage and at the draft determination should therefore give an indication of the allowance for growth within the models.

However, the existence of a number of other changes would mean that this comparison would be distorted if those other changes were not taken into account. Specifically, the other key changes to Ofwat's modelling approach for botex (set out in "PR19 draft determinations: Securing cost efficiency technical appendix") are:

- **Cost driver forecasts**. Ofwat has changed its approach to forecasting a number of cost drivers, namely number of properties and length of mains.
- **Real Price Effects (RPEs) allowance**. Ofwat has allowed for labour RPEs at 0.4%.
- **Change in historical data**. In the water service area, Ofwat has revised its definition and calculation of booster pumping station data. In the wastewater service area, the historical data on total load treated, pumping capacity, tightness of ammonia consents and percentage of load treated at different work size bands has changed for a number of companies. Ofwat also changed a bioresources model specification, the impact of which has been included within this area.
- **Change to bioresources model.** Ofwat has included an additional explanatory variable of percentage load treated at band sizes 1-3.
- **Change in modelled costs**. Ofwat has changed its modelled cost definition to include growth enhancement in the modelled cost base. The way in which growth enhancement is included depends on service area. In the water service area growth enhancement is added to base expenditure without any smoothing. In the wastewater service area growth enhancement is averaged over the historical period (by company) and this average level of growth is assumed to have been incurred in each year. We are not aware of an operational justification for either approach, or why they should differ by service area.

Therefore, to better isolate the impact of including growth we asked Oxera to re-run Ofwat's botex models using all of the draft determination assumptions (including the above) but removing growth costs. Comparing the results of the models with and without growth included should provide a good estimate of how much Ofwat has allowed for growth in the draft determination. The results are shown in Table 11 below. Details of Oxera's calculation methodology are included at Appendix C.

[redacted]

Table 11 - Change in Ofwat's modelled allowance from model re-run

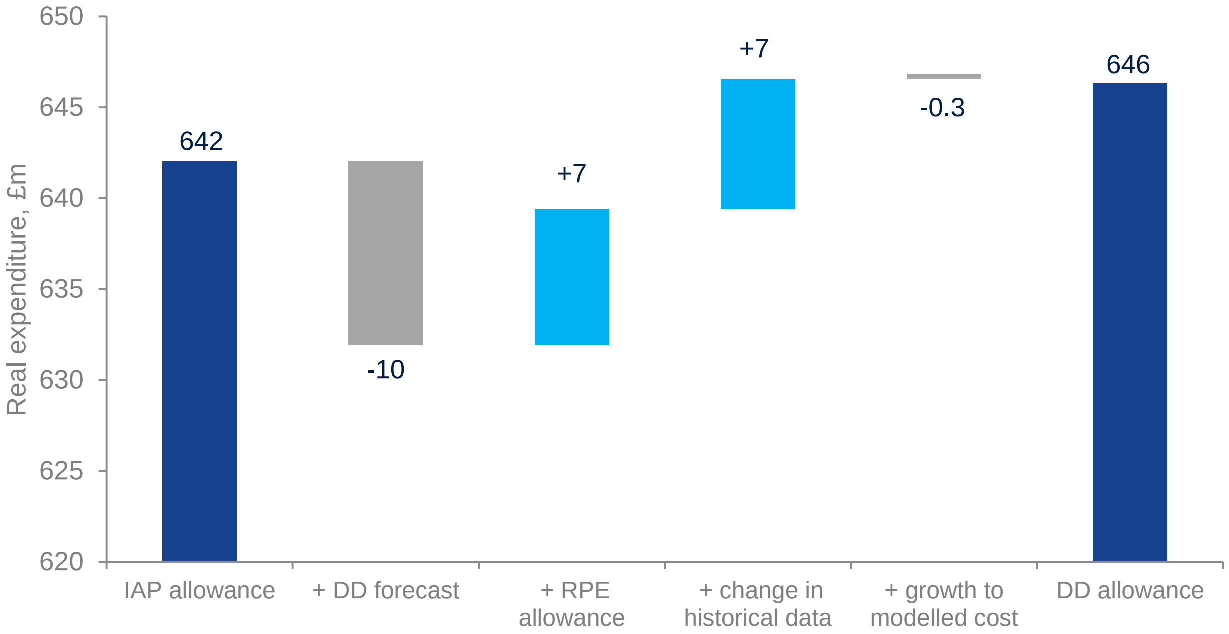
Model	Ofwat's modelled cost allowance at the DD (£m)	Ofwat's modelled cost allowance using the IAP definition of modelled costs (£m)	Implied allowance for growth (£m)
Water	653.0	587.5	65.5
Wastewater	1,526.4	1,396.1	130.3

Source: Oxera, Ofwat

To better understand what is driving the changes between Ofwat's IAP and draft determination modelled cost allowances, we took each of Ofwat's explicit modelling changes at the draft determination and applied them to the IAP model in sequence. This isolated the impact of Ofwat's change to modelled costs and therefore the implied growth allowance. The starting point in the analysis is Ofwat's modelled botex allowance (IAP modelled cost definition) plus Ofwat's allowance for growth allowance for growth expenditure less the implicit allowance for enhancement opex.

Figures 3 and 4 illustrate the progression on modelled costs from the IAP to the draft determination. The final step (growth to modelled costs) illustrates the difference in Ofwat's allowance between the IAP and the draft determination.

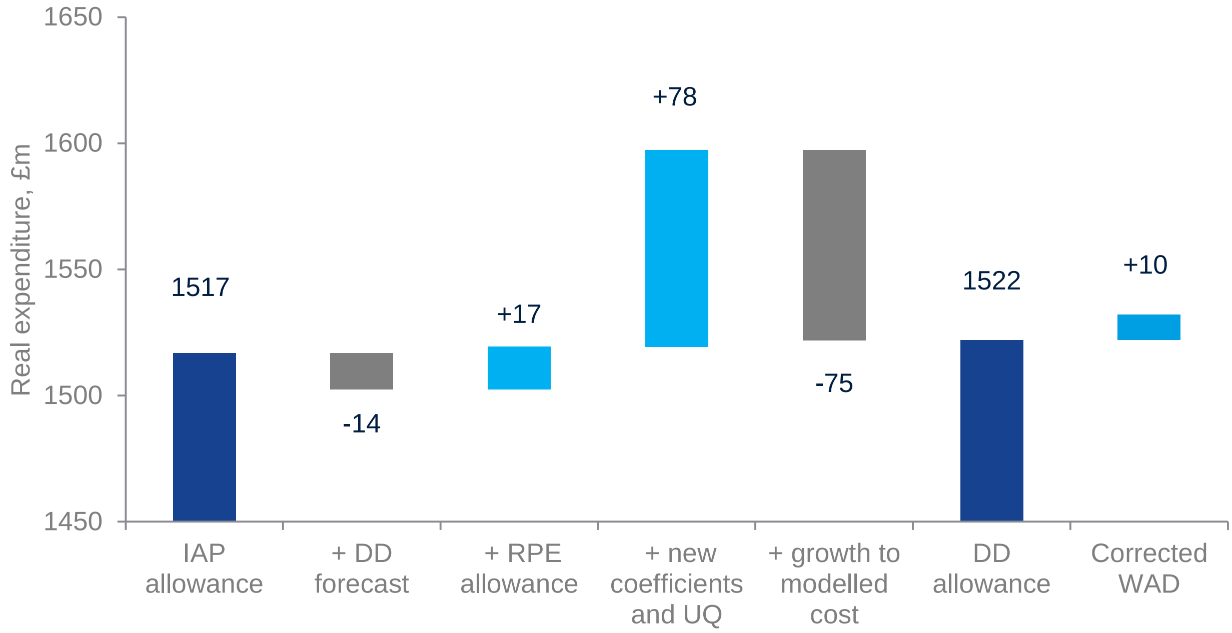
Figure 3: Impact of Ofwat's model changes in water



Source: Oxera

[redacted]

Figure 4. Impact of Ofwat's model changes in wastewater



Source: Oxera

Note: Corrected WAD refers to a computational error made in calculating the weighted average density measure for Southern Water for years 2022 and 2023. This is discussed further in our representation on 'Ofwat's forecast of weighted average density'. [Note, however, that the numerical calculations set out in the rest of this representation (including Table 11 above and Table 12 below) do not include an adjustment to take account of this separate error.

Ofwat's implied growth allowance can therefore be interpreted as Ofwat's IAP allowance for growth enhancement, less the impact on our modelled cost allowance by adding growth to modelled costs. Table 12 below sets out the implied growth allowance. As a sense-check, this verifies the approach of calculating the implied allowance by re-running Ofwat's models at the draft determination less growth from modelled costs (discussed above) as the resultant numbers are identical.

Table 12 – Implied growth allowance from our progression approach

	Water	Waste
Ofwat's IAP allowance for growth enhancement	65.8	205.7
Impact of adding growth to modelled costs at the draft determination	-0.3	-75.4
Implied growth allowance at the draft determination	65.5	130.3

Source: Oxera, Ofwat IAP

[redacted]

3.4 Our AMP7 growth needs and expenditure

In this section we describe the scope of the required expenditure to meet growth included within our business plan and why these costs are both necessary and efficient. Because we have proposed that, if Ofwat does not wish to develop new growth enhancement models, it should carry out a deep dive on our growth costs, we have set out this information in the form of Ofwat's deep dive template. Full details to support a deep dive can be found in Technical Appendices TA.12.WW05, TA.11.WN01 of our September 2018 Business Plan.

Tables 13 and 14 below set out our costs in our September 2018 Business Plan and at the IAP.

Table 13. Our growth costs for water

Model	SRN Sept submission (£m) Gross	Ofwat IAP (£m) Gross	SRN IAP response (£m) Gross
Growth	102.7	65.8	102.7

Source: IAP Technical Annex 6 (Southern Water)

Table 14. Our growth costs in wastewater

	SRN Sept submission (£m) Gross	Ofwat IAP (£m) Gross	SRN IAP response (£m) Gross
Growth at Treatment Works (Opex)	£1.1	£0.0	£1.1
flooding opex	£5.7	£0.0	£5.7
Transferred Pumping Stations (Opex)	£1.7	£0.0	£1.7
growth & PS AFCs	£2.2	£0.0	£2.2
Treatment Growth (capex)	97.2	93	£97.2
Network Growth (capex)	139.2	105	£122.2
Flooding (capex)*	10.3	7.7	£10.3
Total (excl. CAC)	**£257.4**	**£205.7**	**£240.4**
Whitfield CAC (capex)	26.4	0	0
Grand Total	**£283.8**	**£205.7**	**£240.4**

Source: IAP Technical Annex 6 (Southern Water)

3.4.1 Need for investment

What incremental improvement would the proposal deliver? Is there persuasive evidence that an investment is required? Where appropriate, is there evidence assured by the customer challenge group (CCG) that customers support the project?

This expenditure is required to ensure that we can connect an additional 64,963 new water supply properties and 113,135 wastewater properties to our networks in AMP7, with no deterioration in the levels of service to our existing customers or the environment. We have a statutory duty to provide capacity for these additional connections. Customers support us investing in our infrastructure to ensure that the level of development expected in our region does not lead to a deterioration in service levels (see below).

3.4.2 Need for cost adjustment

[redacted]

Is there persuasive evidence that the cost claim is not included (or, if the models are not known, would be unlikely to be included) in our modelled baseline?

In this representation, we have provided detailed evidence of the shortcomings in Ofwat's botex modelling approach, which have resulted in a cost allowance that is inadequate to fund the investment we need to make in AMP7 to cater for the forecast level of growth in our region. In section 3.3 above we provide our best estimate of the implied allowance for growth within Ofwat's botex models. This is materially below the level of our business plan growth costs.

3.4.3 Management control

Is the cost driven by factors beyond management control?

Growth is driven by external factors which are entirely outside of management control. Population growth, combined with migration, is driving growth in the number of customers and connected properties. The need for expenditure is driven by government-led concentrated housing growth. We have a statutory duty to accommodate this growth, without detriment to the environment or customers. If we fail to do so there would be a significant effect on river waters, groundwater and bathing waters, as well as on customer service levels, including more interruptions, pressure problems and sewer flooding.

Is there persuasive evidence that the company has taken all reasonable steps to control the cost?

We are taking significant steps to control costs by improving efficiency through being more proactive and collaborative in our approach to supporting growth and resilience across the South East. These steps include the following:

- We are continuing to build strong relations with stakeholders right across the growth spectrum. This includes county councils, local planning authorities, developers and development bodies. We are implementing a series of 'charrettes' with local stakeholders. These are workshops devoted to co-creation efforts to solve particular problems or plan our approaches to supporting growth in target catchments.
- We are adopting an account management approach with our key developers in the region. This is designed to both improve customer service to the developers but also secure improved data and information about development plans, locations, timings and scale. This further informs our growth planning processes to improve security and certainty of investments across the growth spectrum.
- We are developing Strategic Growth Studies (included within the Distribution Zonal Studies – see TA.11.WN04 of our September business plan) at the water resource zone level to better understand the make-up and timing of new developments and the impact on our network.
- We are developing catchment growth and comprehensive Drainage Area Plans (see TA.12.WW04 of our September Business Plan) with a focus on our high growth areas. This enables a stronger understanding of catchment growth and ensures alignment with Local Area Plans. This approach allows us to take a more strategic approach to supporting growth and resilience, both in relation to network capacity and treatment capacity.

We are also constantly developing innovative solutions that help us to manage growth efficiently, thus controlling costs. For example, in TA.12.WW04 Sewers and Rising Mains, we set out our technology-led strategy for moving towards a 'smart' network.

3.4.4 Best option for customers

[redacted]

Does the proposal deliver outcomes that reflect customer priorities, identified through customer engagement? Is there CCG assurance that the company has engaged with customers on the project and this engagement has been taken account of?

Maintaining the health of our water and wastewater assets is a high priority for customers. They expect us to ensure we can deliver the same level of services in an environmentally friendly manner for future generations. The focus of our customers of the future is on protecting and enhancing the environment in the short and long term. Customers expect us to ensure that future generations have access to the same level of wastewater and water services as we do today, and are, themselves, willing to invest now to ensure that there is no deterioration in services in the future.

Did the company consider an appropriate range of options with a robust cost benefit analysis before concluding that the proposed option should be pursued? Is there persuasive evidence that the proposed solution represents the best value for customers in the long term, including evidence from customer engagement?

In contrast to other areas of expenditure in our plan, growth expenditure is largely reactive to external demand and solutions need to flexible to respond to customer need. The growth costs in our plan are a mixture of solution-specific approaches, or have been developed on the basis of the average costs experienced in AMP6. As applications for connection to our network are received, we work with our developer customers to identify the optimal solutions to meet their needs.

Has risk been assessed? Have flexible, lower risk solutions been assessed? -

A range of risks are highlighted in our business plan, including the following risks:

- New property connections required in AMP7 could occur more frequently than assumed in areas where growth is complex and expensive. This might be because additional demand triggers a requirement for expensive treatment and network investments. This could lead to significant additional costs in AMP7;
- We may not be able to deliver new capacity to the timetable required by developers. This is because their formal forecasts are often unavailable, often optimistic and it is difficult for us to identify those developments which will be delayed for local technical or commercial reasons. Collaborative approaches with developers to develop realistic forecasts will mean we invest efficiently ahead or behind actual need;
- Some of the more innovative lower-cost solutions built into our AMP7 plan, such as the Sustainable Drainage 2030 programme, which aims to divert flood and storm water away from our drainage network, may be less effective than we are forecasting, resulting in the need for more costly, conventional solutions;
- Political or economic pressure may result in local authorities choosing to approve higher levels of developments than is currently assumed. This may not give us enough time to plan, design and re-configure our networks to accommodate these requirements.

Did the company consider an appropriate range of options with a robust cost benefit analysis before concluding that the proposed option should be pursued?

As noted above, growth solutions are typically site-specific and reactive to developer needs. Our plans therefore reflect the typical costs of servicing new development in our region, rather than the output of cost benefit appraisal of specific solutions. This is because, as we highlight in the risk section above, growth may occur in different areas, the level of growth may be higher than we currently expect, or some of our more innovative non-build solutions such as storm water reduction may not be successful.

3.4.5 Robustness and efficiency of costs

[redacted]

Is there persuasive evidence that the cost estimates are robust and efficient?

(i) Water service

Our unit costs for water new connections are at industry frontier levels of efficiency. Our new connections programme will install 64,963 new connections for £45m, a unit rate of £692 per connection (as per our AMP6 programme). This compares to an industry AMP6 average of £890 per connection and the AMP6 industry upper quartile of £764 per connection.[11] This means we are 22% more efficient than the industry average.

Ofwat's own benchmark data for these activities are significantly higher.[12] Against Ofwat's own benchmark data, our proposed unit costs are extremely efficient.

Our Infrastructure Growth Network Capacity and Growth Resilience programme will upgrade booster stations and trunk mains. This will ensure additional growth has no impact on existing customer levels of service and be delivered for £2m. Based on the size of our network, this equates to the lowest per km rate in the industry for network reinforcement (£165 per km, based on Data Table APP2 submissions at the IAP).

(ii) Wastewater service

The impact on our sewer networks of the high rate of growth in the south east is more acute than for the water service, where reductions in total demand have offset the increase in customers. Despite reductions in water demand, increased development leads to more run-off which, along with more frequent severe weather, places very significant pressure on the sewer network.

Despite these pressures, which are more acute in the south east, because historic growth means there is little spare network capacity, our network-related costs[12] of £1,169 per new property connected[13], are in line with the median of £1,158 at the IAP. We note that there is a five-fold difference between the lowest unit costs (£320 for Northumbrian) and the highest (£1,890 for Wessex) suggesting that regional factors have a particularly significant impact on costs in this area.

Our network reinforcement costs reflect our AMP6 incurred costs, to which we have applied our PR19 efficiency targets, in addition to the £17m of additional efficiency that we accepted at the IAP stage. We are therefore confident that, while our costs are above the IAP upper quartile cost, they are nonetheless efficient.

For wastewater treatment growth, where many of the same pressures are seen, our costs per new connection (£857) are just below the median (£905). Again, there is a five-fold difference between the highest and lowest unit costs for sewage treatment growth. The treatment growth programme is more fully defined than the network reinforcement programme, with specific solutions identified at works serving catchments where we forecast that additional treatment capacity is required to meet demand from new development. Because investment in this area reflects company-specific constraints in development hot spots, it is by its nature less amenable to comparative assessment and a more scheme-specific assessment

[12] We consider new development, flooding new additions and growth costs together, as it is clear that there are very significant differences in how companies have allocated costs between these areas, partly reflecting differences in strategy

[13] Based on our IAP response and our business plan forecast of new connections

[redacted]

is required. Details of our wastewater treatment programme are set out more fully in Technical Appendix TA.12.WW05 of our September 2018 Business Plan.

Is there high quality third party assurance for the robustness of the cost estimates?

The costs included in our business plan were externally reviewed by Jacobs, with no material exceptions identified. Details of their assurance work are contained in Technical Appendix TA.2.3 PR19 Assurance Framework of our September 2018 business plan.

3.4.6 Customer protection

Are customers protected if the investment is cancelled, delayed or reduced in scope?

The majority of the costs of growth are met by developer customers. Ofwat is proposing to introduce a new development reconciliation incentive which will adjust allowed revenues in the event that growth in customer numbers is higher or lower than allowed for in price limits. This will insulate household and business customers from the most material risks associated with growth expenditure.[14]

With network reinforcement, developer customer contributions through Infrastructure Charges are set to align with a rolling five-year average of expenditure. As such, if investment is lower (through efficiency or delayed investment), developer charges will fall.

Are the customer benefits linked to outcomes and to a suitable incentive in the business plan?

Our business plan contains a series of performance commitments that will be impacted if we do not invest to meet growth. These include:

- water supply interruptions;
- CRI (which is impacted by interruptions);
- water pressure;
- internal and external sewer flooding; and
- pollution incidents.

These five metrics are associated with financial penalties that have a maximum value of £63m (based on our draft determination representations). This provides a strong incentive to ensure that we manage growth in a way that does not lead to a deterioration in service levels for existing customers.

3.5 The basis of our proposed remedy

[14] As set out in 'Our proposed approach to regulating developer services', Ofwat, July 2019

[redacted]

We have set out above a number of shortcomings in the approach to modelling growth at the draft determination. These include a worsening ability of the botex cost drivers to model growth enhancement, compared to botex; the use of unrepresentative growth forecasts; and a disregard of the evidence on increasing marginal costs of growth. As a result, the models do not adequately allow for the costs of managing growth.

Our estimates of Ofwat's implied allowance for growth suggest that the modelled costs are materially lower than the costs included in our plan, for which we provide evidence of both the need and efficiency.

Since the IAP Ofwat has collected additional data on a more consistent basis from companies and is requiring further data to be provided as part of this draft determination response. Given the clear issues identified in this representation with the inclusion of growth costs within the botex models, we suggest that Ofwat use this data to develop a more robust set of growth enhancement models. We believe there will be merit in collaborative working between Ofwat and companies to achieve this. This will ensure that these models are consistent with company knowledge of the drivers of costs and are based on a consistent interpretation of the data.

Given the limitations on time in the PR19 process, Ofwat may feel that developing new models at this stage is undesirable. If that is the case, given the materiality of the gap between our business plan forecast of growth costs and Ofwat's implied allowance, Ofwat should undertake a careful consideration of our evidence through a deep dive on our growth costs and accept our view of efficient growth costs.

As part of this review, and in order to address some of the specific issues we have identified, Ofwat should update its view of cost drivers to align with our plan view. Specifically, within water, Ofwat should use our forecasts for expected growth in the number of properties and new mains length, and within wastewater, we suggest that Ofwat use our forecasts for expected growth in sewer length and pumping capacity per sewer length. The use of these forecasts would, on its own, reduce the gap between our plan costs and Ofwat's cost allowance by £42m.

Under either approach, this should result in a cost allowance that is equivalent to our revised business plan costs of £103m for water and £240m for wastewater.

4. Data tables impacted by this representation

Table Reference	Table Title
Table WS1	WSI – Wholesale water operating and capital expenditure by business unit
Table WS2	WS2 – Wholesale water capital and operating expenditure by purpose
Table WWS1	WWS1 – Wholesale wastewater operating and capital expenditure by business unit
Table WWS2	WWS2 – Wholesale wastewater capital and operating expenditure by purpose

Appendices

Appendix A. Additional concerns with Ofwat's botex models

Appendix B. Our company forecasts for pumping capacity per sewer length

Appendix C. Oxera analysis

[redacted]

Appendix A: Additional concerns with Ofwat's botex models

In addition to the errors in Ofwat's approach to growth we have identified above, a number of other errors in Ofwat's econometric modelling for PR19 remain. We consider that if Ofwat accepts our proposed solution regarding our cost allowance for growth, as set out in the "Remedy" section above, we would be prepared to accept the concerns set out here.

We first describe the additional shortcomings in Ofwat's econometric models at the draft determination.

A1. Significance of explanatory variables

We observe that some of Ofwat's explanatory variables have decreased in statistical significance in moving from the IAP to the draft determination, with some on the verge of becoming insignificant. Most concerning is weighted average density in the wastewater model, which is now insignificant.

- Booster pumping stations per length of main (WW1): significance has fallen from 1% to 10%
- Pumping capacity per sewer length (SWC1): significance has fallen from 5% to 10%
- Weighted average density (SWC2): significance has fallen from 5% to being insignificant

Ofwat's approach to developing econometric models in PR19 has been focused on developing parsimonious models which are aimed at achieving a desired level of explanatory power with as few explanatory variables as possible. Therefore, we should be expecting high levels of significance from Ofwat's model variables. Ofwat's decision to rely on parsimonious botex models, with limited triangulation across models with alternative specifications, increases the risk of inadequately capturing important industry cost drivers.

A2. Enhancement opex implicit allowance

One of the key changes to assessing enhancement expenditure between the IAP and the draft determination is that Ofwat now considers enhancement on a totex basis. This is more consistent with the totex framework (as it does not provide different incentives for enhancement opex and enhancement capex), and may improve the robustness of the assessment depending on the approach taken.

As enhancement opex cannot be separated from base opex in the historical dataset, Ofwat argues that its base expenditure models implicitly allow for some level of enhancement opex (despite no explicit enhancement opex drivers being included in these). To avoid funding twice the efficient level of enhancement opex in AMP7, Ofwat strips out enhancement opex that it considers is allowed for in the botex models. However, this is based on an approach that is inappropriate because it is too simplistic and results in arbitrary 'winners' and 'losers' without justification. In particular, Ofwat estimates the share of

[redacted]

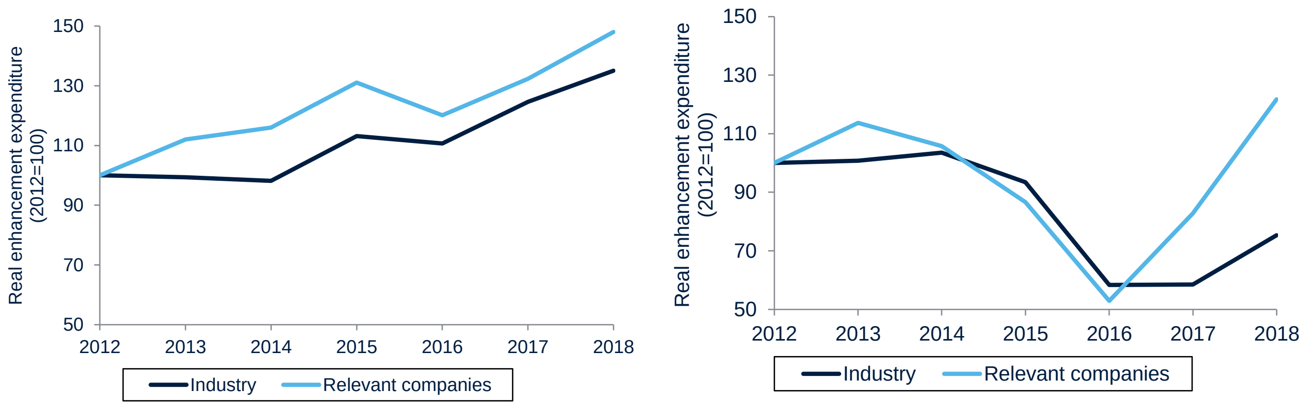
enhancement opex in modelled botex for six companies in 2018 (the only year for which outturn enhancement opex data is available)[15] and multiplies this by the AMP7 modelled botex allowance.

There are several concerns with the way in which the implicit allowance is calculated.

- The range of opex enhancement to modelled botex ratios is large across the companies considered in the analysis (0.03–3.63% in water, with an average of 1.03%; 0.06–0.62% in waste, with an average of 0.29%). The significant variation across companies within the sample means that the results will be highly sensitive to the inclusion of other companies' data.
- Enhancement activity is idiosyncratic (i.e. 'lumpy'), and it is not obvious that enhancement in 2018 will be representative of the entire historical period. If enhancement opex is higher in 2018 than in the average year, Ofwat will overestimate the implicit allowance, which will be detrimental.
- In addition, there often exists a lag between enhancement spend and additional opex requirements. It is not clear that this has been considered by Ofwat.

To assess this, it is instructive to consider how the level of enhancement capex evolved over the modelling period for the water and wastewater service areas. As shown in Figure A1 below, enhancement capex was substantially higher in 2018, particularly for the companies who Ofwat have used to determine the implicit allowance. If the level of enhancement capex is correlated with the level of enhancement opex, this indicates that Ofwat is overstating the amount of enhancement opex that is implicitly allowed in its base expenditure models.

Figure A1: Water and wastewater enhancement capex over the modelled period



Source: Oxera

[15] These companies are Anglian, Southern, Dŵr Cymru, Wessex, Affinity and Seven Trent Water.

[redacted]

A3. Overarching concerns

We also raise additional overarching concerns with Ofwat's approach throughout the price review.

- Ofwat has conducted no bottom-up assessment based on unit costs. We consider that a more balanced approach would be to consider unit costs in addition to econometric modelling, to ensure that Ofwat takes account of efficiency in unit costs. To illustrate, in our IAP securing cost efficiency response, we demonstrated our frontier levels of unit cost efficiency with regards to lead pipe replacement. Ofwat's assessment for lead standards was entirely on econometric models, which resulted in an efficiency challenge to Southern Water, despite our proposals to deliver frontier levels of unit cost efficiency.
- Owat's approach to econometric modelling has been very inconsistent throughout the price review. Ofwat has changed its econometric model approach at different PR19 milestones. Ofwat used Ordinary Least Squares (OLS) models in March 2018, then changed to Random Effects models with new variables at low confidence at the IAP. At the draft determination, botex plus models have been introduced and Ofwat has made a significant change to its modelled cost definition with the inclusion of growth. This makes it very hard for companies to assess Ofwat's progression during the price review and the change to modelled allowances.

[redacted]

Appendix B: Our company forecasts for pumping capacity per sewer length

The approach to taking the average of the last three years of actual data (2015-2018) at the draft determination to forecast pumping capacity per unit sewer length variable does not properly capture our expected growth in this cost driver. To rectify this, a company-specific adjustment should be made, and our company forecasts used in the botex model.

Ofwat's forecasts for pumping capacity per sewer length reduces our botex allowance by £37m.

This appendix is split into two main sections:

- **B.1: Supporting evidence for our company forecasts**
  - This demonstrates why we are an outlier and should be given a company-specific adjustment.
- **B.2: The rationale for changing the approach to certain forecasts between the IAP and the draft determination**
  - This supports making an adjustment for Southern Water in the case of pumping capacity / sewer length.

B1. Supporting evidence for our company forecasts

Our forecast for pumping capacity per sewer length comprises three variables. The table below sets out these three components, along with how we have forecasted them for AMP7.

