4. Delivering outcomes for customers

1. Introduction

In our fast track Draft Determination (DD) response we made a small number of representations relating to performance commitments where we had opted out of the early certainty clause. In this chapter we build on and that response with:

- Representations on **performance commitments or ODIs** where slow-track determinations have changed either the target or the incentive arrangements which we believe create sector wide risks of make Severn Trent an outlier.

- In response to a change in the we have provided **a reforecast baseline for speed of response to leaks** to take into account differences between the definition set out in our DD and the basis on which we originally reported in 2018 (we have not provided updates on other performance commitments, noting that these are not required from fast track companies (in table OC.4) or will be done through a separate process following 2019/20 outturn (leakage and PCC).

- We have undertaken a further detailed review of the **performance commitment definitions** set out in the DD to ensure that they are consistent with relevant reporting guidance, are clearly defined, easy to understand and act in the best interests of customers. We have identified a small number of definitions – in addition to those in our fast track DD response - where minor changes could be made to improve the PC and avoid ambiguity in the future.

- In our **PR14 reconciliations submission** and commentary (15 July 2019), we put forward our forecast position against our Sustainable Sewage Treatment commitment (SC-5). We explained that there was one additional site, Finham sewage treatment works, where the final solution was still being reviewed to confirm it met the acceptance criteria. This document provides an update on that scheme and seeks to update the forecast position included in the 15 July 2019 submission.

2. Performance commitments and outcome delivery incentives

In response to our fast track draft determination (DD) we made a series of representations relating to our common performance commitments and bespoke commitments where we had opted out of the early certainty principles. We look forward to Ofwat's fuller response to these representations in our final determination (FD), but are pleased that in the recently published slow track DDs there have been a number of sensible changes, notably the expanded deadband for CRI in the first two years of AMP7 and the glide-path for supply interruptions (although as we discuss we strongly believe the target for supply interruptions requires further adjustment to ensure it remains deliverable).

Since our DD response however, Ofwat has made four further interventions against the package of PCs and ODIs set out in our fast track draft determination. Where these interventions create sector wider issues or make Severn Trent an outlier, we have specific representations. These relate to five areas:

- SIM – by applying the average SIM score over the first four years of AMP6 to 2019/20 retail revenues the financial incentive payments are disconnected from the underlying level of performance – which can be seen by the C-MEX quarter one scores (and this shows a particular disconnect for Severn Trent);
- Supply interruptions - there is a clear and compelling case for adjusting the proposed UQ target to account for the known optimism bias and promote a more realistic albeit very stretching target;
- CRI – the interventions make this the third most powerful incentive on average, however given the infancy of the measure, issues with assessment and our own improving performance we do not believe the interventions are warranted;
- mains repairs – where our penalty rate is significantly above the upper bound of the reasonable range and the proposed intervention on targets appears disproportionate compared with the rest of the sector; and
- unplanned outages – where slow track companies have been given a glide path to reach the industry 2024/25 target, however, this does not appear to have been applies to our targets.

We discuss each of these in turn.

2.1 Application of the SIM incentive

In the slow track draft determination, the full SIM methodology has been published. In the underlying SIM financial model a SIM penalty of £12m has been calculated on the basis of:

- a penalty rate of 2.02% of retail revenue;
- applied to the AMP6 retail revenues of £121m.

The issue with the proposed approach is that SIM has only been in operation for the first four years of this AMP. This is because Ofwat took the decision *not to run the SIM in 2019-20, but to run a shadow version of C-MeX instead*[1]," (which would help transition to C-MeX).

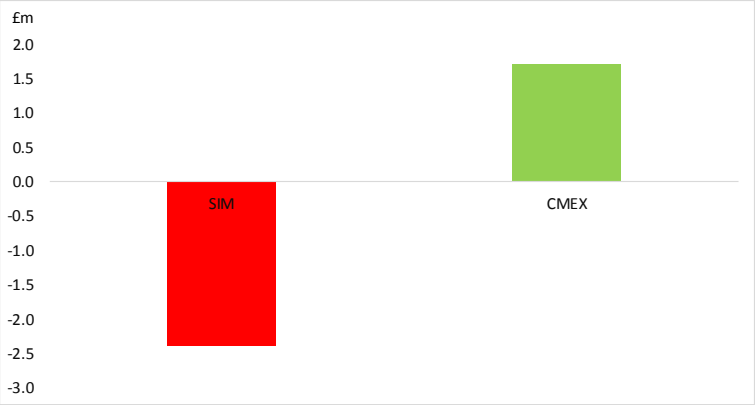
With SIM being retired and CMeX already kicking-off in shadow (and hence reputational form), applying SIM financial incentives to 2019/20 would be odds with this transition, especially if it means judging SIM performance from results in previous years.

It would be more appropriate if SIM incentive payments were not applied to 2019/20, thereby reflecting the reality that genuine SIM scores are not be available for the year. A further advantage is that it would resolve the issue of incentives being applied to a blind year, whereby companies would otherwise see incentive payments determined by average performance from the four preceding years – in other words, financial incentive payments that are disconnected (potentially significantly disconnected) from the true level of performance.

[1] "*Delivering Water 2020: Our methodology for the 2019 price review – Appendix 3: C-MeX and D-MeX*," p6

The last point is particularly relevant for Severn Trent as we can observe a significant improvement in performance this year which would not be reflected in the underlying incentive payment. **If we take CMEX scores from Q1 this year as a proxy of the full-year SIM results for 2019/20, then we would be due a reward of £1.7m instead of the £2.4m penalty that is being applied through the 5-year application of SIM.**

Figure 1 – 2019/20 incentive payment using SIM v C-MEX scores

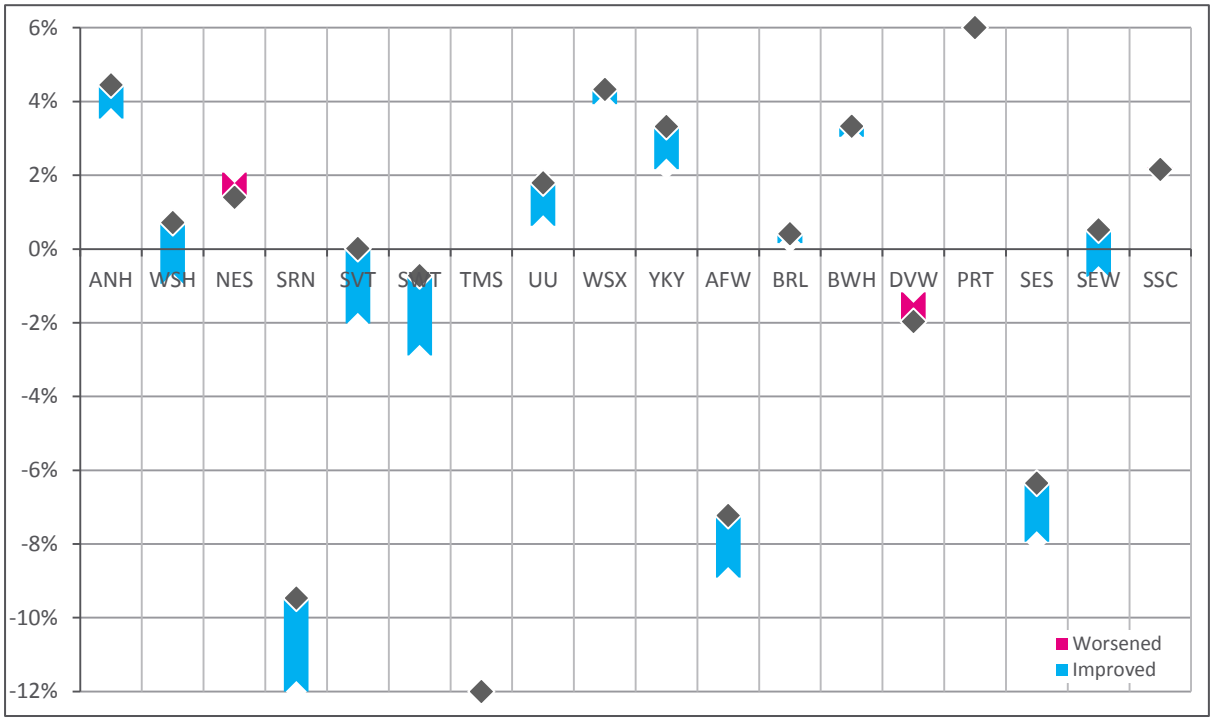


The obvious rebuttal to this approach is that as CMeX uses a different methodology to SIM, a different result might be expected even if there is no change in underlying performance. So, we've carried out cross-checks to make sure that we're not overstating the performance implications of CMeX, simply because of the methodological changes. Our approach was to create an updated set of AMP6 SIM scores for the sector using the service component of C-NEX.

Under our approach we have been able to blend the CMeX data together with the existing SIM scores to estimate a 5-year average[2] score for AMP6. The proxy results that then emerge see our **current 2.02% (£12m) eliminated, alongside notable movements in the applicable SIM payments for a number of other companies**. All of this emphasises the prospect that the incentive payments attributable to 2019/20 will be very much at odds with the performance provided to customers for the year.

[2] We have used industry wide CMeX data for other companies that is on an aggregate basis (which is the only published version), and only the service scores for Severn Trent. The details of how we carried out our calculations are provided at Annex A to this document.

Figure 2 – Change in SIM reward/penalty allocation when CMeX-based SIM estimates for 201920 are incorporated



We're not suggesting of course, that the CMeX score should be used to calculate the incentive payment for 2019/20 (although there would be a stronger logic than using average SIM scores) – the above examples necessarily involve assumptions. However, they do serve to illustrate the extent of the risks and challenges when applying incentives that are blind to performance. Such an outcome would mean some customers are paying for performance that never materialised.

Were SIM to be continuing, we might expect a true-up mechanism to be a suitable solution that would allow 2019/20 performance to be factored into incentive payments, as occurred at PR14. However, because genuine SIM scores won't be recorded and companies are being encouraged to look towards CMeX, this is not possible or even desirable.

As noted above, the shadow reporting of CMeX means that there is a reputational incentive already in place to take over from SIM for 2019/20, and there is a clear basis for limiting the financial incentives for SIM to the four years from 2015/16 to 2018/19.

Box 1 – Methodology for re-estimating AMP6 SIM scores

Step 1 – estimate 2019/20 SIM scores for SVE

For SVE, we updated the 2018/19 SIM score using the percentage-change in the service-component of CMeX – between the average scores from the pilot studies and the latest (Q1) results. As shown in the table below, this has increase increased 5%.

Table A1 – CMeX service scores for SVE

	2018/19 pilot average	Q1 2019/20	Change
CMeX service score	7.83	8.234	5%

Table A2 – Estimated 2019/20 SIM score for SVE

	2018/19 score	2019/20 estimate	Change
SIM score	83.657	87.974	5%

Because this CMeX component is the most closely related to SIM, we used it to infer the annual change in our SIM score. This sees our 2018/19 SIM score of 83.534 increase to 87.974 – our 2019/20 estimate.

Step 2 – estimate 2019/20 SIM scores for the other companies

To estimate the 2019/20 scores for other companies, we needed a slightly different approach because we do not have granularity on their underlying CMeX service scores. Instead, we used the percentage change in their aggregate CMeX scores – between the average of the two pilot studies and the latest (Q1) results. We then applied this percentage change to the 2018/19 SIM scores to create estimated scores for 2019/20. These values relating to these calculations are in the table below.

Table A3 – other companies overall CMeX scores and estimated 2019/20 SIM score

	CMeX scores			Estimating SIM		
	2018/19 pilot average	Q1 2019/20	Change	2018/19 score	2019/20 estimate	Change
ANH	80.300	80.400	0.1%	89.103	89.214	0.1%
WSH	81.400	82.710	1.6%	86.324	87.713	1.6%
NES	81.100	77.040	-5.0%	86.797	82.452	-5.0%
SRN	71.100	72.910	2.5%	78.629	80.631	2.5%
SWT	75.200	75.780	0.8%	87.016	87.687	0.8%
TMS	70.200	65.820	-6.2%	76.703	71.918	-6.2%
UU	77.300	77.670	0.5%	87.000	87.416	0.5%
WSX	79.900	80.140	0.3%	87.578	87.841	0.3%
YKY	78.800	79.760	1.2%	87.731	88.800	1.2%
AFW	72.700	72.570	-0.2%	80.677	80.533	-0.2%
BRL	76.200	74.980	-1.6%	85.255	83.890	-1.6%
BWH	n/a	n/a	Assume no change	86.645	86.645	0%
HDD	75.600	74.500	-1.5%	80.290	79.122	-1.5%
PRT	82.400	81.580	-1.0%	89.233	88.345	-1.0%
SES	73.300	74.160	1.2%	80.153	81.094	1.2%
SEW	71.200	72.300	1.5%	85.236	86.552	1.5%
SSC	78.700	76.510	-2.8%	87.123	84.698	-2.8%

Step 3 – estimate the 5 year SIM score for AMP6 and the resulting SIM incentive allocation

We created an update view of the AMP6 SIM score, as a weighted average of the existing 4-year SIM score (80% weight) and the 2019/20 estimates (20% weighting).

