Appendix RA01

Wholesale water base cost allowance

1 April 2019

Contents

Introduction

Ofwat has used econometric models to estimate wholesale water base cost allowance in PR19.

Broadly this process comprises the following stages:

- Econometric models constructed from 2011/12 to 2017/18 data.
- Future cost driver forecasts independently created by Ofwat and used to generate AMP7 cost allowance from the econometric models.
- Model output adjusted for upper quartile catch up efficiency, calculated from a historic analysis of the cost drivers in the cost models.
- Model output adjusted for additional forward efficiency challenge, derived from the work by Europe Economics and KPMG.

Un-modelled costs are separately assessed and added to the modelled cost allowance.

Following Ofwat's release of the details of the modelling process in its initial assessment of plans (IAP) in January 2019, we have identified a number of factors which are combining to significantly understate our base cost allowance and efficiency. This document addresses these factors.

We recognise that the components of Ofwat's econometric modelling process are interlinked, and therefore that altering one or several components of the process may have an effect on others. We have therefore taken an approach where we assess each of our challenges on a like for like basis to Ofwat's original models to determine its individual materiality and effect. We then conclude this report with a demonstration of the combined effect of all of our challenges on our base cost allowance and efficiency position.

The factors which we cover in this report are:

1. Restatement of the historical and future number of booster pumping stations;
2. Validity of Ofwat's own cost driver forecasts;
3. Business rates, no local council charged rates in Ofwat's assessment;

   and finally;

4. Efficient cost allowance, the combined effect of the above factors.

The four numbered points above correspond to the chapter numbers in this document.

1. Restatement of the historical and future number of booster pumping stations

Summary of the issue

We have identified that we have not amended the reported number of booster pumping stations following the definition change in 2016/17. This affects the current and backdated data from 2011/12 that we reported in 2016/17 and the 2017/18 APR, and the future forecasts from 2018/19 to 2024/25 in our business plan. This data has been used as a cost driver for the first time in Ofwat's PR19 wholesale water base cost models. We have gained independent external assurance on the restatement of our data for the April resubmission.

We commissioned Oxera to calculate the effect of our historically restated data on Ofwat's cost model construction and they determined that the models Ofwat utilised still pass the appropriate statistical tests and are of the same overall quality with our updated historical data incorporated. The increase to the number of boosters we reported is 1% of the total number reported by the industry, but nevertheless there is a small effect on the cost driver coefficients within the models.

On a historical basis, the restated data results in a significant increase to our comparative efficiency ranking, and therefore causes a small change to the upper quartile catch-up efficiency adjustment which is applied to future cost allowances in the models. On a future basis, our restated data results in a £51 million increase to our base cost allowance after accounting for our calculations of model coefficient changes and the higher upper quartile catch-up efficiency adjustment. We recognise that this value is subject to the models remaining broadly the same as used for the IAP.

This outcome aligns with independent models that we commissioned from Oxera for Ofwat's cost modelling consultation in March 2018, which included a range of cost drivers including average pumping head. The substantial majority showed us to be on or ahead of the upper quartile efficiency baseline.

1.1 Historical definition of this data line

The number of booster pumping stations has been reported historically as follows:

- In PR09 asset inventory table C3.1.
- In PR14 table W5 line 13.
- The 2015/16 cost assessment data return, table 'distribution' line 24.
- The 2016/17 cost assessment data return, table 'distribution' line 24.
- The 2017/18 APR, table 4P line 79.
- The business plan tables submission, table WN2 line 31.

We investigated the definitions that had been in place historically for this data line and we found that the definition has changed over time, broadly as follows:

- In the 2015/16 definition high lift pumping was not included, as confirmed by Ofwat in a query log response to Thames Water.
- In the following year, 2016/17, the initial definition also did not include high lift pumping however this was then changed in a re-release of the tables prior to submission, and included an additional sentence on the inclusion of high lift pumping.
- When the cost assessment data migrated to be part of the APR in 2017/18, the wording on high lift pumping had disappeared but the definition was now part of RAG4.07. The boundary definitions in RAG4.07 do state that high lift pumping assets are included in treated water distribution, and we do indeed allocate this function to treated water distribution for power costs and average pumping head reporting.
- Finally within the business plan tables the definition was the same as in the 2017/18 APR.