Table B1: Pumping station / sewer length forecast components

Component of pumping capacity per sewer length	Forecast approach
Number of pumping stations	Based on our site catalogue and forecast growth for AMP7 based on recent trends
Capacity of pumping stations	At 90% of sites, this is based on the kW rating recorded in our maintenance system. In the other 10%, it is based on assumed capacity reflecting the type of pumping station
Length of sewer	Extracted from our company GIS system

With the exception of 10% of sites' pumping capacity being based on assumptions, in each case the data source reflects actual recorded asset data. We acknowledge that Southern Water is an outlier compared to the rest of the industry, but our forecasts are supported by robust data sources.

Sections B.1.1 and B.1.2 below outline:

- Our methodology for calculating pumping station capacity; and
- Why it is reasonable for us to have higher than average levels of pumping capacity.

[redacted]

B1.1 Our methodology for calculating pumping station capacity

We first run a capacity report from our asset maintenance data, using a system called “Ellipse”. This report looks for every pumping station and returns the kW rating for all pumps (including duty, standby and assist pumps). This dataset has been populated over several years, with contributions from numerous in-depth and business as usual studies. The key contributions are as follows:

- Data collected from ongoing engineering designs, as part of business as usual.
- Data collected from field operatives, as part of business as usual.
- Data collected from the transfer of private pumping stations in 2016.
- Data collected from a “Total Care Plan” project in 2014, which looked at over 500 sites to assess pump design and efficiency.

Given the critical nature of a number of these studies, including our assessments during the transfer of private pumping stations, we can be confident in the accuracy and robustness of the data.

Where pumps have a missing kW rating, an additional search is undertaken to look at the pump’s component level kW ratings based on the pump’s equipment set. The sum of this is then used to provide a kW rating. Any pumps which have neither a kW rating nor any equipment set type are assessed based on an average of the kW ratings. Table B2 below shows the averages applied to pumps with missing records, based on their equipment set type.

Table B2: Pumping capacity averages

Site	Pumping capacity average, kW	Site average, kW
Micro pumping station	1.49	2.94
Surface water pumping station (former private)	2.00	3.98
Surface water pumping station	40.96	96.58
Wastewater pumping station (former private)	3.94	7.61
Wastewater pumping station	22.03	51.39

Source: Southern Water

The final total pumping station capacity is a sum of the kW ratings of these sites. This figure is reported and assured as part of our Regulatory Compliance Framework (RCF), which governs the collection and reporting of all regulatory data to Ofwat.

In our most recent 2018-19 RCF process, we were able to provide data for 3,048 out of 3,383 sites, or 90%. For the remaining 345 sites, we assumed the average kW estimate based on the site type. The RCF process has a confidence grade of ‘B3’, which indicates a possible accuracy variance of +/- 10%.

To investigate possible impact of our estimates of pumping capacity being 10% lower, we re-calculated our forecast for pumping capacity / sewer length, assuming pumping capacity is 10% lower. This reduces our forecasts to an average of 3.16 across AMP6. This is equal to Ofwat’s forecast. Therefore, we show that Ofwat’s forecasts are at the lower bound of our possible pumping capacity.

We emphasise that there is an equal probability that our estimates may also lie in the upper bound of our confidence interval and may be 10% higher. We consider that a reasonable approach is to allow our forecasts as submitted, assuming they lie in the middle of the possible confidence interval.

[redacted]

B1.2 Explaining our higher levels of pumping capacity

While our pumping capacity per length of sewer is high compared with other companies, we have no reason to believe it is incorrect. Clearly we do not have access to the assumptions or methodologies used by other companies. However, to investigate further, we carried out additional research and analysis to understand the reasons behind, and the appropriateness of, these higher levels compared to the industry average.

We identified three key reasons, which we now address in turn:

- Our higher than average number of pumping stations per km of sewer;
- Our higher than average capacity per pumping station; and
- Our forecast high growth in the number of pumping stations

(i) Pumping stations per length of sewer

There are high levels of population and property growth in our region, often at a smaller scale of development due to the control of developments within the South Downs. This results in numerous pumping stations, each of which serve a relatively small number of properties, but still require large pumps to overcome the topology. All else being equal, will result in higher levels of pumping capacity per km of sewer.

Our additional analysis, shown in Table B3 below, highlights that Southern Water has the highest number of pumping stations per length of sewer amongst our peers. This would partly explain why our overall kW capacity is higher than the average, as total capacity is the sum of all stations within a site.

Table B3: Number of WPS per 1000km of sewer across the industry

Company	Number of WPS per 1000km of sewer (public + S105A) in 2015-16
Southern	63
Anglian	62
Welsh	60
South West	59
Wessex	48
Thames	44
Severn Trent	40
Yorkshire	38
United Utilities	26
Northumbrian	24
Industry average	**46**

Source: Southern Water

[redacted]

Government legislation in 2011[16] required wastewater companies to adopt private pumping stations (PPS) before October 2016. The number and capacity of PPS that we have adopted are outside our control as they have been installed by private operators, and Southern Water will have had no role in determining or controlling the investment in these stations which will have taken place prior to adoption. Our PR14 final determination provided for the adoption of 642 PPS in AMP6.[17] Our revised AMP6 forecast puts this figure at 807 and is still increasing. This demonstrates that our region had a large amount of growth within private developments that also resulted in a higher amount of pumping stations per sewer length. Table B3 above shows the number of wastewater pumping stations per 1,000km of sewer in 2015-16, showing Southern Water with 63, compared to an average of 46 across the industry.

We also have a higher number of pumping stations per length of sewer because of higher levels of growth (both historically and in the future). These developments occur in less favourable land due to restrictions of building on the South Downs and the coast. As a result, growth is high but in smaller pockets often on the edges of the South Downs, which is more likely to require a pumping station and a relatively large pump. These economic and topological factors are outside of our control and are specific to our region. This highlights that pumping station capacity is an important cost driver for us and evidences why our forecasts should be used.

(ii) Capacity per pumping station

Additional analysis highlights that Southern Water also has a high level of kW capacity per pumping station, relative to others in the sector. Although this may seem unusual at first glance, it can be explained by the fact that we have a large number of smaller pumping stations. This is evidenced in the number of former private pumping stations adopted being above estimates (and, as noted above, we will have had no control over the numbers and capacities of private pumping stations we have been legally required to adopt) and growth being in small catchments due to environmental and topological constraints.

The size of pumps is based on standard industry availability, which means pump options are limited. Pumps will be selected based on the smallest capacity which will be capable of pumping the required flows, but standard pump sizes inevitably mean there will be a degree of oversizing. This oversizing may only be small but becomes significant when multiplied by a large number of small pumping stations. A company with fewer but larger pumping stations would have a lower degree of any oversizing. This explains why, all else being equal, a company with our characteristics would expect to have a higher capacity per km of sewer length.

(iii) Pumping station growth

Our pumping station growth is supported by robust data. In June 2011 we had 2,334 pumping stations. By August 2015 due to growth this increased to 2,544 pumping stations, equivalent to an extra 52.5 pumping stations per year. This was after the recession and before the adoption of private pumping stations and therefore represents a more typical period, providing an explanation for part of the high current and forecast pumping station capacity.

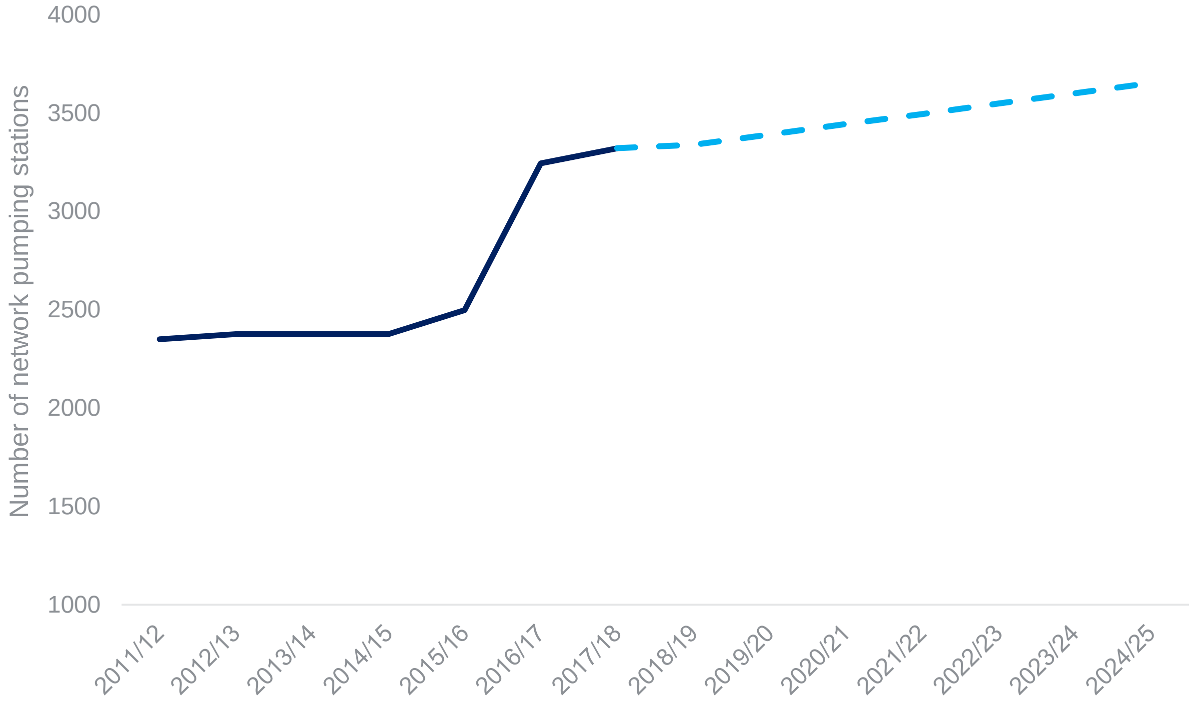
We have seen significant growth in the number of pumping stations through AMP6, partly as a result of private pumping station adoption. Between 2011-12 and 2017-18, the number of pumping stations increased by 41% and we forecast this growth to continue, increasing by a further 9% by 2024-25, as shown in Figure

[16] https://www.gov.uk/government/publications/the-private-sewers-transfer-regulations

[17] Southern Water PR14 Business Plan - Removing Wastewater Effectively Technical Annex - Adoption of PPS - See Section 1.6.8.

B1. By comparison, our sewer length has increased by 2% over AMP6 and is forecast to grow at a similar rate in AMP7. Combined with continued growth in capacity (of over 10% in AMP6 and forecast for AMP7), pumping station capacity per sewer length is increasing in the case of Southern Water. Ofwat's constant forecast of an average of historical data therefore does not capture the growth we expect to see.

Figure B1: Pumping station capacity growth



Source: Southern Water

There are a number of factors driving growth in the number of pumping stations:

- Adoption is still being sought in a number of cases, years after the October 2016 adoption date. Table 5 of TA.12.WW02 Network Pumping Stations, shows a forecast of 34 extra adopted pumping stations (post the September 2018 business plan). The current number of extra adopted pumping stations since September through to July 2019 is 36, with new stations still coming in and therefore 34 was a reasonable estimate at the time, and now appears to be an underestimate.
- Potential new legislation providing for the adoption of 'supplementary' private pumping stations. In our region, at least 90 private pumping stations may fall within scope for AMP7.
- New development as result of above-average population growth in our region. We forecast this will require an additional 262 pumping stations.

The average growth in the industry from 2017-18 to 2024-25 is around 6%; if Southern Water and Thames are removed the average is 3%.

[redacted]

Table B4: Pumping station growth expected across the industry

Company	Increase in the number of network pumping stations 2017/18 - 2024/25
Thames	35%
Southern	**10%**
Wessex Water	6%
Northumbrian	5%
United Utilities	4%
South West	3%
Hafren Dyfrdwy	2%
Severn Trent England	2%
Anglian	1%
Welsh	0%
Yorkshire	0%
Average	**6%**

Source: Ofwat IAP data

Our growth is expected to be stronger than the industry because of continued higher development and population growth within the South East of England (see section 1.1.1 for evidence of the level of growth we expect relative to other regions).

Therefore, we consider that it is justified for Southern Water to be allowed a company-specific adjustment and for our company forecasts for pumping station capacity / sewer length to be used.

B2. The rationale for changing the approach to certain forecasts between the IAP and the draft determination

In this section, we explain how the rationale for changing the approach to forecasting a number of other growth-related cost drivers at the draft determination also supports making a company-specific adjustment in relation to pumping station capacity per sewer length forecasts (in particular given Southern Water's outlier position and expected high level of growth).

Specifically, Table B4 below sets out the rationale for revising some of its forecasts at the draft determination, and outlines why this reasoning holds true in the case of pumping station capacity per sewer length and supports a company-specific adjustment.

[redacted]

Table B4. The rationale for changing some of its forecasts and why these also apply to pumping capacity / sewer length

The rationales for changing forecasts	Why it also applies in the case of pumping capacity / sewer length
"While historical forecasts are independent, we accept that they may not capture changes in growth rates" (used as a rationale to base forecasts on historical growth rates and companies' views of growth rates for length of mains (water) and length of sewers (wastewater))	We have clearly demonstrated in this representation that Southern Water is expecting high levels of growth in AMP7 in the number of pumping stations and therefore capacity. This growth is expected to outstrip that of sewer length. Therefore, by extension, we expect to see a high level of growth in pumping capacity per sewer length. Our historical growth does not capture changes in growth expected in AMP7.
"We accept [the] challenge that it is not appropriate to assume a constant number of booster pumping stations with a growing network" (used as a rationale to base forecasts for booster pumping stations based on historical growth rates per company)	By extension, this argument holds in the case of pumping capacity per sewer length and specifically for Southern Water where we expect high growth rates. Ofwat has applied a constant growth rate for AMP7 in its forecast. This is inappropriate because it does not capture expected growth from a growing network. Ofwat has accepted that it is inappropriate to assume constant growth with a growing network in the case of booster pumping stations. In addition, Ofwat has allowed for an increasing forecast in sewer length. Calculating an indirect forecast using Ofwat's forecasts of pumping capacity and sewer length should, by extension, result in a non-constant forecast. In the case of Southern Water, we expect growth in pumping capacity to outstrip sewer length, so we would expect a forecast of pumping capacity per sewer length that is increasing.

Source: Ofwat (PR19 draft determination technical appendix, pages 21-23)

[redacted]

Appendix C: Oxera analysis

In this appendix, we provide supplementary information regarding Oxera's analysis of the following:

- The "botex" and "growth" regressions on botex cost drivers, as set out in Section 1.1; and
- The calculation of the implied growth allowance, as set out in Section 1.3.

C1. "Botex" and "growth" regressions

Table C1 to C4 present the full set of coefficients from the "botex" and "growth" regressions for water and wastewater, respectively.

Table C1: Regression of botex on botex cost drivers (the "botex" model) - water

	WRP1	WRP2	TWD1	WW1	WW2
Connected properties (log)	1.014***	1.014***		1.029***	1.017***
Lengths of main (log)			1.036***		
Water treated at works of complexity levels 3 to 6 (%)	0.00777***			0.00505***	
Weighted average treatment complexity (log)		0.443***			0.519***
Number of booster pumping stations per lengths of main (log)			0.513***	0.257**	0.277**
Weighted average density (log)	-1.360**	-0.701	-3.057***	-2.057***	-1.649***
Squared terms of log weighted average density	0.0828**	0.0358	0.244***	0.144***	0.115***
Constant term	-5.316***	-7.605***	5.716***	-1.538	-3.083***
Breusch–Pagan test	0	0	0	3.43e-08	0.000176
Test for overidentifying restrictions	0.00687	3.98e-06	0.639	0.00262	4.07e-09
RESET test	0.0131	0.0441	0.881	0.528	0.103
R-squared	0.934	0.921	0.968	0.974	0.975
Efficiency range	74–158%	71–173%	82–130%	79–126%	79–124%

Source: Oxera analysis

Note: efficiency is defined as predicted expenditure divided by actual expenditure.

[redacted]

Table C2: Regression of growth enhancement on botex cost drivers (the “growth” model) - water

	TWD1	WW1	WW2
Connected properties (log)		1.166***	1.122***
Lengths of main (log)	1.134***		
Water treated at works of complexity levels 3 to 6 (%)		0.003	
Weighted average treatment complexity (log)			0.966**
Number of booster pumping stations per lengths of main (log)	-0.393	-0.446	-0.354
Weighted average density (log)	-2.167**	-1.629	-1.428
Squared terms of log weighted average density	0.174**	0.114	0.101
Constant term	-4.231	-10.745**	-11.715**
Breusch–Pagan test	0.000	0.000	0.000
Test for overidentifying restrictions	0.005	0.001	0.003
RESET test	0.198	0.676	0.353
R-squared	0.763	0.756	0.754
Efficiency range	45–177%	45–181%	43–185%

Source: Oxera analysis

Note that we have not included a water resources plus (WRP) growth model as only a few observations had non-zero growth enhancement in this part of the value chain.

Table C3: Regression of botex on botex cost drivers (the “botex” model) - wastewater

	SWC1	SWC2	SWT1	SWT2	BRP1	BRP2
Sewer length (log)	0.819***	0.897***				
Pumping capacity per km sewer (log)	0.281*	0.619***				
Density	1.186***					
Weighted average density		0.193				
Load treated (log)			0.856***	0.847***	0.840***	0.809***
% load treated with tight ammonia consents (<3mg/l)			0.003585***	0.003783***	0.004839***	0.00507***
% of load treated at WTWs in size bands 1-3			0.05771**		0.0509***	
% of load treated at WTWs in size band 6				-0.0150*		-0.01**
Constant term	-8.588***	-6.534***	-6.273***	-4.765***	-5.777***	-4.296***
Breusch-Pagan test	0	0	0	0	0	0
Test for overidentifying restrictions	0	0.00253	0.621	0.569	0.258	0.0960
RESET test	0.197	0.0210	0.0593	0.732	0.0934	0.238
R-squared	0.933	0.874	0.872	0.846	0.922	0.917
Efficiency range	88–115%	81–131%	66–120%	64–127%	70–124%	72–140%

Source: Oxera analysis

[redacted]

Table C4. Regression of growth enhancement on botex cost drivers (the "growth" model) - wastewater

	SWC1	SWC2	SWT1	SWT2	BRP1	BRP2
Sewer length (log)	0.547**	0.551**				
Pumping capacity per km sewer (log)	-0.559*	-0.330				
Density	1.210**					
Weighted average density		0.252***				
Load treated (log)			2.414**	2.062**	2.437**	2.081**
% load treated with tight ammonia consents (<3mg/l)			-0.009	-0.008	-0.009	-0.008
% load treated at WTWs in size band 1–3			0.233		0.235	
% load treated at WTWs in size band 6				- 0.040100		-0.040
Constant	-7.288***	-4.730**	-30.084**	-21.610*	-30.382**	-21.837*
Breusch–Pagan test	0.166	0.153	0.009	0.002	0.009	0.002
Test for overidentifying restrictions	0.021	0.044	0.005	0.000	0.007	0.000
RESET test	0.021	0.027	0.198	0.007	0.195	0.005
R-squared	0.485	0.481	0.293	0.226	0.294	0.227
Efficiency range	49%–144%	49%–141%	28%–281%	19%–350%	27%–292%	19%–364%

Source: Oxera analysis

[redacted]

C2. Calculation of implied growth allowance

Section 1.3.3 of this representation explains how we sought to isolate the impact of including growth by asking Oxera to re-run Ofwat's botex models using all of the draft determination assumptions but removing growth costs. We describe below how Oxera assessed the extent to which the base expenditure plus growth enhancement expenditure (botex+) models of Ofwat implicitly allow for growth enhancement in AMP7.

Ofwat's econometric models were re-estimated using the same definition of modelled botex used at the IAP. This was then compared to the botex+ enhancement allowance, using the following equation to predict the implicit allowance for growth:

Implicit growth allowance = Efficient botex + allowance less Efficient botex allowance

The efficient botex + allowance is that given in Ofwat's feeder model 4 for water[18] and wastewater.[19]

The efficient botex result can be recreated using the do files provided by Ofwat to estimate its wholesale base expenditure models.[20, 21] For water, lines 177–179 should be amended to be consistent with the IAP modelled cost definition.[22] For wastewater, lines 135–137 and 203–205 should be amended to be consistent with the IAP modelled cost definition.[23]

Following this approach results in an implied growth allowance of £66m (£653m-£588m) on water and £130m (£1,522m-£1,396m) on wastewater.[24]

[18] Ofwat (2019), 'Feeder model 4: Wholesale water – Water resources and water N+ cost allowances.xlsx', July.
[19] Ofwat (2019), 'Feeder model 4: Wholesale wastewater – Bioresources and wastewater N+ cost allowances', July.
[20] Ofwat (2019), 'Stata do files: Wholesale water', July, accessed at: https://www.ofwat.gov.uk/wp-content/uploads/2019/07/Stata-do-files_Regressions-Wholesale-water_ST_DD.txt.
[21] Ofwat (2019), 'Stata do files: Wholesale wastewater', July, accessed at https://www.ofwat.gov.uk/wp-content/uploads/2019/07/Stata-do-files_Regressions-Wholesale-wastewater_ST_DD.txt.
[22] Ofwat (2019), 'Stata do files_Regressions, wholesale water', February, accessed at: https://www.ofwat.gov.uk/wp-content/uploads/2019/01/Stata-do-files_Regressions-wholesale-water.txt.
[23] Ofwat (2019), 'Stata do files: Wholesale wastewater', February, accessed at: https://www.ofwat.gov.uk/wp-content/uploads/2019/01/Stata-do-files_Regressions-wholesale-wastewater.txt.
[24] Numbers may not add up due to rounding.

[redacted]

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[redacted]

Ofwat's approach to environmental obligations

1. Issue

In the draft determination, Ofwat has changed its approach to determining a totex allowance for expenditure relating to environmental obligations, i.e. WINEP costs. At the IAP, efficient allowances were assessed separately within each enhancement area, with the lower of the modelled cost and company business plan forecast being allowed. For the draft determination, Ofwat has developed a view of efficient costs at a programme level, aggregating together WINEP expenditure before applying an industry-wide efficiency challenge. Ofwat describes the efficiency challenge as incorporating:

> *"A catch-up element, as well as an expectation that companies will make a step-change in efficiency in the coming regulatory period due to the totex and outcomes approach and ongoing productivity improvements".*[25]

This is therefore a programme-level, forward-looking efficiency challenge.

We agree that assessing efficiency at a programme level better accounts for potential differences in cost allocation and trade-offs between the different enhancement areas, as well as balancing out the differences in accuracy and robustness of the models in each area.

However, the application of a 9% forward-looking efficiency challenge does not take into account the significant efficiency stretch we have already included in our enhancement costs, leading to an underestimation of the required totex and an efficiency challenge at a level more stringent than the upper quartile.

[25] "PR19 Draft determinations: Securing cost efficiency technical appendix", Section 4.7 Environmental obligations, page 63

[redacted]

Specifically, we have concerns with the draft determination approach for the following reasons:

- Our forecasts of enhancement costs already include an assumption of the scope for future efficiencies. Ofwat's efficiency challenge is described as a forward-looking challenge. However, it does not take account of the forward-looking efficiencies already embedded in companies' proposed costs. We demonstrate below the assumptions and efficiencies we applied in forecasting costs and how that leads to a cost proposal that already takes account of the scope for future efficiency. The programme-level challenge therefore represents a double-counting of this scope for efficiency.
- We have already accepted a further significant efficiency stretch in response to the IAP and the draft determination. In moving from our September 2018 Business Plan to our IAP response, we worked extremely hard to challenge our plans and find further efficiencies and reduced our WINEP costs by £106m, or 13%.[26] We are accepting a further £18m challenge at the draft determination resulting in a total efficiency challenge of 16% against our September business plan costs for delivering WINEP (before taking account of the additional 9% challenge). A further, unjustified efficiency challenge will put the delivery of these schemes at significant risk.
- Ofwat does not apply an explicit forward-looking efficiency challenge to any other enhancement expenditure. The approach to WINEP costs is therefore inconsistent. No justification for treating WINEP costs differently to other categories of enhancement spend by applying an apparent upper quartile challenge to programme-level costs is provided.
- There is a mathematical error in the calculation of the efficiency challenge. Ofwat's calculation of the 9% is incorrect. If it is correct to apply an efficiency challenge at all, it should be set at a level of no more than 5%, correctly applying Ofwat's calculation approach. The impact of this calculation error alone reduces our efficient cost allocation by £22m (see Appendix A).

[26] Note that, in fact, we reduced WINEP costs by more than this at IAP, but some of this cost reduction was scope related rather than efficiency related. We are focussing on the efficiency reduction in this representation.

[redacted]

2. Our proposed remedy

The consequence of the revised approach is to reduce our cost allowance by £50m at the draft determination. At the draft determination, Ofwat determined our modelled allowance to be £583m. The application of a 9% efficiency challenge lowers this allowance by £50m to £533m.

The double-counting of future efficiency should be addressed by removing the 9% efficiency challenge applied to the costs associated with delivering our WINEP programme.

In removing this efficiency challenge, it should also be recognised that the 9% proposed as part of the draft determination has been calculated incorrectly and would be 5% (as explained in Appendix A).

[redacted]

3. Supporting evidence

In this section we provide supporting evidence relating to:

- The double-count of future efficiency scope (section 3.1)
- The efficiency that we applied at the IAP and draft determination (section 3.2)
- Inconsistencies in the draft determination approach (section 3.3)

3.1 The scope for future efficiency has been double counted

The WINEP efficiency challenge is described as incorporating:

> *"A catch-up element, as well as an expectation that companies will make a step-change in efficiency in the coming regulatory period due to the totex and outcomes approach and ongoing productivity improvements".*[27]

It is clearly therefore intended to be a forward-looking efficiency challenge.

We understand the merits of applying a forward-looking efficiency challenge when modelling using historic costs, for example in the assessment of base operating costs. However, in the case of enhancement expenditure, company forecasts already include an implicit or explicit assumption about how efficient they expect to be in the future.

Ofwat uses a number of methods of assessment to determine an efficient totex allowance for WINEP costs, before applying an efficiency challenge to the aggregate of these allowances at a programme level. Specifically, Ofwat use a combination of benchmarking based on regression models or unit costs, and deep/shallow dives to assess efficient costs. All of these assessment approaches rely on forward-looking cost forecasts from companies, as opposed to historic costs. It is therefore not appropriate to apply a forward-looking efficiency challenge as if these were historic costs.

In this section, we detail below the multiple layers of efficiency challenge that our WINEP costs have been subject to its date.

[27] "PR19 draft determinations: Securing cost efficiency technical appendix", Section 4.7 Environmental obligations, page 63

[redacted]

3.1.1 Efficiency assumptions applied to forecasts of costs

We carefully considered the potential for future efficiency in forecasting our enhancement costs for AMP7. In our Business Plan our Board confirmed that our plan represents a step change in service and efficiency, as benchmarked against best practice elsewhere in the water industry and beyond. In building our plan we developed well-evidenced enhancement efficiency forecasts, drawing on detailed engineering challenge and reviews of schemes and programmes across the industry. Where costs are repeatable and consistent across all companies, for example in relation to growth-related expenditure, we have updated and used Ofwat's PR19 cost models, applying an upper-quartile adjustment in line with Ofwat's methodology. In the majority of cases, we have relied on the application of detailed engineering assessments and structured internal challenge process to assess the scope for future efficiencies.

In addition, we acquired an independent view from Oxera (TA.14.6 from our September Business Plan) of the likely scope for continuing efficiency and the impact of real price effects. Combined with the analysis provided by Ofwat of the greater scope for efficiency improvements from moving to a totex and outcomes framework, we assumed a 1% cumulative annual increase. This is now substantially in line with Ofwat's revised view of the net frontier shift of 1.1% (net of labour RPEs which Ofwat has now assumed to be 0.4% in the draft determination).

We therefore applied a significant forward-looking efficiency challenge prior to the submission of our Business Plan. Ofwat's proposed 9% efficiency challenge fails to take account of this. As described further in sections 3.1.2 and 3.1.3 below, this position is made worse when the further efficiency challenge accepted by Southern Water in its response to the IAP and the draft determination is also not reflected.

3.1.2 Evidence from across the industry

In the PR19 final methodology, Ofwat was clear that it expected to see a "step change" in efficiency in AMP7 and that companies should consider the scope for future efficiency in developing their business plan cost forecasts.

Reflecting this expectation, Ofwat included a Business Plan data table, APP24a, in which it captured the assumptions that each company had made about future efficiency within its business plan costs. Analysis of the data provided by companies in their September 2018 Business Plans confirm that companies did indeed build significant efficiencies in to the costs they included in their business plans. Table 1 shows that for the Wastewater Network+ price control (which will contain substantially all WINEP costs) the average cumulative five-year efficiency saving was 13% for non-infrastructure costs and 11% for infrastructure costs.

While this data will include an element of catch-up efficiency as well as future efficiency scope, there is no evidence that Ofwat has taken account of the savings already built in to company business plans, have been taken into account in reaching a view on the scope for future efficiency to be delivered in the WINEP programme.

[redacted]

Table 1. Efficiency savings included within Network+ enhancement costs

	Other capital expenditure - non-infrastructure	Other capital expenditure - infrastructure
Anglian	5.1%	5.1%
Dŵr Cymru	10.8%	6.4%
Northumbrian	7.7%	7.7%
Severn Trent	14.0%	14.0%
South West	22.6%	22.6%
Southern	14.0%	14.0%
Thames	2.3%	2.6%
United Utilities	25.8%	3.4%
Wessex	15.5%	15.5%
Yorkshire	15.1%	15.1%
Average	**13.3%**	**10.6%**

Source: Southern Water analysis of company Business Plans (Table APP24a)

This data supports our view that the application of an additional forward-looking efficiency to submitted company costs represents a double-count which will result in efficiency savings that are not deliverable. If a programme-level efficiency challenge is applied, it should first take account of company views of efficiency which are already built in to the costs.