Table A4 – estimated 5 year average SIM score for AMP6, incentive allocations and performance rankings

	SIM performance scores		SIM incentive allocation		Company SIM performance rank	
	4-year average SIM score	5-year estimated SIM score	With 4-year average SIM score	With 5-year estimated SIM score	With 4-year average SIM score	With 5-year estimated SIM score
ANH	87.018	87.457	3.54%	4.45%	3	2
WSH	84.211	84.911	-0.94%	0.72%	11	9
NES	86.102	85.372	2.07%	1.40%	7	8
SRN	77.273	77.944	-12.00%	-9.47%	18	17
SVE	83.534	84.422	-2.02%	0.01%	13	12
SWT	82.984	83.925	-2.89%	-0.72%	14	13
TMS	77.286	76.212	-11.98%	-12.00%	17	18
UU	85.196	85.640	0.63%	1.79%	8	7
WSX	87.265	87.380	3.93%	4.33%	2	3
YKY	86.158	86.687	2.17%	3.32%	6	5
AFW	79.211	79.475	-8.91%	-7.23%	16	16
BRL	84.898	84.697	0.16%	0.41%	9	11
BWH	86.709	86.696	3.04%	3.33%	4	4
HDD	84.060	83.073	-1.18%	-1.97%	12	14
PRT	88.564	88.520	6.00%	6.00%	1	1
SES	79.821	80.076	-7.94%	-6.35%	15	15
SEW	84.330	84.774	-0.75%	0.52%	10	10
SSC	86.190	85.891	2.22%	2.16%	5	6

We calculated an updated view of the sector SIM incentives payable, based on the estimated 5 year average SIM score. We did this by overlaying these results into the Ofwat SIM model, by over-writing the 4-year average scores. This give the updated results set out in the above table.

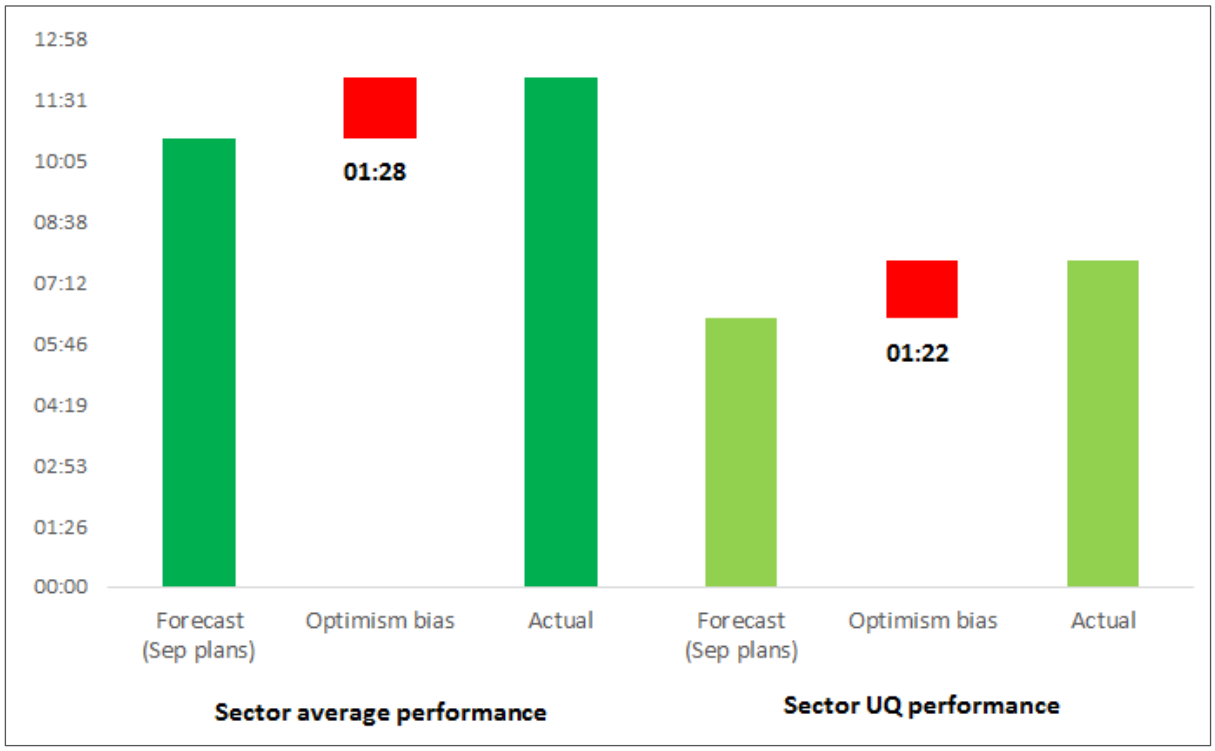
2.2 Supply interruptions – target

We support the concept of the UQ ambition and the need for our sector to continuously push forward the standards of service that we deliver to our customers. However the use of the forecast UQ (3:00) raises significant concerns about deliverability given that the actual UQ has ranged between 06:18 and 07:43 in this AMP. In fact only one company has achieved less than 03:00 during that time.

Although the introduction of a glidepath is welcome, it still doesn't address the fundamental issue that the forecast UQ has been set at a level that will be undeliverable for the majority of companies. This is because it requires a 50%+ improvement for the vast majority of companies. **Based on current performance, every company except Portsmouth would fail supply interruptions in the first year of AMP7.** Such an outcome would be hugely damaging to the reputation of the sector and not be reflective of poor performance as every company could be delivering best ever levels but against an unattainable target.

We recognise that the target included in the Draft Determinations has been set on the basis of company forecasts from the September plans. **However these forecasts suffer from an optimism bias**. This can be illustrated by comparing what companies said they would deliver for 2018/19 in their September plan with what they actually delivered. This is presented below for both average performance and UQ performance.

Figure 2 - Supply interruptions 2018/19 performance



The above analysis shows a clear and consistent optimism bias in company forecasts of approximately 1 min 30 seconds, or 20%. Given that this bias arose when 6 months of performance data was already known, this bias could be even larger in practice.

This analysis demonstrates that there is a clear and compelling case for adjusting the proposed UQ target to account for the known optimism bias and promote a more realistic but still very stretching target. To ensure consistency with the PR19 methodology we propose that the bias should be calculated on the UQ measure, as opposed to sector average. This would lead to a small uplift to the targets of 1:22 each year, as set out in the table below. We note that this target would still require a very significant improvement on current performance (only two companies would meet the target today) however it would more realistic than the current target.

	Year 1	Year 2	Year 3	Year 4	Year 5
DD target	05:24	04:48	04:12	03:36	03:00
Optimism bias	01:22	01:22	01:22	01:22	01:22
Revised UQ target	06:46	06:10	05:34	04:58	04:22

2.3 CRI – incentive rate

In our September business plan we had originally proposed that CRI would be reputational only on the basis that the DWI has its own enforcement powers. In the resulting assessment of our plan, Ofwat noted the following intervention:

> *"We are intervening to ensure companies' outcome delivery incentive rates for common and comparable performance commitments sit within an aligned range. The company should add an outcome delivery incentive underperformance rate of £1.260m/index point."*

As part of our acceptance of fast track status we accepted both the need for a financial incentive and the incentive rate specified. Our acceptance of what we considered an acceptable incentive rate was acknowledged in the fast track DD, which stated, "*No intervention required. The company has complied with the action.*"

In the slow track DDs a number of new policies have been introduced to support further adjustments to incentive rates. For non-customer facing ODIs, including CRI, four tests have been applied to consider whether the incentive rate should be further increased. Where a company is deemed to fail tests 1 and 2 the incentive rate is set at the industry lower bound, whilst failing tests 3 and 4 lead to the incentive rate being set at the sector average.

Overview of Ofwat test applied to proposed non-customer facing ODI rates

Check	Description	Rationale
1. Horizontal check	Are the proposed rates materially below the lower bound of the reasonable range?	Identifies whether the proposed rate is an outlier which requires further investigation. We are concerned to ensure a minimum level of protection for customers from the failure of companies to investing in and maintain assets and as such are focused on the lower bound of the range rather than the higher bound of the range.
2. Company specific evidence	Does the company have a compelling reason for the rate it has proposed, has it explained how that rate benefits customers?	Identifies if the rate the company has proposed takes into account a compelling company-specific reason.
3. Past performance and past delivery check	Has the company underperformed on its equivalent performance commitment during the 2015-20 and/or the 2010-2015 period? Does the company have a well-defined plan to improve performance?	Identifies whether the company requires a stronger incentive to ensure planned improvement is sustained.
4.Comparative performance/ stretch check	Is the comparative performance poor (worse than the 'good' level – refer previous section)? Is the degree of stretch implied by the 2024-25 performance commitment level relative to current performance above or below industry average?	Identifies whether the company requires a stronger incentive to improve closer to the 'good' level of performance of all other companies.

In the slow track DD these tests have been used as the basis for increasing our CRI incentive rate by 50% from £1.26m to around £1.9m per CRI point to be in line with the sector range average for this ODI. The tests have also been used to increase the penalty rate for other companies.

For Severn Trent the explanation given is that, "*the underperformance rate increased due to poor performance*[3]." This increase in the penalty rate suggests that we that we did not pass either check 3 and/or check 4. In practice this means there were either concerns about our:

- past performance on CRI and proxy measures, which means a higher incentive rate is required to ensure planned improvements are sustained; and/or
- comparative performance on proxy measures as noted by Ofwat (given CRI is a new measure).

The application of the above rules would lead to CRI being an extremely high powered incentive – the third strongest ODI on average, whereby companies could easily incur £50m in penalties over the AMP. We have a number of concerns with this intervention, notably:

- it means a very significant amount of money is dependent on a measure which is unaudited;
- the methodology is relatively immature compared to other PCs and is more reliant on assessments that are subjective in nature;
- the process through which scores are developed is very much in its infancy and naturally doesn't have the same rigour as other ODIs; and
- the increase in the penalty rate for Severn Trent has occurred despite improving performance.

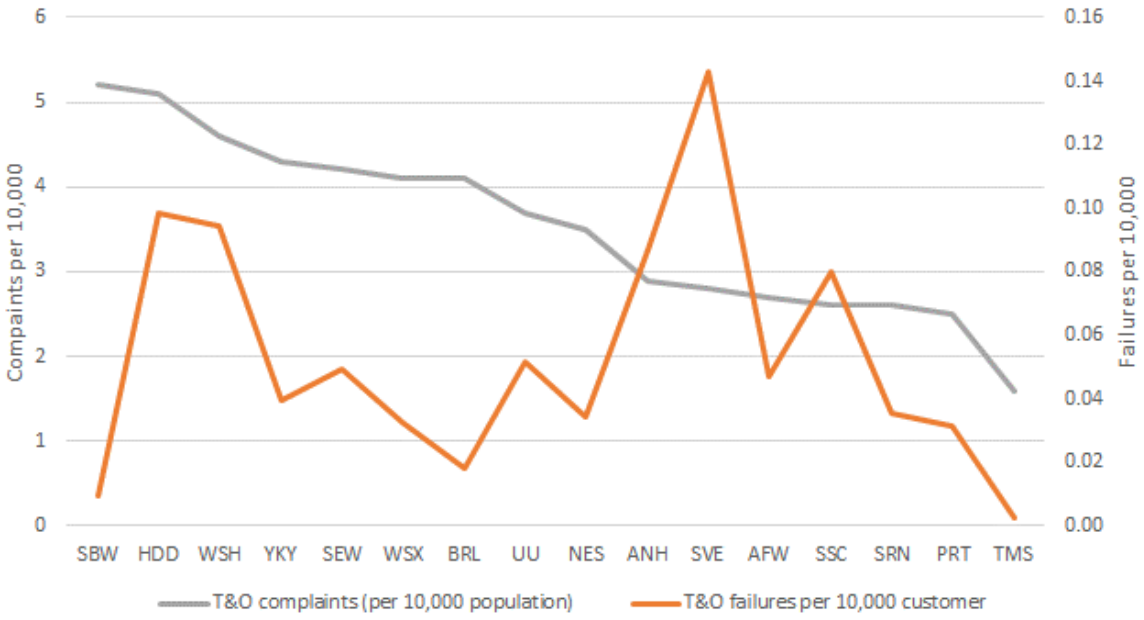
[3] PR19 draft determinations: Delivering outcomes for customers' policy appendix, p76, section 4.4.6.

2.3.1 Appropriateness of CRI being such a high powered ODI

At this early stage in CRI's development we don't think it is appropriate that the interventions lead to this ODI being the third most powerful on average. That is not to say that we don't support CRI – we think it is a great measure because it helps shift the focus of companies towards risk.

