

**Appendix 13j:
RoRE risk framework and
preliminary analysis**

RoRE RISK ANALYSIS

Framework, preliminary analysis and advice for Yorkshire Water

March 2018

Economic Insight Ltd

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1. Introduction and executive summary

Yorkshire Water (Yorkshire) has commissioned Economic Insight to provide ongoing support and critical review regarding the company's return on regulatory equity (RoRE) risk analysis to inform its PR19 Business Plan. In this first report for Yorkshire, we set out: (i) our recommended framework regarding an approach to developing risk scenarios; (ii) our initial views on what plausible RoRE scenarios might look like; and (iii) our recommended next steps for further work in this area. The overall aim of this initial report is to provide Yorkshire with constructive external advice, which it can then reflect as it develops risk analysis, and its approach to risk management, within its Plan.

This first chapter of our report briefly sets the context for RoRE risk analysis, and risk management, at PR19 and the scope of our work. It then summarises the key findings and recommendations arising from our preliminary assessment.

1.1 Key background context

In their PR19 Business Plans, companies are expected to provide a view on the RoRE range associated with their submissions. This includes providing RoRE analysis to assess the impact of upside and downside risk on plan delivery. The RoRE analysis also has an associated test within the Initial Assessment of Plans (IAP), as follows:

“To what extent has the company demonstrated a clear understanding and assessment of the potential risks in its RoRE assessment, including the effect of the risk management measures it will have in place across each of the price controls?”

In defining what a 'high quality' plan would have in order to meet the above test, Ofwat further states: *“The company will demonstrate they have a clear understanding of the risks that could affect the delivery of the plan, including through RoRE scenario analysis, and that they have appropriate risk management practices in place.”*¹

Related to the above, Ofwat has specified that, within their Plan submissions, companies must model a range of specific scenarios and report the associated RoRE impact, focusing on movements in revenue, totex, ODIs and the cost of new debt. Alongside these scenarios, Ofwat expects: *“companies to explain how their RoRE analysis takes into account the steps management would take in practice to mitigate the impact of downside risks... the RoRE analysis will be an important component of our initial assessment of business plans, but we expect companies to consider for themselves what additional evidence they should provide to demonstrate that their plans are underpinned by robust approaches to risk management.”*²

¹ *'Delivering Water 2020: our methodology for the price review Appendix 13: Initial assessment of business plans.'* Ofwat (December 2017).

² *'Delivering Water 2020: our final methodology for the PR19 price review.'* Ofwat (December 2017); page 170.

In its Final Methodology, Ofwat has prescribed the following scenarios for RoRE risk modelling:

- movements in revenue;
- movements in totex;
- residential retail costs;
- business retail costs (where a company has not exited);
- ODIs;
- WaterworCX (C-MeX and D-MeX);
- financing performance (cost of new debt); and
- water trading.

For each of these, companies are required to show RoRE impacts in a ‘high’ and ‘low’ case, which Ofwat defines as being P10 and P90. Ofwat further states that: *“The scenarios are not intended to reflect extreme possibilities.... we would expect these to be specified at the P10/P90 range of probabilities. This means there would be a 20 percent chance of the key risk factor(s) falling outside of the P10 (high case) and P90 (low case) assumptions used for the scenario.”*³ The results of this analysis are used to populate Appointee Data Table App26. This includes the requirement to report scenario impacts separately for each price control area – and, in some cases, to report impacts in relation to specific incentive or uncertainty mechanisms.

Regarding the above, Ofwat has further stated that: *“Each company will need to determine its own approach to assessing the P10/P90 scenarios... However, we expect the explanations and supporting evidence to be compelling. Upside and downside scenarios may take account of historic evidence, where available and be assessed on the basis of forward looking evidence and expert judgement.”*⁴ In its methodology, Ofwat also emphasises the need for companies to provide evidence of their approach to risk management.