3.2 Our efficiency stretch at the IAP and the draft determination

3.2.1 Additional efficiencies applied at the IAP and draft determination

At the IAP and draft determination, Ofwat challenged us to reduce our enhancement expenditure related to WINEP to their view of efficient costs of £487m. In response, we identified opportunities for further efficiencies and lowered our view of efficient costs by £106m (in addition to cost reductions from scope change) at the IAP stage. This was a significant cost reduction efficiency challenge in its own right without applying any further efficiency challenge. We are also accepting a further £18m of efficiencies in our response to the draft determination.

This represents a total efficiency challenge of £125m, or 16% of our original September 2018 Business Plan submission of £804m WINEP related costs. This is a significant efficiency challenge. The challenge at this draft determination stage alone is likely to take us well beyond a frontier level of efficiency for our WINEP programme.

A further 9% (£50m) challenge on top of this would take the total WINEP efficiency challenge to £175m, or 22% compared with our original business plan submission. This level of challenge goes well beyond any reasonable or deliverable level of efficiency challenge and will risk the deliverability of our WINEP programme. We consider that this level of efficiency is not justified by the evidence, nor is it realistically achievable. Table 2 sets out the efficiencies we applied in each enhancement area at the IAP, and the further efficiencies we are accepting at the draft determination.

Table 2. Efficiencies applied to WINEP costs at the IAP and draft determination, before the application of Ofwat's further 9% challenge

WINEP Programme	Cost reduction at IAP as a result of efficiency challenge (£m)	Potential draft determination cost efficiency challenge (£m)	Total efficiency challenge applied to WINEP costs (£m)
P-Removal	81	0[28]	81
Storm tank capacity	20	8	28
Chemicals removal	0	-1	-1
Flow to Full treatment	3	2	5
Conservation drivers	2	2	4
Event Duration monitoring	0	1	1
Flow monitoring	0	0	0
N-removal	0	0	0
Spill frequency	0	0[29]	0
Studies and investigations	0	4	4
Thanet CAC	0	3	3
Total efficiency challenges accepted up to draft determination	**106**	**18**	**125**

Notes: [1]Totals may not exactly add due to rounding, [2]Excludes additional cost reductions due to scope changes.

3.2.2 Risk to deliverability of WINEP programmes

We have a relatively large WINEP programme in AMP7 compared with other wastewater companies.

The scale of new permits and investigations being driven by this programme are also one of the largest we have ever delivered. This will place pressure in terms of the availability of both skilled third parties to enable us to deliver these schemes, such as specialist surveying companies, as well as increased demand for resources to enable us to deliver the programme.

[28] Ofwat have confirmed in the SRN post draft determination query response 16, that they will fully fund P-removal in their modelling allowance at Final Determination. This removes the £6.5m remaining efficiency challenge for this element of the environmental obligations

[29] There was a £5m over-funding for Spill Frequency in the Ofwat modelling allowance, conversations with Ofwat have confirmed this will not be included in the Final Determination

[redacted]

Our draft determination response includes £595m[30] of expenditure related to WINEP for wastewater. This represents c.93% of our total business plan wastewater enhancement (excluding growth, which is now part of botex). The imposition of a further 9% efficiency challenge to our programme therefore has a disproportionate effect on our overall Business Plan.

We must assess the scope for future efficiencies against the risk of not being able to successfully deliver investments which are essential to protect consumers and environments. We consider that this level of efficiency is not justified by the evidence, nor is it realistically achievable.

As demonstrated above, we have already applied a 16% efficiency to our WINEP costs and any further significant efficiency challenge would not be deliverable. Table 3 shows the level of efficiency challenge for each element of our AMP7 WINEP programme.

Table 3. Efficiency challenges and remaining investment by WINEP programme

WINEP Programme	September business plan costs (£m)	Total efficiency challenge applied to WINEP costs (IAP and DD) (£m)	Percentage efficiency challenge (%)
P-Removal	321	81	25
Storm tank capacity	130	28	22
Chemicals removal	45	-1	-2
Flow to Full treatment	152	5	3
Conservation drivers	20	4	20
Event Duration monitoring	6	1	11
Flow monitoring	0.2	0	0
N-removal	9	0	0
Spill frequency	0.4	0	0
Studies and investigations	23	4	17
Thanet CAC	33	3	9
Ultraviolet disinfection	14	0	0
Sanitary parameters	50	0	0
Total potential efficiency challenge	**804**	**125**	**16**

[30] This reflects our original Business Plan submission of £804m, less a total of £125m efficiency and £84m scope reductions / other updates applied at the IAP and draft determination stages (noted that figures making up the £804m and £595m are rounded)

[redacted]

Note: excludes £84m of scope reductions (totals may not add exactly due to rounding)

The areas in which we have already made the largest reductions are:

- P-removal - £81m (25%) efficiency challenge already applied
- Storm Tanks - £28m (22%) efficiency challenge already applied
- Thanet Sewers CAC - £3m (9%) efficiency challenged already applied

It is very unlikely that we will be able to achieve further efficiency savings on these schemes. These three areas equate to c.60% of the total remaining WINEP programme costs in our draft determination response. This means that most, if not all, of the £50m of extra efficiency challenge would need to be found within the remainder of the WINEP programme. This would be a practically impossible efficiency challenge to achieve as the remaining 40% of the WINEP programme equates to less than £250m of investment. This 40% of the programme would need to absorb efficiencies of more than 20%, on top of those already applied, in order to successfully absorb the £50m.

By way of illustration, in our IAP response, we provided detailed independently benchmarked and assured cost evidence in our Thanet Sewers Cost Adjustment Claim that demonstrated that delivery of this scheme was already at the maximum levels of efficiency (TA.14.2 Cost Adjustment Claim 2 – Thanet Groundwater Protection Scheme of our September Business Plan). We are accepting the further draft determination cost challenge of £3m on this scheme. An additional 9% efficiency challenge simply cannot be absorbed.

In Section 5 below, we set out a summary of our assurance from Jacobs, which states that a number of our programmes, for example P-removal, have a significant risk of not being deliverable for the proposed cost allowance (see TA_CA_Jacobs Letter of Assurance).

Compounding these cost pressures is the considerable risk of 'scope creep' in our WINEP requirements. To illustrate, in the case of P-removal schemes, the Environment Agency wrote to us in April 2019 (see TA_CE_Letter from the Environment Agency) informing us of the need to do an end of pipe-solution. This is associated with additional costs, for which there is no allowance in our plan.

The combination of the further efficiency already applied at the IAP and draft determination, as well as the risk of an increase in WINEP requirements, will significantly hinder our ability to meet our environmental obligations. If further efficiency savings must be found from elsewhere in our plan, this will put wider performance and resilience for customers at risk.

3.3 Inconsistencies in the draft determination

Ofwat's general approach to assessing enhancement costs recognises that assumptions of future efficiency have already been considered and built in to companies' business plan cost forecasts. In no other area of its assessment of enhancement costs is an industry-wide forward-looking efficiency challenge applied. We have not see any reasoning or evidence to suggest that WINEP expenditure requires a different approach. This is clearly inconsistent. For a company like Southern Water, for whom the WINEP programme represents a large proportion of our Business Plan expenditure, this approach has a disproportionate adverse impact.

4. Data tables impacted by this representation

Table Reference	Table Title
Table WWS1	WWS1 - Wholesale wastewater operating and capital expenditure by business unit
Table WWS2	WWS2 - Wholesale wastewater capital and operating expenditure by purpose

5. Assurance

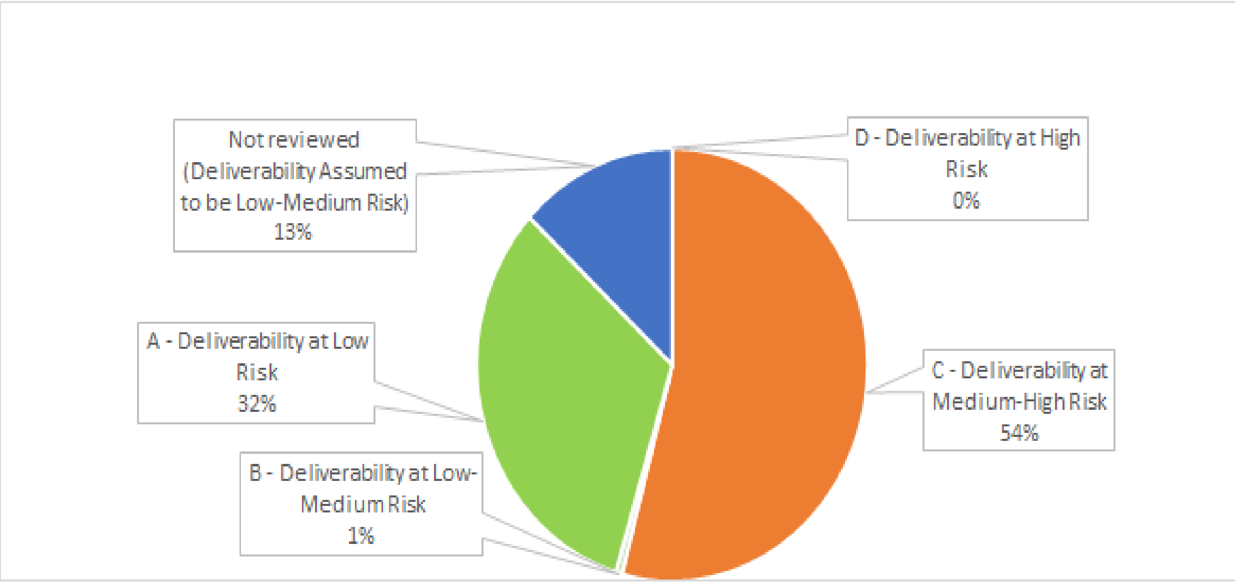
Our key argument that Ofwat's additional programme-level efficiency poses a significant deliverability risk is supported by independent cost assurance by Jacobs. Their summary comments stated:

> *"On the deliverability of the WINEP programme we have identified two areas (P removal and Storm Tank Capacity programmes) where we consider there to be a high risk to delivery at the revised investment levels. Based on the evidence available we consider the Thanet scheme, the Flows to Full Treatment Programme, the Sanitary Parameters Programme and the UV Disinfection Programme to be medium to high risk for delivery at the revised investment levels."*

Furthermore, at IAP response, Jacobs review of deliverability showed our WINEP programme to be at medium risk overall (32% at low risk and 54% at medium to high risk), as shown in Figure 1. At the draft determination stage, with additional modelling and programme level efficiencies being applied; they now assess the majority of our WINEP programme to be at medium to high deliverability risk (91% of our WINEP programme), with 54% of our programme being at high deliverability risk, as shown in Figure 2.

This is a significant and concerning change in deliverability risk from IAP to Draft determination stage; particularly in the high cost areas of our WINEP programme. Please see TA_CA_Jacobs Letter of Assurance.

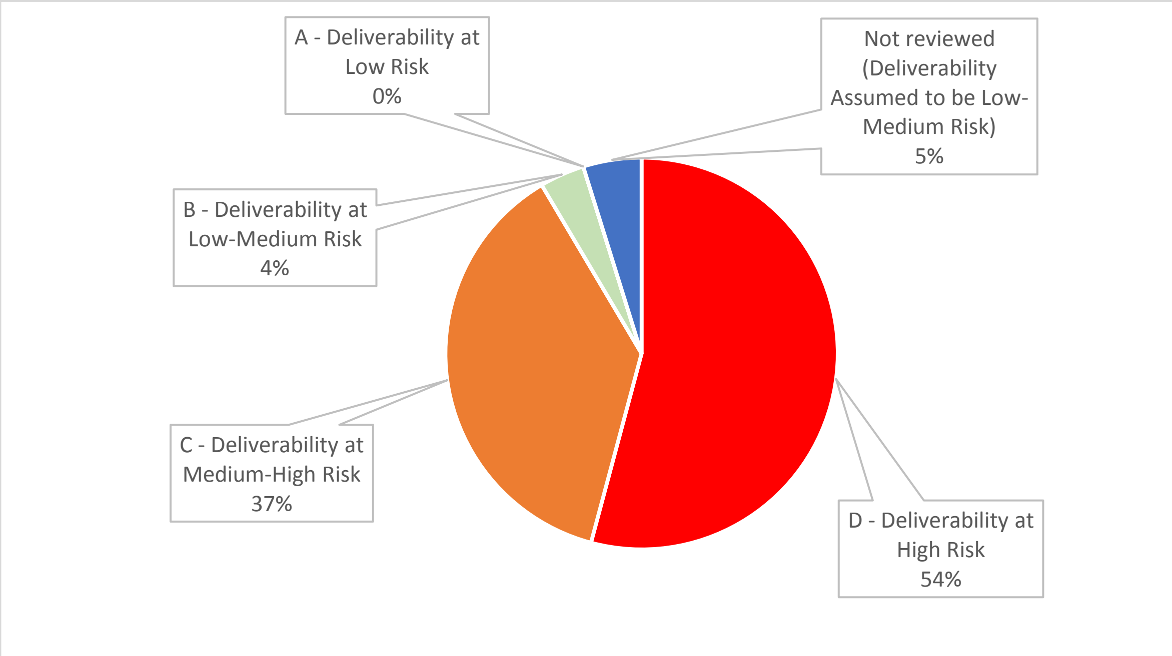
Figure 1. Summary of Jacobs view of deliverability of our WINEP areas of investment at IAP



[redacted]

Source: Jacobs

Figure 2. Summary of Jacobs view of deliverability of our WINEP areas of investment at draft determination



Source: Jacobs

6. Appendices

Appendix A: Material errors in the calculation of the efficiency challenge

[redacted]

Appendix A: Material errors in the calculation of the efficiency challenge

Notwithstanding our view that there is no justification to selectively apply a further efficiency challenge to this area of enhancement expenditure, we note that:

- The calculation of the 9% efficiency stretch is inconsistent with the description of the nature of this challenge.
- There is a material error in the calculation of the 9% in the published models.

A1. Derivation of the 9% efficiency challenge

Within its published model FM_E_aggregator_ST_DD, Ofwat aggregates the modelled cost allowances for WINEP expenditure for each company in each enhancement area.[31] An 'efficiency score' for each company is calculated based on their modelled allowance relative to their business plan totex. It then calculates the efficiency at the 25th percentile, or the lower quartile. This gives an "efficiency" of 91%. The specific calculation within the "WINEP in-the-round" tab is as follows:

=PERCENTILE(H5:H15,0.25) = 91%

Where the cell range H5:H15 contains the ratio of Ofwat's allowance to company requested totex for the 11 water and wastewater companies.

Ofwat then multiply each company's modelled WINEP cost allowance by 91%, representing an efficiency challenge of 9%. This is consistent with what Ofwat state in their methodology, that they "consider a challenge of nine percent is appropriate".[32]

However, the approach is erroneous and is clearly not what Ofwat intended to achieve. As we demonstrate below, there are a number of material inconsistencies and contradictions between the stated methodology and calculations in "FM_E_aggregator_ST_DD".

A2. Inconsistency with the stated intention of the adjustment

In the draft determination, Ofwat describes the basis of the 9% efficiency challenge as follows:

[31] "FM_E_aggregator_ST_DD", tab "WINEP in-the-round"
[32] "PR19 draft determinations: Securing cost efficiency technical appendix", Section 4.7 Environmental obligations, page 63

[redacted]

> *"This challenge incorporates a catch-up element as well as an expectation that companies will make a step-change in efficiency in the coming regulatory period due to the totex and outcomes approach and ongoing productivity improvements"*

In "FM_E_aggregator_ST_DD", company totex is compared to Ofwat's view and the lower quartile is calculated to set a challenge. There is no analysis to determine these two separate components to the efficiency challenge.

3.4.3 Errors in the calculation

As described above, the 9% is calculated as the 25th percentile of company efficiency scores. In using the efficiency at the 25th percentile, the challenge is effectively based on inefficiency. In the model an efficiency score of 91% means that, for the company at the 25th percentile, Ofwat's modelled allowance is 91% of business plan totex, or 9% inefficient.

This approach is clearly counter-intuitive. There is no logic to calculating an efficiency challenge based on the upper quartile of inefficiency. Notwithstanding that the challenge is described in a different way, it would seem apparent that it was intended to scale the challenge using the upper quartile of efficiency rather than inefficiency.

To correct the error, the 75th percentile rather than the 25th percentile of the efficiency scores should have been calculated, using the formula:

=PERCENTILE(H5:H14,0.75)

Using this correct formula, and removing Hafren Dyfrdwy, which is a clear outlier in terms of both scale and modelled costs, the upper quartile efficiency score is 105%. This means that the upper quartile company's costs are 5% more efficient than Ofwat's modelled allowance would predict, so using Ofwat's method, the correct level of efficiency at the upper quartile level would therefore be 5% not 9%.

Ofwat state that the catch-up element of the efficiency challenge is "significantly less stringent than the upper quartile". Even when an assumption for frontier efficiency (which is set to be 1.1%) is applied, this suggests that the correct efficiency challenge that was intended to be applied is no more than 5% - and certainly not the 9% level applied at the draft determination.

The impact of this calculation error is to reduce our efficiency challenge by £22m as shown in Table 4 below.

Table 4. Ofwat's mathematical error

	Challenge applied to WINEP costs (%)	Challenge to Southern Water (£m)
Ofwat's approach to calculating challenge using lower quartile	9	50
Correct approach to calculating challenge using upper quartile	5	29

[redacted]

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Funding for upper quartile leakage targets

1. Issue

Our September 2018 Business Plan included leakage reductions of 15% between 2020 and 2025, in line with Ofwat's clear expectations and our customers' preferences. By 2025 our leakage levels will be 75 l/prop/day. This is below the level achieved by the frontier company in AMP6 and aligns with the prediction of the industry upper quartile as published in the IAP in January 2018. However, the draft determination does make any allowance for the costs of delivering this step-change in performance.

It is well established that as leakage is reduced, the marginal costs of further reductions increase substantially[33]. In order to deliver the planned leakage reductions for AMP7 we need to invest in new practices, new technology and critical infrastructure. In our Business Plan we classified the additional investment to achieve the 15% reduction as 'enhancement' expenditure. This is consistent with the classification of all other options that materially improve our supply/demand balance, such as our water efficiency (programme Target 100), for which the draft determination proposes to make a full cost allowance.

At the IAP, Ofwat argued that the cost of reducing leakage is reflected in its botex models, based on the rationale that leakage reductions have been delivered in the past. At the draft determination, there has been a change in the approach to allow funding for reductions beyond the future upper quartile, but has restated its IAP position with respect to not allowing any funding of reductions up to this point.

The result of this approach is to allow just £76m (11%) of the total expenditure of £663m included within companies' Business Plans. A total of £586m of costs that companies believe are required to deliver a step change in leakage in AMP7 have been disallowed. Southern Water, like 10 other companies, has no specific cost allowance at all,[34] resulting in a £33m shortfall for our supply/demand activities in AMP7.

We consider the approach taken in the draft determination inappropriate because:

- There is no evidence to support the view that the relevant costs are included within botex allowances. The enhancement costs included in our business plan cover work items that are wholly incremental to the work carried out during AMP6; and the dataset used to derive the botex models covers a period when the average level of leakage reduction was negligible.

[33] See, for example, UKWIR, The Economics of Balancing Supply and Demand, UKWIR Report Ref. No. 02/WR27/3, 2002
[34] Only three companies, ANH, BRL and SEW have been allocated any funding at all. A further three (HDD, NES and SWB) did not seek any enhancement expenditure for leakage.

[redacted]

- Failing to fund leakage reduction on the same basis as other supply / demand interventions will skew future company incentives away from leakage reduction no cost allowance is made in favour of other options for which the costs are allowed.
- Failing to allow for the necessary expenditure to deliver the leakage reductions to which companies have committed ignores customer preferences and creates a risk of significant reputational damage to the sector as a whole if large numbers of companies are unable to deliver these stretching targets with no additional expenditure.
- It is difficult to reconcile the approach in this area with Ofwat's statutory duties to ensure an efficient company can finance its functions, as a notional efficient company could not deliver a 15% reduction in leakage without incurring incremental totex.

[redacted]

2. Our proposed remedy

The case for not allowing our Business Plan leakage reduction expenditure of £33m should be revisited in full in light of the clear and compelling evidence to support its inclusion.

[redacted]

3. Supporting evidence

In this section, we provide supporting evidence relating to:

- The view that the relevant costs are included within the botex model (section 3.1)
- The disincentive to pursue leakage reduction as a supply / demand option (section 3.2)
- The reputational risk for the sector from the approach (section 3.3)
- The consistency of Ofwat's decision with its statutory duties (section 3.4)

3.1 There is no evidence to support the view that the relevant costs are included within modelled botex allowances

The £33m sought by Southern Water covers new activities incremental to those at AMP6

To maintain leakage at current levels using current methods we forecast that we will need to spend £88m in AMP7. To achieve the 15% leakage reduction we have committed to in our Business Plan we will incur an additional £33m. Specifically, this will fund the following new activities which are incremental to those carried out by Southern Water in AMP6:

- Installing 15,000 advanced acoustic loggers to increase leakage 'find and fix' efficiency (£6m).
- Using machine learning/Artificial Intelligence to control pressure reduction valves to reduce leakage and bursts (£7m).
- Using satellites and drones to remotely sense leaking pipes and allow more rapid remediation (£2m)
- Installing new smart meter devices (to help customers reduce both consumption and customer side leakage (£18m).
- Combining the above as part of a Single Integrated Network Strategy (SINES) to develop a smart network which, as well as delivering leakage reductions, will contribute to achieving upper quartile performance in per capita consumption, bursts and appearance.

Each of these activities is incremental to those carried out in AMP6, where our expenditure has been principally on conventional find and fix activity. These activities involve implementing new technologies at a scale which has not been done before by the sector (particularly not at enterprise scale and not scaling/integrating multiple new technologies at the same time). The incremental nature of our proposed leakage enhancement investment is explained further in our Business Plan submission at Technical Appendix BP_TA.11.WN04. Water Networks.

The costs included in our plan for leakage reduction are demonstrably new, will not form part of our costs in AMP6 and therefore will not be reflected in the botex model dataset.

AMP6 delivery is not comparable to forecast AMP7 performance

In support of its position that the costs of reducing leakage are reflected in base costs modelled on historic performance, it is asserted that leakage reductions have been delivered in the past. However, historic

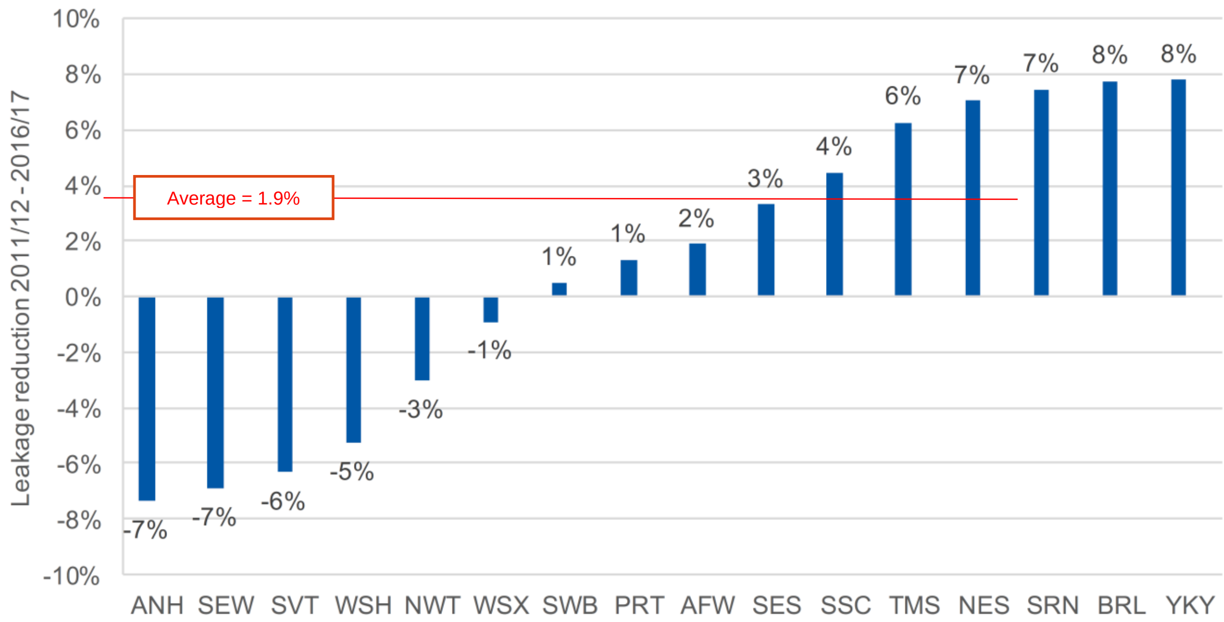
[redacted]

leakage reductions are not comparable to the step change in performance that Ofwat is requiring in AMP7. Indeed it is noted, in the final methodology[35] that,

> *"The industry achieved large reductions in leakage in the late 1990s, but since 1999-00 leakage levels have remained relatively static."*

The data used to develop the botex models covers a period (2011-2017) where the average leakage reduction across the industry was just over one tenth (1.9%) of the 15% target set for AMP7 as shown in Figure 1 below.

Figure 1. Leakage Reduction from 2011-2017 for English and Welsh Companies



It is therefore not correct that modelling based on past performance provides a reasonable basis for predicting future leakage costs. This is even more so the case for companies like Southern Water, which achieved material leakage reduction during the period in question, given the increase in the incremental costs of further leakage reductions.[36]

[3] Ofwat (2017), "Delivering Water 2020: Our Final Methodology for the 2019 Price Review"
[36] UKWIR, The Economics of Balancing Supply and Demand, UKWIR Report Ref. No. 02/WR27/3, 2002

[redacted]

The independent economic critique of Ofwat's approach is not addressed

Given the importance of this issue to the sector, for the IAP response, along with a number of other companies, we commissioned a report from independent economic consultants NERA on the appropriateness of Ofwat's IAP approach.[37] A copy of their report, which supports Southern Water's position, is appended to this representation.

NERA's report concluded that:

- Ofwat's models will systematically understate companies' investment requirements, as they will not capture the step change in companies' leakage reduction expenditure.
- Failure to allow for enhancement expenditure associated with leakage reduction is inconsistent with precedent from PR14 and from other sectors.
- Ofwat's single median unit cost approach to funding reductions greater than 15% will not capture the tendency of unit costs to increase for attaining and maintaining lower levels of leakage.

NERA recommended that changes to the methodology are required to ensure companies can fund the efficient costs of delivering large leakage reductions in AMP7. They set out a number of options for doing so, including developing appropriate cost assessment tools, which recognise the increasing unit costs of leakage reduction or revising the "gated" approach to allowing for the costs of delivering leakage reductions.

Given the materiality of the issue to the sector, with forecast costs of over £600m involved, it is important that this critique is fully considered in delivering the approach which Ofwat has not yet done.

3.2 Ofwat's approach dis-incentivises Southern Water from pursing leakage reduction as a supply / demand balance option

Expenditure on leakage is a key contributor to balancing supply and demand and our 15% leakage reduction commitment forms an integral part of our plan to balance supply and demand in AMP7. Disallowing all of the costs associated with our leakage reduction commitment is inconsistent with the general approach to making allowance for supply / demand management options. Allowances have been made in the draft determination for the costs of other demand management options, such as water efficiency and metering, along with supply enhancement options.

[5] NERA (2019), "Assessing Ofwat's Funding and Incentive Targets for Leakage Reduction"

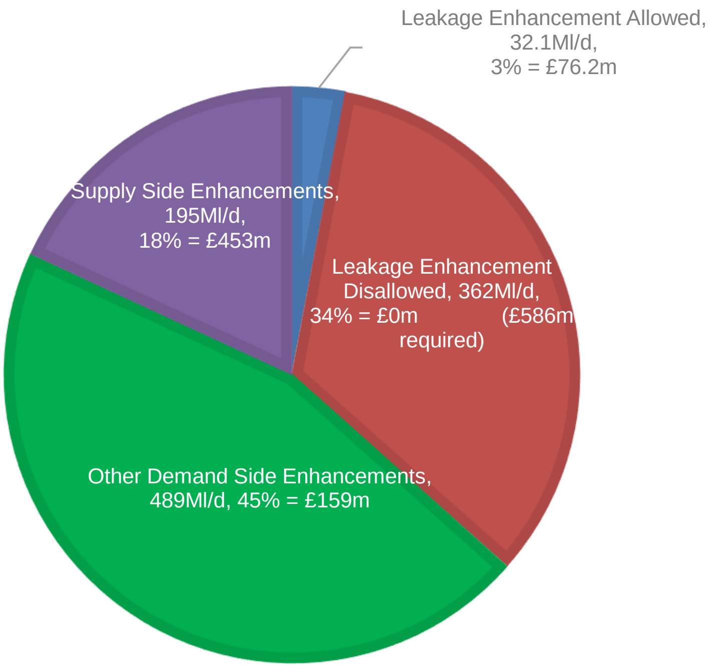
[redacted]

This inconsistent treatment creates a perverse incentive for companies to minimise the contribution of leakage to balancing supply / demand, on the basis that it is the only option for which no cost allowance is made. To demonstrate this principle, our cost allowance would have been £52.7m higher through Ofwat's supply / demand model if we had proposed to develop 15.79 Ml/d of new resources rather than reduce leakage by 15%. Note this is £19.6m more than the requested leakage reduction enhancement of £33.1m. This is based on our average cost of developing long term resources (£3.34m per Ml/d including Ofwat's application of the company level efficiency). We do not believe this would have been the intended outcome.

This may also lead to further unintended consequences if these flawed principles are applied to future Water Resources Management Plans and Regional Resilience Plans. The most likely consequence would be that high carbon new resources (such as desalination plants and water-reuse) would be developed in preference to leakage reduction as companies would have no incentive to pursue the latter. This is also contrary to the principle of DEFRA’s twin-track approach of balancing demand reduction and building new water sources.