However we don't think it is appropriate at this early stage in the CRI's development that its incentives are effectively supercharged. Because CRI is different to other measures, drawing on unaudited data, which is often very subjective in nature, it is difficult to reliably compare performance at this stage (in contrast to other ODIs where the assessment is much more binary in nature). However the approach to incentive rates for CRI means that on average across the sector it is the third most powerful ODI based on published P10s.

The fact that CRI is new also means there are still a number of methodological issues to resolve, particularly in terms of reducing the subjective nature of the assessment. For example some scores are a function of company policy and more stringent companies are effectively punished. On other components like taste and odour the current assessment relies on each company having a panel that judges the taste and odour of drinking water. The issue with this approach is that the results contrast significantly with the (audited) customer complaints data on taste and odour, illustrated in the figure below.



In practice we would expect a strong correlation between the stated preference (failures) and the revealed preference (complaints) given that they relate to the same underlying issue – the taste and odour of drinking water. However we can observe from the above analysis that there is no correlation between these two data sets, with the correlation coefficient equal to 0.05 (a factor of +/-1 is perfect correlation). This raises questions about the consistency of how the T&O failures are being measured and reported by the panels (in contrast we can have more confidence about the accuracy of complaints give the size of the data set).

We also note that there are a number of process issues that need be addressed to ensure this measure has the same level of robustness as other high powered ODIs like sewer flooding. For example:

- the assessment process is not time bound, so performance from prior years impact scores for multiple years moving forward – this means AMP7 scores will be impacted by AMP6 performance;
- companies do not have performance updates until the year is largely over, limiting the ability to actually respond to the incentive in-period; and
- there is no known external assurance process by an independent party, which there is no known external assurance process by an independent party, which is particularly important given the size of

the incentive, the maturity of the measure and we believe would be expected for a comparable ODI with a reward element.

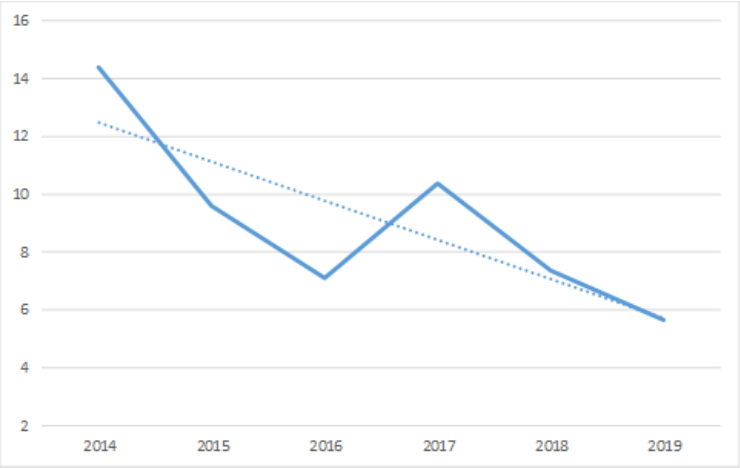
2.3.2 CRI Performance

We also consider that the rules in the current form have not been applied appropriately to Severn Trent. This is because our CRI performance has been consistently improving, despite the absence of an ODI.

Although CRI is a new measure with limited history, the DWI has provided us with data to retrospectively calculate performance over AMP6 (for Severn Trent only). In forming a historical view of CRI we have used 2014-2016 data provided by DWI and from 2017 onwards used our own performance reporting.

Our overall performance on CRI, as illustrated in the chart below, shows that **CRI is improving across time.** Of particular importance is the trend line for this measure which has a strong downward slope under different forms of calculation (eg linear v exponential).

Figure 3 – CRI performance over AMP6



This improvement in CRI has occurred despite the absence of any financial ODI. This is because there are strong drivers for improvement, not least the DWI's own enforcement powers and regulatory strategy.

For example, the DWI can issue enforcement notices which provides a strong incentive to improve given these are very public and enforceable through sanctions if they are not acted on. This is particularly relevant for Severn Trent given that in 2012 and 2014 we were issued with a District Services Reservoir All Sites Notice and a Water Treatment Works All Sites notice respectively. More recently the DWI has acknowledged our positive and improved performance and in 2018:

- the Water Treatment Works All Sites was rescinded; and
- the District Services Reservoir All Sites Notice was successfully revised to remove the "All Sites" element.

The DWI's use of notices in this way is part of its wider regulatory strategy of requiring companies to enter into transformation programmes on the basis of its Recommendation Risk assessment. The rationale for requiring companies to first enter into a transformation programme contrasts strongly with Ofwat's rationale for intervening on the CRI and increasing the penalty rate; the DWI advocates using defined actions and recommendations as an incentive for companies to improve before escalating to sanctions (*"the objective is to encourage companies to act for themselves before the need for formal enforcement action"*)[4].

Given the fact that we have demonstrated an improving performance on the CRI, we have responded positively to the incentives created by the DWI's transformation programme approach, and the DWI deemed it appropriate

[4] Drinking Water 2018 Report

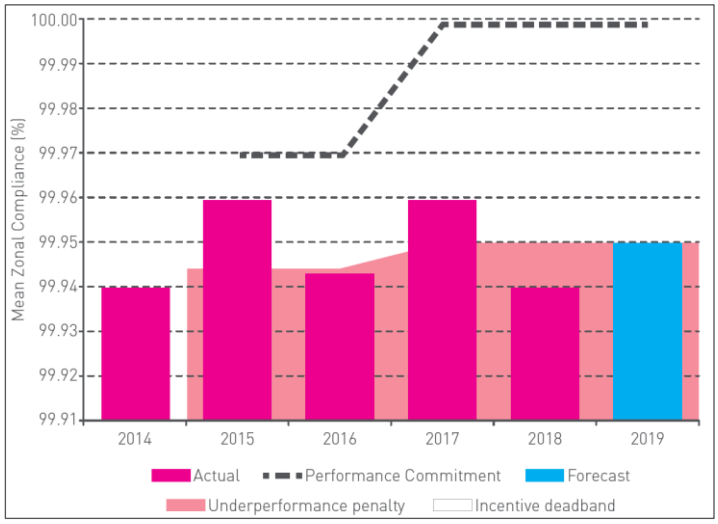
to remove the All Sites Notices, we don't believe there is a compelling past performance issue or concerns that we will not continue the trajectory of improvement.

We understand from the DD that proxy measures have been used to form a proxy view about CRI past performance and comparative performance. For CRI the most relevant comparative is MZC given that in the PR19 Methodology Outcomes Technical Appendix, this measure was **designated** as the predecessor to CRI:

> *CRI will replace the current Mean Zonal Compliance (MZC) index to accommodate upcoming drinking water quality regulations amendments, and to adopt a risk-based monitoring methodology to assess compliance.* Ofwat[5]

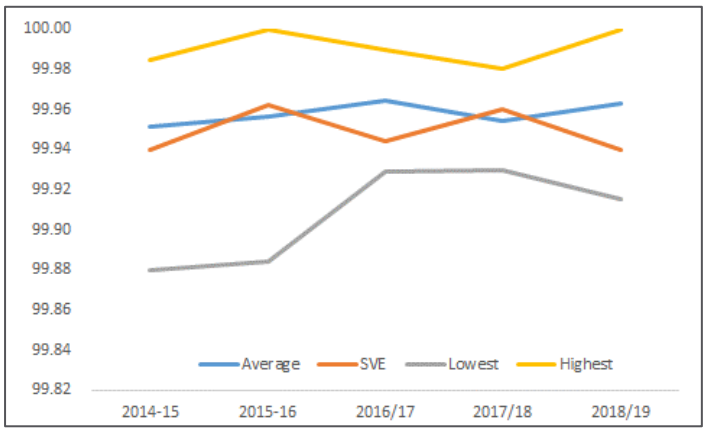
In terms of actual performance on MZC there has been (i) no demonstrated pattern of consistent underperformance that has incurred consistent penalties, and (ii) no overall trend that might suggest performance is deteriorating. Instead, performance in AMP6 has varied between landing in the deadband and triggering small penalties, as shown in the chart below.

Figure 4 – MZC performance relative to the target and deadbands



We have also examined our relative performance on MZC. As can be seen in the figure below, our performance this AMP is consistent with the industry average, rising above the average in two years and falling below the average in two years.

Figure 5 – Comparative MZC performance



[5] https://www.ofwat.gov.uk/wp-content/uploads/2017/07/Appendix-3-Outcomes-technical-definitions.pdf p. 4

While we know that we have more to do to improve – and we are very much focused on doing so – there are notable inconsistencies between the historic performance of companies, and the applicable ODI penalty rates (relative to the normalised range).

2.3.3 Conclusion – the proposed ODI penalty rate is disproportionate

We don't think it is appropriate at this early stage in CRI's development that its incentives are effectively supercharged and CRI becomes the third most powerful ODI on average. Because CRI is different to other measures, drawing on unaudited data, which is often very subjective in nature, it is difficult to reliably compare performance at this stage (in contrast to other ODIs where the assessment is much more binary in nature).

The above analysis also shows that our performance on CRI is one of significant improvement over AMP6, with the DWI recognising the achievements through the removal of the all sites notice. On the precursor to CRI, MZC, our performance has been relatively consistent with performance ranging close to the industry average over AMP6.

What is particularly important about the above improving performance on CRI, is that this has occurred in the context of no financial incentive. Looking ahead to AMP7 the continued presence of the DWI's own enforcement powers, combined with the new incentive rate of £1.26m per point will create an extremely strong incentive to continue our current trajectory.

In this context, the intervention to increase the AMP7 penalty rate by 50% not only seems disproportionate but also ultimately unnecessary. Having considered the available evidence and the PR19 methodology, our views is the ODI rate for CRI, the penalty rate should remain unchanged at £1.26m per point.

2.4 Mains repairs

In the light of the latest changes made to the DD, our mains repair measure, covering both the target and incentive rate, looks to be disproportionately focused on penalties, particularly when compared to every other company. This can be illustrated by the fact that:

- the penalty rate is significantly larger than any other company on a comparable basis while our reward rate has been reduced; and
- we've been set a target that is better than the defined 'good' level, with the target being selected based on performance in years when conditions were more benign.

Below, while we discuss each component in turn, it is important to consider that both impact the balance of our overall package, and therefore should not be considered in isolation.

2.4.1 Mains repair ODI penalty rate

In our business plan we had originally proposed symmetrical incentive rates for mains repairs. In the IAP Ofwat noted that "we *are intervening to ensure companies' outcome delivery incentive rates for common and comparable performance commitments sit within an aligned range*."

As a result of this intervention, our ODI reward rate was reduced from £0.561m/burst per 1,000km of mains, down to £0.185m/burst per 1,000km of mains. This change reflected the "aligned range" which Ofwat had determined lay between £0.055 and £0.075 per-household per-burst per-1,000km of mains (our originally proposed rate was £0.167 per per-household per-burst per-1,000km of mains).

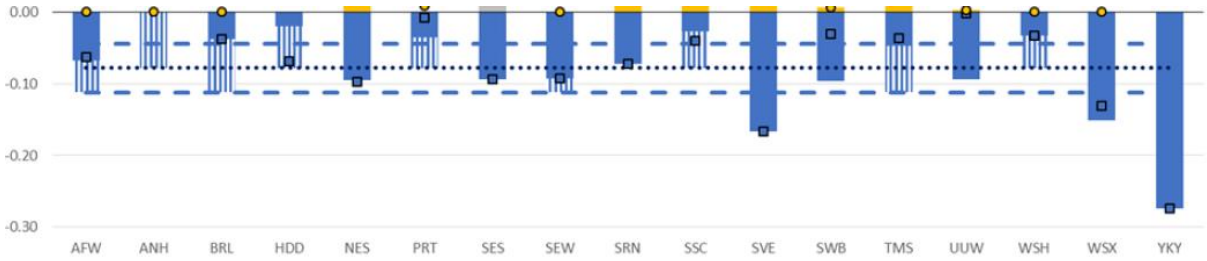
Concerns with the penalty rate

When we proposed the penalty and reward rates in our original Business Plan, we'd set symmetrical rates based on 50% of the WTP values obtained through our customer engagement and research. In other words, both rates were calculated using the same methodology and approach. However an asymmetric approach has been applied to the interventions on the incentive rate, at the same time as introducing a significantly more challenging target.

In our fast track DD we were prepared to take on the risk of the higher penalty rate subject to the target being set at a more reasonable level, consistent with other companies. However given the stated position in the slow track DD that Ofwat has not been persuaded of the need for more mains repair to reduce leakage, we consider it important to address the specific outlier that is our penalty rate.

Currently the mains repair penalty rate has been retained at the original value of £0.561m/burst per 1,000km of mains – the mirror image of the reward rate that we first put forward. However, this rate can be seen clearly to be underpinned by a value that lies some way outside of the reasonable range as shown in the chart below (which is replicated from the slow track DD outcomes policy appendix[6]). As illustrated below, the acceptable penalty range were given as £0.066 and £0.095 per-household per-burst per-1,000km of mains. This compares with our own equivalent value of £0.167.