In defining the scenarios, Ofwat also requires that: *“companies should consider the full range of financial impacts for each scenario. This includes any direct impacts, but also take account of any efficient management responses to the relevant change.”*⁵

³ [‘Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return.’ Ofwat \(December 2017\); page 11.](#)

⁴ [‘Delivering Water 2020: our methodology for the price review Appendix 2: Aligning risk and return.’ Ofwat \(December 2017\); page 14.](#)

⁵ [‘Delivering Water 2020: Our methodology for the 2019 price review Final guidance on business plan data tables.’ Ofwat \(December 2017\); page 28.](#)

1.3 The scope of our work

In the above context, Yorkshire asked us to provide ongoing support and critical external review in relation to its RoRE risk analysis and risk management at PR19. We are working iteratively with Yorkshire, where our input includes:

- providing pro-active advice on the overall approach and methods the company should adopt in developing risk analysis;
- critically reviewing risk analysis developed by Yorkshire and providing constructive feedback as to how it can be improved; and
- developing our own independent analysis and evidence that can be used to challenge and inform the company’s RoRE risk analysis and approach to risk management.

This report represents our first formal output to Yorkshire in relation to the above issues. Here, the primary aim of this initial work is to:

- (i) set out our views as to the appropriate framework and methods Yorkshire should apply when developing its risk analysis and approach to risk management;
- (ii) relatedly, identifying practical steps that the company can take to apply the methods ‘in practice’; and finally
- (iii) where feasible, to set out our own early indications as to what the evidence might imply regarding input assumptions to be used in the RoRE scenarios (our analysis of risk ranges is set out in Chapter 4)

1.4 Summary of key recommendations

Following our initial scoping work and analysis, our recommendations are as follows:

- Yorkshire should ensure that its approach to developing risk scenarios **starts form a careful consideration and identification of all relevant risks**. Yorkshire should similarly ensure that its scenarios explicitly take into account relevant risk management actions – and that its supporting evidence is clear about how this has been done.
- **Yorkshire should draw on a combination of four methodologies when developing its supporting evidence for RoRE risk analysis.** This should include:
 - top-down analysis;
 - historical risk analysis;
 - bottom-up risk analysis; and
 - expert judgment.
- Recognising that the above approaches have relative advantages and disadvantages, Yorkshire should take care to consider which approaches are likely to be most suitable for the specific risk scenarios under consideration.
- **The historical risk analysis set out in our report provides one source of evidence – and it would be appropriate for Yorkshire to draw on this** (alongside other information) in defining its P10 and P90 scenarios. Regarding this, we further suggest:

- this evidence is perhaps most robust in relation to the totex risk scenarios and the residential retail cost analysis;
- the evidence is also informative in relation to the revenue scenarios – but is perhaps more robust for retail than for wholesale revenue; and
- this analysis is arguably least robust for ODIs, as risk exposure for these will fundamentally turn on the extent of value Yorkshire attaches to these in its PR19 Plan, and the underlying volatility of performance relating to them (both of which may differ markedly from PR14 ODIs).

- **For specific subparts of the scenarios, such as those relating to the impact of incentive or uncertainty mechanisms, we recommend Yorkshire develops bottom-up approaches.** These should start from collecting data and information on the underlying risk factors of relevance – and impacts should then be derived by applying calculations that accurately reflect the way said mechanisms function in practice.
- Similarly, **to better reflect price control specific risk, Yorkshire may also wish to develop bottom up analyses that are control specific** (e.g. to recognise that revenue risk may be greater in, say, bioresources than in wastewater network plus). Yorkshire should take a proportionate approach in this regard, however, noting that Ofwat is applying a common cost of capital across the wholesale controls.
- **For the ODI scenarios, again we recommend that a bottom-up approach should be applied.** Here, we note that Ofwat’s guidelines suggest techniques such as Monte Carlo modelling / taking covariance into account. We are developing a model that addresses this requirement as part of our broader support for Yorkshire at PR19.
- **In relation to financing risk, there would seem to be merit in obtaining expert views from finance professionals** regarding the likely scope to out/under-perform against the iBoxx. This is because historical data will be inherently coloured by the industry’s previous approaches to financing.
- **In considering whether risk (for specific scenarios, or more broadly) is ‘symmetrical’ or is ‘skewed’ to either upside or downside,** Yorkshire should be explicit regarding:
 - » **The level of risk exposure inherent in its base case.** That is to say, in broad terms, the more ‘stretching’ or ‘ambitious’ Yorkshire’s Plan is, the more limited any remaining upside would be (i.e. the greater the extent to which risk would be skewed to the downside).
 - » The extent to which it regards **Ofwat’s central assumptions** for key price control parameters (or relative incentive mechanisms) themselves represent a ‘balanced’ position, or whether they might also result in risk being skewed one way or another (for example, most likely ODIs will be skewed to the downside for this reason).