At an industry level, the result of the draft determination approach is that 34% of the water companies' supply / demand enhancement (or 362 Ml/d out of the total of 851 Ml/d of total supply/demand enhancements) required by the water companies Water Resource Management Plans are unfunded. On an industry wide basis, £586m of funding necessary to meet this statutory enhancement requirement has been disallowed (see Figure 2).

Figure 2. Industry wide AMP7 supply / demand expenditure



Source: Ofwat’s draft determination Supply Demand Model FM_E_WW_SDB_ST_DD

[redacted]

3.3 Reputational risk for the sector

Failing to make appropriate allowance for the costs of significantly reducing leakage in AMP7 and dis-incentivising companies from pursuing further leakage reductions in future represents a significant reputational risk to the water sector as a whole.

Leakage is one of the highest priority issues for customers (see Appendix 3: Research and engagement deliverables from our September 2018 Business Plan submission). Throughout our customer research, customers highlighted reducing leakage as a high priority and view it as a moral issue which customers consider is a higher priority than reducing customers' consumption of water.

The approach in the draft determination of making allowance for the vast majority of water efficiency / metering expenditure (which is regarded as a lower priority by customers), whilst disallowing the vast majority of expenditure for leakage reduction (which is a high priority for customers), is therefore contrary to customers' interests and preferences.

In addition to being a high priority for customers, leakage is also a high priority issue for all industry stakeholders. Ofwat has recognised this and have successfully encouraged companies to set stretching leakage reduction targets of at least 15%. However, allowing just 11.5% of the forecast £663m of leakage expenditure (see Table 1), puts the sector at risk of not being able to meet these stretching targets.

Table 1. Ofwat's leakage allowance versus company Business Plans

Year	Leakage enhancement expenditure in companies Business Plans (£m)	Leakage enhancement expenditure allowance (£m)	%
AFW	48.2	-	0.0
ANH	76.9	69.245	90.0
BRL	4.2	2.394	56.6
HDD	-	-	0.0
NES	-	-	0.0
PRT	1.5	-	0.0
SES	17.4	-	0.0
SEW	29.6	4.639	15.7
SRN	33.1	-	0.0
SSC	10.3	-	0.0
SVE	30.4	-	0.0
SWB	-	-	0.0
TMS	156.9	-	0.0
NWT	40.0	-	0.0
WSH	52.9	-	0.0
WSX	25.3	-	0.0
YKY	136.5	-	0.0
Totals	**663.4**	**76.279**	**11.5**

If the draft determination position is retained for the final determination, it will create a significant risk of reputational harm to the sector as a whole as a result of its failure to make appropriate allowance for the costs of meeting AMP7 leakage reduction targets. This comes at a time when the sector as a whole is working to rebuild public trust.

[redacted]

3.4 Ofwat's approach appears inconsistent with its statutory duty to ensure water companies are able to finance their functions

Ofwat has set an effective regulatory requirement on companies to reduce leakage by at least 15% in AMP7, but has disallowed substantially all of the costs which an efficient company would expect, in order to achieve this level of leakage reduction. Such an approach seems difficult to reconcile with Ofwat's statutory duties to ensure an efficient company can finance its functions, as a notional efficient company could not deliver a 15% reduction in leakage without incurring incremental totex.

Ofwat has already imposed a significant efficiency stretch on companies' costs by setting the cost allowance on the basis of the upper quartile efficiency level and applying a 1.5% frontier shift. To additionally require companies to absorb the additional costs of reducing leakage by 15% within that cost allowance is unreasonable and undeliverable.

[redacted]

4. Data tables impacted by this representation

Table Reference	Table Title
Table WS1	WSI – Wholesale water operating and capital expenditure by business unit
Table WS2	WS2 – Wholesale water capital and operating expenditure by purpose

[redacted]

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[redacted]

Cost allowance for raw water deterioration

1. Issue

At the draft determination, Ofwat has improved its approach to modelling enhancement costs. It now takes a totex approach to most areas of enhancement, which is consistent with the wider totex-based regulatory model. We support this change in approach. For raw water deterioration, Ofwat has taken a different approach. Within its enhancement models, no allowance is made for the opex arising from enhancement capex, on the basis that the botex models include a treatment complexity variable and thus take account of any such additional costs. However, our treatment complexity forecast is not accounted for in the botex model, which uses a flat forecast. This has the effect of wholly omitting the impact of increased treatment complexity from our botex allowance. This approach is inconsistent with the revised approach to modelling generally. It also treats us differently to other companies that have directly comparable increases in treatment complexity.

The impact of this approach is to reduce our efficient modelled cost allowance by £10.6m. These are additional costs we will incur from factors which are beyond our control, namely increasing treatment levels to reduce the concentration of nitrate levels from our raw water. To illustrate the specific challenge faced by Southern Water, our weighted average treatment complexity is expected to increase at a rate 33% higher than the industry average, with an average annual growth rate of 0.4%, compared to an industry average of 0.3%. Both Ofwat (through its deep dive assessment) and the DWI support our optioneering, which demonstrates we have chosen the lowest totex options.

2. Our proposed remedy

To address the issue in the final determination, it would be appropriate to use our forecast for treatment complexity as an input for the botex model. This will have the effect of ensuring that the opex that we will incur as a result of increased treatment complexity is properly reflected in our cost allowance, and will increase our efficient modelled cost allowance by £10.6m.

[redacted]

3. Supporting evidence

3.1 Changes to the approach to assessing cost efficiency

In moving from the IAP to the draft determination, two key changes have been made to the general approach to assessing cost efficiency:

- Ofwat now sets a totex allowance for enhancement costs. At the IAP, it was assumed that base allowances included a full allowance for enhancement opex. Recognising the capex bias in this approach, enhancement assessments are now conducted on a totex basis and an implicit allowance of enhancement opex is removed from base totex allowances.
- A number of forecast cost drivers have been removed, including the number of properties and mains/sewer length. At the IAP, the forecast value of cost drivers was largely based on their historical value, with a linear time trend of a historical average used in most cases to project values forward. Ofwat has recognised that these forecasting approaches are unsuitable, especially in many cases where there is a significant change in what is required in AMP7. In general in the draft determination, Forecasts are now based on figures from the Office for National Statistics and take account of company forward-looking forecasts.

We welcome the recognition that the IAP approach was inconsistent with a totex framework and that the approach to forecasting was inappropriate in many cases[38]. However, in the case of raw water deterioration, the use of a forecast based on a historical average means that:

- Our expected deterioration in raw water quality and resultant increase in treatment complexity is not captured; and
- All opex associated with this increase in treatment complexity is effectively disallowed.

This is inconsistent with the key revisions to the general approach in a way that we do not consider justified.

[38] Note, however, that in a number of our other representations - namely cost allowances for growth - we demonstrate that Ofwat's revised approach to forecasting cost drivers continues to underrepresent our expected growth.

[redacted]

3.2 The approach to forecasting Raw Water Deterioration is inappropriate and is inconsistent with the general modelling approach

In this section, we demonstrate that by using a forecast based on historic average treatment complexity, the draft determination models materially understate our expected raw water deterioration and hence the costs of managing this deterioration.

Ofwat clearly recognises the need to consider additional opex arising from capital investment to manage increases in treatment complexity. In the draft determination, it is acknowledged that:

> *"Where complexity is higher, costs are expected to increase due to the challenge of maintaining and operating multiple stages of treatment that utilise significant amounts of consumables, such as power and chemicals."*[39]

But, it goes on to say:

> *"…we disallow operational costs of new treatment on this enhancement line as our modelling of base costs includes a treatment complexity variable."*[40]

The botex model is designed to account for changing future treatment costs, by including treatment complexity as a model input. We agree that, in principle, this is the correct approach to accounting for the costs of running and maintaining a changing asset base. However, this approach only works if the correct forecast of treatment complexity is used as the input for the model.

The draft determination fails to make appropriate allowance for future increases in opex in its botex model, because it uses inappropriate forecasts of treatment complexity which fail to capture our expected increases. Ofwat applies a flat forecast of 4.47 (weighted average) for AMP7, which is an average of our historical data from 2011-12 to 2017-18. This flat forecast is incorrect as it is:

- Significantly lower than the actual reported level in 2017-18, which was 4.87.
- It assumes no increase in complexity over the AMP7 period, where, as a result of investment essential to manage the impact of raw water deterioration, we forecast an increase to 4.97 by 2025; and
- It is inconsistent with the general approach to modelling, which is revise its forecasts where a clear increase is expected for AMP7. No evidence is presented to justify adopting a different modelling approach to raw water deterioration compared with other cost areas.

[39] "PR19 draft determinations: Supplementary technical appendix: Econometric approach 1", Section 3.4 'Our choice of cost drivers', page 12
[40] "PR19 draft determinations: Securing cost efficiency technical appendix", Section 4.8 'Other enhancement activities', page 75

[redacted]

3.3 Raw water deterioration is driving an increase in treatment complexity which is beyond Southern Water's control

In our Business Plan Technical Annex TA.11.WN02 Nitrate, we provided evidence demonstrating that the opex related to raw water deterioration in AMP7 is additional to that incurred in AMP6 and is therefore not captured in our base operating costs. The increase in operating costs is driven by a decrease in raw water quality which is outside of our control. Decreased raw water quality poses a significant risk to public health. Interventions are therefore required to protect customers, who view safe and high quality water as one of their top priorities (see "TA.4.3 Triangulation of customer priorities" from our Business Plan Submission).

The specific challenge faced by Southern Water is the need to reduce the concentration of nitrate in our water to ensure that it remains wholesome. The over-use of nitrate fertilisers during the 1980s is a major source of nitrate in ground and surface waters. It takes many years for the impact of the application of these fertilisers to impact water quality and the delayed effects of this over-use are increasing year on year and we expect raw water nitrate concentrations to continue increasing throughout AMP7. In certain zones such as Thanet in Kent, the majority of sites will be at, or close to, the Prescribed Concentration Value (PCV) for nitrate. The PCV is set by the DWI and operates as a legal limit on the levels of nitrate in drinking water.

We have mitigated the cost of works necessary to combat raw water deterioration to the fullest extent possible. We evaluated a range of programme-level options and have used our Network 2030 approach to ensure the best long-term costs for customers (see our Business Plan Technical Annex TA.11.WN02 Nitrate for details of our optioneering). Through this analysis, we concluded that a combination of additional treatment and raw water blending solutions are the most cost effective way to reduce nitrate concentrations. The DWI has issued regulation 28 notices (please see the collection of technical annexes, TA_CE_DWI notice 00007 to TA_CE_DWI notice 00033) which agree with and support our proposals to resolve these public health risks, and indeed impose an obligation on us to deliver them. We have also demonstrated that our proposals for AMP7 are robust and more efficient than those in AMP6, with a lower enhancement cost of nitrate removal per megalitre at £700k for AMP7, compared to £800k for AMP6 (see Business Plan Technical Annex TA.11.WN02 Nitrate). Ofwat recognised this by allocating a 'Pass' for the optioneering of the capex component. However, Ofwat states that any additional opex resulting from the additional treatment complexity would be accounted for in the botex model.

For the avoidance of doubt, we have removed all non-enhancement costs from our Business Plan forecast for the costs of raw water deterioration schemes. We reviewed each item in our cost breakdowns, and, where the item was new equipment directly required to remove nitrate, we allocated the expenditure to enhancement. Where the item was the replacement of existing equipment not required to remove nitrate, we allocated the expenditure to base capital maintenance. These costs are not included within our total enhancement costs for raw water deterioration of £78.3m.

Table 1 on the provides illustrative examples of costs allocated to enhancement and to base expenditure.

[redacted]

Table 1. Example items for Base and Enhancement allocations

Investment allocation	Example items
Enhancement	Ion exchange nitrate removal plant, Pipelines to facilitate blending, Electrical and control equipment to permit operation of nitrate removal plant and pipelines
Base (excluded from raw water deterioration costs)	Plant upgrades required due to combining sites (Chlorine, Ortho, UV) Replacement of existing nitrate plants Pump replacement/upgrade required due to combining sites

Source: Southern Water

Further details of our raw water deterioration schemes can be found in our Business Plan Technical Annex TA.11.WN02 Nitrate.

We have controlled costs by identifying and selecting the lowest whole life totex options to mitigate the raw water deterioration risk, which is a result of factors wholly beyond our control. The modelling should therefore allow for these efficient costs by incorporating our forecast treatment complexity.

3.4 Impact of the draft determination approach

The removal of nitrate from raw water unavoidably increases treatment complexity. As described above, we have taken all steps within our control to minimise the number of sites where we need to physically remove nitrate through the use of blending solutions. Nevertheless, there remains an unavoidable increase in treatment complexity resulting from factors outside of our control. This can be seen in Business Plan data table WN1, lines 9 to 22 which are repeated in Appendix A.

Ofwat's Water Feeder Model 3 provides for an input with respect to "Weighted average treatment complexity". If our submitted forecast was adopted, the feeder model would state that our weighted average treatment complexity forecast is as shown in the Table 2 below:

Table 2. Weighted average treatment complexity (SRN original forecast)

Year	2020-21	2021-22	2022-23	2023-24	2024-25
Weighted average treatment complexity (SRN original forecast data)	4.87	4.87	4.90	4.90	4.97

Source: "FM_WW3_ST_DD" (Ofwat)

However, Ofwat's Feeder Model 3 does not use our forecast data. Instead it uses a flat profile that is generated by averaging our historic data for the past seven years (2011 to 2018). The data used for Southern Water is also stated in Ofwat's Water Feeder Model 3 and is shown in Table 3 below:

Table 3. Current botex model input data for weighted average treatment complexity

Year	2020-21	2021-22	2022-23	2023-24	2024-25
Weighted average treatment complexity (Ofwat forecast data for SRN – historical average 2011-18)	4.47	4.47	4.47	4.47	4.47

Source: "FM_WW3_ST_DD" (Ofwat)

This approach fails to consider the unavoidable increase in treatment complexity that we describe above, and therefore materially understates our weighted average treatment complexity over the course of AMP7.

[redacted]

Our treatment complexity forecasts have been independently assured and verified by Jacobs. Further details are presented in Section 5 below and in TA_CA_Jacobs Letter of Assurance.

The result is that no allowance is made for £10.6m of expenditure, which is required to operate new nitrate solutions to maintain supplies to our customers.

3.5 Southern Water is treated inconsistently with companies with similar characteristics

The forecast for treatment complexity is based on the seven year historic average approach for 14 of the 20 companies listed in the feeder model. The 'company forecast' is used for two companies and an average of three years (2015 to 2018) is used for four companies. In the latter cases, this is because they have experienced the highest growth in treatment complexity since 2011 (Ofwat draft determination Feeder model 3: Wholesale water: Forecast of water cost drivers).

This approach is inconsistent in that it does not treat all companies with similar characteristics in a similar way.

For Hafren Dyfrdwy and Severn Trent (England), where no historical trend exists, the company forecast is used. In both cases, the company forecasts exhibit an upward trend, increasing by 1.6% across AMP7 in the case of Severn Trent for example. It is arbitrary to accept increasing trends in these two cases only and there is no objective justification for this approach. We have not only experienced some of the highest increases historically, but are forecast to experience an average annual increase in treatment complexity 33% greater than the rest of the industry during AMP7 (at 0.4% per annum compared to an industry average of 0.3%). It is inconsistent to accept increasing trends in these two cases, while effectively penalising Southern Water for having a fuller historical dataset.

In addition, an average of the past three years has been used in the case of four companies which have seen the highest historical average annual increases, namely Portsmouth, South Staffs, South West and United Utilities. As demonstrated in Table 4 below, our average annual growth rate is 2.1%, which is only 0.1 percentage points lower than that of South West, for whom the model uses as average of the past three years (and 0.5 percentage points clear of the company with the next highest growth rate). The result of these four companies being treated differently is a greater opex allowance, reflecting increased treatment complexity.

We do not believe there is any evidence to support the use of a seven year average (2011-2018) for Southern Water in circumstances where it appears to satisfy the criteria applied in determining which companies should be subject to a three year forecast.

We show below that Southern Water's historical growth is greater than both the industry average and the upper quartile.

Table 4. Historical increase in treatment complexity across the industry

Company[41]	Average annual rate in weighted average treatment complexity (2011-2020)[42]
PRT	7.4%
SSC	5.3%
NWT	2.4%
SWB	2.2%
SRN	2.1%
WSH	1.6%
SEW	1.2%
SVT	1.0%
SVH	1.0%
AFW	0.9%
DVW	0.6%
YKY	0.5%
ANH	0.4%
BRL	0.2%
TMS	0.2%
SES	0.0%
NES	0.0%
WSX	-0.9%
Industry average	**1.1%**
Industry upper quartile	**2.0%**

Source: Southern Water analysis of “FM_WW3_ST_DD” (Ofwat)

3.6 Conclusion

The approach to forecasting treatment complexity in the botex models fails to account for the significant increase in costs that we will experience in AMP7. In light of the evidence provided above regarding the unavoidable deterioration in raw water quality and resultant increase in treatment complexity, the botex model should use our Business Plan forecast of treatment complexity for AMP7. This will have the effect of increasing our efficient modelled cost allowance by £10.6m.

[41] HDD and SVE are excluded as no historical data is available
[42] Includes historical data (2011-2018) and company forecasts (2018-2020)

[redacted]

4. Data tables impacted by this representation

Table Reference	Table Title
Table WS1	Wholesale water operating and capital expenditure by business unit
Table WS2	Wholesale water operating and capital expenditure by purpose

5. Assurance

We asked Jacobs to verify that our treatment complexity forecast (as stated in data table WN1 lines 9 to 22) is correctly calculated and reflects the need to increase treatment to maintain treated water quality, in the face of deteriorating raw water quality.

In TA_CA_Jacobs Letter of Assurance, Jacobs confirm that,

> *"We have reviewed and verified, as far as reasonably practicable without going over elements previously assured by PWC, that SRN's treatment complexity forecast is correctly calculated and reflects the need to increase treatment to maintain treated water quality."*

Appendices

Appendix A: Data table extract – treatment complexity

[redacted]

Appendix A: Data table extract – treatment complexity

Table A1: Extract from Data table WN1 lines 9 to 22. Southern Water's submitted treatment complexity forecasts

Line	Description	Units	2020-21	2021-22	2022-23	2023-24	2024-25
9	Total water treated at all SW simple disinfection works	Ml/d	0.00	0.00	0.00	0.00	0.00
10	Total water treated at all SW1 works	Ml/d	0.00	0.00	0.00	0.00	0.00
11	Total water treated at all SW2 works	Ml/d	0.00	0.00	0.00	0.00	0.00
12	Total water treated at all SW3 works	Ml/d	61.73	61.11	60.66	60.00	59.48
13	Total water treated at all SW4 works	Ml/d	8.98	8.89	8.83	8.73	8.65
14	Total water treated at all SW5 works	Ml/d	101.87	100.84	100.10	99.01	98.15
15	Total water treated at all SW6 works	Ml/d	0.00	0.00	0.00	0.00	0.00
16	Total water treated at all GW simple disinfection works	Ml/d	24.22	23.97	23.80	23.54	23.34
17	Total water treated at all GW1 works	Ml/d	0.00	0.00	0.00	0.00	0.00
18	Total water treated at all GW2 works	Ml/d	32.59	32.26	30.13	29.80	13.75
19	Total water treated at all GW3 works	Ml/d	12.48	12.36	12.27	12.13	11.42
20	Total water treated at all GW4 works	Ml/d	215.14	212.97	203.73	201.52	211.13
21	Total water treated at all GW5 works	Ml/d	67.95	67.27	76.34	75.52	79.91
22	Total water treated at all GW6 works	Ml/d	0.00	0.00	0.00	0.00	0.00

Source: Southern Water data table WN1

[redacted]

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[redacted]

Water enhancement cost challenge

1. Issue

In the draft determination, an additional 7.1% efficiency challenge has been applied to a number of our enhancement costs for water. This has the effect of reducing our cost allowance by £15.4m, with the largest impacts being in the areas of:raw water deterioration, interconnections and long-term enhancements.

Our concerns with the proposed approach are as follows:

- Base expenditure is fundamentally different to enhancement expenditure. An assessment of potential enhancement efficiency should therefore not be based base operating efficiency.
- We have already imposed a significant efficiency stretch in response to Ofwat’s IAP and the draft determination. Pushing further efficiency challenges at this stage could result in significant delivery risk.
- In our representation “cost allowances for growth”, we show that Ofwat’s modelled allowance should increase significantly. If a company-specific efficiency challenge is applied to our water enhancement costs, this should not be 7.1%, but the minimum level of 5% applied in Ofwat's deep dives.

[redacted]

2. Our proposed remedy

We request that Ofwat reconsiders, and removes the 7.1% efficiency challenge in the following areas of enhancement, increasing our allowance by £15.4m:

- Long-term supply-demand enhancements
- Raw water deterioration
- Interconnections
- Impounding reservoirs
- Shoreham desalination scheme
- Water Framework Directive

On the basis that it is not material, we are accepting Ofwat's challenge on WFD (opex - £0.2m).

3. Supporting evidence

Table 1 sets out the areas of our plan that are impacted by the 7.1% efficiency challenge.

Table 1: Investment areas impacted by the 7.1% draft determination Efficiency Challenge

Investment areas	SRN IAP Response (£m)	7.1% Efficiency Challenge (£m)
Areas where we are challenging the 7.1% challenge		
Long-term enhancements (excl. Shoreham)	**67.3[43]**	4.8
Raw water deterioration	**78.3**	4.7
Interconnections	**56.6**	4.0
Impounding reservoirs	**9.3**	0.5
Shoreham desalination	**8.8**	0.5
WINEP investigations	**15.2**	0.9
Total challenge	**235.5**	**15.4**
Areas where we are accepting the 7.1% challenge		
Water Framework Directive (opex)	**2.5**	0.2
Total accept	**2.5**	**0.2**

In this section, we first outline why the calculation of the efficiency challenge is inappropriate. We then provide evidence of the efficiency stretch we have already made since our September 2018 business plan and evidence to support our view of efficient costs.

[43] This includes a £0.5m reduction at draft determination as a result of an update to the investment required for the Portsmouth water bulk supply transfer at Gaters Mill (related to Havant Thicket).

[redacted]

3.1 The application of botex efficiency to enhancement costs

Calculation of the efficiency challenge

In the "Company-efficiency-factor_ST_DD" model, Ofwat states it has calculated the efficiency challenge as the *"percentage gap between the company view of modelled base costs and [Ofwat's] view of efficient modelled base costs"*. Ofwat's view of efficiency in botex is therefore used to determine the level of challenge on enhancement costs.

Ofwat states that *"we consider it reasonable to assume that the company's scope for efficiency in its proposed enhancement costs will be at a similar level to that of base costs".* The draft determination does not provide any evidence to support this claim, and we believe this to be an inappropriate way to assess efficiency in enhancement costs. We consider that there are no grounds for concluding that the same level of inefficiency should hold across both base operating costs and enhancement costs, which are qualitatively different, as we describe below.

3.1.1 Evidence of the qualitative differences between base and enhancement expenditure

The same level of efficiency / inefficiency in botex and enhancements should not be assumed because:

- The activities captured within base operating costs and enhancements are inherently different; for example, enhancement will typically involve new capital schemes, whereas botex comprises chiefly opex and capital maintenance;
- The activities covered by botex are repeated every year, allowing companies to gain expertise and efficiency in delivery through experience; in enhancement, expenditure is irregular and one-off;
- Activities covered by botex tend to be delivered in-house, while enhancement activities are typically delivered by contracting partners;
- Enhancement spending will typically be subject to market testing when contractors are appointed; and
- Efficiency in operational delivery depends on a good understanding of the asset base and workforce management, while efficiency in enhancement expenditure is achieved through effective procurement, engineering design expertise, and contract and project management. The management skills required to deliver the two are very different.

By way of example, a number of our WRMP enhancement schemes, such as effluent re-use and desalination, are new areas of technological design and build activity where there is limited experience anywhere in the UK Water industry on how to deliver these innovative schemes. These schemes will also have more complexities, risks, planning activities, land buying, and other costs that most standard capital maintenance schemes will not have. Therefore, the costs to deliver these schemes will be of an entirely different nature with equivalently scaled base maintenance activity.

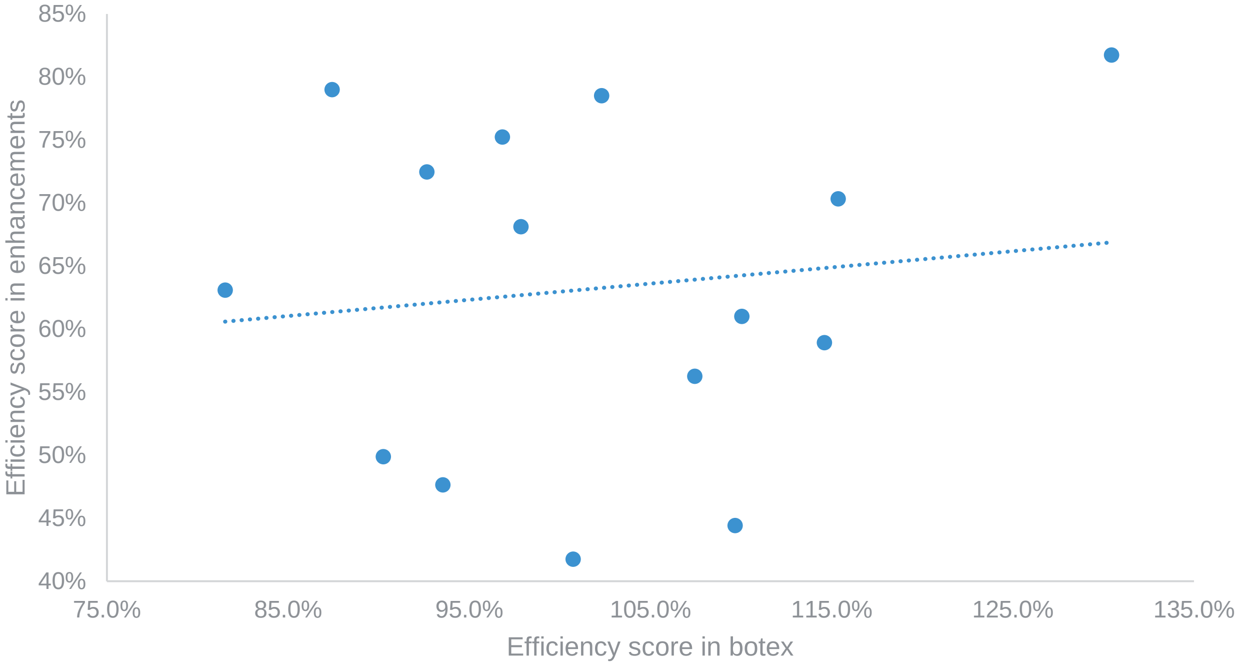
3.1.2 Quantitative evidence of the relationship between base and enhancement efficiency

In order to consider whether the conclusion that efficiency in botex should be the same as efficiency for enhancement spend is correct, we also looked at the relationship between a company's efficiency score in botex and efficiency in enhancements. The efficiency score is the ratio of Ofwat's view of efficient costs to a company's business plan submission, calculated separately for botex and enhancements.

As Figure 1 and Figure 2 illustrate, the relationship between efficiency in the two areas is very weak. There is no evidence that the two are equivalent. The average efficiency in botex in water is 95%, compared to 63% in enhancement and there is a correlation coefficient of just 0.1. In wastewater, the average in botex is 94%, while the enhancement average stands at 79%. The correlation coefficient is actually negative, at -0.1.

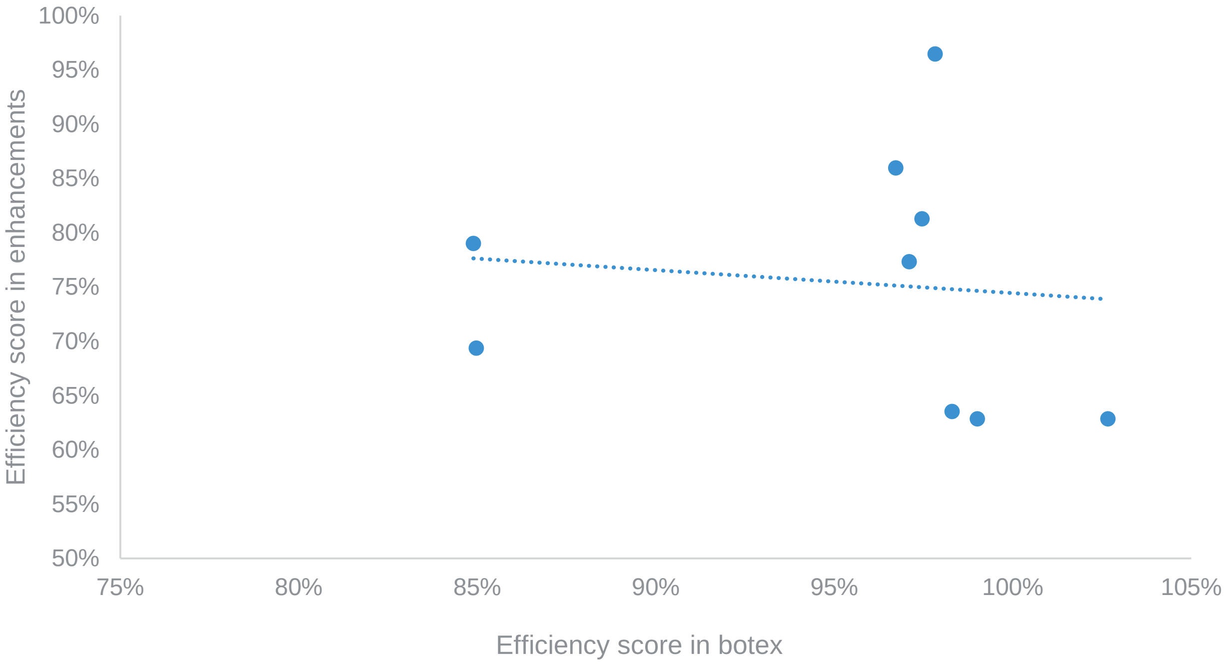
[redacted]

Figure 1. Efficiency in botex and enhancement in water



Source: Southern Water analysis, FM_E_aggregator_ST_DD, FM_WW4_ST_DD

Figure 2: Efficiency in botex and enhancement in wastewater



Source: Southern Water analysis, FM_E_aggregator_ST_DD, FM_WWW4_ST_DD

The differences between botex and enhancement expenditure are clearly recognised by Ofwat and are reflected in the different approaches to assessing efficient costs within botex and enhancement expenditure.