To ensure we fully understood the definition we have clarified it with Ofwat. On 21st February 2019 Ofwat responded to our first query with the following statement:

"*The term 'booster pumps' in this definition refers to the wider pumping activities as defined in the 'treated water distribution' activities set out in RAG4, and as such would include high lift pumping and any sites within the stated boundary points.*"

We further queried how sites which directly lift from boreholes into supply are treated. On 6th March 2019 Ofwat confirmed that:

"*Any site that boosts potable water into the distribution system from that site should be counted in Wn2 Line 31 'Total number of booster pumping stations'.*"

We welcome the clarity of the definition which has been provided and this has allowed us to ensure that we are now fully compliant with this definition in our restated data.

1.2 Restated data

Following the release of the IAP in January 2019 and additional checks with Ofwat on the definition, we have identified that we have not included the 'high lift' component of a source or treatment site (that supplies treated water into the network) in this site count, although we did believe they were included in the 2016/17 cost assessment data and 2017/18 APR.

We are disappointed that this error has passed through our rigorous assurance processes. The mistake was the result of a genuine oversight of the change in the definition rather than a systematic error. We have carried out a full review of what sites should fall into this count following Ofwat's clarification of the definition.

As well as the booster sites that are wholly within the pipe network that we have already included, we should have also included all of our abstraction sites and treatment works sites where either a dedicated 'high lift' pumping function exists or where a shared abstraction and high lift pumping function ('direct lift') exists.

Across both of our regions this amounts to an additional 38 sites in 2011/12 rising to 49 sites by 2024/25 compared to our originally stated data. We already proportionally allocate across the value chain for both power costs and average pumping head so the restated data will be consistent with these other allocations.

The restated data (historic and future) is as follows:

Historic	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2016/17
Number of booster pumping stations	111	112	111	111	111	111	114
Future	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Number of booster pumping stations	115	116	118	119	121	122	123

The number of sites now reported in this line can be validated against the number of sites we have reported in other lines in the business plan tables such as the number of borehole and surface water sources in table WR1 line 12, and the number of treatment works in table WN1. Our increased number of sites reported in the boosters line in table WN2 is consistent with these groundwater and treatment works sites reported in the other tables. The variation over time is due to a combination of factors:

- Whether sites were utilised in the year – we have only counted sites that were utilised i.e where it has pumped water to supply in the year;
- The construction of new sites – we have constructed new booster sites to meet growth needs over time, and further constructions are planned for future years.

Our assurance framework had identified this data as low risk due to it being a simple, factual data line, historically understood and not subject to significant variation over time. We unfortunately did not identify the significance of the change in definition in 2016/17, for the inclusion of 'high lift' pumping sites. We have learned the lessons of this error and will implement additional checks on all our operational and asset-based data in our next assurance plan where we intend to make this a targeted area. For the business plan resubmission we have examined the other operational or asset based data lines across WR1,

WN1 and WN2, and we are satisfied that there are no other definition conflicts in the rest of the data.

Jacobs have has independently assured our restated figures. They have undertaken a comprehensive systematic review of the additional sites we have included, firstly by studying our operational diagrams and secondly by visiting a sample number of sites to verify the existing pumping configurations.