Figure 6 – Reasonable range assessment for mains repair (£/household/burst per 1,000km)



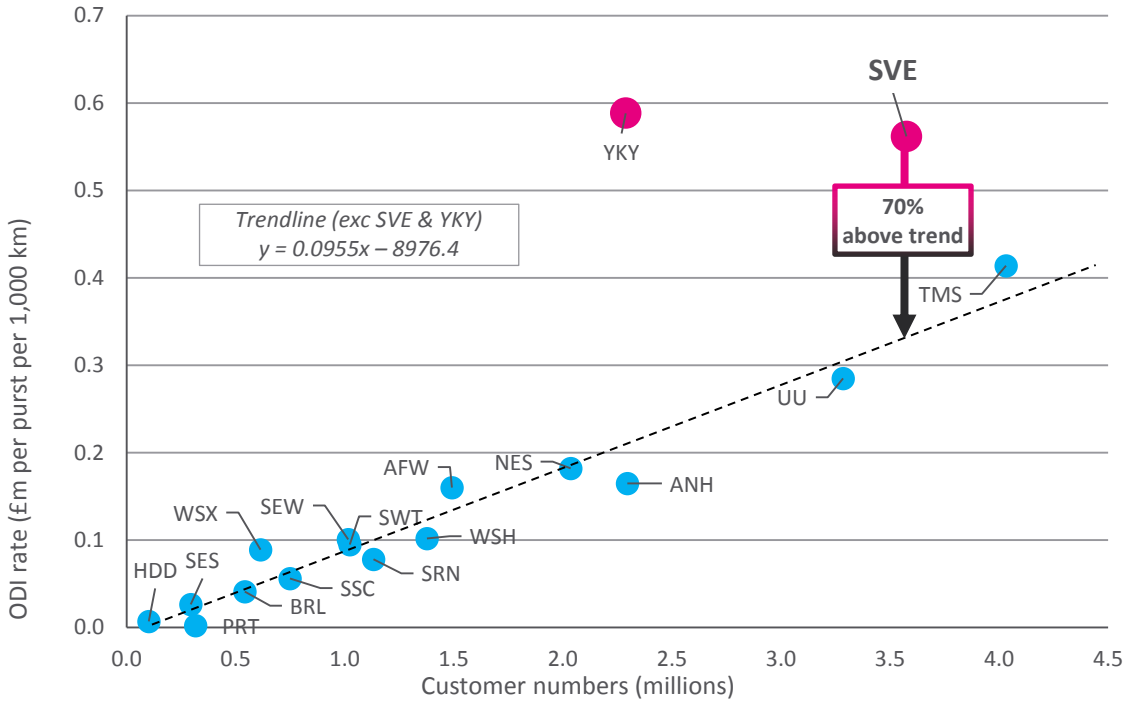
Given that reward incentive rate was reduced to ensure it was aligned to what was considered an acceptable range, we think the same logic should be applied to the penalty rate. This would also ensure consistency with other DD decisions, for example:

- the reduction in South East Water's leakage penalty rate given that it was *materially higher than the reasonable range that we set out in PR19 draft determinations*;
- the reduction in Southern Water's drinking water quality penalty rate whereby Ofwat noted *its rates remain materially higher than industry average*; and
- the reduction in Northumbrian drinking water quality penalty rate, whereby Ofwat noted that the *company's proposed rates are materially above the reasonable range that we set out in PR19 draft determinations*.

The extent to which our penalty rate is an outlier is further reinforced by the next chart where the full proposed penalty rate for each company is plotted against company-size in terms of household numbers (this helps normalise the incentive on a WTP basis). The chart recognises that increases in ODI rate are generally consistent with increases in company size, with a very clear trendline apparent when the two outliers are excluded. What is also clearly evident is the extent to which we are a significant outlier (alongside YKY).

[6] July 2017, "*PR19 draft determinations – Delivering outcomes for customers policy appendix*," p156

Figure 7 – The extent the proposed penalty rate is an outlier



In comparison with the sector trendline, our penalty rate is almost 70% higher than it should be for a company of our size. The IAP acceptable ranges finds the overvaluation to be somewhat larger at 76%. If our proposed penalty rate were adjusted in light of these percentages, the respective revised values would be £0.332m and £0.319m per burst per 1,000km.

On balance, we believe that **adjusting the rates to £0.332m per burst per 1,000km** is an appropriate way to: (i) provide consistency with the intervention on the reward rate and its justification; (ii) deal with the significant extent of the outlier valuation; (iii) bring about much better alignment with the rest of the sector and (iv) provide the first part of the solution for resolving the disproportionate in-the-round impact on the mains repair package. This rate would also ensure it is consistent with the acceptable range, as it translates to £0.099 per-household per-burst per-1,000km of mains (with an acceptable range of £0.066 and £0.095).

2.4.2 Mains repair revised PC targets

In the slow track DD we have been set a more stretching target on mains repairs. The DD also sets out that the intervention method will be to use a flat profile from 2020-2025 based on the average of 3 years of best historical performance between 2011 and 2018.

Background on the targets proposed in the revised Business Plan

At the IAP, the feedback on our proposed targets was that:

> "The company is forecasting a deterioration in performance during AMP7 due to increased leak detection activity. The company provided insufficient evidence to demonstrate the relationship between leakage levels and the total number of repairs. Company to commit to providing further evidence to substantiate the increase in mains repairs due to active leakage control. As a minimum the evidence should show the historical correlation between active leakage control, and pro-active and reactive mains repairs. It should also show the impact of this relationship on forecast repair rates from the output of asset performance modelling"

We responded to this challenge by submitting evidence that we considered would demonstrate that additional mains repairs are required to reduce leakage. And so, we proposed higher mains repair targets to account for our challenging and stretching leakage targets.

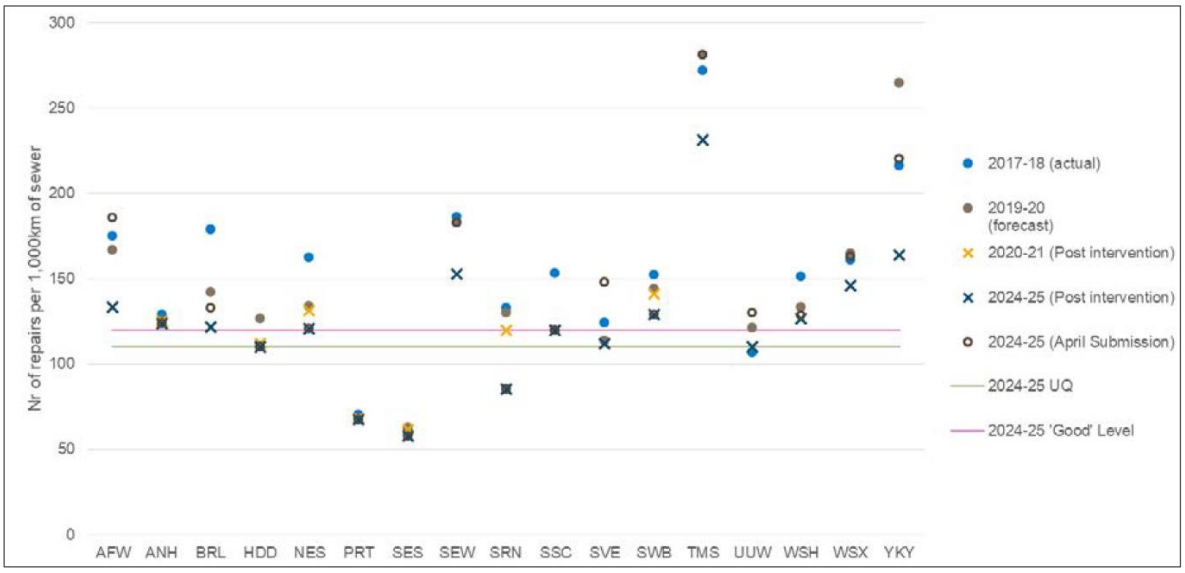
In the fast track DD, Ofwat found that our evidence did not sufficiently quantify a clear link between additional mains repairs and a reduction in leakage. This resulted in a proposed intervention to reduce the bursts target from the levels that we'd put forward. In response to this challenge, we set out the empirical data that demonstrates the historic relationship between leakage and burst and the impact this relationship would be expected to have in AMP7.

Following the slow track DDs, it is clear that we are not going to be able to set out sufficient evidence that reducing leakage requires us to have higher levels of mains repairs. Nevertheless, we believe that the current target should be reconsidered to ensure that the interventions are proportionate and fair when compared to the slow track companies.

Concerns with the proposed interventions

As mains repair is a common PC, we support Ofwat's use of relative comparisons. In the figure below extracted from the DD, we can observe the targets proposed by companies, the resulting interventions and how this compares to the UQ and also the "good level" defined by Ofwat.

Figure 8 – Ofwat view of Mains repairs – actual levels, forecasts, 2020-21 and 2024-25 determination levels, 2024-25 commitment from April submission and 2024-25 upper quartile and 'good' levels



In the figure above just three companies have had interventions that move targets to the UQ level (including Severn Trent). In contrast there are seven other companies where the interventions are not even tightening the targets to the 'good' level, for example Affinity, Bristol, South East, South West, Thames, Welsh, Wessex and Yorkshire.

Given that we are a fast track company with very good historic performance, we think it is fair that our targets are revised to the *good performance* level. This would still ensure targets more stretching than the seven mentioned above, with our overall target being 120 bursts per 1,000km. We would also support the use of a reward deadband at the 112 bursts level to prevent undue outperformance payments on the upside.

2.5 Unplanned outages

An important new measure of asset health in AMP7 is unplanned outages. Given the development of a standardised methodology, there has been considerable effort at improving the data and developing a reliable baseline.

At the IAP, we were informed that there were , "*…some concerns that the company's forecast performance level is not determined using data consistent with the common definition*," and that we should provide our response in May (after the publication of our fast track DD). This we did in the form of an early APR submission for this measure, which set a target of 4% for each year of AMP7.

In the slow track DD a sector wider intervention has been put forward, whereby all AMP7 targets for unplanned outage are to be set at least as high as the good level of 2.34% (the one exception being Southern given the significant step change required). An important feature of the intervention method is that it is set on the basis of an **improving profile from 2020/21** to the good level in 2024/25. In other words the target is graduated to create a glide-path to improve the deliverability of the new target. This is summarised in the table below.

Table 1 – Assessment approach and interventions on unplanned outage

Performance Commitment	Calculated 'good' level	Historical data completeness	Intervention methods
Unplanned outage – a common performance commitment	2.34% - median level of 2024/25 forecasts	Only 2 years	An improving profile from 2020/21 to the median level of 2.34% in 2024/25

An important feature of the intervention method is that it is set on the basis of an **improving profile from 2020/21** to the good level in 2024/25. In other words the target is graduated to create a glide-path to improve the deliverability of the new target.

For Severn Trent there appears to have been a mistake as this graduated profile does not appear to have been applied as per the rules. Instead for Severn Trent the target has been set at 2.34% lost capacity of company maximum production every year (although we note that we do not have an outcomes appendix in the slow track publications so we cannot confirm this position). This intervention appears to be inconsistent with the underlying rule and the position taken for a number of slow track companies. To ensure alignment with the rules we believe the target should be set by reference to our 2020/21 target and on a straight line, deliver the "good level" by 2024/25, as illustrated below.

Table 2 – AMP7 targets for unplanned outage

2020/21	2021/22	2022/23	2023/24	2024/25
4.00	3.59	3.17	2.76	2.34

We recognise that Ofwat may have set the target at 2.34% every year on the basis that our shadow performance in AMP6 was better. However, as we noted in our APR18, September Business Plan and unplanned outages submission, we are still making improvements in our reporting processes and a number will not take full effect until the 2019/2020 reporting year. In particular:

- our approach did not identify asset failures (and therefore production loss) which result in only a partial loss of production output. We have only captured data for surface works where unplanned outages have resulted in complete loss of works output; and
- for reporting year 2018/19 we have not accurately captured the volume lost as a result of planned outages.

This means that in practice our performance on surface water outages is understated, however until we complete all the reporting actions we are not in a position to say by how much. This is why in our business plan we set the target on the basis of our ground water outage of 4% (rather than the surface water outage of 0.07%).

The immaturity of the data has been acknowledged by Ofwat, "*…this is a new measure, with only two years of shadow reporting, so long-term projections are likely to be unreliable*."[7] Against this backdrop, a profiled approach to the AMP7 targets starting from 2020/21 (when reporting is complete) is a sensible action which is equally as applicable to Severn Trent as other companies.