[redacted]

No clear rationale to support the application of the company specific factor and we do not believe there is a justification for the use of relative efficiency in botex to assess enhancement costs.

3.2 Demonstrating our efficiency

At the IAP and draft determination stages, we have carefully considered Ofwat's assessments and worked hard to identify further opportunities for efficiencies based on the information available. In this section, we outline the stretch we have already applied at the IAP to our costs within the enhancement areas in question, as well as provide additional evidence to support our efficient view of costs and provide Ofwat with the additional information they require from their deep dive.

3.2.1 Efficiencies already applied at the IAP stage and further efficiencies applied at this draft determination response stage

At the IAP and draft determination stages, Ofwat has challenged us to reduce our enhancement expenditure related to these water enhancement areas. The gap between our view and Ofwat's view of costs stood at £51m in these areas (September submission vs Ofwat draft determination view of costs). We have worked hard at both the IAP and draft determination stages to identify opportunities for further efficiencies and as a result we have reduced our view of efficient costs in these areas by £21m (a 46% reduction of the gap).

Table 2: Efficiencies applied to water enhancement costs at the IAP (£m)[44]

Investment areas	Our September business plan costs (£m)	Efficiency challenges applied at the IAP (£m)	Efficiency challenges applied at the DD (£)	Total efficiency challenge since September (%)
Long-term enhancements (excl. Shoreham)	67.8	0	0[45]	0%
Raw water deterioration	78.3	0	0	0%
Interconnections	70.8	14.2	0	20%
WINEP investigations	15.2	0	3	20%
Impounding reservoirs	11.7	0	1.9	16%
Shoreham	8.8	0	1.8	20%
Water Framework Directive (opex)	2.5	0	0.2	8%
Total	**255.1**	**14.2**	**6.9**	**8%**

We consider that an 8% reduction of costs related to efficiency challenges on these costs is stretching and represents the total scope for such cost challenges. Combined with several other of challenges in the draft determination, namely the effective exclusion of our opex arising from new capital expenditure in raw water deterioration (£9.4m) and the 20% optioneering challenge to impounding reservoirs (£1.9m), this additional company-specific challenge represents a significant challenge to the deliverability of our programme of enhancements.

3.2.2 Demonstrating our view of efficient costs

The company-specific efficiency challenge has been applied where, following a deep dive, it is considered that our costs are inefficient. In this section, we provide additional evidence, for the most material cases, to demonstrate that these costs are efficient. We do this by outlining how we have comprehensively assessed

[44] This excludes any cost reductions related to scope, for example £2.3m for impounding reservoirs.
[45] The £0.5m reduction applied at draft determination for the Portsmouth water bulk supply transfer at Gaters Mill (related to Havant Thicket) is not an efficiency related adjustment.

[redacted]

costs, for example through robust optioneering, benchmarking and careful design and challenge with engineers.

Supply Demand Balance

The supply demand balance model (FM_E_WW_SDB_DD) encompasses long-term enhancements and interconnections. At the Draft Determination, for both long-term enhancements and interconnections, Ofwat intervened to amend our bespoke performance commitments, long term supply demand schemes (PR19SRN_WN12), to ensure adequate protection for customers.

We have accepted Ofwat's intervention to the Long term supply demand schemes performance commitment (see our response to interventions SRN.OC.C3 and SRN.CE.A2).

Ofwat states its intention on interconnections is to:

> *"Review this allocation for final determination in the context of the integration of the internal interconnections with the supply-demand balance enhancements (2020-25 and long-term) and strategic regional water resource solution development and any further detail the company provides regarding the deficit it requires any strategic regional water resource solution to address."*

We have provided this evidence (as explained below) and believe it to be sufficient for Ofwat's requirements.

We provided detailed further information with regards to the requirements for the interconnections in our response to query SRN-DD-OC-002 sent on 9th May 2019. In summary this response highlighted:

- That based on current resources, Peak Week Production Capacities (PWPC) and network connectivity, the Western Area is resilient to peak week demands.
- The sustainability reductions on the River [redacted] and River [redacted] (which account for the majority of the 188 Ml/d reduction) severely impact the resilience of the current configuration.
- These reductions are required as part of our Section 20 agreement with the Environment Agency (EA). These took effect in March 2019 and will produce a significant supply / demand deficit in drought conditions.
- That in order to resolve this challenge we require several new sources, bulk transfers and internal interconnections which form the Western Grid, which will be supported by leakage and consumption reductions, and work to support water quality via catchment management.
- That each of the pipeline components (interconnections) is critical to redressing the supply / demand deficit (no matter which strategic regional option is selected) and also provides additional regional resilience benefits.

In answering this query we framed the response in the context of the collaborative development of regional solutions (further details can be found in our Strategic Regional Solutions Development submission to Ofwat 3rd May 2019 and our IAP response reference SRN.CE.A3) and wider long term plans to increase resilience (please see BP Technical Annex 11.3 The Regional Water Grid). As the Strategic Regional Solutions Development continues we will be making further more detailed representations to Ofwat (and other stakeholders) prior to the Final Determination. The interconnections in the Western Area in particular are a critical part of our investment to restore our supply demand balance and to be able to meet our target levels of customer service, and are needed notwithstanding the final mix of new sources that is selected by the strategic resources process.

[redacted]

Raw water deterioration

At the Draft Determination, in *FM_E_WW_raw-water-deterioration_ST_DD*, Ofwat stated the following:

> *"We pass expenditure of £55.413m capex and £10.518m opex. We apply a company efficiency challenge to all the passed expenditure to make an allowance of £ 61.240m. At IAP we required Southern Water to provide further evidence to demonstrate how the cost split of the treatment schemes is split between enhancement and base. We find no evidence of this at DD, it remains a requirement."*

Below, we provide the evidence underpinning the cost split of treatment schemes between enhancement and base costs (costs allocations as at our September Business Plan submission).

For clarity, we have removed all non-enhancement costs from our raw water deterioration schemes. The methodology used was to review each item of scope in our cost breakdowns. Where the scope item was new equipment directly required to remove nitrate we allocated the expenditure to enhancement. Where the scope was to replace existing equipment because of the scheme, but not required to remove nitrate, we allocated the expenditure to base capital maintenance. These base costs are not included within the £78.3m. Table 3 below provides examples of costs that were allocated to enhancement and also those allocated to base.

Table 3: Example items for Base and Enhancement allocations

Investment allocation	Example items	Raw water deterioration cost allocations in our September business plan
Enhancement	Ion exchange nitrate removal plant, Pipelines to facilitate blending, Electrical and control equipment to permit operation of nitrate removal plant.	£78.3m
Base (excluded from raw water deterioration costs)	Plant upgrades required due to combining sites (Chlorine, Ortho, UV), Pump replacement/upgrade required due to combining sites	£20.4m

Further details of our raw water deterioration schemes can be found in our Business Plan technical annex 'TA.11.WN02 Nitrate'.

We believe the above evidence (in combination with the other evidence referred to) is comprehensive and robust, and demonstrates the degree to which we have challenged ourselves on water enhancement cost efficiency.

Accordingly, the application of a further company-specific efficiency challenge to our enhancement costs is no longer appropriate.

3.3.3 Southern Water's efficiency in botex

Notwithstanding our contention that, i) our costs are efficient and therefore no efficiency challenge should be applied, and ii) the approach to determining a company-specific efficiency challenge is inappropriate, we consider that we are efficient in botex.

In our other representations, namely "Cost allowances for growth", we present evidence of the shortcomings in the approach to modelling growth in the botex models. To remedy these shortcomings, as we set out in those representations, Ofwat should either develop new growth enhancement models, or carefully consider our growth costs as requested at the IAP and undertake a deep dive. We provide evidence to support the efficiency of our growth costs, and we believe our botex allowance should increase by £137m as the difference between our IAP growth costs and our highest estimate of Ofwat's implied growth allowance.

This significantly closes the gap between Ofwat's view of efficient botex and our IAP costs. If notwithstanding our case set out above, if it is still felt appropriate to impose a company-specific efficiency challenge to our water enhancement costs, this should be no higher than the minimum level of 5% applied in Ofwat's deep dives.

4. Data tables impacted by this representation

Table Reference	Table Title
Table WS1	WS1 - Wholesale water operating and capital expenditure by business unit
Table WS2	WS2 - Wholesale water capital and operating enhancement expenditure by purpose

[redacted]

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[redacted]

Sanitary parameters

1. Issue

We welcome many of the changes made to the approach to modelling wastewater enhancement expenditure between the IAP and the draft determination. However, we have concerns about the determination of the efficient costs which relate to expenditure to meet statutory WINEP obligations in respect of reductions in sanitary parameters.[46] These are determined using the model:

- Reduction of sanitary parameters enhancement feeder model (FM_E_WWW_sanitary-parameters_ST_DD.xls)

We consider there to be particular shortcomings in the modelling of the costs required to meet tightening sanitary parameters which mean that the modelled cost allowance for Southern Water is erroneously low. Specifically, this particular model is notably weak in its predictive power, with an implausibly wide range of efficiency scores, suggesting that much of the gap between Ofwat's allowance and our revised Business Plan costs can be explained by factors other than efficiency which are not accounted for in the model.

The consequence for Southern Water is an additional efficiency challenge of £6.1m compared with our post IAP Business Plan.

In response to the IAP we reduced our plan costs in this area by 40% and are expressly accepting a further efficiency challenge at the draft determination stage (see below). We therefore see no additional scope for efficiency in this area.

[46] We also believe Ofwat has made an error in the application of a 9% efficiency challenge to the WINEP programme generally, see representation 'Ofwat's approach to environmental obligations'

[redacted]

2. Our proposed remedy

Ofwat should revisit its modelled cost for sanitary parameters.

Given the uncertainty of the draft determination model and the reductions in our costs made at the IAP stage, we suggest that Ofwat should base its allowance on the IAP capex model adjusted for associated enhancement opex. This would result in a cost allowance of £28.1m compared with the Draft determination allowance of £25.0m. (Note this remains below our revised Business Plan costs of £31.1m but we are prepared to accept this additional efficiency challenge.)

3. Supporting evidence

A total of £25m has been allowed in the draft determination for addressing the impact of the reduction in sanitary parameters. This compares to £31.1m in our revised Business Plan, a gap of £6.1m.

Table 1: Evolution of sanitary parameters cost allowance

£m	Business Plan (capex)	IAP allowance (capex)	Revised Business Plan (totex)	Draft determination (totex)
Sanitary parameters	48.0	25.6	31.1	25.0

3.1 Robustness of sanitary parameters model

For the draft determination, the allowance is based on two total cost, logarithmic models. These models were not used at the IAP stage, which was based on unit cost econometric models.

A robust efficiency model, capable of isolating genuine differences in efficiency between companies, as opposed to other factors, should exhibit a relatively narrow range of efficiency scores. Efficiency is measured as the difference between company cost forecasts and Ofwat's assessment of efficient costs. CEPA make this point in their 2018 report for Ofwat:

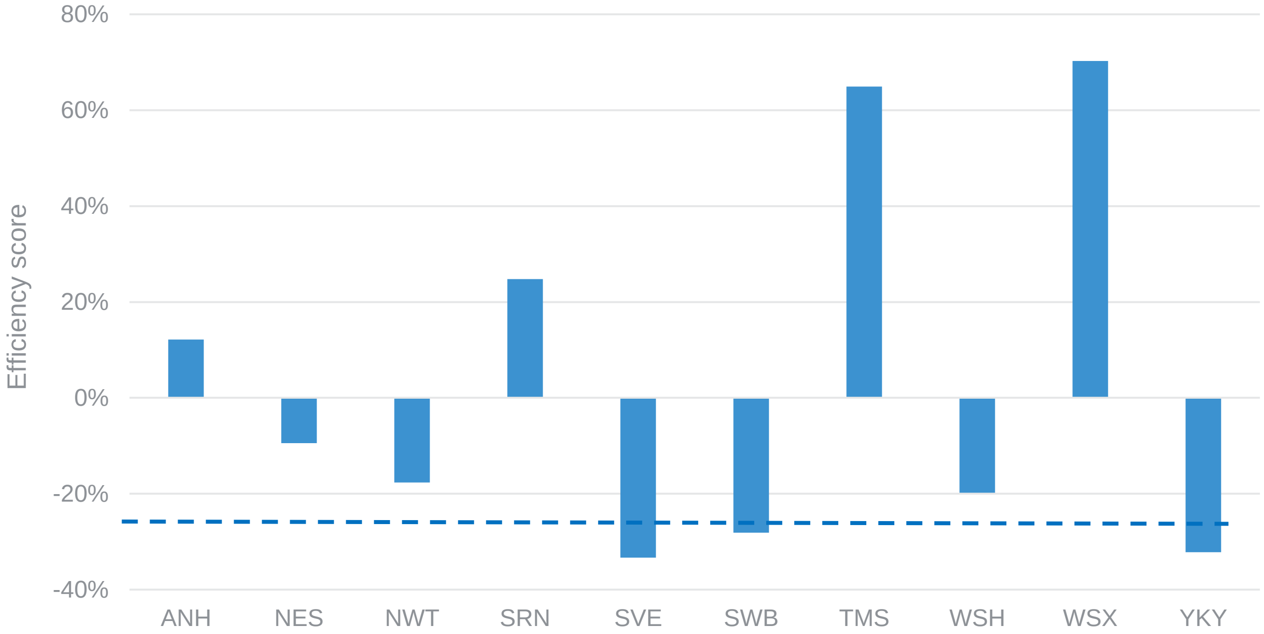
> *"Given the expected use of these models, it was important to consider the predictive power of the models and whether the cost estimates lie within a reasonable range."*[47]

The range of efficiency scores for the sanitary parameters model is -33% to +70%, a range of 103%. Of the ten companies modelled, only four had costs which were within +/- 20% of the modelled cost, as shown in Figure 1 below.

[47] PR19 Econometric Benchmarking Models, Ofwat. Section 5.1.3, p47, CEPA, March 2018

[redacted]

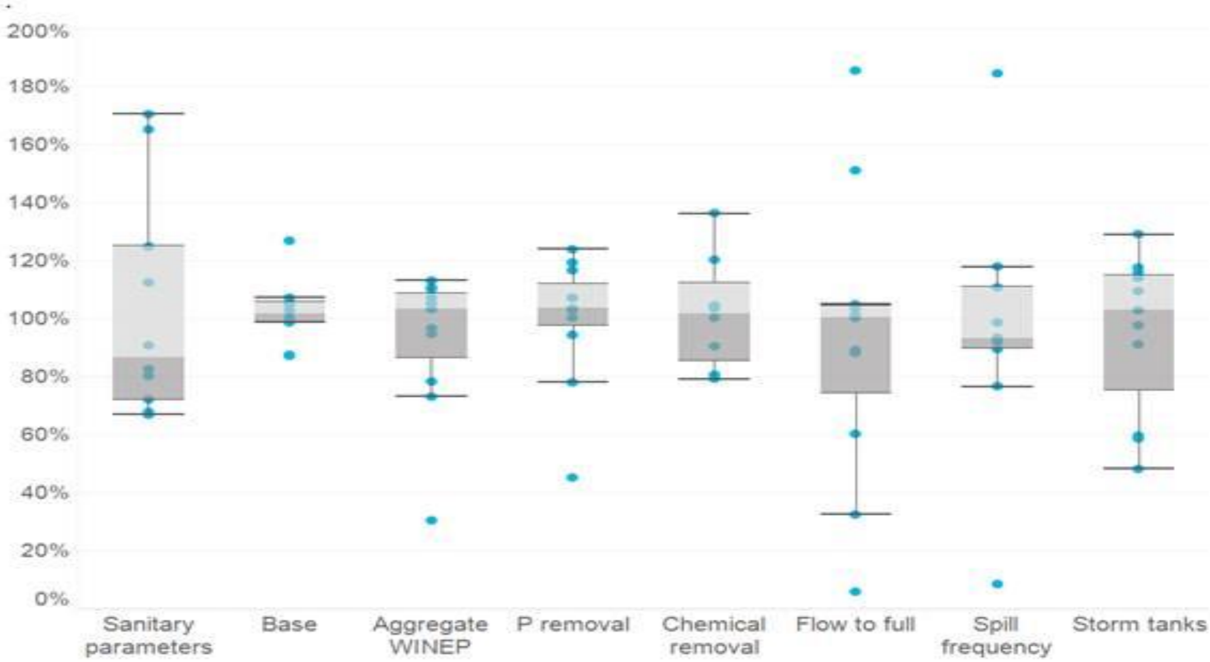
Figure 1. Efficiency score range – sanitary parameters model



Source: Oxera analysis of Ofwat data

The range of efficiency scores for sanitary parameters is among the widest of any of the WINEP enhancement models, as shown in Figure 2 below. Further, the outcomes for the lower performing half of the industry (i.e. those with efficiency scores >100%) are considerably skewed towards inefficiency.

Figure 2. Range of efficiency scores for enhancement models



Source: Oxera analysis of Ofwat data

[redacted]

The fit of the model is also among the poorest of the WINEP enhancement models, with an 'R squared' value of 76.5%–76.9%. There is only one enhancement with a lower r squares, which is one of the flow to full treatment models; though the impact in that case is mitigated in the triangulation of the results with a more robust model. Such a low model fit suggests that much of the unexplained gaps between predicted and submitted costs result from a failure to capture all of the relevant drivers, data inconsistencies or the relationship being mis-specified, rather than being due to differences in efficiency.

Together with Oxera, we have carried out statistical significance tests of the cost drivers. These demonstrate that the model has been mis-specified. Only the number of sites is statistically significant across both models. Neither population equivalent nor tightening of ammonia consents are statistically significant.

Given these significant technical shortcomings with the model, it is necessary to take a very cautious approach to the interpretation of the model results.

3.2 Movement in modelled costs for Southern Water between the IAP and Draft determination

As was the case for enhancement expenditure generally, at the IAP Ofwat included only capital expenditure (capex) was included in the sanitary parameters model. For the draft determination, Ofwat has recognised that this approach has the potential to both reinforce a bias towards capital solutions and neglect legitimate new operating costs arising from capital investment. As a result Ofwat's updated models are largely based on total expenditure (totex). [48] We support this development.

In principle, the inclusion of operating expenditure within the draft determination models should lead to an increase in the cost allowance compared with the capex only model at the IAP. For most companies that is indeed the case. However, as shown in Table 1 above, for Southern Water the allowed costs have reduced by £0.6m between the IAP and draft determination, despite the latter having a wider cost scope. This is counter-intuitive and demonstrates that the draft determination modelling approach does not make appropriate allowance with respect to Southern Water.

3.3 Cost efficiencies already made

On the basis of the challenge that Ofwat set in the IAP we reduced our sanitary parameters capex by £22.4m (40%). Our updated Business Plan capex of £28.7m was just £3.1m above Ofwat's IAP allowance of £25.6m. We did this by removing two schemes, identifying synergies with other programmes and updating the design of some schemes. Given this, and the additional efficiency challenge Southern Water is willing to accept at the draft determination stage (see below), there is no scope for further efficiencies within our remaining programme.

[48] We note, however, that Ofwat has not adopted this approach in respect of our cost allowance for raw water deterioration. See our representation 'Cost allowances for raw water deterioration' in this document, where we set out why we consider it an error not to adopt this approach in that instance.

[redacted]

3.4 Remedy for the final determination

We suggest that Ofwat base its allowance for Sanitary Parameters on the IAP capex model adjusted for associated enhancement opex, in the way it has for enhancement spend generally. This would result in a cost allowance for Southern Water of £28.1m compared with the draft determination allowance of £25.0m.

- IAP capex - £25.6m
- Opex arising from capex - £2.5m
- Total cost allowance - £28.1m

Note this remains below our revised Business Plan costs of £31.1m, but we are prepared to accept this additional efficiency challenge.

[redacted]

4. Data tables impacted by this representation

Table Reference	Table Title
WWS1	Wholesale wastewater operating and capital expenditure by business unit
WWS2	Wholesale wastewater operating and capital expenditure by purpose

[redacted]

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[redacted]

Ofwat's forecast of weighted average density (waste)

1. Issue

Weighted average density is a key cost driver in Ofwat's wastewater botex models, accounting for the impact of urbanity/rurality on company costs. We have identified a number of computational errors in the forecast of the weighted average density variable for wastewater which have a material effect on our modelled allowance for botex. The errors involve the use of several Anglian Water numbers in place of Southern Water data within Ofwat's "Density-indices-forecast_ST_DD" model. The errors result in an incorrect forecast for 2022 and 2023.[49]

The errors in the calculations are, in summary, as follows:

- 2022 forecast: an incorrect column reference which results in the population per company using Anglian Water's 2018 value, instead of Southern Water's 2021 value, to calculate weighted average density (WAD-w); and
- 2023 forecast: an incorrect column reference which results in the formula returning Anglian Water's mapping of local authority districts to wastewater companies' percentage to then calculate an incorrect 'population per company' variable for 2022. This then results in an incorrect calculation of weighted average density.

The consequence of the error is to materially understate our botex allowance for wastewater by £10m.

[49] We refer to the year of Ofwat's forecast in its botex models; this is 2021 and 2022 data from Ofwat's "Density-indices-forecast_ST_DD" model as Ofwat applies the data with a lag

2. Remedy

The computational errors within the “Density-indices-forecast_ST_DD" model should be updated to use the correctly calculated forecasts for 2022 of 1512.4 (rather than 1163.4) and 1519.0 for 2023 (rather than 850.0) respectively.

Correcting this error increases our modelled botex allowance for wastewater by £10m.

[redacted]

3. Supporting evidence

We set out in detail below, the computational errors identified above and how they should be corrected.

We note that the model uses the values from its weighted average density forecasts to forecast expenditure with a one year lag. This means that when we refer to the ‘2022 forecast’, for example, we are referring to the year of Ofwat’s forecast in its botex models, but which is 2021 data from the Ofwat model:

- Density-indices-forecast_ ST_DD

3.1 Forecast for 2022

Within the density model, in the tab entitled “Mapping LAD to population waste”, Southern Water’s WAD-w, or weighted average density (cell reference BE356) is incorrectly calculated. Figure 1 below shows that an inconsistent formula has been applied in our case, as evidenced by the green triangle in the left hand corner of the relevant cells in the “SRN” column.

Figure 1. Inconsistent formula for 2022 forecast

					2021		
ties by LAD		Population per water					
e v)	squared ((ln (people per sq km))	ANH	NES	NWT	SRN	SVT	SV
93	48.02	0	0	0	0	0	

		ANH21	NES21	NWT21	SRN21	SVT21	SV
	Total	6,859,541	2,683,720	7,411,878	4,886,898	9,598,593	1
	WAD-w	845.20	1,293.73	1,841.15	1,163.44	2,075.35	
	WALD-w	6.0	6.6	7.1	8.3	7.0	
	WALD2-w	37.8	45.2	51.3	51.9	50.9	

Source: Density-indices-forecast_ST_DD

To calculate weighted average density (WAD-w), the model uses the sum product of ‘people per sq km’ and ‘population per water company’, divided by ‘total population’ across all water companies.

In our case for 2021, the model calculates the sum product of our 2021 ‘people per sq km’ data and Anglian Water’s 2018 ‘population per water company’ data (rather than Southern Water’s), divided by the total population across all water companies in 2021.

Figure 2 below sets out Ofwat’s formula.

[redacted]

Figure 2. The erroneous formula

=SUMPRODUCT($AY$4:$AY$352,O$4:O$352)/BE355

AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
				2021										
				Population densities by LAD			Population per water company by LA							
	WSH	WSX	YKY	People per sq km	ln (people per sq kw)	squared ((ln (people per sq km))	ANH	NES	NWT	SRN	SVT	SWT	TMS	WSH
0	0	0	196,470	928.22	6.83	46.69	0	0	0	0	69,264	0	0	
0	0	0	546,933	1,604.89	7.38	54.48	0	0	0	0	41,342	0	0	
0	0	0	538,100	1,473.22	7.30	53.22	0	0	0	0	0	0	0	
0	0	0	212,300	585.44	6.37	40.61	0	0	0	0	0	0	0	
0	0	0	443,800	1,089.49	6.99	48.91	0	0	0	0	0	0	0	
0	0	0	799,600	1,454.89	7.28	53.04	0	0	0	0	0	0	0	
0	0	0	344,700	1,022.42	6.93	48.02	0	0	0	0	0	0	0	
20	WSH20	WSX20	YKY20				ANH21	NES21	NWT21	SRN21	SVT21	SWT21	TMS21	WSH21
#####	3,542,101	2,940,739	5,195,319			Total	6,859,541	2,683,720	7,411,878	4,886,898	9,598,593	1,800,835	########	3,552,
56.24	600.65	1,376.58	1,102.88			WAD-w	845.20	1,293.73	1,841.15	=SUMPRODUCT($AY$4:$AY$352,O$4:O$352)/BE355				
8.0	5.8	6.4	6.6			WALD-w	6.0	6.6	7.1	8.3	7.0	5.8	8.0	
65.5	34.6	42.2	45.1			WALD2-w	37.8	45.2	51.3	51.9	50.9	35.9	65.6	

Source: Density-indices-forecast_ST_DD

The erroneous formula is:

=SUMPRODUCT($AY$4:$AY$352,O$4:O$352)/BE355

The correct formula should be:

=SUMPRODUCT($AY$4:$AY$352,BE$4:BE$352)/BE355

Table 1 below sets out the details of the relevant cells / cell ranges in the formulae above. It can be seen that the cell range BE$4:BE$352 (Southern Water's population per water company) needs to be substituted in place of O$4:O$352 (Anglian Water's population per water company).

Table 1. Cell references for 2022 forecast

Cell reference	Description of data	Company	Year
$AY$4:$AY$352	People per sq km	All companies	2021
O$4:O$352	Population per water company	Anglian Water	2018
BE355	Total population	All companies	2021
BE$4:BE$352	Population per water company	Southern Water	2021

Substituting the correct formula will result in the correct forecast, set out in Table 2 below.

Table 2. Ofwat forecast and corrected forecast

Year	Ofwat forecast	Corrected forecast
2021	1163.4	1512.4

[redacted]

3.2 Forecast for 2023

Within the density model, in the tab entitled “Mapping LAD to population waste”, Southern Water’s 2022 data for ‘population per water company by LA’ has been incorrectly populated by conducting an index match to Anglian Water’s data instead of that of Southern Water. Figure 3 below shows that an inconsistent formula has been applied in our case, as evidenced by the green triangle in the left-hand corner of the cells in the “SRN” column. It also shows an identical dataset to Anglian Water (see the “ANH” column).

Figure 3. Inconsistent formula for 2023 forecast

2022									
Population per water company by LA									
ANH	NES	NWT	SRN	SVT	SWT	TMS	WSH	WSX	YKY
0	0	0	0	0	0	153,000	0	0	0
0	0	0	0	0	0	128,900	0	0	0
0	0	0	0	0	0	154,500	0	0	0
1,814	0	0	1,814	0	0	88,886	0	0	0
0	0	0	0	0	0	226,900	0	0	0
0	0	0	0	0	0	136,400	0	0	0
0	0	0	0	0	0	89,500	0	0	0
150,600	0	0	150,600	0	0	0	0	0	0
61,050	0	0	61,050	0	0	31,450	0	0	0
0	0	0	0	0	0	160,000	0	0	0
0	0	0	0	0	0	107,500	0	0	0
113,734	0	0	113,734	0	0	24,966	0	0	0
0	0	0	0	0	0	97,300	0	0	0
0	0	0	0	0	0	102,500	0	0	0
207,500	0	0	207,500	0	0	0	0	0	0
180,500	0	0	180,500	0	0	0	0	0	0
281,436	0	0	281,436	0	0	17,964	0	0	0

Source: Density-indices-forecast_ST_DD

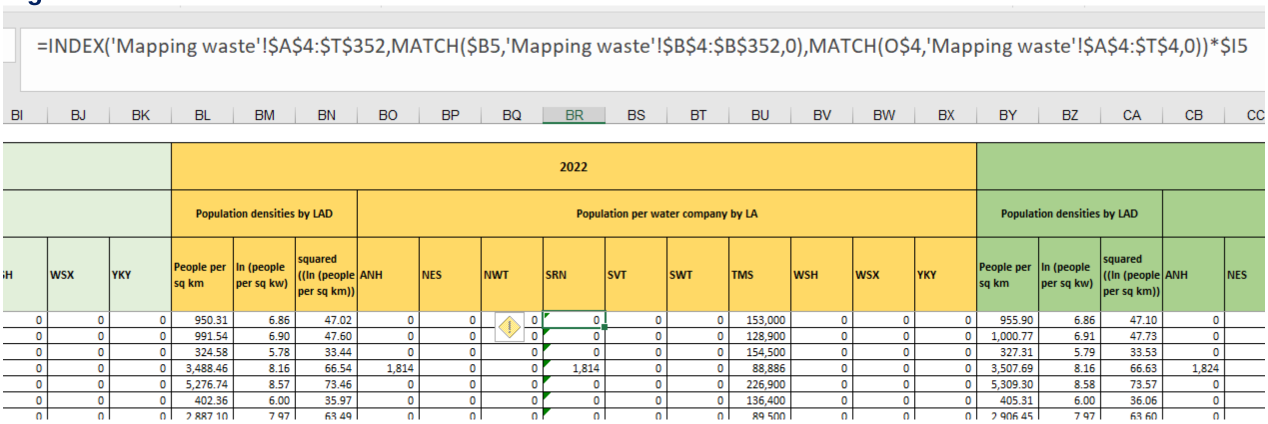
To impute ‘population per water company by LAD’, the model applies an index match formula, which matches local authority name and company name within the “Mapping LAD to population waste” tab to cell references in the “Mapping Waste” tab.