1.3 Effect on cost model construction

We recognised that altering our historical values for this data may cause the models Ofwat has constructed to behave differently. We commissioned Oxera to rebuild Ofwat's models using our restated historic data. The additional number of sites we have included is 1% of the total number reported by the industry in 2017/18. Oxera's modelling identified that the coefficients do change slightly as would be expected, however they all remain statistically significant and the overall quality of the models is not affected. We asked Oxera to undertake diagnostics tests on the revised models, and they have provided the following comments on this:

"As part of the analysis, we focused on statistical diagnostic tests that Ofwat has considered in the modelling consultation in March 2018 and in the analysis undertaken for IAP. Specifically, we tested for the existence of possible non-linear relationships between costs and cost drivers using the Ramsay RESET test and for the presence of multicollinearity with the Variance Inflation Factor (VIF). Using alternative booster pumping station data for SSC has little impact on the statistical diagnostics. The RESET test persistently suggests that there are no further non-linear relationships (p-value greater than 10% in all models) and the VIF score is always above 10 suggesting that multicollinearity may be an issue. The latter is to be expected given translog functional form with respect to weighted average density in Ofwat's IAP models. The overall model fit improves marginally in TWD models (from 0.968 to 0.970) and reduces slightly in WW models (from 0.978-0.979 to 0.976-0.978) but the cost driver remains statistically significant across all specifications. In addition to the tests used by Ofwat, we also tested for the existence of a panel structure in the data (and therefore the appropriateness of the random effects estimator compared to pooled OLS) using the Breusch-Pagan test. The test supports the use of the random effects estimator over pooled OLS in all models tested." – Oxera 12th March 2019.

1.4 Effect on historic efficiency

We substituted the revised cost driver coefficients for the three models in section 1.3 into Ofwat's spreadsheet FM_WW2 which is used to calculate the historic comparative efficiency position.

We have also replaced the original number of booster stations with our restated data in spreadsheet FM_WW3 which captures the cost drivers. This spreadsheet calculates the number of booster stations per length of mains for 2011/12 to 2017/18 which is then passed into the comparative efficiency spreadsheet model FM_WW2.

This has a significant effect on our comparative efficiency position in several of the rankings and the final triangulated ranking output from model FM_WW2. The change in ranks also causes the upper quartile catch-up efficiency value to become slightly tougher.

The efficiency score derived from the historic data also passes through into the company specific efficiency challenge used for some enhancement cost areas, so this value would also become zero given our improvement in efficiency to better than upper quartile in base models.

We appreciate that changes to models or data from other companies may also affect historic efficiency assessment, and that Ofwat will want to rerun its calculations itself to validate our conclusions.

1.5 Future cost allowances

We have substituted the revised cost driver coefficients for the three models in section 1.3 into Ofwat's spreadsheet FM_WW4, which is used to calculate the future cost allowances.

We have also replaced the original number of booster stations with our restated data in spreadsheet FM_WW3 which captures the cost drivers. This spreadsheet calculates the number of booster stations per length of mains for 2020/21 to 2024/25 which is then passed into the future cost allowances spreadsheet model FM_WW4.

We have also replaced the upper quartile catch-up efficiency value in spreadsheet FM_WW4 with the revised value that results from the restatement of our historic data and the update of the cost driver coefficients (as discussed in section 1.4 above).

As we have restated the number of boosters to a corrected higher value, this results in an increased cost allowance for AMP7, post all efficiency challenges, as shown in the table below:

	Business plan	Ofwat IAP January 2019	Revised data, coefficients and UQ efficiency	Change from IAP
Wholesale water base costs	£404m	£369m	£420m	+£51m

The revised data results in a cost allowance that is in excess of the base costs we put forward in our business plan by 4%, demonstrating that our costs are efficient in the future as well as in the past. We recognise that this value is subject to the models remaining broadly the same as used for the IAP.

2. Validity of Ofwat's own cost driver forecasts

Summary of the issue

In this section we examine Ofwat's forecasts of our cost drivers for the following:

- Treatment complexity
- Property numbers
- Length of mains

For all cost drivers, Ofwat has used its own forecasts rather than those from companies' business plan tables. In our case, Ofwat's forecasts significantly understate our future operating conditions and this materially affects our cost allowance.