WHETHER RISK IS SYMMETRICAL, OR IS SKEWED TO THE DOWNSIDE OR UPSIDE, WILL IN PART DEPEND ON ‘HOW AMBITIOUS’ YOUR BASE PLAN IS.

1.6 Summary of initial evidence

Our work here includes an initial risk assessment across the key scenario areas, including undertaking historical risk analysis to identify P10 and P90 values, where appropriate. We have generally presented these as percentage figures relative to a base case, so that Yorkshire is able to readily apply them to whatever its 'base case' figures are in its plan (e.g. for wholesale water totex risk, we define a P90 scenario as 9.5% of base case costs – consequently, Yorkshire could multiply this by whatever its Plan costs are in order to derive the associated £m impact under the P90 case). These impacts are described in full within Chapter 4 of our report.

For summary purposes, we have further calculated the RoRE ranges implied by our analysis. These are set out in the following table, alongside Ofwat's PR19 guidelines and the RoRE ranges Ofwat published for Yorkshire in its PR14 Final Determination. Again, Chapter 4 explains how these figures have been derived.

Table 1: Summary of RoRE range impacts and comparison to Ofwat's PR19 guidelines and reported PR14 RoRE range for Yorkshire at the Final Determination

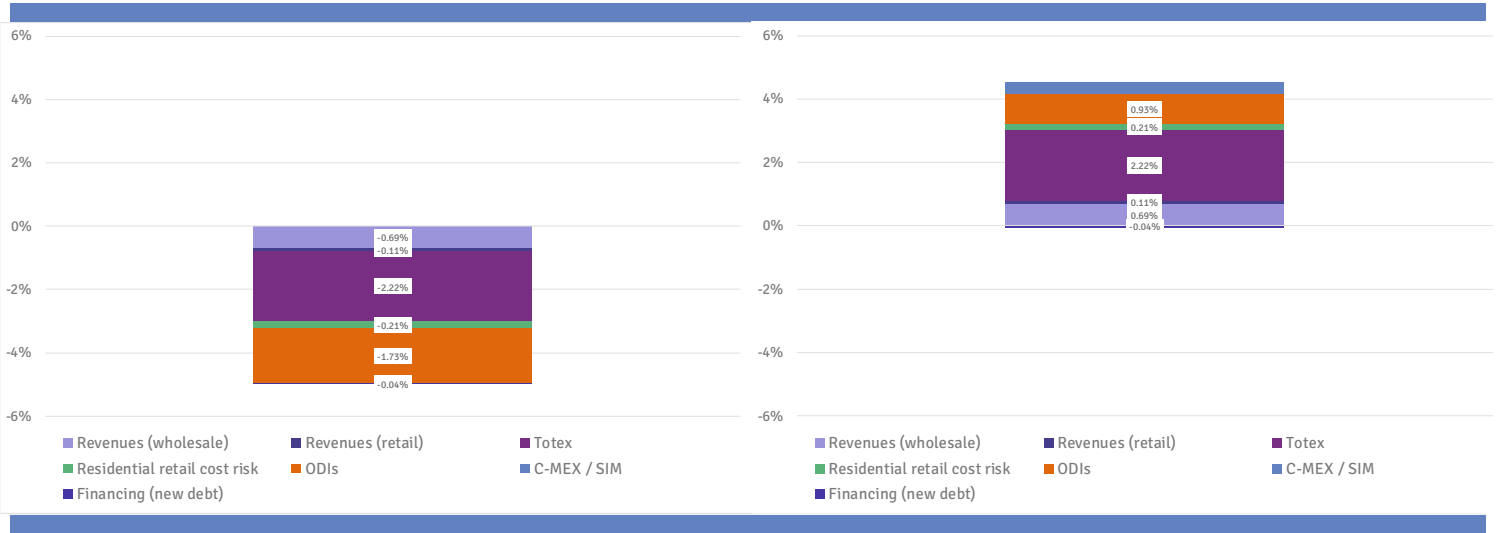
	EI indicative		Ofwat PR19 guidelines		Ofwat PR14	
	Downside	Upside	Downside	Upside	Downside	Upside
Revenues (wholesale)	-0.51%	0.51%				
Revenues (retail)	-0.11%	0.11%				
Totex	-2.22%	2.22%	-2.00%	2.00%	-1.90%	2.20%
Residential retail cost risk	-0.21%	0.21%				
ODIs	-1.73%	0.93%	-2.00%	2.00%	-1.20%	0.40%
C-MeX / SIM	0.00%	0.36%	*-0.50%	*0.50%	-0.10%	0.20%
Financing (new debt)	-0.04%	-0.04%	< -0.50%	<0.50%	-0.40%	0.40%
Total risk exposure	-4.82%	4.30%	-5.00%	5.00%	-3.60%	3.20%
Risk exposure (comparable metrics only)	-4.20%	3.68%	-5.00%	5.00%	-3.60%	3.20%