In our case, the model has index matched using an incorrect company name. Instead of matching to SRN, they match to ANH, thereby pulling in Anglian Water’s data for 2022.

[redacted]

Figure 4 below sets out the formula.

Figure 4. The erroneous formula



=INDEX('Mapping waste'!$A$4:$T$352,MATCH($B5,'Mapping waste'!$B$4:$B$352,0),MATCH(O$4,'Mapping waste'!$A$4:$T$4,0))*$I5

BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC
			2022																	
			Population densities by LAD			Population per water company by LA										Population densities by LAD				
H	WSX	YKY	People per sq km	ln (people per sq kw)	squared ((ln (people per sq km))	ANH	NES	NWT	SRN	SVT	SWT	TMS	WSH	WSX	YKY	People per sq km	ln (people per sq kw)	squared ((ln (people per sq km))	ANH	NES
0	0	0	950.31	6.86	47.02	0	0	0	0	0	0	153,000	0	0	0	955.90	6.86	47.10	0	
0	0	0	991.54	6.90	47.60	0	0	0	0	0	0	128,900	0	0	0	1,000.77	6.91	47.73	0	
0	0	0	324.58	5.78	33.44	0	0	0	0	0	0	154,500	0	0	0	327.31	5.79	33.53	0	
0	0	0	3,488.46	8.16	66.54	1,814	0	0	1,814	0	0	88,886	0	0	0	3,507.69	8.16	66.63	1,824	
0	0	0	5,276.74	8.57	73.46	0	0	0	0	0	0	226,900	0	0	0	5,309.30	8.58	73.57	0	
0	0	0	402.36	6.00	35.97	0	0	0	0	0	0	136,400	0	0	0	405.31	6.00	36.06	0	
0	0	0	2,887.10	7.97	63.49	0	0	0	0	0	0	89,500	0	0	0	2,906.45	7.97	63.60	0	

The erroneous formula is:

=INDEX('Mapping waste'!$A$4:$T$352,MATCH($B5,'Mapping waste'!$B$4:$B$352,0),MATCH(O$4,'Mapping waste'!$A$4:$T$4,0))*$I5

The correct formula should be:

=INDEX('Mapping waste'!$A$4:$T$352,MATCH($B5,'Mapping waste'!$B$4:$B$352,0),MATCH(BE$4,'Mapping waste'!$A$4:$T$4,0))*$I5

Table 3 below sets out the details of the relevant cells in the formulae above. It can be seen that the formula is index matching the incorrect company name - i.e. referring to cell O$4 (Anglian Water) when it should be referring to BE$4 (Southern Water).

Table 3. Cell references for 2023 forecast

Cell reference	Table heading including list of company names	Company
O$4	Company name (within the above lookup table)	Anglian Water
BE$4	Company name (within the above lookup table)	Southern Water

Substituting the correct formula will result in the correct forecast is set out in Table 4 below.

Table 4. Ofwat forecast and corrected forecast

Year	Ofwat forecast	Corrected forecast
2022	850.0	1519.0

[redacted]

3.3 Effect of correcting the forecasts on our efficient modelled cost allowance

By inputting the correct forecasts into "FM_WWW4_ST_DD", our efficient modelled costs increases by £10m, as shown in Table 5 below.

Table 5. Change to Ofwat's modelled cost allowance

	Southern Water efficient modelled costs (£m)
Using Ofwat's forecast	1,526.4
Using corrected forecasts	1,536.4
Increase in our allowance	**10.0**

[redacted]

4. Data tables impacted by this representation

Table Reference	Table Title
WWS1	Wholesale wastewater operating and capital expenditure by business unit

[redacted]

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[redacted]

UV disinfection: Optioneering efficiency

1. Issue

In the draft determination, a 20% cost efficiency reduction has been applied to the totex value of the UV disinfection schemes required by our WINEP programme. This challenge is applied for the following reasons (Ofwat's full response is provided in Table below):

- Lack of detailed supporting cost evidence (scheme specific details or optioneering) in resubmitted plans.
- Uncertainty if there is any double counting for UV and storm tanks (IMP6) for primarily [redacted] (but also confirm for [redacted]
- There is an adjustment mechanism for areas of uncertainty, but no reference to a performance commitment or ODI.

In this representation, we provide further supporting cost evidence and demonstrate that there has been no double-counting.

Table 1. Ofwat's assessment of UV optioneering

Need for investment	Pass	WINEP still references a 'Pan area / Water company scale' programme, but Southern Water has confirmed there to be 2 schemes. It confirms in its Business Plan that the requested expenditure includes UV schemes under SW_ND driver. Other non-UV SW_ND schemes have been included in WINEP - Conservation.
Need for adjustment	Not assessed	
Management control	Not assessed	
Best option for customers	Fail	There does not appear to be any further supporting evidence provided on scheme specific details in WINEP or optioneering in resubmitted plans for us to fully evaluate this gate. As a result we apply a 20% optioneering cost challenge.
Robustness and efficiency of costs	Partial pass	High level costs have been provided for the two schemes, with some detail on how costs are generally developed. We appreciate that the least whole life cost solutions have been selected (in the absence of cost benefit analysis). However, in the TA.12.WW06 business case we see [redacted]Copse storm tank costed separately to the UV scheme, whereas [redacted] is listed as "UV and storm tank". We are concerned that there is an element of double counting with the [redacted] storm tank storage scheme (IMP_6 driver), as it is also referenced under the Conservation Drivers enhancement section of the Response to IAP annex 6. Southern Water has not provided sufficient evidence that their costs are efficient.
Customer protection	Partial pass	There is an adjustment mechanism in place for areas of uncertainty, however we find no other reference to a PC / ODI in the company's submissions.
Affordability	Not assessed	
Board assurance	Not assessed	

2. Our proposed remedy

We provide further evidence to show that the 20% optioneering efficiency challenge is not appropriate. We also show that there are no double counts in the costs provided and provide clarity on customer protection measures.

Based on this additional evidence, we would expect that the final determination would make full allowance for the costs of our UV Disinfection programme of £13.5m totex.

[redacted]

3. Supporting evidence

3.1 Scheme Specific Details and Optioneering Assessment

3.1.1 Options

There are only two potential options that are proven and accepted within the water industry for disinfection treatment of continuous discharges to shellfish waters:

- UV disinfection
- Pump-away solution.[50]

In simple terms, the pump-away solution is unlikely to be a viable option based on basic feasibility assessment and least Whole Life Cost, as discussed in more detail in the next section below.

3.1.2 Pump-away Review (as an alternative option)

A pump-away solution is the only possible proven alternative to the proposed UV schemes. In this section we consider reasons why the pump-away option at [redacted] and [redacted] are not viable options. Below we provide an assessment of the pump-away option including:

- An assessment of the pipeline to transfer flows
- Treatment required at the receiving works.

<u>Pipeline to transfer flows</u>

When considering transferring the flows from one treatment works to another, please refer to the plan below showing all wastewater treatment works identified with a 20km radius of the two UV schemes. Note that [redacted] and [redacted] are identified in green in the centre of the ring on the figure below.

[50] A pump-away solution is where discharge water is pumped to neighbouring wastewater treatment works to be treated. Under this solution pipe-work and pumps are required to pump the water where required. The treatment works that receives this effluent must have the capacity and capability to treat the extra effluent to the required standards if pumped there.

[redacted]

Figure 1. WwTWs within a 20km radius of the required UV schemes

[redacted]

The 20km radius was chosen as a guide; beyond which it will be uneconomic to use the pump-away solutions, purely on cost grounds. An estimate of pipeline costs (which can vary significantly depending on location, whether urban or rural, and size of pipe) would be approximately £1m per km, which is considered to be on the low side given that the cost of transfer pipelines increases with distance[51]. Therefore, any site with both capacity and appropriate treatment available is likely to cost £20m or more over this 20km distance before treatment costs are considered. Anything over £20m would certainly fail on whole life cost benefit when compared to the UV disinfection options.

[redacted] and [redacted] are large sites (approx. 70,000 and 150,000 population equivalent ("p.e.") respectively). They would both require very large transfer pipeline schemes to pump-away the continuous flows. We would not normally consider pumping away flows this large unless there was spare treatment capacity very close.

[51] £1m per km is a general rule of thumb calculation used in our engineering design teams based on historic experience for installation of pump-aways. However, we further verified that £1m per km is reasonable on the basis that we costed, to target cost level of detail, a pump-away option for an AMP6 scheme at [redacted] WTW and [redacted] WTW to Horsham catchment; the combined length of the rising mains was 7km and we assessed the target cost to build these rising mains to be £7.3m (excluding corporate overheads and price base uplifts).

The feasibility of any pipeline scheme would also need to be questioned given the relatively urban setting and the size of the pipes/pumping stations required. The complexities and associated additional costs would be considerable given the scale and location.

Treatment at receiving works

Table 2 below provides details of the wastewater treatment works within the 20km radius of the proposed UV schemes, also showing distance, p.e. and spare capacity for the larger sites. The table shows both [redacted] and [redacted] are comparatively large sites within the 20km radius.

Table 2. Data of WwTWs within a 20km radius of the required UV schemes

Site Name	Distance (km)	Population Equivalent 2020	Spare Hydraulic Capacity (large sites)
[redacted]		147,109	
[redacted]		75,083	
[redacted]	19.7	268,490	No headroom available. Growth scheme required in AMP7
[redacted]	10.1	107,301	No available headroom. Growth scheme required in AMP7
[redacted]	5.7	83,462	No available hydraulic capacity
[redacted]	5.0	70,328	Just been rebuilt, no apace available for expansion
[redacted]	19.7	55,437	
[redacted]	19.2	44,390	
[redacted]	10.3	19,844	
[redacted]	16.1	15,238	
[redacted]	11.7	14,915	
[redacted]	10.2	4,822	
[redacted]	11.7	4,261	
[redacted]	8.0	3,795	
[redacted]	18.1	2,700	
[redacted]	18.0	2,685	
[redacted]	18.0	2,399	
[redacted]	18.1	1,124	
[redacted]	18.7	872	
[redacted]	14.4	650	
[redacted]	11.0	503	
[redacted]	9.8	206	
[redacted]	14.6	141	
[redacted]	11.6	114	
[redacted]	10.3	113	
[redacted]	15.8	111	
[redacted]	16.0	111	
[redacted]	10.3	77	
[redacted]	11.2	51	
[redacted]	19.3	41	
[redacted]	16.3	36	
[redacted]	15.4	22	
[redacted]	4.2		redundant
[redacted]	9.8		redundant
[redacted]	14.1		not SWS (unadsopted)
[redacted]	14.8		site unadopted owned by Testway [redacted]
[redacted]	19.7		demolished

[redacted]

Few sites have the required equivalent treatment capacity, and none of those identified have anywhere near sufficient spare capacity to treat either [redacted] and/or [redacted] flows. New treatment capacity would need to be developed for a pump-away solution.

With regards to developing additional treatment at a separate site, the following are all likely to significantly increase costs well beyond comparative cost benefit levels:

- Land may be a complexity, particularly given the scale of the new treatment required
- The additional treatment would require a complete set of works processes, not just a single UV process - i.e. new inlet, screening, primary, secondary, sludge handling, etc.
- In developing new treatment at another site, the development would need to consider both treatment capacity and hydraulic capacity
- The Environment Agency may not accept (permit) increasing the flows / loads being discharged from an alternative site
- Assuming the Environment Agency did provide a permit, given the additional load being discharged to the receiving environment, permits at the site being developed would likely be tightened, not only requiring more advanced treatment to be developed for new flows, but also for the existing flows.

As an indication of costs, [redacted] was a recent scheme we developed requiring complete new treatment processes. This scheme cost approximately £90m for a treatment capacity of 65,000 p.e. Costs can vary significantly dependant on land, complexities, treatment stages, types of treatment, etc, although p.e. is the most appropriate and the standard metric used to estimate the cost of a scheme. Also [redacted] [redacted] and [redacted] are all coastal works in the same region. Although we have not undertaken a precise costing for new treatment processes at the relevant works that are large enough, we note that the cost comparison is to a cost of £5m and £8m for 75,000 p.e. and 150,000 p.e. for [redacted] and [redacted] UV schemes respectively. The UV schemes are significantly less expensive. That is before considering the additional cost of pipelines for the pump-away schemes.

The nearest works of a similar size (but not necessarily having spare capacity) are 6km and 5km away, at [redacted] and [redacted] WwTW respectively. Initial high level estimates would put these pump-away options at these two sites at £11m (at £1m / km). This is before treatment at the receiving waters and other issues with transferring effluent are considered. We know that these sites would require treatment capacity improvements in order to receive this continuous effluent discharge. The costs for treatment improvement at both these sites could easily exceed £90m, given the precedent at [redacted] Pump-away and treatment options of c.£100m or more are not going to be cost beneficial when compared to the UV disinfection schemes put forward (£13m). Once additional treatment, capacity and other cost issues are included, the costs are clearly going to be higher even at the desktop review level, so no further design and costing work was carried out (and to have done so would not have involved an efficient use of funds).

[redacted]

3.1.3 Wider Industry Position / Other WaSC WINEP Specifics

The fact that UV disinfection is understood to be the only realistic and feasible option is highlighted by the Environment Agency in its WINEP3 document (see WINEP3[52]). Where the Environment Agency identify the 'Shellfish Water No Deterioration (SW_ND)' WINEP3 requirements, for continuous discharges to shellfish waters, they specifically state in the scope and proposed permit limit requirements that these requirements should be delivered through UV disinfection.

Table 3 below shows an example extract of other company 'Shellfish No Deterioration' disinfection obligations (for continuous discharge), which are specified as UV disinfection by the Environment Agency. Our selected UV disinfection solution options are consistent with the rest of the sector and in-line with Environment Agency expectations for shellfish schemes of continuous discharges to shellfish waters. Where UV disinfection requirements have been selected and identified elsewhere in the sector, Ofwat has fully funded the investment put forward. We would expect to be fully funded in the same way.

Table 3. Extract from WINEP3 of WaSC Shellfish Water No Deterioration requirements (for continuous discharges to shellfish waters)[53]

Water Company	Unique ID * (completed on company collation)	Scheme Name/Name of Investigation/Site Name/License name	Name of Waterbody	WFD Operational Catchment	Driver Code (Primary)	Measure Type	Level of Certainty? (P= Purple, R=Red, A=Amber, G=Green	Implementation Scope	Proposed Permit Limit (mg/l)	Proposed Permit Limit Other
United Utilities	7UU200395	Carlisle STW secondary treated	Lower Eden	Eden	SW_ND	Continuous Discharge	Green	UV (validated dose)		UV (validated dose)
Wessex Water Service Ltd	7WW200245	CORFE CASTLE STW	Corfe River	Poole Harbour Rivers	SW_ND	Continuous Discharge	Green		UV disinfection Design Criteria specified	
South West Water Ltd	7SW200603	Kenn & Kennford STW	Kenn	Creedy and West Exe	SW_ND	Continuous Discharge	Green	UV disinfection of discharge.		UV disinfection

3.1.4 Options Summary

In summary, given the issues of feasibility, complexities and significant costs relative to the UV scheme, assessing pump-away options was not taken any further in assembling the solution. Using only basic desktop calculations, the pump-away solution was considered significantly more expensive than the UV solution even before the notional design stage. This is why we do not have further detail on pump-away costs – the option was not a viable solution even at the desktop stage.

Furthermore, Jacobs have provided independent assurance at each stage of the Business Planning process. Jacobs provide independent support for the fact that UV disinfection at [redacted] and [redacted] is the only viable option, and state (TA_CA_Jacobs Letter of Assurance):

[52] Link to WINEP3 here: https://data.gov.uk/dataset/a1b25bcb-9d42-4227-9b3a-34782763f0c0/water-industry-national-environment-programme#licence-info

[53] Southern Water lines are omitted as they do not provide the equivalent detail except to state 'Water Company Scale' due to the current Environment Agency prosecution.

[redacted]

> *"The SRN response correctly includes the pump away solution as being the only other viable and widely tested options other than UV…It is agreed that a pump away solution is likely to be significantly more costly than the in-situ UV treatment being proposed."*

3.2 Scope and cost breakdown

Our [redacted] and [redacted] UV schemes were costed from a site specific assessment. The tables below provide a breakdown of scope and costs that were developed using our bottom-up cost estimating approach. All costs have been through our Business Planning challenge, review and assurance process (as detailed in *TA.14.4 Bottom-Up Cost Estimation*). We reduced the costs considerably at the IAP, in response to feedback received from Ofwat.

For both sites, the tables below provide further detail for the complexity costs attributable to ICA costs (Instrumentation, Control and Automation – e.g. building telemetry and controls etc.), M & E costs (mechanical and electrical engineering work – e.g. building pumps etc.), and Civils cost (civil engineering – e.g. building concrete or putting in foundations, building walls etc.).

The project uplifts (£3.5m and £2.2m) are for non-infrastructure investment, and are driven by contractor on-costs, but also include some site complexity and risk simulations. These standard contractor and project related on-costs are significant parts of the non-infrastructure costing process. These on-costs were reviewed and independently assured by Jacobs prior to our September 2018 submission and were considered to be reasonable, robust and cost efficient (particularly when applied at the programme level). To prove the point that these are using standard uplifts, we highlight the fact that the same non-infrastructure on-cost uplift factors have been used for schemes such as Budds Farm (Flow to Full Treatment) and Bathing Water CAC (the non-infrastructure costs element); these costs were scrutinised in detail and the project on-costs were considered to be reasonable through Mott Macdonald's independent assurance (see IAP Technical Annex 6 – Securing Cost Efficiency). In addition, Ofwat's assessment of the Bathing Water CAC, for example, are deemed to be a 'PASS' on cost robustness and efficiency; this further acknowledges that cost uplifts used seem efficient and reasonable. The corporate overhead is a standard uplift applied to our capital programme schemes.

In summary, the costs provided for these UV schemes are in our view efficient and robust and provide the best value solution for our customers to deliver against these 'shellfish water no deterioration' environmental obligations. Further independent assurance review by Jacobs at DD stage has reaffirmed that they are satisfied that these UV disinfection costs are robust and efficient and have been costed in-line with our robust Business Planning methodologies (TA_CA_Jacobs Letter of Assurance); Jacobs state:

> *"Detailed cost breakdowns have been provided in SRN's response at DD stage and we have reviewed these with checks back to unit costs. In some areas direct links to unit costs were not used ('complexities'), these were sample tested and the cost assumptions appear to be reasonable."*

[redacted]

Table 4. [redacted] scheme breakdown (£m)

	Post Efficiency 17/18 Prices
New screen facility	0.364
Screening Structure	0.550
UV screening bagging unit	0.118
MCC	0.231
Other Site Specific Issues: ICA - Complexity	0.129
Other Site Specific Issues: M&E - Complexity	1.308
Other Site Specific Issues: Civil - Complexity	0.878
Build Total	3.577
Contractor On-costs (also includes Risk Simulations & Missing Items)	2.609
Tender to Outturn Ratio (TOR)	0.887
Project Uplifts Total	3.496
SW Corporate Overheads	0.969
Total Project Cost	8.042

Table 5. [redacted] ICA complexity cost breakdown (£)

Cost Curve Description	Unit Quantity (Number Of)	Qty	Yardstick	Designers Comments	Assigned Discipline	Total	Estimators Comments
LEVEL MEASUREMENT	4	1.0	Unit (No.)		ICA	£ 4,270.81	
ACTUATED PENSTOCK	4	3.0	Area (m2)	Penstocks at each end of the channels.	ICA	£ 53,484.00	
FLOW MEASUREMENT	1	850.0	Flow (l/s)		ICA	£ 2,529.82	
TURBIDITY MEASUREMENT (Waste	1	1.0	Number (No)		ICA	£ 9,902.00	
				Systems intergration to include new UV plant into exsiting telemetry and SCADA system approx 5 days man hours	ICA	£ 3,750.00	
				modification to existing spare MCC feeder to supply new UV plant	ICA	£ 10,000.00	Based on 2 x feeder panel mods, no power upgrade included
NITRATE MEASUREMENT	1	1.0	Unit (No.)	It has been assume that new instruments will be required on the new FE chamber.	ICA	£ 19,123.08	
AMMONIA MEASUREMENT	1	1.0	Unit (No.)	It has been assume that new instruments will be required on the new FE chamber.	ICA	£ 16,094.09	
TURBIDITY MEASUREMENT (Waste Water)	1	1.0	Number (No)	It has been assume that new instruments will be required on the new FE chamber.	ICA	£ 9,902.00	
						£ 129,055.79	

Table 6. [redacted] M&E complexity cost breakdown (£)

Cost Curve Description	Unit Quantity (Number Of)	Qty	Yardstick	Designers Comments	Assigned Discipline	Total	Estimators Comments
GATE VALVE	1	1000.0	Diameter (mm)	Gate valve associated with the live connection.	MandE	£ 11,405.80	
ULTRAVIOLET MODULE (LAMPS)	2	73.4	Design Flow (ML/d)	Based upon FFT of 850 l/s.	MandE	£ 1,171,079.00	Total based on 1275L/s
LIFTING BLOCK/HOIST (EQSET)	1	2.0	SWL (T)	Electric hoist with remote control. 2 t capacity.	MandE	£ 21,470.88	Factor added for span and based on internet prices for this size
LIFTING RUNWAY BEAM	2	2.0	SWL (t)	20m long runway beams	MandE	£ 40,126.47	
ACCESS STRUCTURE	1	55.0	Length (m)	Handrailing around the perimeter of the UV structure	MandE	£ 7,990.36	
ACCESS STRUCTURE	2	3.0	Length (m)		MandE	£ 8,127.02	
ACCESS	4	11.0	Area (m2)		MandE	£ 31,558.76	
CABLE TRAY	20	300.0	Width (mm)		MandE	£ 1,052.44	
CABLING	5	100.0	Length (m)		MandE	£ 8,856.70	
CABLING	6	50.0	Length (m)	Diversion of existing cables	MandE	£ 7,372.24	
						£ 1,309,039.66	

[redacted]

Table 7. [redacted] civils complexity cost breakdown (£)

Cost Curve Description	Unit Quantity (Number Of)	Qty	Yardstick	Designers Comments	Assigned Discipline	Total	Estimators Comments
Coring Concrete Wall	1	1000.0	Diameter (mm)	CET to adjust cost to reflect that this will need to be a live connection by specialist contractor with specialst equipment.	CIVIL	£ 9,538.88	,
WASTEWATER TANK SET	1	850.0	Design volume (m3)	Item included to allow for additional costs for construction of overall buried "tank" structure in which the UV channels will be formed, i.e. to allow for additional excavation and additional wall depths below the surrounding ground level. Overall volume of structure 20 m long x 8.5 m wide x 5 m deep. Note that the GA of the Peel Common UV system has been used as a reference for developing this equipment set.	CIVIL	£ 334,000.00	
PIPEWORK(CIVIL)	70	700.0	Diameter (mm)	Diversion of the existing FE pipe from FSTs 7 & 8.	CIVIL	£ 57,079.40	
DUCT	6	50.0	Length (m)	Diversion of existing cable ducts.	CIVIL	£ 21,422.34	
DRAWPIT	3	1.5	Area (m2)	New drawpits on diverted cable runs.	CIVIL	£ 10,782.11	
DUCT	3	75.0	Length (m)		CIVIL	£ 14,091.10	
DRAWPIT	2	1.4	Area (m2)		CIVIL	£ 6,968.97	
ROAD (EQSET)	1	1200.0	Area (m2)	1200 m2.	CIVIL	£ 122,639.97	
COFFERDAM (LAND BASED)	1	1200.0	Volume (m3)	It has been assumed that the new UV channel and the new screen facility will be constructed close to the site boundary and that the excavation will need to be within a cofferdam. 40 m long x 10 m wide x 3 m deep.	CIVIL	£ 97,447.40	
RETAINING WALL - Concrete and Block retaining wall	60	2.0	Wall Height (m)	Wall 60 m long. CET to enhance cost derived from the curve to reflect that the wall will be constructed from reinforced concrete and not blockwork. The new UV channel and screens will need to be constructed close to the boundary and site levels differ from the surrounding area. It has been assumed that a retaining wall will be required - similar to FSTs 7 and 8.	CIVIL	£ 78,000.00	
PIPEWORK(CIVIL)	30	100.0	Diameter (mm)	Washwater extension	CIVIL	£ 4,929.00	
DUCT	6	50.0	Length (m)	Diversion of existing ducts	CIVIL	£ 21,422.34	
CHAMBER	1	9.0	Area (m2)	New FE Chamber	CIVIL	£ 19,626.21	
Additional Project Related CapEx Costs						£ 80,000.00	
						£ 877,947.72	

Table 8. [redacted] scheme cost breakdown (£m)

	Post Efficiency 17/18 Prices
UV Pumping Station	0.320
MCC	0.201
Other Site Specific Issues: ICA - Complexity	0.100
Other Site Specific Issues: M&E - Complexity	1.228
Other Site Specific Issues: Civil - Complexity	0.379
Build Total	2.228
Contractor On-costs (also includes Risk Simulations & Missing Items)	1.625
Tender to Outturn Ratio (TOR)	0.552
Project Uplifts Total	2.178
SW Corporate Overheads	0.603
Total Project Cost	5.009

[redacted]

Table 9. [redacted] ICA complexity cost breakdown (£)

Cost Curve Description	Unit Quantity (Number Of)	Qty	Yardstick	Designers Comments	Assigned Discipline	Total	Estimators Comments
LEVEL MEASUREMENT	4	1.0	Unit (No.)		ICA	£ 4,270.81	
ACTUATED PENSTOCK	4	2.0	Area (m2)	Penstocks at each end of the channels.	ICA	£ 39,883.60	
FLOW MEASUREMENT	2	430.0	Flow (l/s)		ICA	£ 3,417.55	
TURBIDITY MEASUREMENT (Waste Water)	1	1.0	Number (No)		ICA	£ 9,902.00	
				Systems intergration to include new UV plant into exsiting telemetry and SCADA system approx 7 days man hours	ICA	£ 5,250.00	
TELEMETRY (EQSET)	1	1.0	Number (Nr)		ICA	£ 2,731.95	
PROGRAMMABLE LOGIC CONTROLLER	1	90.0	Number IOs (No)		ICA	£ 34,966.35	
						£ 100,422.26	

Table 10. [redacted] M&E complexity cost breakdown (£)

Cost Curve Description	Unit Quantity (Number Of)	Qty	Yardstick	Designers Comments	Assigned Discipline	Total	Estimators Comments
GATE VALVE	2	800.0	Diameter (mm)	Gate valve associated with the live connection.	MandE	£ 14,184.00	
ULTRAVIOLET MODULE (LAMPS)	2	37.2	Design Flow (ML/d)	Based upon FFT of 430 l/s.	MandE	£ 999,237.00	
LIFTING BLOCK/HOIST (EQSET)	1	2.0	SWL (T)	Electric hoist with remote control. 2 t capacity.	MandE	£ 21,470.88	Factor added for span and based on internet prices for this size
LIFTING RUNWAY BEAM	2	2.0	SWL (t)	15 m long runway beams	MandE	£ 40,126.47	
ACCESS STRUCTURE (EQSET)	1	50.0	Length (m)	Handrailing around the perimeter of the UV structure	MandE	£ 7,398.70	
ACCESS STRUCTURE (Stairs)	2	3.0	Length (m)		MandE	£ 8,127.02	
ACCESS STRUCTURE(Platform)	4	11.0	Area (m2)		MandE	£ 31,558.76	
CABLE TRAY	30	300.0	Width (mm)		MandE	£ 1,578.66	
CABLING	10	100.0	Length (m)		MandE	£ 17,713.40	
POWER SUPPLY - New Transformer (outside)	1	650.0	Power (kVA)		MandE	£ 47,622.35	
INCOMING SWITCH BOARD	1	2000.0	Amps (A)		MandE	£ 23,125.93	
KIOSK (EQSET)	1	24.0	Area (m2)		MandE	£ 16,270.70	
						£ 1,228,413.86	

Table 11. [redacted] civils complexity cost breakdown (£)

Cost Curve Description	Unit Quantity (Number Of)	Qty	Yardstick	Designers Comments	Assigned Discipline	Total	Estimators Comments
	2			"Hot tap" connection to existing pipeline to feed the new UV Feed P.S. Typical specialist subcontractor cost, based on quotation received from UPS for Ford is £20 000. Cost excludes excavation. CET to include additional cost for excavation and ground support. Excavation required typically 3 m x 3m x 2 m deep.	Civil	£ 20,000.00	,
WASTEWATER TANK SET	1	510.0	Design volume (m3)	Item included to allow for additional costs for construction of overall buried "tank" structure in which the UV channels will be formed, i.e. to allow for additional excavation and additional wall depths below the surrounding ground level. Overall volume of structure 15 m long x 8.5 m wide x 4 m deep.	CIVIL	£ 107,000.00	Dave Wheeler pricing
PIPEWORK(CIVIL)	150	800.0	Diameter (mm)	Inlet and outlet pipework	CIVIL	£ 138,591.00	
DUCT	6	50.0	Length (m)	Diversion of existing cable ducts.	CIVIL	£ 21,422.34	
DRAWPIT	3	1.5	Area (m2)	New drawpits on diverted cable runs.	CIVIL	£ 10,782.11	
DUCT	6	75.0	Length (m)		CIVIL	£ 28,182.21	
DRAWPIT	4	1.4	Area (m2)		CIVIL	£ 13,937.94	
PLINTH/BASE SLAB	2	2.0	Volume (m3)	Plinth/slab associated with the live connections.	CIVIL	£ 3,120.00	
ROAD (EQSET)	1	200.0	Area (m2)	200 m2 of reinforced concrete road.	CIVIL	£ 24,935.54	
PIPEWORK(CIVIL)	10	600.0	Diameter (mm)	Pumped delivery to UV.	CIVIL	£ 7,069.00	
PLINTH/BASE SLAB	1	7.0	Volume (m3)		CIVIL	£ 4,210.00	
						£ 379,250.12	

[redacted]

3.3 Demonstrating no double-counting of costs

Ofwat states in its draft determination: *'We are concerned that there is an element of double counting with the [redacted] storm tank storage scheme (IMP_6 driver)'*

We demonstrate here that there is no double counting with both the [redacted] Copse and [redacted] UV disinfection and storm tank schemes.