For treatment complexity, Ofwat has used a simple average of two or three years prior to 2017/18. This significantly understates our future treatment complexity which is increasing over time due to a need to increase the complexity of several treatment works. These projects are planned to either happen in the remainder of AMP6 or in AMP7, in which case they feature in our business plan enhancement costs. By not taking these into consideration in the cost driver forecasts, our cost allowance is understated by £11m for AMP7.

For property numbers, Ofwat has used a trend based approach instead of plan based approach required by the water resources management plan, which results in an understatement of our property growth of 2.1% by 2024/25 and therefore an understatement of our cost allowance by £3.94 million for AMP7.

For length of mains, Ofwat has used a trend based approach in the same way as properties. Our mains length forecast is linked to the forecasts made for new connection numbers in the water resources plan and to the new development enhancement costs in table App28. Ofwat's forecast understates our length of new mains by 3.6% by 2024/25 and therefore results in an understatement of our cost allowance by £2.5m. There is also a consequential effect on the number of boosters per length of main cost driver if the length of mains forecast changes, which is discussed in more detail in chapter 4 where we bring together the combined effect of all challenges.

2.1 Treatment complexity

Ofwat uses a treatment complexity cost driver in four out of five of its wholesale water base models. There are two forms of the cost driver, which derive from the same data set, one representing a subset of treatment complexity (bands 3 through 6) and one representing all complexity bands in a weighted average form.

Ofwat's forecast significantly understates our future treatment complexity in both cost drivers as it does not account for the treatment enhancement we are making in the remaining two years of AMP6 or in AMP7.

The following table shows the treatment complexity upgrades that we are undertaking in the remainder of AMP6 and in AMP7, which takes us from the current 71% band 3-6 complexity to 85% by 2024/25.

Year	Site	Scheme	Volume
2018/19	Hopwas groundwater source Kinver groundwater source	Installation of UV Installation of UV	2 Ml/d 11 Ml/d
2019/20	Prestwood groundwater source Duxford Grange groundwater source	Installation of UV Installation of UV	19 Ml/d 2 Ml/d
2020/21	Croydon groundwater source Kingston groundwater source St Ives groundwater source	Filtration and installation of UV Filtration and installation of UV Filtration and installation of UV	1.4 Ml/d 1.0 Ml/d 1.5 Ml/d
2021/22	-	-	-
2022/23	Ashwood groundwater source	Nitrate removal	18 Ml/d
2023/24	-	-	-
2024/25	Cookley groundwater source Somerford groundwater source	Nitrate removal Installation of UV	16 Ml/d 2 Ml/d

As of March 2019 we have completed the installation of UV at Kinver and Hopwas groundwater sources and these sites are operational. The Prestwood and Duxford Grange projects are underway and will be completed in the 2019/20 year. These schemes mean that by the end of AMP6, our band 3-6 treatment complexity will have risen to 75%.

The AMP7 schemes that lift our band 3-6 complexity to 85% have been included in our business plan and considered in the IAP stage of the enhancement cost allowance. By the end of AMP7 the band 3-6 complexity will have risen to 85%.

We have substituted Ofwat's forecasts for these two cost drivers with our correct forecasts from our business plan data, into Ofwat's FM_WW3 and FM_WW4 models (keeping everything else the same). The effect is an increase of base cost allowance of £11m (post catch up and forward efficiency challenge), representing over 2% of our net business plan totex of £538m.

2.2 Property numbers

The number of properties that a water company supplies is one of two cost drivers chosen to represent overall scale, which has a direct bearing on the absolute costs incurred for delivery of services. Ofwat uses the number of properties in four out of five of its wholesale water base models as the main scale driver.

The difference in forecast arises from Ofwat's use of a simple trend based approach, as opposed to a plan based approach used in the business plan forecast that is now required by the water resources management plan methodology.

The plan based methodology is a change to recent guidance and is reflective of the change in the planning authority housing aspirations. This change to an aspirational housing needs assessment is driven by central government who has cascaded a greater building target down to the UK's planning authorities. To support the drive for delivering a greater number of new houses over the short and medium term by introducing changes to the National Planning Policy Framework (NPPF) which, amongst others spells out that development of brownfield sites should take preference over greenfield sites. The plan based methodology therefore now reflects this increased pressure on housing development which, if the strategy succeeds, lead to an increased rate of growth of housing development in the future compared to the past.