Source: Economic Insight (*includes D-MeX)

WE HAVE BEEN ABLE TO UNDERTAKE A 'HISTORICAL RISK' ANALYSIS TO IDENTIFY P10 AND P90 VALUES ACROSS A NUMBER OF SCENARIOS – AND CALCULATE THE IMPLIED RoRE RANGES.

Figure 1 below summarises our implied RoRE risk range for Yorkshire, as set out in the table above. Given the nature of our analysis here, this should be regarded as ‘indicative’ at this stage. In particular, and as highlighted elsewhere, whilst we consider the overall *risk ranges* to be robust and credible, further work will be needed to carefully reflect Yorkshire’s chosen calibration of risk as its Plan develops.

Figure 1: EI indicative RoRE range for Yorkshire using historical risk analysis



Source: Economic Insight analysis

2. Framework for risk analysis

This chapter sets out our framework for developing risk analysis. Here, our approach starts from identifying, for each scenario specified by Ofwat, our own objective view of the key risk factors and the associated risk management approaches you should consider. In the subsequent chapter of our report, we then set out thoughts and recommendations regarding what evidence and analysis Yorkshire could draw on to inform plausible P10 and P90 scenarios.

To define P10 and P90 scenarios, we think it is important to root any framework in a **clearly identified set of risk factors or drivers**, relating to each of the predefined scenarios specified by Ofwat. Once these risk factors are identified, one can then examine evidence in relation to each, so as to build up to an internally consistent and coherent set of assumptions which, collectively, can inform the setting of the P10 and P90 scenarios.

Accordingly, in this chapter we develop a risk framework for each scenario area in turn: (i) revenue risk; (ii) totex risk; (iii) residential retail costs; (iv) business retail costs; (v) ODIs; (vi) WaterworkCX; (vii) financing performance; and (viii) water trading. The primary purpose of this is to provide Yorkshire with guidance as to the ‘issues’ it should incorporate within modelled scenarios.

2.1 Revenue risk

2.1.1 Risk factors

Due to the form of price control regulation that applies in the water sector, the only risk factor relating to revenue is ‘demand’. This is because: (i) whilst doubtful-debt related risk could impact revenue, this effects the retail controls (where we note residential retail costs have their own distinct scenario – and so we address this issue there); and (ii) price is not a risk factor.