In summary, there are three potential areas where double counting could occur for the [redacted] and [redacted] Copse schemes UV and storm tank schemes. Costs could be double counted under the following drivers:

- UV disinfection
- Conservation drivers
- IMP6 Storm tank storage

In section 1.2 above, we provided a detailed breakdown of the UV disinfection related costs where none of these costs relate to storm tank storage at either [redacted] or [redacted] Copse. This shows that there are no storm tank related costs being double counted within the UV disinfection numbers.

Although not related to this UV case, in terms of the potential double count with conservation driver storm tanks and IMP6 storm tanks, the table below highlights that the potential area of double count is [redacted] However, the conservation driver costs for [redacted] storm tank have been removed as part of the Business Planning process and this confirms that [redacted] storm tank costs are not double counted under the conservation driver (they are only included under the IMP6 storm tank storage driver).

Table 12. Breakdown of capex scheme costs associated with conservation driver programme

Driver	Site Name	DD Capex	Comment
Conservation Driver	[redacted]	£ 8,381,667	
	[redacted]	£ -	CAPEX removed at Business Plan
	[redacted]	£ 758,600	
	[redacted]	£ 1,213,219	
	[redacted]	£ 2,748,626	
	Total for 'Conservation Driver'	£ 13,102,112	

[redacted] Copse does not have an IMP6 storm tank driver and is not listed under IMP6. Therefore, the storm tank element for [redacted] Copse is only dealt with under conservation drivers and is confirmed as not being included in the UV disinfection costs or under IMP6 storm tank storage costs.

As detailed in our business cases, the costs detailed for [redacted] IMP6 storm tank and [redacted] Copse conservation driver storm tank have been derived using costs curves and follow our scheme cost estimation approach. These storm tank costs only include storm tank related costs.

[redacted]

Thus, we can confirm that no UV disinfection related costs have been included in the storm tank costs and no storm tank costs have been included within UV disinfection costs. We can also confirm that there is no storm tank double count between IMP6 storm tanks and conservation drivers storm tanks.

3.4 PC or ODI linked to the UV schemes

We have no specific company-defined Shellfish ODI for just the two UV schemes. However, the performance commitment 'Delivery of water industry national environment programme requirements' (PR19 draft determinations: Southern Water – outcomes performance commitment appendix) incentivises us to deliver the NEP obligations.

The shellfish schemes were not listed by the Environment Agency in WINEP3, as given the current Environment Agency prosecution, the Environment Agency would not detail individual schemes for SWS for this driver. However, we were required to include the obligations that we calculated as being required under this driver. These shellfish UV schemes calculated as being required are the Southern Water WINEP shellfish UV schemes (i.e. these are NEP requirements and covered by the Ofwat defined 'Delivery of water industry national environment programme requirements' performance commitment).

To protect customers from any change in NEP requirements we have proposed an adjustment mechanism for the UV and other shellfish schemes. If schemes are removed the funding will be reconciled in line with the adjustment mechanism proposed.

4. Data tables impacted by this representation

Table Reference	Table Title
Table WWS1	WWS1 - Wholesale wastewater operating and capital expenditure by business unit
Table WWS2	WWS2 - Wholesale wastewater capital and operating expenditure by purpose

5. Assurance

As detailed in TA_CA_Jacobs Letter of Assurance and discussed in Sections 1.1.4 and 1.2, Jacobs have independently assured this Draft determination response case. They summarise their assurance review findings:

> *"The options considered for the UV disinfection programmes at [redacted] and [redacted] Copse appear to be appropriate and the basis of the costs are reasonable."*

It is noted that in relation to assuring our optioneering approach Jacobs scored this element with their A grade (low risk – observed substantial evidence in support of the area. Evidence considered to be robust). This further highlights their independent stance that our optioneering approach was robust and appropriate.

It is noted that in relation to assuring the robustness of our UV disinfection scheme costs, they scored this element with their B grade (low to medium risk – reasonable degree of evidence readily available to support this area. Some areas for further substantiation identified). This highlights their independent stance that our costs put forward for UV disinfection schemes are reasonable.

[redacted]

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[redacted]

Funding for upper quartile pollution targets

1. Issue

Our September 2018 Business Plan included a pollution reduction of 41% by 2024 (in comparison with our 2016 performance), which is in line with and our customers' preferences (reference TA.12.WW07 Business case Flooding and Pollution Strategies section 4.1). The target performance by 2024 is 19.50 pollution incidents per 10,000km (circa 79 incidents cat 1 to 3 pollutions). This is above the current Industry frontier level of performance in AMP6 and aligns with the predicted industry upper quartile at the IAP in January 2018.

In order to deliver the planned reductions for AMP7, we need to invest in new practices and new technology to create a smart and resilient sewer network. The fact that our future AMP7 pollution targets are beyond the current industry frontier performance means these costs would not be included within the the botex models. The additional investment required to achieve the 41% reduction should be classified as enhancement, as it provides a step change in capability and performance not otherwise achievable.

At the IAP, it was argued that funding for enhanced pollution performance should not be allowed as this would amount to funding historic under-performance compared to other companies at the revised upper quartile performance level. However, our targets within AMP6 were based on customers' willingness to pay to reach an agreed estimated upper quartile performance. Therefore this approach penalises Southern Water as our targets were based on our customers' priorities and expectations rather than the performance of other companies.

A total expenditure of £10.7m was included within our Business Plan to reach upper quartile pollution performance and deliver a 41% improvement (from 2016 performance by 2024). Compared with other companies, this is an efficient and ambitious plan however no funding has been allowed in the draft determination. The delivery of our performance targets cannot be achieved without new investment in our network and technology. The environment is one of our customers' highest priorities and they are willing to pay to ensure a resilient long-term future.

We continue to believe that the approach is inappropriate because:

- The draft determination approach represents a significant change in policy which does not align to the historic regulatory approach and customers' willingness to pay;
- The revised approach results in a significant risk that is to an extent beyond our control e.g. through mis-connections or severe weather; and
- Failing to allow for the necessary expenditure to deliver the pollution reductions that companies have committed to creates a risk of significant reputational damage to the sector as a whole if a large number of companies are unable to deliver within the allowed funding and may not be consistent with the statutory duties of Ofwat.

[redacted]

2. Our proposed remedy

The case for not allowing our Business Plan pollution expenditure of £10.7m should be revisited in full in light of the clear and compelling evidence to support its inclusion.

[redacted]

3. Supporting evidence

Our September 2018 Business Plan included pollution reductions from 35 Category 1 to 3 pollutions per 10,000km of sewer down to 21 between 2016 and 2024. At the IAP, in order to be in-line with expectations of a revised 'upper quartile of upper quartile', the 2024 target was revised down to 19.5. This represents a 44% improvement in performance, and this is well below the current upper quartile level for AMP6.

In the final PR14 price control determination notice for 2015-20 (December 2014)[54] Ofwat set a target of 158 Category 3 incidents (including clean water) for 2017/18 onwards (or 40 Category 3 pollutions per 10,000km of sewer). We achieved this in 2016 and 2017 with 144 and 131 incidents respectively.

Figure 1: AMP6 performance commitments for Category 3 pollution incidents

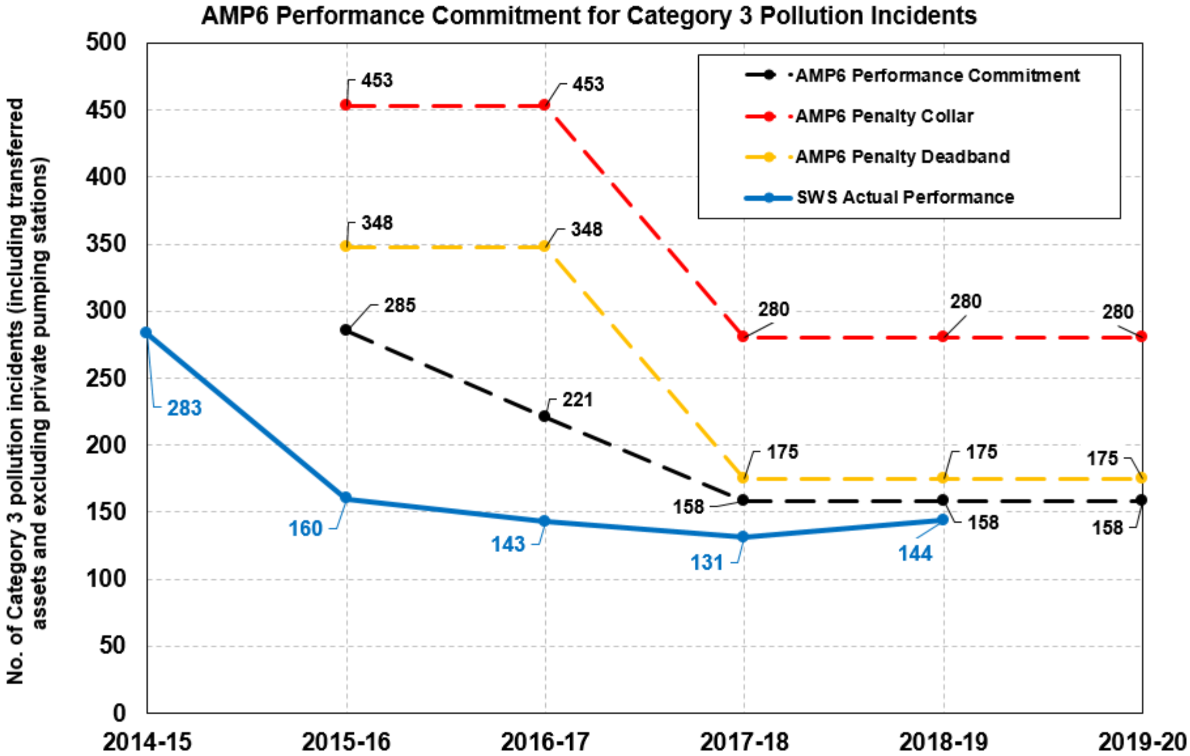

Figure 1 represents an improvement of 49% improvement between 2014 and 2018 for Southern Water. Each year's performance is below the set AMP6 performance commitment.

Ofwat also states in 2014,

[54] Setting price controls for 2015 – 2020, final price control determination notice: company-specific appendix – Southern Water (Ofwat, December 2014)

[redacted]

> *"The company's performance was below upper quartile and therefore we intervened to incentivise the company to reach upper quartile performance by 2017-18".*

See PR14 final determination extract below.

Table AA4.2 Representations specific to the comparative assessments on wholesale wastewater

PC/ODI affected	What we did at draft determination	Representations	What we did at final determination	Why we did it
Category 3 pollution incidents (asset health)	Adjusted the company's annual PC levels for this measure on the basis of comparative assessments, so that the company is aligned with the industry upper quartile level by 2017-18. We set its PC level at 156, penalty deadband at 156, and penalty collar at 261 from 2017-18.	The company states that this adjustment has not been applied consistently across all companies. The company goes on to state that companies were not given the opportunity to feed into the methods used in the comparative assessments, which would have enabled a number of important points with respect to the pollution incidents target to be considered by us earlier. The company states that it has concerns with how Ofwat has normalised the data in setting the upper quartile level, and the low level of self-reporting by some companies. It states that we have not taken any account of future incidents caused by private pumping stations in its calculation of the upper quartile level. The company would like the annual targets for category 1, 2 and 3 pollution incidents to be reinstated to the levels in its business plan.	We intervened on the PC definition so that it is for category 3 incidents only. We applied new PC levels following comparative assessments. We set the PC level at 158, the penalty deadband at 175 and the penalty collar at 280 from 2017-18 to 2019-20. We set the PC level at 285 and 221 in 2015-16 and 2016-17 to offer a glide-path to upper quartile performance. We set the penalty deadband in 2015-16 and 2016-17 at the company's current performance. We set the penalty collar in 2015-16 and 2016-17 to maintain a penalty range of 105 incidents.	We applied our updated comparative assessment for final determinations based on stakeholder representations on draft determinations. The company's performance was below upper quartile and therefore we intervened to incentivise the company to reach upper quartile performance by 2017-18. See policy chapter A2 for further details.

The above table shows Ofwat's PR14 definition, Southern Water met the estimated upper quartile level performance by 2017/18. Therefore not funding Southern Water for not being at a revised industry driven "upper quartile" performance is inappropriate as Southern Water did reach the set target during PR14, and the PR19 approach could not have been anticipated.

3.1 Additional incremental costs

The total investment required to lower pollution by at least 44% is £10.7m and includes the following new activities: (further information in TA.12.WW07 Business case Flooding and Pollution Strategies Table 7).

- Installing smart sewer level monitors, WPS flow monitors & smart remote re-sets and power efficient pumps at sewerage pumping stations;
- Increasing our customer education to reduce the amount of wet wipes and fat which damage sewerage pumping stations which can lead to pollutions through using intense and targeted campaigns;
- Increase use of Jetting and CCTV to maintain the sewer network in conjunction with advanced analytics to reduce risk and impact through CAST root cause analysis (Causal Analysis Systems Theory);

[redacted]

- To roll our condition based maintenance by installing pump performance monitors to help generate data for leading indicators and intelligent dash boards to spot and intervene on issues before a pollution can develop; and
- Combining the above as part of a smart network to achieve upper quartile performance in pollution, and to help with improvements in internal and external flooding.

Each of these activities is incremental to those carried out in AMP6, where our expenditure has been principally on conventional find-and-fix activity. These activities are incremental because they involve implementing new technologies in pilots and then at a scale which has not previously been done before (particularly not at enterprise scale and not scaling and integrating multiple new technologies at the same time). Investment is required for this step change in performance to allow the network to transition into a smart and resilient system. The PR19 improvements planned are on top of a 49% improvement in performance between 2014 and 2018 (see Figure 1).

3.2 Reputational risk for the sector

Throughout our customer research, our customers told us they expect us to protect and enhance the environment, while ensuring we do no harm through pollution being the minimum they expect. As a result pollution is a medium priority issue for customers (also see TA.4.3 from our September 2018 Business Plan submission).

The approach to funding improved pollution performance is inconsistent with its broader approach to funding based on customer priorities. For example Ofwat has funded water efficiency / metering expenditure as enhancement which customers regard as a lower priority than reducing pollution (which Ofwat has not funded). We consider our customers' priorities should be fully reflected in the cost allowances made in the final determination, and Ofwat has previously stated that it shares this view.[55]

Ofwat has recognised the aspirations of the Environment Agency and have successfully encouraged companies by setting stretching pollution reduction targets of at least 40%. However by not allowing these costs, there is a significant risk of not meeting these stretching targets. In order to meet pollution targets without adequate funding, companies will either choose to accept reduced levels of service in other areas or deploy high risk technologies with lower chances of success. Therefore, there is significant reputational risk to the sector should the approach to funding these reductions mean that a large number of companies fail to meet these enhanced levels of service.

[55] See 'Delivering Water 2020: Our final methodology for the 2019 price review', December 2017, e.g. page 239: "*A high quality business plan: is grounded in excellent customer engagement […] it should include stretching outcomes and performance commitments that reflect what customers want, and their relative priorities […]*".

[redacted]

Table 2 Draft determination pollution allowance compared to business plans

	September 2018 Business Plan[56] (£m)	Ofwat Draft determination (£m)	Comment
Anglian	0	0	No enhancement called pollution
Welsh	4.2	0	Capital expenditure purpose ~ Pollution Strategy
Northumbrian	0	0	No enhancement called pollution
Severn Trent England	0	0	Pollution control strategy (ESL) but no enhancement requested
Southern	10.7	0	Pollution Resilience
South West	0	0	No enhancement called pollution
Thames	68.4	0	Pollution Resilience
United Utilities	0	0	No enhancement called pollution
Wessex Water	27.9	0	Pollution Reduction Strategy
Yorkshire	41.6	0	Pollution - UQ
Hafren Dyfrdwy	0	0	No enhancement called pollution

[56] WWS2 data tables

[redacted]

4. Data tables impacted by this representation

Table Reference	Table Title
WWS1	Wholesale wastewater operating and capital expenditure by business unit
WWS2	Wholesale wastewater capital and operating expenditure by purpose
WWS18 Line 2	Number of serious pollution incidents (category 1 and 2)
WWS18 Line 3	Number of serious pollution incidents (category 3)

5. Appendices

Appendix A: Data table extract – Wholesale wastewater WWS18

[redacted]

Appendix A: Data table extract – Wholesale Wastewater WWS18

Table A1: Extract from Data table WWS18 lines 2 & 3: Southern Water's submitted pollution forecasts and targets

Line	Description	Units	2020-21	2021-22	2022-23	2023-24	2024-25
2	Number of serious pollution incidents (category 1 and 2)	Number	0.00	0.00	0.00	0.00	0.00
3	Number of serious pollution incidents (category 3)	Number per 10,000 km of sewer	24.51	23.74	23.00	22.40	19.50

Source: Southern Water Data table WWS18

[redacted]

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[redacted]

Totex cost sharing rate

1. Issue

In the draft determination, a number of changes have been made to the approach to setting cost sharing rates. These include:

i. No longer setting the cost allowance based on the application of the relevant sharing rate to the company cost forecast, but relying solely on Ofwat's view.
ii. Steepening the slope of the cost sharing curve, to enhance the incentives to submit efficient costs in response to the draft determination.
iii. Basing the cost sharing rates on the average of a companies' September 2018 Business Plan submission and its response to the draft determination.

We do not propose to make any representations on points (i) and (ii). However, we believe that point (iii) does not provide appropriate recognition of companies that responded positively to the IAP cost challenge by closing the cost gap at that stage. Such cost reductions are entirely disregarded by the revised approach to setting cost sharing rates. This is inequitable and will have a negative impact upon the effectiveness of such process incentives at subsequent price reviews if there is no apparent benefit to engaging positively with Ofwat's regulatory challenge.

For Southern Water, the IAP highlighted a significant gap of £767m between our September 2018 Business Plan costs and Ofwat's modelled efficient costs. We responded to the new information provided by Ofwat's benchmarking by examining every aspect of the costs in our plan, including scheme solutions, design standards, costing benchmarks and ongoing productivity gain assumptions. As a result, we identified cost reductions of £443m in our updated Business Plan submitted in April 2019, representing a closing of 58% of the cost gap.

A number of other companies did not respond to the IAP in such a positive way, and in many cases companies chose not to amend their costs to such a significant degree in response to clear inefficiencies revealed by Ofwat's benchmarking.

Given the very large gap between our September Business Plan costs and Ofwat's view at the IAP there is now no reasonable prospect of our final determination resulting in an acceptable cost sharing rate on the proposed approach. Even if we were to adopt Ofwat's draft determination cost allowance in its entirety, we would still be subject to a 37%/63% cost sharing rate for both water and wastewater. This is despite the fact that we materially reduced our costs in light of the new information revealed at the IAP, which was not available to us when we developed our initial Business Plan in September 2018.

[redacted]

2. Our proposed remedy

The IAP revealed new information about our comparative efficiency, which was not available to us when we developed our Business Plan in September 2018. We believe the cost sharing rates should take proper account of how we responded to this new information.

Specifically, for those companies (including Southern Water) that reduced the gap between their September Business Plan costs and Ofwat's IAP cost allowance by at least one third, we suggest that cost sharing rates on a combination of the IAP response and the draft determination response (i.e. 50% IAP response; 50% draft determination response).

We propose a threshold of one third as that equates to the upper quartile of cost reductions proposed by companies in responding to the IAP.

For those companies that did not reduce their costs or closed less than one-third of the cost gap between the September Business Plan and the IAP cost allowance, cost sharing rates should be set on the basis proposed in the draft determination (i.e. 50% September Business Plan; 50% draft determination response).

[redacted]

3. Supporting evidence

We demonstrate below how the gap between our Business Plan submission costs and Ofwat's IAP modelled allowance means that there is no reasonable prospect of us securing an acceptable cost sharing rate based on the proposed new methodology.

We go on to demonstrate that our proposed alternative approach would result in a more equitable cost sharing rate that recognises the positive way in which we responded to the new information revealed at the IAP.

3.1 Impact of the proposed methodology on Southern Water

Based on the methodology proposed in the draft determination, the tables below show the resulting sharing rates for a number of scenarios.

As can be seen, even if we were to agree with Ofwat's draft determination cost allowance in its entirety (Table 2), we would still be subject to a punitive cost sharing rate of 37%/63% (calculated using the revised cost sharing rates, pg.94, 'Securing cost efficiency technical appendix'). To achieve a 50%/50% cost sharing rate, we would need to propose totex 26% below Ofwat's draft determination allowance (Table 3).

Table 1. We do not change our view of costs from the IAP

		Water	Wastewater
	September Business Plan	1,288	2,440
	Draft determination response	1,180	2,107
	Company view (average)	1,234	2,274
	Ofwat view	1,024	1,934
Cost sharing rate	Outperformance	30%	32.5%
	Underperformance	70%	67.5%

Table 2. We accept Ofwat's draft determination cost allowance

		Water	Wastewater
	September Business Plan	1,288	2,440
	Draft determination response	1,024	1,934
	Company view (average)	1,156	2,187
	Ofwat view	1,024	1,934
Cost sharing rate	Outperformance	**37%**	**37%**
	Underperformance	**63%**	**63%**

[redacted]

Table 3. To achieve a 50%/50% cost sharing rate

		Water	Wastewater
	September Business Plan	1,288	2,440
	DD response	760	1,429
	Company view (average)	1,024	1,934
	Ofwat view	1,024	1,934
Cost sharing rate	Outperformance	**50%**	**50%**
	Underperformance	**50%**	**50%**

3.2 Application of our proposed alternative methodology

Our proposed alternative approach to determining cost sharing rates gives weight to the revised Business Plan costs of those companies, like Southern, who responded positively to the new information revealed by the IAP cost models by closing the cost gap at that stage.

We are proposing that this approach should apply to all those companies that reduced their costs by at least one-third in responding to the IAP, which equates to the upper quartile of cost reductions. In Appendix A we show our analysis of the cost reductions proposed by companies in response to the IAP. This shows that the two wastewater companies which would meet this requirement are Southern and Thames. The three water companies would be Southern, Portsmouth and Yorkshire.

Table 4 illustrates Southern Water's sharing rates under our proposed methodology, on the assumption that we were to agree with Ofwat's draft determination cost allowance in its entirety (per Table 2 above). This demonstrates that giving weight to the IAP response results in a more equitable sharing rate and ensures that the effectiveness of such process incentives at subsequent price reviews is retained by providing companies with a strong incentive to engage positively with Ofwat's regulatory challenge.

Table 4. Proposed alternative methodology

		Water	Wastewater
	IAP response	1,180	2,107
	DD response	1,024	1,934
	Company view (average)	1,102	2,021
	Ofwat view	1,024	1,934
Cost sharing rate	Outperformance	**42%**	**45%**
	Underperformance	**58%**	**55%**

[redacted]

4. Data tables impacted by this representation

None

5. Appendices

Appendix A: IAP cost reductions

[redacted]

Appendix A. IAP cost reductions

Table A1. Water service IAP cost reductions (£m)

Company	Business Plan (£m)	IAP (£m)	Ofwat (£m)	Ofwat view minus Business Plan (£m)	Ofwat view minus IAP (£m)	Totex efficiency plan reductions (%)
PRT	224	166	189	-35	23	166%
SRN	1,288	1,180	1,024	-264	-156	41%
YKY	2,069	1,920	1,684	-385	-237	39%
HDD	119	120	121	2	2	34%
WSX	660	647	610	-50	-37	26%
TMS	5,718	5,321	4,164	-1,554	-1,157	26%
ANH	2,907	2,845	2,075	-832	-770	7%
BRL	464	459	389	-75	-69	7%
AFW	1,443	1,436	1,311	-132	-126	5%
SSC	600	598	526	-74	-72	3%
SES	259	258	215	-44	-43	1%
SEW	1,005	1,005	866	-139	-139	0%
NES	1,712	1,717	1,611	-101	-105	-5%
WSH	1,650	1,670	1,340	-310	-330	-6%

Table A2. Wastewater service IAP cost reductions (£m)

Company	Business Plan (£m)	IAP (£m)	Ofwat (£m)	Ofwat view minus Business Plan (£m)	Ofwat view minus IAP (£m)	Totex efficiency plan reductions (%)
SRN	2,440	2,107	1,942	-498	-165	67%
TMS	4,442	4,137	3,622	-820	-515	37%
HDD	22	22	23	1	1	14%
WSX	1,460	1,431	1,235	-225	-196	13%
NES	1,171	1,141	929	-242	-212	12%
YKY	2,569	2,558	2,000	-568	-558	2%
ANH	2,949	2,951	2,514	-435	-436	0%
WSH	1,446	1,450	1,229	-217	-222	-2%

[redacted]

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[redacted]

Metaldehyde

Ofwat reference: SRN.CE.A5

1. Actions

There may be significant impacts in terms of investment or type of investment as a result of the metaldehyde ban. The company should investigate and agree with the DWI the scale and timing of any potential changes compared to its submitted plans. Significant changes and uncertainty may require an outcome delivery incentive to protect customers in the instance of expenditure not being required.

Should the company propose a performance commitment and outcome delivery incentive, the company should provide evidence to justify the level of the performance commitment and the outcome delivery incentive rates proposed, in line with our Final Methodology. We expect to receive evidence of customer support for outperformance payments, where proposed, and that the incentive rates proposed are reflective of customer valuations

The Company to provide evidence to confirm DWI agreement with its submitted plans/revised undertakings and that no metaldehyde specific costs are included in the requested allowance.

2. Response

After assessing the impact of the metaldehyde ban, we can confirm that the ban does not have a material impact on Southern Waters' Business Plan and no metaldehyde specific costs are included in the enhancement allowance. Southern Water will continue to comply with its existing pesticides undertaking through our existing catchment management programmes funded through the base allowance.

Ofwat note in their raw water deterioration deep dive for Southern Water that,

> *"We note that in its response [Annex 6 Securing Cost Efficiency - 5.SRN.CE.A5 the Thanet Catchment CAC SRN P129] Southern Water states that its undertakings with the DWI cover multiple pesticides and that it has confirmed with the DWI that following implementation of the metaldehyde ban the catchment management schemes will still be required and that the cost of the work will not change. We therefore accept this cost."*

The DWI undertaking for pesticides, SRN 3294, is in "TA_CE_DWI Pesticide Undertaking SRN3294".

The DWI undertakings does not change (no revisions are required) as the result of the metaldehyde ban and remain the legal instruments with which we must comply in AMP7.

We do not propose any additional performance commitments or outcome delivery incentives relating to the metaldehyde ban, as there are no changes to our plan.

[redacted]

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Strategic Solution Development – SRN company specific response

1. Issue

In the draft determination received from Ofwat, our funding allowance for development of strategic supply solutions was £82m. This differs only slightly, with respect to both scope and cost, from the costs in our revised Business Plan at the IAP.

This response requests some variations to the timing of gates and the funding allowance, as the result of the addition of new transfers from Wessex Water and South West Water and the addition of Bristol Water into the strategic solutions group. It also provides further information on the revised scale of the deficit the solutions are intended to address as requested by Ofwat in the draft determination:

> *"Southern Water to provide clearly evidenced detail of the deficit the solutions are required to address, accounting for the significant draft determination allowance for other projects delivering supply- demand benefits."* SRN CE.A3.

Information received from South West Water, Wessex Water and Bristol Water shows that an adjustment is needed to the size of the cost allowance, its allocation and the timing of the gates[57]. More schemes are proposed than are contained in the draft determination, hence the need for additional funding. Bristol Water is allocated some funding in this response, and the requested total is split equally between the four companies.

These companies are unable to meet the accelerated gates proposed by us, and accepted by Ofwat for the development of de-salination or alternatives. Given that the schemes are earlier in development than others as they are not in the preferred strategies of any company's WRMP at present, some additional development funding is proposed.

We make this response in addition to the joint response from eight companies, in which we have fully participated.[58]

[57] See Joint proposal for Strategic regional water resource solutions, August 2019 submitted by West Country Water Resources Group on behalf of South West Water, Wessex Water, and Bristol Water
[58] Strategic regional water resource solutions, 30 August 2019, the joint response by eight water companies

[redacted]

2. Our proposed remedy

We propose jointly with the three West Country companies an increase in funding provided, the addition of some schemes and a change to the timing of the gate, as set out below.

2.1 Funding allowance

Table 1 shows the revised proposed allowances, made in consultation with Wessex Water, South West Water and Bristol Water, and the West Country Water Resource Group (WCWRG). This group has identified that Bristol Water may also be able to contribute via development of the second Cheddar reservoir.[59] Proposed changes from the draft determination are highlighted.

Table 1. Proposed costs for our Strategic Solution Development (£m)

Solution development	Total allowance	Allowance to SRN
Thames to Southern Transfer	15.0	7.5
Desalination	37.4	37.4
River [redacted] effluent re-use	35.8	35.8
West Country - Southern transfer	10.4	2.6
West Country - Sources	4.0	1.0
Totals	**105.6**	**84.3**

Source: Ofwat's draft determination, Water Country Water Resource Group[60]

The costs of the West Country sources and transfer are split equally between the four parties.