The property forecast from the plan based approach is produced by following the EA/Ofwat/Defra/NRW water resources planning guidelines and by referring to relevant UKWIR publications. We use Artesia and CACI consultancies as they are both industry leading technical specialists in this area. We describe the process in detail in section 6 of the draft WRMPs that we published for public consultation in 2018 as well as within the relevant appendices. As we use the same consultants that produce many other companies' demand forecasts, our assumptions are in line with those made by our peers as well as being in line with the regulatory guidance. We use the best data available and we take this from official sources such as ONS and Local authorities. This will align with data used by central and local government.

As there is no cost true up in the wholesale price control for property growth either outperforming or underperforming the forecast, it is imperative that the most robust forecasting approach is adopted which takes appropriate account of the changing future central government strategy, which the plan based approach achieves.

The gap between Ofwat's forecast and our forecast is at 2.1%. Substituting our property forecast into Ofwat's base cost model spreadsheet FM_WW4 (making no other changes) results in an increase to our cost allowance of £3.94m, post all efficiency adjustments. This has a materiality of 0.7% against our net business plan totex of £538m.

2.3 Length of mains

The length of mains that a water company operates to supply customers is one of two cost drivers chosen to represent overall scale, which has a direct bearing on the absolute costs incurred for delivery of services. The length of mains cost driver is used in just the TWD1 wholesale water base model.

Our length of mains forecast is dependent on two other forecasts:

- The number of new connections
- The average length of main laid per new connection

Both of these forecasts are used to derive the cost forecast that is used in table App28 for new development enhancement. The number of new connections forecast links to the property forecast derived in the water resources management plan, and the average length of main laid per new connection is derived from recent historical data and an examination of the future mix of schemes planned by developers.

Therefore, the mains length forecast we made in our business plan links to our property forecast in our business plan, our water resource plan property forecasts and to our new development enhancement costs.

Ofwat's forecast uses a linear trend of the historical data, as it does with property growth, and therefore takes no account of the future increased growth arising from the plan based approach (as with properties) or the recent and future mix of development types which influence the length of main laid.

The gap between Ofwat's forecast and our forecast is 3.6%. Substituting our property forecast into Ofwat's base cost model spreadsheet FM_WW4 (making no other changes) results in an increase to our cost allowance of £2.5m, post all efficiency adjustments.

However we recognise that the mains length value acts as the normaliser for the boosters per length of main variable, which we are restating (see chapter 1), and a higher value for length of mains results in a lower value for boosters per length of mains, negating the increase to the cost allowance that changing the length of mains forecast alone would give.

We believe that Ofwat should use our mains length forecast even though the effect is small and negated by the boosters per length of main reduction, because it ties in to our enhancement costs for new development and to our property growth forecasts. It also affects the boosters per length of mains cost driver. Therefore, to properly assess our efficiency taking on board all of the factors, our mains length forecast should be utilised.

Chapter 4 presents the combined effect of all of the changes on the cost allowance.

3. Business rates, no local council charged rates in Ofwat's assessment

Summary of the issue

The valuation office ratings that Ofwat has used for independent assessment of all companies rates do not include any business rates charged locally by councils. This means that the rates for our main office sites located at Green Lane, Walsall and Fulbourn Road, Cambridge have not been allowed for.

These offices are appointed business assets and should naturally be included in Ofwat's assessment of our business rates. This addition, of £1.4m into base costs, would bring Ofwat's assessment in line with our business plan.

Ofwat's approach to modelling business rates in the IAP was to use the 2017 cumulo rateable values provided by the Valuation Office.

The rateable values used are as per the published central rating list which contains the cumulo rating assessments of the network property of major transport, utility and telecommunications undertakings and cross-country pipelines.