[7] DD outcomes policy appendix, section 9.2, p125

3. Outcomes technical issues

In this section we respond to four types of technical issues that were set out in the draft determination or within Ofwat's delivering outcomes for customers' policy appendix. These relate to the following:

- The definitions for our metering, persistent low pressure and value for money performance commitments, whereby some small minor amendments are needed to ensure that they work in the interests of customers.
- An update on shadow reporting – focussing on speed of response to visible leaks.
- Resilience performance commitments – in the *delivering outcomes for customers policy appendix* Ofwat requested extra detail and calculations for the risk of severe drought restrictions and risk of sewer flooding in a storm measures from fast track companies.

3.1 Performance commitment definitions update

In our submission in May 2019, we provided improvements to a number of the performance commitment definitions set out in the Draft Determination including: AIM; increasing water supply capacity; public sewer flooding and protecting schools from lead. This was aimed at ensuring that definitions are consistent with relevant reporting guidance and the PR19 methodology, are clearly defined, easy to understand and that the commitments themselves continue to act in the best interests of customers.

In addition to the above metrics following a further internal review, we have identified three further performance commitments would benefit from greater clarification in the Final Determination to avoid ambiguity on the process adopted to measure activity undertaken (and avoid the need for amendments post FD as occurred at PR14). They are the 'number of water meters installed', 'persistent low pressure' and 'value for money' performance commitment definitions.

Number of water meters installed

There are three areas of the 'number of water meters installed' performance commitment definition as outlined on page 112, PR19 Draft Determination, Outcomes Performance Commitment appendix that would benefit from further clarification:

- the benefit attributed to the performance commitment;
- the additional detail on measurement units – the property status; and
- other relevant information – the aggregate outperformance cap.

They are set out in the table below.

DD Page No.	Ofwat -DD Outcomes PC appendix	Suggested amendments for Final Determination	Reason for change
112	The DD outlines the benefit of the PC as "*providing customers with meters allows them to pay according to the amount of water they use, and helps reduce overall demand for water*".	For clarity we suggest the benefit of the PC should be "*providing customers with meters improves demand management (through leakage and customer demand)".*	The main reason for the inclusion of this PC was to allow us to detect customer-side supply pipe leakage with greater accuracy and thereon support initiatives to balance the supply demand balance. Our challenging leakage target means that with a greater accuracy of leakage detection we can deploy leakage repair resources more efficiently and effectively. Appendix A3 as submitted with our original business plan

	The additional detail on measurement units also reads that "*the property status should change following the installation from unmetered to metered charging*".	We suggest that any reference to the property status is **removed** from the definition.	submission details that both leakage repair and customer demand reduction will be the main benefits of this performance commitment. Furthermore and in relation the property status **we are not legally permitted to start enforcing compulsory charging on properties that have a meter installed**. As we are not within an area classified as 'water stressed' we will not be able to change the property status from unmetered to metered charging.
112	Currently Ofwat states 'NA' in the any other relevant information section of the DD	For clarity due to the overall AMP7 cap, we suggest the DD reads: "*If the company reach the aggregate outperformance cap early in AMP7 then no penalties will apply in subsequent years if the company do not install further meters".*	In Appendix A4 as submitted with our original business plan we state on page 35 that we will be using the ODI to return money to customers if we do not install an average of 65k meters each year, unless the aggregate cap for the period has been achieved. Therefore the performance commitment definition should detail that if we reach the aggregate outperformance cap early in AMP7 then no further underperformance payment incentives will apply in subsequent years if we do not install further meters as we would have achieved the installation average of 65K meters per year.

Persistent low pressure

The 'persistent low pressure' performance commitment definition as outlined on page 97, PR19 Draft Determination, Outcomes Performance commitment appendix would benefit from further clarification on:

- the reference to residential properties only.

DD Page No.	Ofwat -DD Outcomes PC appendix	Suggested amendments for Final Determination	Reason for change
97	The DD outlines the detailed definition of the PC as "*the number of low pressure days experienced by residential properties which have exceeded the persistent low pressure threshold*".	For clarity, both residential and non-residential properties should be included so that the detailed definition reads "*the number of low pressure days experienced by residential and non-residential properties which have exceeded the persistent low pressure threshold".*	This is a new measure, however, we believe that keeping consistency to the way we measure our current AMP6 DG2 performance commitment by including both residential and non-residential properties is easier for customers.

Value for money

The 'value for money' performance commitment definition as outlined on page 53, PR19 Draft Determination, Outcomes Performance commitment appendix would benefit from further clarification on:

- the detail on the question to be asked and the responses customers will be able to answer from.

DD Page No.	Ofwat -DD Outcomes PC appendix	Suggested amendments for Final Determination	Reason for change
54	The DD outlines part of the additional detail on measurement units as "*The question about value for money is asked, amongst others, in the following way: "How do you rate the water and sewerage services you receive from Severn Trent Water in terms of value for money?". Respondents answer the question with 5 possible responses: very poor value for money, poor value for money, neither good nor poor value for money, good value for money and very good value for money. The figure for value for money is defined as the total percentage of customers who rate Severn Trent Water as either 'good' or 'very good' value for money"*	We request that the exact wording of the question is not specified, but rather that the definition refers to consistent measurement.	We are currently reviewing our tracker surveys to ensure they are ready for AMP7. Should the outcome of this review recommends changes to the questions to ensure comprehension for customers, we would like to be able to take this into account.

Strategic regional transfer solution

In our May 2019 draft determination representation we proposed a new performance commitment relating the Severn-Thames transfer. We propose that this performance commitment is removed in line with the latest direction for strategic water resource solutions set out in Ofwat's Strategic regional water resource solutions appendix.

3.2 Shadow reporting

Within our Fast Track DD response we proposed that we should update our numerical forecasts for leakage and PCC for the 2019-20 *actual* baseline to ensure it is reflective of the consistency improvements we have made and the percentage improvements we committed to make.

We note that Ofwat has subsequently confirmed that we should do so in its slow track draft determination Q&A document:

> *"The 2019-20 baseline for companies for leakage and per capita consumption will be the actual performance, not forecast. It will be calculated on the three year average of 2017-18, 2018-19 and 2019-20."*

We are assuming that we will provide the leakage and PCC data through a separate process (as actual performance for 2019-20 will not be known until after the final determination).

We also note that for one bespoke measure, the speed of response to leaks, two clarifications have been included in the draft determination which alter the basis on which we originally reported the data. We therefore believe it's appropriate that we provide updated figures consistent with the draft determination definition.

We outline the updated forecasts performance commitments below. The values presented have also been updated within the DD representations data tables.

Speed of response to visible leaks

We have updated our forecast for 2019-20 to reflect a stronger forecasting methodology (using a 3 year average) and two clarifications provided in the definition of the performance commitment included in the draft determination:

- we have treated the term 'arithmetic average' as the mean time to fix all leaks that are included in this measure (we had previously used a median); and
- we have taken into account the removal of barriers and traffic management within the time to fix and reinstate the leak area.

Adjusting for the above reporting clarifications, we have set out a revised forecast our 2019-20 baseline and subsequent AMP7 performance commitment levels below (retaining the existing percentage improvement we committed to in our plan).

2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
13.9 days	12.5 days	11.1 days	9.7 days	8.3 days	7.0 days

3.3 Resilience performance commitments

There are two common resilience performance commitments across the sector: risk of severe drought restrictions; and risk of sewer flooding in a storm. Within Ofwat's *delivering outcomes for customers policy appendix* we have been asked to provide updated information on the data, models and coverage underlying these measures in line with the actions on the slow track and significant scrutiny companies.

Risk of severe restrictions in a drought

As per the sector wide request we provide a full set of intermediate calculations at a zonal level, underlying the risk calculations (for both baseline levels and performance commitment). These are attached to this document (as annex 1) and supporting spreadsheets are available if required. It is confirmed that the performance commitment levels are reflective of our water resources management plan position and includes the potential that we will have access to drought orders and permits.

The programmes of work and schemes that impact our forecast of drought risk are an integral part of our final water resources management plan (fWRMP19). This is because these programmes of work and schemes are in the plan to keep our supply demand balance in a surplus throughout the planning period under our current drought planning scenarios and levels of service. The fWRMP19 will be published during August 2019. The programmes and schemes can be found on table 6 of the fWRMP planning tables and in section 6 the main narrative of the fWRMP, with further details in Appendix D of the plan.

It is worth noting that as the submitted intermediate calculations are now based on fWRMP as opposed to draft WRMP, the numbers have been revised accordingly. The table below contains the updated performance commitment levels as submitted in the attached intermediate calculations. These values are also reflected in the DD representations data table.

2020-21	2021-22	2022-23	2023-24	2024-25
56.2%	56.2%	56.2%	56.2%	56.2%

Risk of sewer flooding in a storm

Ofwat has requested that the following information be confirmed:

- we are using the updated parameters in the catchment vulnerability assessment (and setting out any additional criteria that it intends to use);
- we are reporting the extent to which we use 2D or simpler modelling; and
- we are adopting FEH13 rainfall as standard and if we are not when we expect to do so

In the latest APR submission (2018-19) we provided a comprehensive supporting commentary to Ofwat regarding this performance commitment and believe that we have covered the above information, or explained our position with regards to the measure, in full detail.

For completeness, in our APR response we confirm the following:

- we have full model coverage of all of our catchments with appropriately validated hydraulic models;
- our 2018-19 data return used the buffered zone approach but to allow a direct comparison we have also undertaken the 2D flood routing approach - the details of which are within Appendix B of the APR19 supporting commentary for this measure; and
- we have used FEH13 rainfall parameters for our assessments.

4. Sustainable Sewage Treatment – Updated 2019/20 Forecast

On 15 July 2019 we submitted our PR14 reconciliation forecasts to Ofwat as part of the PR19 process. This included performance forecasts for each of our AMP6 performance commitments and the relevant outcome delivery incentive (ODI) implications. This document specifically relates to one measure, the Sustainable Sewage Treatment commitment (SC-5) – it does not affect the forecasts for any other performance commitments. Within our supporting narrative submitted in July we explained that there was one additional site, Finham sewage treatment works, where the final solution was still being reviewed to confirm it met the acceptance criteria; this document is intended to formally update our forecast to include Finham sewage treatment works for this measure.

It covers:

- how the measure was developed through PR14;
- the assessment criteria;
- a detailed explanation of the Finham traditional and sustainable solutions;
- the formal adjustment to the forecast 2019/20 outturn ODI; and
- assurance of this submission.

4.1 Developing the measure at PR14

As an industry we had traditionally looked for tried and tested solutions, which have a higher degree of certainty in the output, when meeting the challenges of higher quality standards and growth pressures. As a company we were in the mind-set of using known design solutions to overcome the problems we faced.

This had been recognised by our key stakeholders. Our customers, and the Water Forum, were challenging us to deliver more sustainable solutions. Our regulators were looking for us to do more for less, and share learnings with our peers. And as a company we were seeking opportunities to use new and novel technologies in a way we had never considered before to deliver greater benefits for our customers and the environment.

Despite this, a traditionally risk averse industry takes small steps towards implementing new and innovative solutions. By developing this measure we sought to change this mind-set.

Creation of the measure

The measure was first proposed as part of our response to the PR14 Risk and Reward request from Ofwat in early 2014. Ofwat's challenge to the industry, during the risk-based-review assessment, was for each company to explore options to further increase the scope of risk and reward that their plan would deliver through the suite of ODIs. Our response to this challenge included increasing the unit rate for penalties and rewards for some measures, the removal of deadbands to strengthen the impact of incentives, the addition of financial incentives where previously they were reputational only and the creation of six new measures with ODIs.

It was with this in mind that we developed two new measures, Catchment Management and Sustainable Sewage Treatment, which were specifically designed to challenge us as a company to look at new, more innovative solutions to traditional problems. Within our submission these measures stood apart by requiring us to take additional risk. They should also be more sustainable, especially in terms of embedded carbon. Ultimately the measures identified solutions where a successful outcome was less certain and we would have to successfully work with stakeholders within our catchments to succeed.

Evolution through PR14

The Sustainable Sewage Treatment measure was initially designed to incentivise more innovative thinking about how we deal with the challenge of growth within our wastewater catchments. By thinking differently and not necessarily continuing to build in additional capacity into our sewerage system and treatment works, we believe that we could reduce the cost burden on our customers in future AMP periods. Incentives of a similar type had been applied in the energy industry. Gas distribution companies have been incentivised to achieve efficient outcomes, in terms of resolving network constraints, by encouraging customers to bid for interruptible capacity where the consumer can change its mode of operation.

Principally growth is driven by two factors: the long term population growth forecasts or changes to the industrial activity that discharge to sewers. During AMP5 we were exploring solutions to a future growth issue in our catchment feeding the Rugby STW, where an increase in both trader discharges, and future population growth, exceeded the capacity of our existing processes. It was with this scenario in mind that the initial concept for this measure came about; an incentive designed to reduce the impact of the trade discharge to allow for us to accommodate the population growth within the existing capacity.

As a company we enhanced our way of thinking and evolved our Systems Theory approach. By understanding intimately the component parts of the end-to-end process, and the interrelationship between these components, we can intervene at the most effective point with the optimum solution.