[59] For these purposes Cheddar II is presumed to be "developed", i.e. no development funding is required.
[60] See Joint proposal for Strategic regional water resource solutions, August 2019 submitted by West Country Water Resources Group on behalf of South West Water, Wessex Water, and Bristol Water

[redacted]

2.2 Timing of gates

Table 2 below shows the proposed gate times relevant to us, based on further consultation with other companies. Changes from the draft determination are highlighted.

Table 2. Draft determination gate times

	Gate 1	Gate 2	Gate 3	Gate 4
Thames to Southern Transfer*	April 2021	April 2022	April 2023	June 2024
Desalination	Sept 2020	Sept 2021	June 2022	April 2023
River [redacted] effluent re-use	Sept 2020	Sept 2021	June 2022	April 2023
West Country - Southern transfer**	April 2021	April 2022	April 2023	June 2024
West Country – Sources**	April 2021	April 2022	April 2023	June 2024

Source: Ofwat draft determinations and joint response from 8 companies

*The combined response from eight companies proposes changes to the dates of the dates for Gates 1 and 2[61]

**The response from the West Country Water Resource Group proposed to use the standard gate times for the West Country Transfers

[61] See Strategic regional water resource solutions, 30 August 2019, the joint response from the eight companies to the draft determination.

[redacted]

3. Supporting evidence

3.1 Funding Allowance

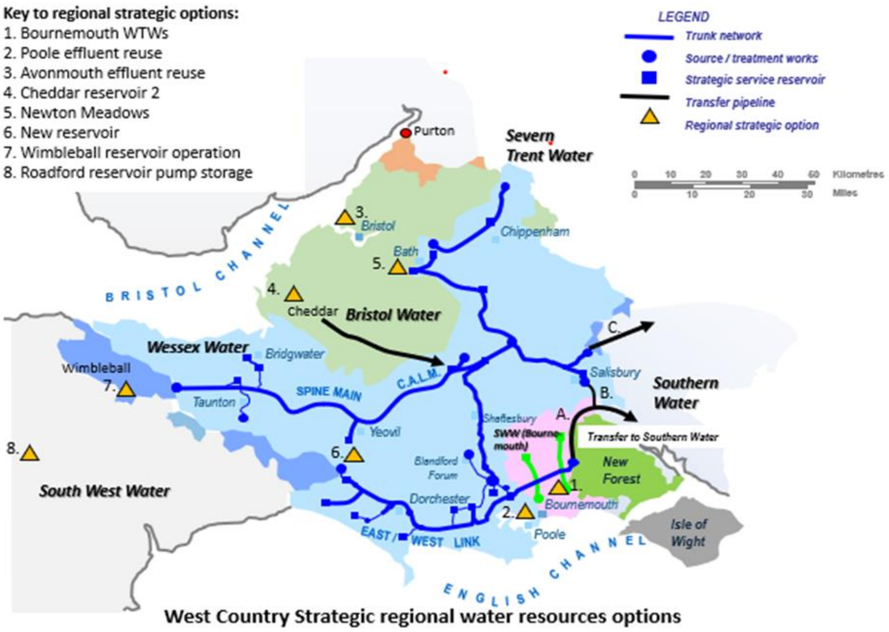
The response from the WCWRG sets out proposals for a combined capacity of potential trades to Southern Water of c.115 Ml/d, comprising 20 Ml/d already planned between South West Water (via Bournemouth) and Southern Water, and c.95 Ml/d from a range of other sources. This is considerably in excess of the capacity envisaged in our IAP response of 1 April 2019, where we identified 10-15 Ml/d of potential trades from Wessex Water and an additional 10 Ml/d from South West Water.[62]

These proposals have been augmented a range of new schemes:

- Additional transfer from Wessex Water, 15 ml/day
- Additional transfer from Southwest Water, 10 ml/day
- Wessex Water, 15 Ml/day, effluent re-use from Poole waste treatment works
- Bristol Water, 16 Ml/day, Cheddar II new reservoir
- Bristol Water, 5 Ml/day, use of surplus from [redacted] [redacted] treatment works
- South West Water, 35 Ml/day, additional pumped storage capacity from [redacted] reservoir

An outline of these schemes is shown in Figure 1.

Figure 1. Map of West Country sources and transfers



[62] See our follow up to IAP action SRN.CE.A3, submitted on 3 May 2019

[redacted]

The additional capacity will require further development of new sources, as well as additional network re-enforcement between the networks of Bristol Water and Wessex Water, Bournemouth Water and Southern Water.

The WCWRG note sets out the basis for the costing derived from South West Water's draft WRMP statement of response, identifying a cost of £59m for the West Country sources as originally proposed in the draft determination and a cost of £138m for the transfer. The note shows that Ofwat's calculation was incorrect.

Using Ofwat's proportion of 6% of total cost being attributable to development, this gives £11.8m of development costs, rather than the £4m in the draft determination, for a total capacity of 45 Ml/d.[63]

Table 3. Development funding at capacity in the draft determination

£m	Draft Determination	proposed
West Country Transfers	2.6	3.5
West Country Sources	1.4	8.3
Total	4.0	11.8

The four companies are now proposing an increase in scope, via the three additional schemes. The WCWRG note sets out revised costs for the increase in scope and capacity (see Table 3).

Table 4. Development funding at increased capacity

£m	DD	proposed
West Country Transfers	2.6	4.0
West Country Sources	1.4	10.4
Total	4.0	14.4

The proposed split is in equal shares between South West Water, Wessex Water, Bristol Water and Southern Water for a total capacity of 95 Ml/d.

[63] See Table 2 of the WCWRG response

[redacted]

3.2 Gate Timing

The WCWRG note sets out the challenges in meeting the gate times in the draft determination, having consulted with us, and conclude it is not possible to meet them. In summary, these reasons are:

- The West Country has not to date needed to actively investigate supply side resource options in the region, nor have they had to undertake planning or modelling at a regional scale. They expect to take least 12 months to carry out regional modelling work, given this capability is only now being created.
- Southern Water anticipates that the September 2020 deadline for Gate 1 mainly relates to the desalination scheme or alternatives. At this stage it is anticipated that a scheme that can deliver up to 75 Ml/d will need to be in construction during AMP 7. It is very unlikely that the West Country schemes could be sufficiently developed to provide a viable alternative to Fawley by the accelerated Gate 1, though they may be able to contribute to a reduction in size at later Gates.
- Robust regional and company model testing is particularly important given that the Group expects the Environment Agency's National Framework to require them to do more work to evaluate drought resilience including for more extreme 1 in 500 drought events on a comparable basis. There will not be time to do this by September 2020.
- Inter-regional transfers would most likely occur partly by displacement of demand in the supply areas in the West. The ability to meet the needs of customers in area in droughts and continue to support new trades at the same time needs more planning investigation
- An accelerated gateway for schemes at an early stage of development could lead to sub-optimal options or solutions that may not deliver the best possible value.

The WCWRG and Southern Water propose to submit progress reports on schemes at the accelerated Gate 1 even if they are not being considered at that Gate.

We proposes that the Thames – Southern transfer reverts to the standard gate times. At present the identified source for this transfer is the South East Strategic Reservoir Option (SESRO) being developed by Thames Water, or conceivably the Severn- Thames transfer. Neither source is capable of being ready to deliver water to Southern via the Thames-Southern transfer in time to meet our need to remedy our deficit by 2027.

It remains of interest to us as a longer term solution, but does not need to be *"construction ready"* in AMP7. To meet that need was the reason why we originally argued for accelerated gates for desalination and direct alternatives.

Please see "TA_CE_Strategic solution development – All Company Working Group join document" for more information.

[redacted]

4. Data tables impacted by this representation

We have included Ofwat's draft determination view of strategic regional solution investment (£82m) in our table WS2 (there is also a corresponding change in table WS1). We have not included the revised position of £84.3m in our investment data tables, but we do note the revised position as a double-sided adjustment in the Ofwat draft determination proforma (RP1).

Table Reference	Table Title
Table WS1	WSI – Wholesale water operating and capital expenditure by business unit
Table WS2	WS2 – Wholesale water capital and operating expenditure by purpose

5. Appendices

Appendix A: Additional information on the supply demand deficit

[redacted]

Appendix A: Additional information on the supply demand deficit

A1. Summary

This information repeats the information provided to Ofwat on 19 August 2019, reference SRN-DD-CMI-002.

Table A1 shows the baseline supply-demand balance (pre-interventions) for the dry year Minimum Deployable Output (MDO) planning scenario from 2020 to 2030 with a deficit of 88Ml/d in 2020 increasing to 188Ml/d in 2030. The major factor driving the deficit is the [redacted] and [redacted] abstraction licence changes. The information is presented graphically in Figure A1 below.

Once interventions have been added the supply-demand balance is in surplus through the ten year period from 2020 to 2030, but this assumes benefit from drought permits and orders for the Rivers [redacted] and [redacted] sources to maintain supplies. The impact of needing to rely on drought permits and orders during this period is that the actual level of service we expect to deliver is less than our planned level of service shown in Table A1 below. The key departures from our planned level of service relate to the frequency of needing to implement Temporary Use Bans (TUBs) and frequency of needing to apply for and implement drought permits and drought orders.

The frequency of needing to implement TUBs is 1 in 4 years from 2020 to 2027 and 1 in 8 years from 2028 to 2030, compared to a planned level of service of 1 in 10 years. The frequency of needing to apply for drought permits / orders is 1 in 4 years from 2020 to 2027 and 1 in 10 years from 2028-2030 compared to a planned level of service of 1 in 20 years. Note that application for drought permits does not mean they will always be applied. Application of the permits will depends on weather and river flow conditions.

The results are summarised in the table below. Note that the information is derived from our draft WRMP, which does not contain additional volumes from the West Country transfers.

Table A1. Summary of supply demand balance and levels of service, before and after interventions, Ml / day

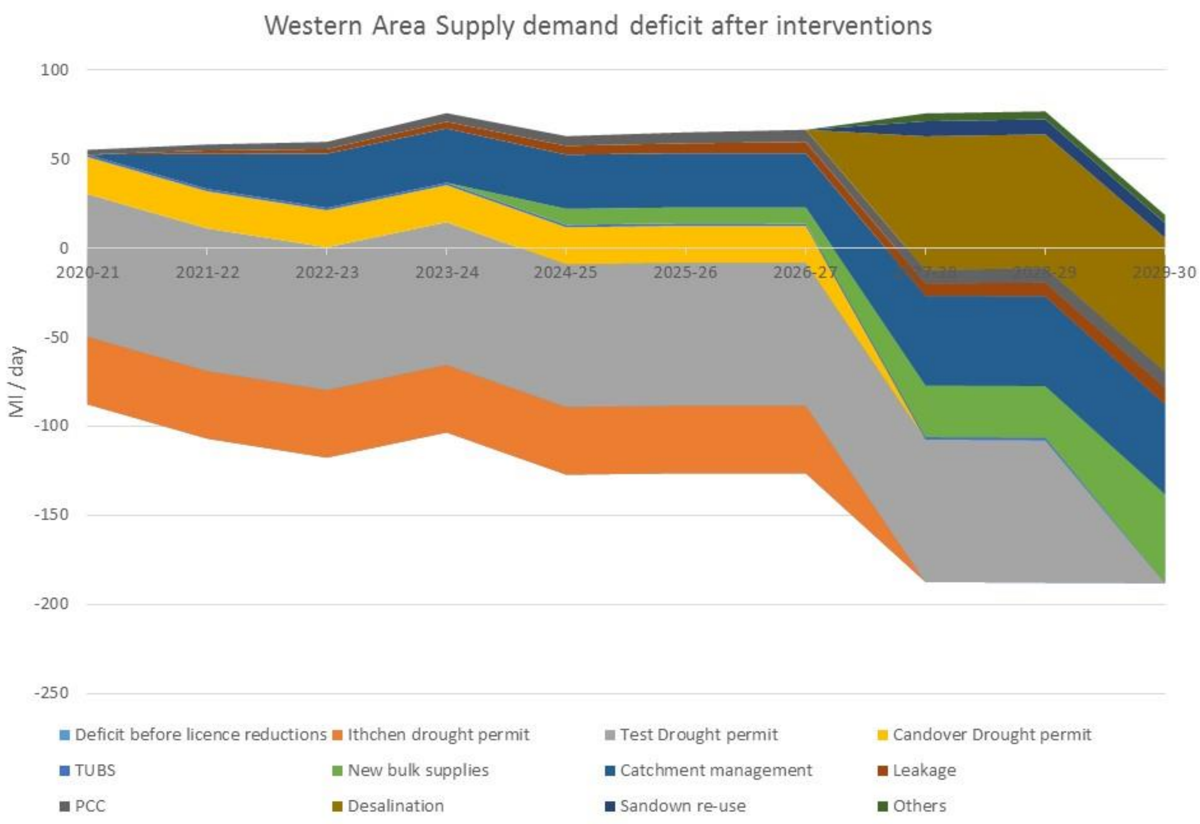
Component	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Supply forecast (deployable output)	299.7	299.7	299.7	299.7	299.7	299.7	299.7	299.7	299.7	299.7
Climate change & licence reductions	19.4	0.1	-10.1	-9.5	-32.7	-32.4	-32.1	-92.7	-92.6	-92.5
Licences changes ([redacted] & [redacted]	-165.7	-165.7	-165.7	-165.7	-165.7	-165.7	-165.7	-165.7	-165.7	-165.7
Outage	31.2	30.9	30.9	16.9	16.9	15.9	15.9	15.9	15.9	15.9
Net imports and exports	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Target headroom	15.9	16.2	16.4	16.7	16.9	17.1	17.3	17.4	17.6	17.8
Total demand	198.7	198.7	198.8	199.1	199.3	199.6	199.8	200.1	200.3	200.6
Balance pre-interventions	-87.7	-106.9	-117.6	-103.5	-127.1	-126.3	-126.4	-187.4	-187.8	-188.0
Balance after interventions	55.1	58.1	59.6	75.7	62.8	64.9	66.4	75.6	76.7	18.6
Actual TUB frequency (after interventions)	1-in-4	1-in-4	1-in-4	1-in-4	1-in-4	1-in-4	1-in-4	1-in-4	1-in-8	1-in-8
Actual NEUB frequency (after interventions)	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20
Actual DP/DO Application, (after interventions)	1-in-4	1-in-4	1-in-4	1-in-4	1-in-4	1-in-4	1-in-4	1-in-4	1-in-10	1-in-10
Actual DP/DO Implementation	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-20	1-in-100	1-in-100
Actual EDO frequency	1-in-500	1-in-500	1-in-500	1-in-500	1-in-500	1-in-500	1-in-500	1-in-500	1-in-500	1-in-500

[redacted]

WATER for LIFE from Southern Water

Figure A1 presents this information gaphically, to illustrate the timing and capacity of different interventions, including the use of drought permits and drought orders.

Figure A1. Western Area supply and demand deficits



A2. Further information on deficits and completed data table

We have completed the table as requested, and it is provided as spreadsheet as supporting information.[64] Please note the data presented are subject to the following assumptions:

- We have assumed that "*planned level of service*" is equivalent to our "*target level of service*" as set out in Annex 1 of our Revised Draft Water Resource Management Plan[65] (rdWRMP). This data is provided in Table A2.

[64] See Western_Area_SDB_Breakdown_excel.xlsx
[65] Southern Water Revised Draft Water Resource Management Plan, Annex 1, Pre-consultation and problem characterisation September 2018

[redacted]

Table A3. Planned level of service

Planned level of service	Frequency	Comments
Temporary use ban (TUB)	1-in-10 years	Target Level of Service
Drought order (Non-Essential Use Ban)	1-in-20 years	Target Level of Service
Emergency drought order (EDO – e.g. standpipes)	1-in-500 years	Target Level of Service
Application of drought permit/order (increase licence quantities)	1-in-20 years	Target Level of Service
Implementation of drought permit/order (increase licence quantities)	1-in-200 years	Target Level of Service

Source: See Western_Area_SDB_Breakdown_excel.xlsx

- We have constructed the data using a *“bottom up”* approach based on the most recent revision of our published Water Resource Management Planning tables
- We have assumed that the *“critical planning scenario”* is that with the largest baseline supply demand deficit, which for our Western area, is the Minimum Deployable Output (MDO) scenario.
- Our baseline design drought severity for the MDO scenario is for a 1-in-200 year drought.
- For the baseline deployable output we have sourced the data from line 7BL (Deployable Output - baseline profile without reductions) from each MDO WRP table for each Water Resource Zone (WRZ) and supplied the total deployable output with time.
- For the baseline deployable output we have excluded the confirmed sustainability reductions incurred as part of the 2019 licence changes to the Lower River [redacted] and Lower River [redacted] sources as the magnitude of these sustainability reductions was requested to be reported separately.
- Note that in our published WRP tables, and in our rdWRMP we had assumed a further sustainability reduction for the River [redacted] of 26Ml/d occurring in 2024. In March 2019 we received a request for further information from Defra and were requested to remove this unconfirmed sustainability reduction from our baseline supply demand balance. In our June 2019 addendum to our Statement of Response66 we acknowledged this request and in our final plan we will move this to an unconfirmed sustainability reduction with a 75% probability of occurring. This is likely to reduce the baseline deficit by approximately 6.5Ml/d.
- The impact of further uncertain sustainability reductions has been sourced from line 8BL (Baseline forecast changes to Deployable Output) of each MDO WRPM table for each WRZ. Note that this line includes both uncertain sustainability reductions, losses of sources due to deterioration in water quality and a residual adjustment to account for our probabilistic aggregated risk approach.
- As requested we have presented the sustainability reductions caused by the March 2019 licence changes separately. These reductions do not appear in our WRPM tables as the change has been incorporated in our baseline deployable output forecast. However as we were requested to report

[66] Southern Water Revised Draft Water Resource Management Plan, Addendum to Statement of Response, June 2019

[redacted]

this separately we have calculated the magnitude of the sustainability reduction by comparison of Deployable Output against the previous abstraction licences.

- The "Outage" line includes both our Outage allowance and Process Losses. These have been calculated based on the sum of lines 10BL (Outage Allowance) and 9BL (Raw water losses, treatment works losses and operational use) respectively from our MDO WRPM tables.
- The Net imports and exports have been calculated from lines 2BL (Raw Water Imported), 3BL (Potable Water Imported), 5BL (Raw Water Exported) and 6BL (Potable Water Exported) of our MDO WRPM Tables. These only relate to existing external bulk supply agreements, notably with Portsmouth Water, Wessex Water and an export to an industrial third party.
- Target Headroom has been sourced and totalled from Row 16BL (Target Headroom) of our MDO WRPM Tables.
- Total Demand has been sourced and totalled from Row 11BL (Distribution Input) of our MDO WRPM Tables.
- The Supply Demand Balance without interventions is equivalent to the total presented in our baseline MDO WRPM Tables (Row 18BL) and has been calculated by the following formula:

Supply Demand Balance =

Baseline DO + Supply forecast reductions (climate change & licence changes)

+ Licences changes ([redacted] & [redacted]

- Outage

+ Net Imports and Exports

- (Total Demand + Target Headroom)

- Leakage reductions have been sourced from Table 6 Preferred (Scenario Yr) (RO) for our preferred plan in our MDO WRP Tables. Specifically the total presented in Line 59 (Distribution Side Management).
- Water efficiency / PCC savings have been sourced from Table 6 Preferred (Scenario Yr) (RO) for our preferred plan in our MDO WRPM Tables. Specifically the total presented in Line 61 (Customer Side Management).
- The individual supply side options have been sourced from Table 6 Preferred (Scenario Yr) (RO) for our preferred plan in our MDO WRPM Tables and occur in block 58 (Resource Management) options
- Where internal transfers (e.g. the Hampshire Grid) are represented as preferred options we have checked that thee options balance between water resource zones and that there is no double counting or net creation/loss of water.
- In our summary table we have included our original preferred option for the modular 75Ml/d planned desalination plant at Fawley in our HSW zone. However, we recognise that this solution is subject to further investigation under the regional strategic solution gated process and may be replaced by alternative options.
- The resultant Supply-Demand Balance after interventions is calculated using the following formula:

Supply Demand Balance =

Baseline DO + Supply forecast reductions (climate change & licence changes)

[redacted]

+ Licences changes ([redacted] & [redacted]

- Outage

+ Net Imports and Exports

- (Total Demand + Target Headroom)

+ Total benefit of supply side options

- We have cross checked the resulting supply demand balance against the total supply demand balance (total of rows 18FP) within our WRPM tables to ensure that the data match and are equivalent.
- We have included our forecast levels of service as requested. This has been derived from Annex 1 of our rdWRMP. Note that in our Western area the level of service is driven not by the magnitude of the deficits but the agreed timing and drought management actions set out in the Section 20 Agreement (s20 agreement) with the Environment Agency. These actions are largely driven by flow triggers on the River [redacted] and River [redacted]
- The s20 agreement states that after 2027 we cannot rely upon the River [redacted] Drought Order and can only use the River [redacted] Drought Permit/Order in extreme (<0.5% annual probability) drought events. This strategy is to reduce abstraction pressures on sensitive receptors in these catchments. The s20 agreement specifies the phasing of Temporary Use Bans (TUBs) and Non Essential Use Bans (NEUBs) in the affected resources zones. TUBs are required before implementation of the River [redacted] Drought Permit and partial implementation of NEUBs are required before the River [redacted] or River [redacted] Drought Orders are applied for. The expected frequency and probability of these events has been incorporated into our forecast levels of service.
- Note there is an interim period from 2027 to 2029 when some drought permits and order options are required at lower frequency when much of the deficit has been removed, but whilst we are awaiting implementation of the Havant Thicket reservoir Bulk Supply.
- In the longer term, under all of our planning scenarios we consider that, if our preferred plan is delivered, we will not require the use of Drought Permits and Orders to increase abstractions beyond licenced quantities out to droughts of 1 in 200 year drought severity (0.2% annual probability) in any zone. Emergency Drought Orders for standpipes and rota cuts will not be required unless we are faced with an extreme drought (<0.2% annual probability) beyond a 1 in 500 year event.

Table A4. Supply demand balance and levels of service, before and after interventions

Component	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	Comments
[redacted]	299.73	299.73	299.73	299.73	299.73	299.73	299.73	299.73	299.73	299.73	[redacted]
[redacted]	19.42	0.14	-10.14	-9.55	-32.70	-32.39	-32.14	-92.65	-92.62	-92.50	[redacted]
[redacted]	-165.67	-165.67	-165.67	-165.67	-165.67	-165.67	-165.67	-165.67	-165.67	-165.67	[redacted]
[redacted]	31.23	30.93	30.93	16.93	16.93	15.95	15.95	15.95	15.95	15.95	[redacted]
[redacted]	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	[redacted]

[redacted]

											[redacted]
[redacted]	15.89	16.16	16.42	16.68	16.95	17.11	17.27	17.43	17.59	17.75	
[redacted]	198.72	198.72	198.84	199.07	199.32	199.58	199.79	200.09	200.34	200.57	
[redacted]	-87.67	-106.91	-117.58	-103.47	-127.14	-126.28	-126.40	-187.37	-187.75	-188.02	
[redacted]	0.00	-1.91	-2.54	-3.88	-4.96	-5.54	-6.42	-6.95	-7.73	-9.52	
[redacted]	-2.65	-3.37	-4.07	-4.76	-5.46	-6.16	-6.82	-7.48	-8.20	-8.88	
[redacted]											
[redacted]	0.00	0.00	0.00	0.00	9.00	9.00	9.00	9.00	9.00	9.00	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.00	
[redacted]	20.80	20.80	20.80	20.80	20.80	20.80	20.80	0.00	0.00	0.00	
[redacted]	0.00	0.00	0.00	0.00	17.08	16.50	15.85	24.00	24.00	24.00	[redacted]

											[redacted]
[redacted]	0.00	0.00	0.00	0.00	-17.08	-16.50	-15.85	-24.00	-24.00	-24.00	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-7.50	-7.50	-7.50	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.50	7.50	7.50	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.10	-1.10	-1.10	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	1.10	1.10	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	25.00	25.00	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	25.00	25.00	[redacted]

[redacted]

[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	25.00	25.00	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.93	0.60	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.15	-0.93	-0.60	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.31	5.23	5.08	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.31	-5.23	-5.08	[redacted]
[redacted]	-7.77	-7.31	-7.05	-6.85	-6.12	-5.68	-5.42	-13.85	-13.57	-4.78	[redacted]
[redacted]	7.77	7.31	7.05	6.85	6.12	5.68	5.42	13.85	13.57	4.78	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	20.00	20.00	

[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.11	2.11	2.11	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12	1.12	1.12	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	1.15	1.15	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	
[redacted]	38.00	38.00	38.00	38.00	0.00	0.00	0.00	0.00	0.00	0.00	
[redacted]	0.00	0.00	0.00	0.00	38.00	38.00	38.00	0.00	0.00	0.00	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.20	1.20	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	

[redacted]	0.00	0.00	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	
[redacted]	0.00	19.60	19.60	19.60	19.60	19.60	19.60	19.60	19.60	19.60	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.17	18.17	18.17	
[redacted]	0.00	0.00	0.00	0.00	2.28	2.18	2.14	0.00	0.00	0.00	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.29	-1.32	-1.40	[redacted]
[redacted]	0.00	0.00	3.10	3.10	3.10	3.10	3.10	0.00	0.00	0.00	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-3.10	-3.10	-3.10	[redacted]
[redacted]	0.00	0.00	0.00	0.00	-2.28	-2.18	-2.14	0.00	0.00	0.00	[redacted]

[redacted]											[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29	1.32	1.40	[redacted]
[redacted]	0.00	0.00	-3.10	-3.10	-3.10	-3.10	-3.10	0.00	0.00	0.00	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10	3.10	3.10	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.50	8.50	8.50	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.91	27.09	5.98	[redacted]
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-27.91	-27.09	-5.98	[redacted]
[redacted]	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	0.00	
[redacted]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	

[redacted]	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.00	
[redacted]	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.00	
[redacted]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
[redacted]	55.11	58.10	59.57	75.70	62.81	64.95	66.37	75.57	76.69	18.56	
[redacted]	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-8 Years	1-in-8 Years	
[redacted]	1-in-20 Years	1-in-20 Years	1-in-20 Years	1-in-20 Years	1-in-20 Years	1-in-20 Years	1-in-20 Years	1-in-20 Years	1-in-20 Years	1-in-20 Years	
[redacted]	1-in-500 Years	1-in-500 Years	1-in-500 Years	1-in-500 Years	1-in-500 Years	1-in-500 Years	1-in-500 Years	1-in-500 Years	1-in-500 Years	1-in-500 Years	
[redacted]	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-4 Years	1-in-10 Years	1-in-10 Years	

[redacted]

Table A6. Definitions

All units in Ml/d for components of the supply-demand balance and 1-in-X years for the frequency of customer and environmental interventions.

Table component	Description
Supply forecast (Deployable Output) – Ml/d	The combined output of all sources within the region for the design drought under the critical planning scenario, as constrained by: hydrological yield; licensed quantities; environment (represented through licence constraints); pumping plant and/or well/aquifer properties; raw water mains and/or aqueducts; transfer and/or output main; treatment; water quality. Confirm the drought severity (return period) that this DO forecast is based upon.
Supply reductions (climate change & licence reductions) – Ml/d	Reductions in deployable output resulting from climate change and changes to abstraction licences (not River [redacted] or [redacted]
Licences changes ([redacted] & [redacted] – Ml/d	Combined abstraction licence deployable output impact of changes to the Rivers [redacted] and [redacted] licence conditions expressed in Ml/d under the critical planning scenario. This should also be reflective of the actual levels of service referred to below.
Outage and process losses – Ml/d	The risk-based allowance for temporary loss of deployable output due to planned or unplanned events under the critical planning scenario, as defined under UKWIR guidance. Also, process losses as a result of treatment.
Net imports and exports – Ml/d	Net of imports and exports from the area as measured in deployable output.
Target headroom – Ml/d	The allowance for uncertainty in all components of the supply demand balance under the critical planning scenario, as defined under UKWIR guidance.
Total demand – Ml/d	Total demand for area. This should reflect any changes to actual level of service though the period.
Supply-demand balance (pre-interventions) – Ml/d	The difference between all supply components listed above and headroom, including imports and exports, and the total demand forecast, under the baseline critical planning scenario. Critical planning scenario is the scenario used to drive the SDB enhancement expenditure at AMP7 (e.g. MDO, DYAA, DYCP, etc.).
Leakage reduction – Ml/d	The benefits to the supply-demand balance under the critical planning scenario through leakage reduction (distribution losses and customer supply pipe losses) in the area, not included in the baseline demand forecast scenario.
Water efficiency/PCC savings – Ml/d	The benefits to the supply demand balance under the critical planning scenario through savings in household and non-household consumption in the area, not included in the baseline demand forecast scenario.
Supply-side options – Ml/d	The benefit of every preferred supply-side option to be delivered in the area under the critical planning scenario. Each supply option delivering a benefit before 2030 to be listed as a separate row.
Resultant supply-demand balance (after interventions) – Ml/d	The difference between all supply components listed above and headroom, including imports and exports, and the total demand forecast, after the planned intervention (both demand and supply – as listed above).
Actual TUB frequency (after interventions)	The expected return period of customer temporary use bans in the preferred critical planning scenario (after all SDB investment).

[redacted]

Actual NEUB frequency (after interventions)	The expected return period of customer non-essential use bans in the preferred critical planning scenario (after all SDB investment).
Actual EDO frequency (after interventions)	The expected return period of demand-side emergency drought orders in the preferred critical planning scenario (after all SDB investment).
Actual DP/DO frequency (after interventions)	The expected return period of implementing supply-side drought permits/drought orders in the preferred critical planning scenario (after all SDB investment).

[redacted]

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