The central list values however exclude any business rates charged locally by councils that are not assessed as part of the cumulo valuation. We believe that these sites need to be included in the total allowance. We note that Ofwat has included these sites when they have assessed business rate costs at previous price reviews.

We have two such sites; our offices at Green Lane, Walsall and Fulbourn Road, Cambridge.

The valuations for these premises can be found on the gov.uk website where it is possible to search by address. Please see the links below for:

Green Lane, Walsall, WS2 7PD – RV £480,000: https://bit.ly/2TzhLdw

90 Fulbourn Road, Cambridge, CB1 9JN – RV £312,500: https://bit.ly/2tTxEgp

There is no transitional relief for either location.

The total rateable value of these premises is £792,500. This should be added to the RV currently included in Ofwat's modelling of £10,000,000 to give a revised RV figure of £10,792,500. This change brings Ofwat's allowance for business rates into alignment with our business plan submission.

4. Efficient cost allowance, the combined effect of the above factors

Summary of the issue

In sections 1 to 3 above we have individually discussed issues with the assessment of our base cost allowance.

As Ofwat's modelling approach has several interactions, between cost model coefficients, catch-up efficiency, cost driver forecasts and un-modelled costs; we wanted to model all of the changes together to determine the net effect on our cost allowance and efficiency.

We have updated Ofwat's modelling spreadsheets with our changes which collectively result in a significant increase to our cost allowance compared to the IAP.

In the chapters above we have presented:

1. That we have made an error in our reporting of the number of booster stations. Following clarification of the definition with Ofwat, we should have counted water resource sites and/or water treatment works that supply water into the distribution system. We have restated our data in our 1st April business plan submission to correct this error.

2. That our future forecasts for treatment complexity, properties and length of mains are robustly derived, closely linked to our water resources management plan or business plan activity, and therefore should be used in place of Ofwat's forecasts. We believe it is important to use all of our own forecasts because there are interactions between them or effects on other cost drivers due to normalising. Using all of our forecasts will ensure a consistent view of our efficiency position taking into account all of the factors we have presented.

3. That Ofwat should include the local council charged element of our business rates for our two main office sites in Walsall and Cambridge.

We have modified spreadsheets FM_WW2, FM_WW3 and FM_WW4 to take account of all of the changes we have covered in this document, in order to set out the combined effect of all changes on our cost allowance and efficiency position.

The changes we have made are shown in the table below for each model, and cover all of the changes that we have individually discussed in chapters 1 to 3 of this document.

Spreadsheet	Change
FM_WW2	• We have updated the model coefficients for models TWD1, WW1 and WW2 in the 'model coeffs' sheet to reflect the change to the models, calculated by Oxera on our behalf, due to our restated historical data for the number of booster pumping stations. This changes the efficiency ranks and upper quartile catch-up efficiency value.
FM_WW3	• We have updated our historical and future values for the number of booster pumping stations arising from our restatement of this data. Restating the number of booster stations causes the calculated cost driver, booster stations per length of main, to change. • Instead of taking Ofwat's AMP7 forecasts for the cost drivers forward into the FM_WW4 spreadsheet, we have instead taken our business plan forecasts forward, including the restated data for booster pumping stations.
FM_WW4	• We have updated the upper quartile catch-up efficiency value calculated in FM_WW2 in the 'controls' sheet, cell F5. • We have updated our cost driver lines for properties, mains length, treatment complexity bands 3-6, weighted treatment complexity and number of booster stations per length of mains. These all appear in sheet 'forecast drivers' and we have updated cells K85:O89 which represent the five years of AMP7 for SSC. • We have updated the model coefficients for models TWD1, WW1 and WW2 in the 'Coeffs' sheet to reflect the change to the models, calculated by Oxera on our behalf, due to our restated historical data for the number of booster pumping stations. • We have added £1.49m to our un-modelled costs to allow for the missing local council charged component of our business rates.

These changes collectively result in a significant increase to our cost allowance compared to the IAP.