As an example, if we could reduce trade effluent load, at lower cost than providing a traditional solution to increase capacity, then this was in the best interests of customers, but with higher risk for us as a company. Our initial discussions with Ofwat focussed on an incentive that installed pre-treatment at the site of a trade effluent discharger to reduce the biological oxygen demand entering the sewerage system and, as such, reducing the growth impact on the sewage treatment works.

During the summer of 2014 we submitted our final amendments to our initial business plan to Ofwat; this included the proposals for our new performance commitments. Our proposal for Sustainable Sewage Treatment had evolved from a measure that required the solution to be installed at the site of trade effluent discharge to one that could also include pre-treatment installed at the receiving sewage treatment works that resulted in the same output.

As a novel performance commitment we recognise that it has continued to evolve during AMP6 as we move further through our Systems Theory approach. When it came to detailed feasibility and design there were more options to deal with growth pressures without the need to build additional secondary treatment capacity. As well as reducing the volume at source, or pre-treatment phases at the works, there were also developing technologies that could improve the efficacy of existing processes, resulting in the same outcome as above.

As new, innovative technologies were somewhat unknown at the time of drafting the performance commitment we consider that schemes that meet the spirit of its intent should be considered for qualification. That is, schemes that deal with growth in the catchment, at a lower whole life cost, by using innovative, higher risk solutions and do not result in additional traditional secondary treatment capacity being built.

Our final performance commitment

Outlined below is the final proposal submitted to Ofwat for inclusion in our company specific appendix for the PR14 Final Determination (STW Outcomes – Annex (Final to Ofwat 140708)). As can be seen from the detailed definition, our final proposal did not require the solution to be installed at the site of a trade discharger, therefore incorporating solutions which included a pre-treatment technology on our sewage treatment works site itself.

Whilst not formally written in to the measure itself, there were a number of criteria underpinning its development, discussed at various times through our submissions to Ofwat, which we have used as guidelines for the development of our detailed assessment criteria within AMP6. In summary, these are:

- The scheme proposed is related to expected growth identified in Local Authority development plans or expected changes in trader requirements within the catchment;
- The solution has released either headroom at a sewage treatment works and/or capacity within the sewerage system by not constructing additional traditional treatment capacity (e.g. activated sludge aeration volume or biological filter beds) at our works or upsizing the existing sewerage network;
- We do not include any investment in our PR19 plan to address growth at these proposed sites. We propose that this measure be evaluated in 2018/19, in line with the timing of our PR19 submission.
- Final sign-off from our Water Forum that the scheme has met the criteria and can therefore be claimed against this measure – this will occur once the scheme has been delivered

Performance commitment S-C5: Sustainable sewage treatment

Detailed definition of performance measure:

This measure is the number of works where future capital investment is avoided by the development of innovative solutions to reduce capacity pressures at Sewage Treatment Works to accommodate growth.

Incentive type: Financial – reward only.

Performance commitments

		Starting level	Committed performance levels				
	Unit	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
PC	No.						0

Incentive rates

Incentive type	Performance levels		Incentive rate (£/works/year)
	Lower	Upper	
Reward	1		£28,000

Additional details

Necessary detail on measurement units	The above incentive rate is for a notional 1,000 population equivalent capacity increase avoided. The incentive would be scaled up or down for each works according to the scale of the capacity increase avoided.
Frequency of PC measurement and any use of averaging	Performance commitment measured, assured and reported on an annual basis and reviewed through the successor to Water Forum.
Timing and frequency of rewards/penalties	Reward applied in 2019-20, with five years' reward based on number of improvements delivered to 2018-19 and expected performance in 2019-20.
Form of reward/penalty	Adjustment to revenue.
Any other information or clarifications relevant to correct application of incentive	No solutions yet available for inclusion in Severn Trent Water's plan, so the performance commitment is zero.

4.2 The assessment criteria

During the 2015/16 report year we identified a number of measures where there was uncertainty in the interpretation of the Final Determination wording, as such we worked to develop our evidence base through our assurance programme. This included producing a more detailed set of assessment criteria for this measure as part of our Process Description Template (PDT). Within this document we outlined the assumptions we had made, these are:

- The innovative solution should not have been used at full scale by Severn Trent prior to the start of AMP6. The technology may have been demonstrated at pilot plant or bench scale. The overall treatment should be to the same standard as if the conventional treatment was used.
- The intention is that Severn Trent should pay for the innovative technology. The intention is not to reduce trade effluent revenue. The innovative technology option should have a lower whole life cost than the conventional solution.
- The new technology could be installed in the network, at a treatment works or at a trader's property.
- The avoided investment for growth could be at a treatment works or in the network.
- The innovative technology should be in operation before the end of AMP6 in order for the reward to be claimed. This can be demonstrated by providing a signed Plant In Use Certificate up to and including 31st March 2020.

Throughout AMP6 we have continued to refine and develop the qualitative assessment criteria that we consider would demonstrate our proposed solutions qualify for this performance commitment. Whilst we recognise that ideally the criteria would have been developed prior to the AMP, this is an area where innovation and opportunity is continually evolving. To accommodate this we have continued to adapt our assessment criteria ensuring we can provide the most robust case for any qualifying schemes.

As such we describe below the three key test criteria, each with sub-tests, that we have developed to determine whether or not a solution meets the requirements of this measure.

Test 1 – Has conventional capacity increase been avoided?

The definition of the measure specifically references the avoidance of future capital investment, and by that we mean investment from 1st April 2020. As noted above, but not specifically referenced in the Final Determination, we considered a period of 10 years to be appropriate, noting that the solution could not guarantee there would never be a need to invest future capital to increase capacity at the works due to domestic growth in the catchment.

It is worth noting here that the intention was never that the solutions would be delivered at zero cost within AMP6, or that only operational solutions were valid. Principally we note that in our data table commentary to the summer 2014 revised business plan, we stated in 'Section F_Data Tables Commentary_02Wastewater' on page 78 that delivery of the performance commitment would be made through a solution with a lower whole life cost.

This test, therefore, considers the whole life cost of the conventional solution, based on AMP6 unit costs and standard designs, to the whole life costs of the innovative solution whereby ongoing costs for the innovative solution relate only to the operation and maintenance and not to future capital investment to further increase the capacity through either the traditional or innovative solutions until AMP9.

In the event that we do have to invest in additional capacity to accommodate domestic growth during AMP7 or AMP8 at works where we have successfully claimed delivery against this measure, we would work with our regulators and customer representatives (the equivalent of our Water Forum at the time) to agree an appropriate approach to compensate our customers.

In order to pass this test, we have defined the following two sub-tests, both of which must be passed to meet the criteria.

Test Number	Name	Definition	Evidence
1a	Existing capacity	What existing capacity exists within the secondary treatment phase of the site?	Design and performance (average/peak) information showing the current spare capacity
1b	Growth forecast	Is there sufficient growth forecast in the near future to require expansion?	Growth forecasts in the catchment over at least the next 10 years

A qualifying scheme will pass test one if the 10 year growth forecast is greater than the current spare capacity.

Test 2: Does the innovative process add treatment capacity through conventional processes?

Critical to this measure is our ability to demonstrate that we have removed the growth pressures by avoiding increases in sewer capacity or the building of conventional treatment at the sewage treatment works in the future. Within our submission documents at PR14 we referenced avoiding future investment at the site for a 10 year period.

We also need to detail what we consider to be conventional treatment. In short this related to two specific secondary treatment processes, activated sludge and biological filtration. Our test is not binary in its application based on the existing processes at a site. For example, if a treatment works currently utilises activated sludge processes, we would not be allowed to install new biological filter beds as part of the solution.

For each of these generic treatment processes, there are a number of different solutions which could be installed. Our test would exclude all works where any type of conventional treatment processes that falls under the broad heading of activated sludge or biological filtration was being installed as part of the solution, or planned to be installed within the next 10 years (AMP7 and AMP8).

As such, any solution must deliver the necessary performance improvement without constructing additional activated sludge or biological filtration secondary treatment processes. This could be through either removal of the additional biological oxygen demand (BOD) at source, preventing it from entering the sewerage system, removing it as a pre-treatment stage at the sewage treatment works prior to the secondary treatment phase or through use of novel technology to increase the efficacy of existing secondary treatment processes.

Test Number	Name	Definition	Evidence
2a	Conventional process	Was there an alternative conventional comparative option assessed?	Options appraisal includes expansion of the current secondary treatment phase
2b	Secondary treatment	Does the proposed solution require any additional secondary treatment capacity to be installed (ASP or biofilter)?	Detailed design of the solution showing no additional ASP lanes/extensions or biological filters are being installed.

A qualifying scheme will pass test two if it can demonstrate a final solution that does not build new or extend existing secondary treatment processes but has been compared to a traditional solution of this type.

Test 3: Is the solution innovative?

The first two tests use quantified data to demonstrate that they have been successfully delivered. This third test relating to innovation uses a series of assumptions about what constitutes innovation. To develop this test we have pulled on a number of reference files, including but not limited to:

- Ofwat's Driving Innovation in Water – December 2017
- The Government's rules on tax relief for research and development:

- Look for an advance in science and technology
- Have to overcome uncertainty
- Try to overcome this uncertainty
- Could not be easily worked out by a professional in the field

- Ofgem's Electricity Network Innovation Competition criteria that requires each project to demonstrate one of the following:
  - A specific piece of new (ie unproven in GB) equipment (including control and/or communications systems and/or software);
  - A specific novel arrangement or application of existing electricity transmission and/or distribution equipment (including control and communications systems software);
  - A specific novel operational practice directly related to the operation of the electricity Transmission System/Distribution System; or
  - A specific novel commercial arrangement.
- Our internal definition:
  - An innovation is something new and inventive, something that will delight our customers or unlock potential savings for our business. An innovation doesn't have to be new to the world it could just be new to Severn Trent. Innovations are often born as a solution to a problem.

We have also drawn on the current consultation by Ofwat on driving transformational innovation within the water industry, which considers the benefits of additional financial incentives for innovation. We recognise here that one of the options, end-of-period innovation reward, is designed to operate in the same way as this performance commitment by rewarding a company ex-post for the successful roll out of innovative technologies that are to the benefit of customers.

Specifically we note the following points, which we consider align to our design of this measure:

- Innovation should be understood to not just be about the development of new technologies. Innovation can also be developed by doings things differently and having the right systems, processes and people to support activities;
- Being a 'fast follower' is still innovative where a new technology has not been broadly or consistently adopted
- The purpose of any intervention is to drive transformational innovation that companies would not otherwise explore or invest in;
- Proposals should be just as much about the roll out of innovations at scale and the more broad adoption of new technologies across the industry…; and
- Companies will be required to fund a proportion of project costs to ensure risks are appropriately shared between customers and shareholders.

We believe that being a 'fast follower' of novel technologies should still be considered to be innovative if we are continuing to prove the use of the technology in new ways. In these situations we're likely to be using un-proven technology, at a scale that has not been installed before, or to deliver a level of performance previously not attained. This is, in part, what drives our internal definition to include technology which is specifically new to Severn Trent PLC but also, we believe, why other definitions of innovation do not explicitly exclude it.

We have split this test in to five sub-tests enabling us to demonstrate, in a more targeted way, exactly why we believe the solution is innovative. In order to pass this test a solution must pass each of the five sub-tests. The five sub-tests are outlined in the table below.

Test Number	Name	Definition	Evidence
3a	Deployment	Has the process successfully been deployed within Severn Trent prior to single solution selection?	Demonstrate that at the time of selection the solution was not in use at any treatment works within the Severn Trent area
3b	Standard	Is the process included as a standard process in the design manual?	Within Severn Trent we do not have a design standard for the proposed solution.
3c	Multiple Use	Does the process have multiple deployments in SVT/HD?	The solution is not being deployed across multiple sites concurrently.
3d	Risk	Does the process selected represent a significant increase in risk due, in part, to its innovative nature?	Is the risk level in the process risk log in the Process Options Report "Stretched" or higher and is the solution referenced in the innovation log (if present)?
3e	Totex	Was there a material (>5%) reduction in TOTEX (assessed over the lifetime of the innovative asset?	Whole life cost analysis or equivalent annualised cost analysis is presented.

To pass test three, a qualifying scheme will, therefore:

- Not be deployed within Severn Trent prior to the decision being made;
- Will not have a design standard within the Severn Trent manual;
- Will not be being widely deployed concurrently;
- Be a solution marked as innovative, with a stretched risk, based on our internal design processes; and
- Have a >5% reduction in Totex compared to the conventional solution over the life of the asset.

In order to qualify for inclusion in this measure any solution must pass all three tests, including all five sub-tests for innovation.

4.3 Candidate site – Finham STW

Finham STW, based just outside of Coventry, serves over 430,000 of our customers. It provides secondary treatment through activated sludge treatment with chemical dosing for phosphorus removal and has a sludge digestion centre. Specifically there are three activated sludge plants (with 4 lanes in each plant) where each stream has 4 final settlement tanks.