In relation to demand related revenue risk, this is generally ‘low’ for companies (this view is consistent with PWC’s previous report for Ofwat on the balance of risk at PR19).⁶ Specifically, as the majority of the value chain is subject to ‘total revenue’ controls, recovered revenues are typically expected to be very close to allowed revenues. Notwithstanding this, Yorkshire will be exposed to *some* demand related revenue risk as follows:

- Both the **bioresources** control and the **household retail** control are set on an ‘average revenue’ basis. As such, demand related revenue risk will apply in these two elements.
- In the **water resource control**, whilst a ‘total revenue’ approach is being applied, Ofwat’s methodology also includes a ‘within-period’ demand risk adjustment mechanism. This mechanism is intended to adjust revenues only to reflect the difference between projected and required capacity arising from (bilateral)

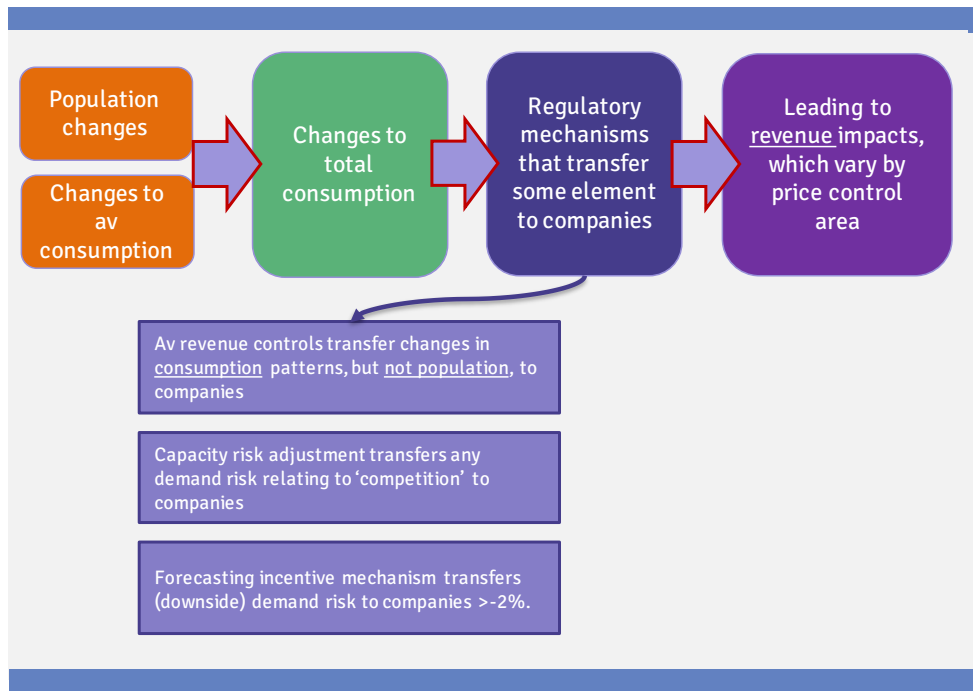
⁶ *‘Balance of risk and reward across the water and sewerage value chain.’ PWC (December 2015).*

competition. As such, there will be some degree of demand risk in this element of the value chain.

- In the **water resources, water network plus**, and **wastewater network plus** controls, Ofwat will further apply a revenue forecasting incentive mechanism. Under this mechanism, Ofwat will apply a penalty, within period, to differences between forecast and actual revenues, where it those differences are greater than 2%. Accordingly, Yorkshire faces a degree of demand related revenue risk through this mechanism.
- In the **water resources** and **water network plus controls**, recovered revenues can further be impacted by water trading incentives.

Following from the above, the next figure summarises our view of the appropriate risk factors to consider when developing revenue risk scenarios.

Figure 2: risk factors for revenue



Source: Economic Insight

2.1.2 Risk management responses

In developing revenue risk scenarios, we think it is important to take account of (and provide good evidence on) the following potential risk management responses:

- **Forecast accuracy.** In keeping with Ofwat’s forecasting incentive mechanism, clearly risk can be mitigated and managed better if companies have high quality demand / revenue forecasts. As such, we would expect: (i) any scenarios developed to take account of the robustness of Yorkshire’s forecasts; and (ii) Yorkshire to provide evidence relating to how its forecasts are constructed and why they are reliable.

- **Capacity planning in water resources.** In water resources, because the risk transfer is contingent on the difference between planned and used capacity, risk can further be managed through good capacity planning processes. By this we mean, demonstrating that the way in which you configure and plan capacity is ‘optimal’.