The activated sludge plant was built in AMP2 to accommodate an ammonia limit tightening from 15mg/l to 5mg/l in April 1999. It was then further tightened to 3mg/l in March 2002, without any significant asset additions.

Modelling of the future loads for Finham, based on the domestic and trade growth rates forecast within the drainage catchment, estimate that the works will need to treat around 490,000 population equivalent by 2028. This is a 14% increase in capacity.

The current site has some spare capacity to absorb this pressure. Our design estimates predicted spare capacity for growth of 4.17% (17,951 pe). The additional load forecast, equivalent to over 40,000 customers, cannot be accommodated within the current processes and maintain permit compliance.

In May 2014 we began feasibility work on a scheme at Finham STW to deliver tighter permit limits for both ammonia and phosphorus. The drivers of the scheme were as follows:

- Ammonia limit tightening from 3mg/l to 1.6mg/l to meet Water Framework Directive (WFD) no deterioration objectives;
- Total phosphorus (TP) limit tightening from 1mg/l to 0.25mg/l to meet WFD improvement to 'fair share' of Good status;
- Other general capital maintenance drivers.

The ammonia WFD no deterioration driver was a reflection of the risk to river quality deterioration from increasing population and was proposed to mitigate against this.

In July 2016 the statutory drivers changed, in line with the Water Industry National Environment Programme to:

- The ammonia limit will now remain at 3mg/l (the WFD no deterioration driver was revoked)
- The TP limit will tighten to 0.22mg/l rather than 0.25mg/l
- 14% growth is predicted in the catchment increasing the population from 430,470 to 489,687 by 2028

Despite the ammonia tightening being rescinded it was acknowledged that "the works will not be able to meet…the existing permit value for Ammonia at the future PE (population equivalent) with the current process stream." (1)

A traditional solution to deliver this additional capacity would have been to build a fourth activated sludge plant, consisting of four lanes and final settlement tanks, increasing the secondary treatment volume by 33%. GPSX modelling showed that this magnitude of capacity enhancement was required to reduce the risk of ammonia limit breach to acceptable levels and reduce the ammonia loading rate down to design manual standard levels (2). This solution was estimated to cost £17.7m CAPEX (3).

Following the initial feasibility assessment, an alternative solution was proposed in light of the growth pressures; this solution would install IFAS (Integrated Fixed Film Activated Sludge) technology into the existing 12 ASP (Activated Sludge Plant) lanes, refurbish all ASPs with a new uprated aeration system and modify/improve the RAS (Return Activated Sludge) system. This innovative approach provides the equivalent additional capacity of the 33% ASP volume increase solution without the addition of treatment volume. This alternative solution was estimated to cost £10.8m CAPEX (4).

We are aware that IFAS is used as a technology elsewhere in the water industry. However, at the point the single solution was selected the there was no comparable installation of the same scale delivering to the same final effluent ammonia standards as our proposed site at Finham. The following table includes the sites that we are aware of operating at the time of our solution selection, we have included Finham for comparison:

Site	Company	Population equivalent	DWF	FFT	Ammonia
Armthorpe	Severn Trent	20,000	2,475 m^3/d	122.7 l/s	3 mg/l (LUT)
Bedford	Anglian	200,000	35,000 m^3/d	1,278 l/s	7 mg/l (LUT)
Colchester	Anglian	125,000	29,284 m^3/d	884 l/s	15 mg/l (LUT)
Deephams	Thames	1,000,000	232,656 m^3/d	5,749 l/s	1/3 mg/l (LUT)*
Finham	Severn Trent	490,000	115,000 m^3/d	2,588 l/s	3 mg/l (LUT)

** The Deephams site has different summer and winter limits for ammonia and was in the commissioning phase at the point we were making our single solution selection for Finham*

In addition to the ASP and IFAS solutions, to mitigate the growth and ammonia compliance risks, a chemical dosing installation and new tertiary solids removal facility was proposed to meet the 0.22mg/l TP limit.

At this point the conventional ASP expansion option was rejected on the basis of higher Equivalent Annual Cost (EAC). The EAC of the IFAS solution was 32% lower and will also result in a significant net reduction in embodied

and operational carbon dioxide equivalent emissions compared to the conventional ASP solution. These proposals were taken to the Secondary Treatment Community of Practice (CoP) for endorsement in August 2016, as any innovative secondary solution requires endorsement before moving to the single solution phase (3).

Following endorsement from the CoP the scheme has now proceeded with the IFAS option as the single solution. The process is currently in the installation/commissioning phase as of July 2019.

4.4 Assessing Finham against the test criteria

Assessment Criteria

Test 1 – Has conventional capacity increase been avoided?

In the Process Design Report, which summarises the assets required to deliver the chosen process option, there is no additional ASP capacity included (neither aeration nor settlement capacity) (2). On page 12 the required key assets required are given as follows:

- *Secondary Chemical Dosing: Replacement of the asset expired ferrous sulphate dosing system*
- *IFAS: The specification is included such that suppliers can design the asset appropriately*
- *Tertiary Chemical Dosing: Installation of a new dosing system*
- *Tertiary Mixing and Flocculation*
- *TSR: The specification is included such that suppliers can design the asset appropriately*
- *Sludge: Modifications to the existing sludge treatment process to accommodate the increase in sludge production*

None of the above assets would be considered as conventional capacity.

The delivery of the selected innovative option has avoided conventional capacity increase.

Subtest 1a: What existing capacity exists within the secondary treatment phase of the site?

The Process Options Report, which summarises the current capacity of the site, shows that the site has limited capacity to accommodate an increase in load (3).

In the Executive Summary, page 2, it is stated that (emphasis added):

> *"Based on OSM [Operator Self-Monitoring] sampling Finham is meeting its current permit, but on-line ammonia sampling has revealed that final effluent quality is generally worst during the night, when few OSM samples are taken, and the Works exceeds its upper tier limit for ammonia on occasions. Process calculations and GPSX simulation modelling indicate that* ***additional process capacity is required to reliably meet the existing ammonia permit****."*

In the Current Performance section, page 12, the current ammonia performance is quoted as follows, in breach of the existing permitted limit:

- *Permitted limit = 3mg/l*
- *95%ile* performance – 4mg/l*

* Where 95%ile is equivalent to the methodology used to calculating performance against the permitted limit.

Furthermore in Appendix III - Works Asset Capacity Assessment, page 42, there is a summary of the treatment capacity of the Activated Sludge Plant. One key criteria is the organic loading rate (also known as F:M ratio).

These are given as follows:

- *Design manual criteria – F:M = 0.1*
- *Process value 2012 – F:M = 0.096*

- *Process Value 2025/26 – F:M = 0.11*

In the same section there is also an analysis of the ammonia loading rate, another criteria used to assess capacity.

These results are given as follows:

- *Design manual criteria – F:M = 0.021*
- *Process value 2012 – F:M = 0.026*
- *Process Value 2025/26 – F:M = 0.03*

The capacity assessment shows that the site can accommodate 4.17% growth (17,951 population equivalent), based on the organic loading rate. Based on the ammonia loading rate the site has insufficient capacity to treat the current loads.

The existing site has limited capacity to accommodate additional growth.

Subtest 1b: Is there sufficient growth forecast in the near future to require expansion?

The Design Envelope Summary (DES) is the document which summarises the scope for the project in terms of growth and capacity (4). In the 'Load Summary' tab the populations are quoted as:

- *Current OAR13 indicative ePOP = 430,470*
- *Future 2027/28 indicative ePOP = 489,687*

These values are used for the process designs in both the Process Options Report (3) and Process Design Report (2) to calculate the increase in loads the plant will have to treat in the future. The estimates were generated from ONS CACI population growth forecasts and verified by checking against planned developments and analysis from reports prepared for Warwick District Council (see the 'Data' tab in the DES).

This growth represents an uplift of 59,217 population equivalent or 14% of the current population over a 15 year period from 2013. This is in excess of the current capacity within the secondary treatment phase at Finham.

There is growth forecast in the near future to is significantly in excess of the available spare capacity, necessitating expansion of the secondary treatment phase.

The scheme at Finham demonstrates that a 15 year growth forecast from 2013 is in excess of the current available spare capacity within the secondary treatment phase.

Test 2 – Does the innovative process add treatment capacity through conventional processes?

In the Process Design Report section titled "Single Solution – Retrofit IFAS in ASP Lanes and TSR", pages 12-13, the additional assets required are summarised (2). With reference to the IFAS solution it says the following:

> *"IFAS is to be installed in a section of each ASP lane to supplement the suspended growth biomass within the system with fixed film biomass which develops on the IFAS media."*

This shows that the innovative process has been designed to supplement the biomass to add treatment capacity but that is not through the addition of conventional processes.

The IFAS solution adds treatment capacity without creating additional activated sludge lanes.

Subtest 2a: Was there an alternative conventional comparative option assessed?

The Process Options Report, in the Executive Summary, proposes that Option 3: Works Expansion (ASP 4) is costed and evaluated in terms of whole life cost and risk (3) (p2). In the Process Options section the works expansion option is described, pages 21-22. The report summarises the additional tankage as follows:

Process Tank Sizing

The new ASP stream will be identical to the existing streams.

Additional Plant	Number	Size	Units
Anoxic Tank	4	512	m^3
Aerobic Tank	4	4180	m^3
Mixers in Anoxic Tank	TBC	TBC	

In addition to sizing the traditional solution, we also considered the capital expenditure impact of this as well as the embodied carbon.

The IFAS solution had an embodied emissions figure of around 375 tCO_2e, whereas the conventional ASP option had embodied emissions of greater than 1600 tCO_2e. Therefore there is a net emissions reduction of at least 1200 tCO2e by choosing the innovative IFAS option.[8]

The carbon emissions estimates related to power usage also show that the IFAS solution results in less annual carbon equivalent emissions. The IFAS solution results in an emissions increase of around 525 tCO_2e/annum whereas the conventional ASP option results in an increase of around 620 tCO_2e/annum. Overall the IFAS solution offers a net reduction in emissions relative to the ASP option of around 95 tCO_2e/annum.

Expansion of the existing activated sludge process was proposed and assessed as a potential solution as part of the options appraisal

Subtest 2b: Does the proposed solution require any additional secondary treatment capacity to be installed (ASP or biofilter)?

In the Process Design Report section titled "Single Solution – Retrofit IFAS in ASP Lanes and TSR", pages 12-13, all additional assets required are described (2). There are no additional volumes proposed and the existing ASP volumes are summarised on page 13-14. The IFAS system was designed to work within the existing secondary treatment volume.

The IFAS option requires no additional secondary treatment volume is added.

Test 3 – Is the solution innovative?

The particular media used in the IFAS solution at Finham has been deployed twice in Severn Trent (5).

- Hodsock WwTW

[8] This was high level assessment of the difference between the two options and the conventional ASP option excluded muck disposal, M&E equipment, concrete steel reinforcement, steel platforms, roads and footpaths' embodied emissions. Using typical construction values we estimate that embodied emissions could be closer to 2205 tCO2e for the conventional options

- Armthorpe WwTW (not included in the Eliquo|Hydrok reference sheet)

At Hodsock the media was deployed in a tertiary ammonia treatment capacity (6), unsuccessfully[9] (7).

At Armthorpe the media was deployed in an IFAS capacity (8), unsuccessfully[10].

Although the innovative process has been used in Severn Trent, it was deployed unsuccessfully

Subtest 3a: Has the process successfully been deployed within Severn Trent prior to single solution selection?

Prior to the installation at Finham, IFAS media had been deployed at two sites within the Severn Trent area. These were as follows:

- Hodsock WwTW as a tertiary treatment stage
- Armthorpe WwTW as an IFAS process

The Hodsock example is being discounted as the media was deployed as a tertiary treatment stage rather than in an IFAS deployment within the secondary treatment process (7). We consider that this deployment does not prove the ability of the media within an IFAS deployment as it is not configured and installed in a comparable manner.

The Armthorpe example is comparable to the Finham deployment as it was installed in the IFAS configuration within the secondary treatment phase. However its deployment was unsuccessful. The evidence for the lack of success is shown through extracts from the Process Options Report which reviews the IFAS performance post-installation (8) (p2):

- "Over the [post IFAS installation] winter period significant concentrations of ammonia were present in the final effluent introducing an unacceptable risk to permit compliance."
- "A number of temporary treatment measures and investigations were undertaken to avoid permit failure and understand why performance was inadequate."
- "The results showed that optimisation of the current assets gave an insufficient improvement in performance and until additional process capacity could be delivered, temporary treatment would be required."

The options offered to return the site to an acceptable compliance risk level were (8) (p2):

- *Option 2 – ASP expansion*
- *Option 3 – ASP expansion and replace IFAS media with alternative type*
- *Option 6 – Conversion to a membrane bioreactor*

The selected option was Option 2 – ASP expansion which was delivered in September 2017[11]. In the Finham scheme the single solution was selected in July 2016[12].

In the Process Options Report for Armthorpe the lessons learnt were summarised (11). The key lessons were as follows:

- Although within supplier manufacturer specifications, the 'biomass available [on the IFAS media] for treatment was too low, leading to incomplete nitrification in a number of scenarios'; on cold days (effluent temperatures <12^{o}C) and during storm events on cold days (effluent temperatures <15^{o}C).

[9] Where it was deemed unsuccessful as the media was removed and replaced with a different type of media

[10] Where it was deemed unsuccessful as post-installation of the IFAS additional conventional ASP capacity was required and prior to the long term solution temporary treatment was required to remain compliant.

[11] Delivery data taken from the scheme gate 5 date (TBC)

[12] Delivery data taken from the scheme gate 3 date (TBC)

- Though biological assessments undertaken by lifting the IFAS cages the biomass estimated from the weight of the cages was significantly less than anticipated. Also, the IFAS biomass (sessile) was less active than that of the mixed liquor (suspended biomass) and with a low nitrification activity. This was pronounced in the samples from the end of the IFAS plant.
- Process modelling and tracer testing indicated significant amounts of short circuiting creating treatment bypassing around the IFAS cages.

Therefore, whilst we can demonstrate that the IFAS technology has been installed at another Severn Trent site, it had not been successfully commissioned. Lessons were learnt from this installation but additional conventional treatment capacity was required to ensure reliable permit compliance. At the point at which we selected the IFAS solution for Finham we did not have a successfully installed solution at any of our treatment works. There was no confirmed design and operating standard, leading to a solution with inherently higher risk.

However, we had gained operational knowledge from our Armthorpe installation and were able to develop more robust solutions in our subsequent schemes.

The single innovative solution at Finham was chosen prior to the IFAS process being successfully deployed as a secondary treatment process within Severn Trent.

Subtest 3b: Is the process included as a standard process in the design manual?

The design manuals which apply to IFAS are as follows:

- Process Selection Criteria (9), which covers all process options at a high level for sewage treatment.
  - All references in this document are to conventional activated sludge processes, there is no mention of IFAS or equivalent processes
- Activated Sludge (10), which covers all implementations of activated sludge processes from small to large
  - There is a specific section in the 'Upgrade Options section (page 7) which summarises "proprietary/innovative alternatives to major works extensions" and includes an entry for Integrated Fixed-film Activated Sludge (IFAS)
  - The comments state "The fixed-film media can be structured plastic, buoyant or non-buoyant random plastic, or non-woven fabric. Random media requires use of retention screens with appreciable headloss but has a generally better track record than non-woven fabric."

The extracts above prove that IFAS is not currently a design standard within our process selection criteria to enable its selection and deployment across the company. Whilst IFAS is specifically referenced in the section on upgrading activated sludge sites, it is included as a proprietary/innovative solution.

As referenced in subtest 3a we had gained operating experience and key lessons from the Armthorpe installation. To consolidate this learning and inform future designs a 3 page 'How to Guide' was written. This document contains design considerations for future projects.

In AMP6 we selected 2 sites in total for IFAS solutions, Goscote and Finham. From what we have learnt we have made adjustments to our design assumptions and mitigated against design flaws, as follows:

- Adjusted our assumptions of how much biomass the IFAS media adds to the system
- Limited the maximum fill proportion of IFAS media in the ASP volume, to maximise the efficiency of the nitrifying biomass
- Reviewed CFD modelling to better specify the IFAS cage geometric positioning within the ASP

The IFAS process is not included as standard within the design manual.

Subtest 3c: Does the process have multiple deployments in SVT/HD?

As referenced in Tests 3 and 3a there have been two deployments of the media in Severn Trent. In addition to this, concurrent with the deployment at Finham we are also installing IFAS at Goscote. This solution is being deployed within the same configuration as Finham, as an enhancement to the secondary treatment process.

We have not included the installation at Goscote within the claim because it does not meet the criteria of test 1, specifically subtest 1a. Upgrades in AMP4 incorporated a capacity enhancement for a future population equivalent of 140,000. The current scheme, installing IFAS, has a design horizon population equivalent value of 133,553. Whilst we consider the solution is similarly innovative and adds treatment capacity whilst avoiding additional conventional capacity the AMP4 scheme already provided for forecast population increases. The key driver for the innovative solution is the implementation of a tighter ammonia limit rather than growth.

Therefore, Goscote does not qualify for this measure.

There has only been one single deployment in Severn Trent

Subtest 3d: Is the risk level in the process risk log in the Process Options Report "Stretched" or higher and is the solution referenced in the innovation log (if present)?

The process risk schedule and innovation log are both present in Finham's Process Options Report (3).

The process risk summary, page 4, states that Option 6 – IFAS is a "Stretched"[13] process risk level and a note explaining the risk level is included which states "STW have experienced problems in meeting low ammonia permits with this technology. The reduced hydraulic retention time cf to standard ASP may be a problem".

The Innovation Log of Process Options, page 33, states that Option 6 – IFAS is an innovative option. The description given is "Limited experience in STW. No experience with suspended carrier elements". The benefits and risk of innovation are given as "Uprates the existing ASP system with minimal civil build. STW have had problems meeting low ammonias using a fixed media system".

The risk level of the IFAS solution is "Stretched" and the option is included in the innovation log as an innovative option

Subtest 3e: Was there a material (>5%) reduction in TOTEX?

As part of the optioneering process a cost benefit analysis is undertaken which involves calculating both the Capital Expenditure (CAPEX) and Revenue Effect Of Capital (REOC) (treated as a delta on the Operating Costs (OPEX)). These were compared between the following solutions:

- IFAS
- Granular Activated Sludge (an innovative process)
- ASP (as the conventional option)

The TOTEX used in our standard options appraisal is the Equivalent Annual Cost (EAC). The financial summary is as follows:

Solution	Initial capital investment	Construction period	Annual operating cost	Asset Life	EAC

[13] **Stretched risk is described as: Level understood, and could potentially be reduced to standard risk by further spend (CAPEX or OPEX)**

ASP (conventional)	£17.679m	2 years (offline)	£629k	60 years for civils and 20 years for aeration	£1,186,560
Granular activated sludge	£14.937m	2 years (offline)	£365k	60 years for civils and 20 years for aeration	£962,759
IFAS	£10.759m	2 years (online)	£265k	20 years for IFAS media and 20 years for aeration	£803,606

Therefore the IFAS option offers a 32% EAC saving compared to the conventional option.

The IFAS option was materially cheaper on TOTEX terms compared to the conventional option

4.6 Reward calculation

The reward calculation is described in the Final Determination where the measurement units are described as:

> *"The above incentive rate is for a notional 1,000 population equivalent capacity increase avoided. The incentive would be scaled up or down for each works according to the scale of the capacity increase avoided"*

At the time of the solution design, as described in the internal Design Envelope Summary (DES), Finham is described as requiring capacity to treat an additional 59,217 population equivalent by 2027/28.

As referenced in the Process Design Report, there is a summary of the treatment capacity of the existing Activated Sludge Plant. This quoted that there was the equivalent of 17,951 population equivalent capacity for growth within the current design of Finham STW at the time of decision.

The remaining additional population equivalent capacity supplied by the innovative technology is therefore 41,266 (59,217 – 17,951), which divided by 1,000 gives 41.266.

The reward rate is given as £28,547 per 1,000 population equivalent capacity increase per year (of the AMP), therefore £142,735/1,000 pe in total.

Therefore the outperformance payment for Finham is £5,890,160.

In our PR14 reconciliation submission in July 2019, we included a forecast outperformance payment of £2.0992m relating to the scheme at Rugby. We are formally updating our forecast to now include the Finham STW site, resulting in two completed schemes and a total outperformance payment of £7.9893m.

4.7 Assurance of this submission

We understand that submitting robust and accurate information that our customers, stakeholders and regulators can trust is important to build trust and confidence in the sector as a whole. Below we summarise the different assurance and review steps we have undertaken prior to making this submission:

- Inclusion within our established annual assurance programme as part of the Annual Performance Report submission since April 2016. This included the development of the process description template (PDT) with independent external review provided by Jacobs Consulting.
- A continual evolution and expansion of the PDT, including the assessment criteria, as the AMP and our understanding of the key assumptions required to demonstrate successful delivery of the measure has progressed.
- At APR19 Jacobs made a number of recommendations regarding our interpretation of the Performance Commitment and our proposed tests used to claim a reward for innovation. Following this further work has been undertaking including:
    - An internal regulatory review of the short-listed candidate sites against the draft assessment criteria to provide internal, independent challenge.
    - A phased internal review process of the submission document which included:

  - Independent internal review by our expert Regulation Manager,
  - Review by our Strategic Leadership team focussed on compliance and regulation,
  - Review by our Executive lead for the measure,
  - Independent Executive review by our Managing Director of Production,
  - Internal Audit review of the data included within the submission.
- An interim 'critical friend' review by Jacobs in August 2019 assessed the evidence we intended to submit to support our claim. Jacobs provided further recommendations which have been noted as actions and are being tracked through our governance process for completion prior to our APR20 assurance.
- Final review and approval for submission as part of our Draft Determination representation through our established governance process.

Annex 1: Risk of severe restrictions in a drought

Methodology:

Following the methodology outlined in the Ofwat "Drought resilience metric – Risk of severe restrictions in a drought" guidance, we calculated the total population at risk of severe restrictions during a 1 in 200 year drought over a 25 year average from 2020-2045 using a number of the results reported in our fWRMP19.

Step 1:

For each water resource zone (WRZ), fWRMP workbooks are copied and two new sheets were added to each workbook ("Forecast" and "Commitment") - they are used to calculate our forecast performance based on baseline data and commitment based on final plan data.

- **Forecast Calculation:** The forecast calculation represents what percentage of our population is at risk of severe restrictions in a 1 in 200-year drought in that year for our baseline performance
- **Commitment Calculation:** The commitment calculation represents what percentage of our population is at risk of severe restrictions in a 1 in 200-year drought for our final plan performance on average over the 25 year period 2020-2045 including the schemes included in the WRMP19 to improve the supply-demand balance (SDB).

Step 2:

Change the DO value in line 7BL in sheet "2. BL Supply" to reflect the 1 in 200 year drought DO reported in Table 10 for all years between 2017 and 2045. The 1 in 200 drought DO values are now reflected in the Total Water Available For Use (WAFU) value in line 13BL in sheet "4. BL SDB" and line 13 FP in sheet "7. FP SDB" and can be used in the calculation of the SDB for this metric.

Step 3:

In the "Forecast" sheet a table was created to calculate the SDB and the population at risk of severe drought restriction for all years between 2017 and 2045. Inputs required for the SBD are lines "BL WAFU", "BL Distribution Input" and "BL Target Headroom" in the "Forecast" sheet. These inputs are available in sheet "4. BL SDB" in lines 13BL, 11BL and 16BL respectively and were linked to each corresponding year in the "Forecast" table. If a WRZ has reported marginal benefits of drought measures (e.g. drought permits) in Table 10 these are added to the WAFU value.

Step 4:

Calculate the supply demand balance (SDB) as BL WAFU – BL Distribution Input – BL Target Headroom. This calculated figure takes into account the supply imports and exports, the details of which are found within fWRMP table.

Step 5:

The input required to calculate the population of a WRZ at risk of severe drought restrictions in 1 in 200-year drought is Total Resource Zone Population (53 BL in sheet "3. BL Demand). This was linked to line "BL WRZ Population" table in the "Forecast" sheet and multiplied by 1000 to account for the unit recording used in the WRMP tables.

Step 6:

Calculate whether the WRZ is at risk of severe drought restrictions (deemed at risk if SDB is negative) this is calculated using a conditional formula (Y = At Risk, N = Not At Risk) in line "At Risk?". If WRZ is at risk then the population of the zone is shown in line "Population At Risk" this is also calculated using a conditional formula.

Step 7:

For the "Commitment" sheet repeat steps 3 to 6 but the input values for WAFU, Distribution Input and Target Headroom values are taken from the sheet "7. FP SDB" lines 13FP, 11FP and 16FP. This sheet includes a WAFU

with our preferred options to manage the supply demand balance over the next 25 years. WRZ Population comes from line 53 FP in sheet “8. FP Demand”.

Step 8:

Calculate company totals for the population at risk using for both the “Forecast” and “Commitment” variables using the sum of population at risk for all WRZs and the sum populations for all WRZs. 25-year average customers at risk (2020-2045) value were also calculated using the OFWAT guidance for the company level.

Step 9:

A summary workbook was created (attached as intermediate calculations spreadsheet) to show the supply demand calculations and percentage of customers at risk calculations for each WRZs and at company level. This workbook includes “Baseline level” and “Performance Commitments” sheets which have a table with data taken from “Forecast” and “Commitment” tabs of each of the 15 WRZs risk calculation spreadsheets discussed in steps 1 – 8.