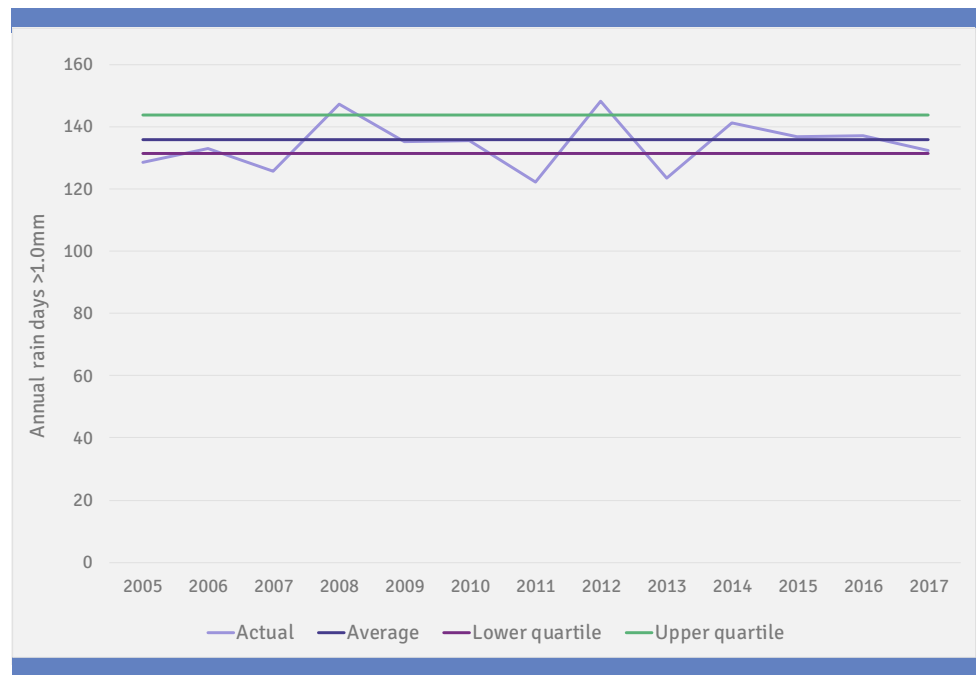
2.2 Totex risk

2.2.1 Risk factors

In relation to wholesale totex, we consider the main risk factors to be as follows:

- **Demand risk.** Variation in demand, which can arise both through changes in customer numbers and / or changes in consumption patterns, can impact the ‘variable’ component of company totex.
- **Underlying wholesale input price pressure.** Whilst allowed revenues at the wholesale level are indexed by inflation (CPIH), companies bear actual cost risk. Therefore, a cost factor to consider in any RoRE risk analysis is the potential variance around input price pressure. This is distinct from cost performance risk (which is captured through the cost efficiency factor outlined below).
- **Cost efficiency performance.** There is uncertainty both regarding: (i) Yorkshire’s *true* relative efficiency position; and (ii) the extent to which, in practice, the company achieves totex efficiency savings. The former issue arises because no cost benchmarking analysis is ever entirely reliable – and so efficiency challenges may be set ‘above’ or ‘below’ the appropriate level. The latter issue arises because, even if efficiency challenges are set appropriately, there is a risk that the company fails to achieve them – or equally, upside risk that the company might achieve efficiency savings beyond the target level.
- **Material weather / environmental events.** In the water sector, incurred costs are dependent on weather patterns and environmental factors. In relation to these, there is an inherent level of uncertainty that persists over time, but *within relatively narrow bounds* (e.g. average rainfall patterns have a relatively narrow interquartile range over the last 20 years in Yorkshire, as shown in the following figure). Our understanding is that these ‘typical’ variations will have only small totex impacts. Consequently, when considering P10 and P90 scenarios, it is more important to identify ‘material’ events that could feasibly occur over PR19.

Figure 3: Total annual rain days > 1.0mm (North East & East)



Source: Met Office (averages and interquartile range calculated over 20 yrs to 2017)

Following from the above, the next figure summarises our proposed risk factors to consider in relation to wholesale totex.

Figure 4: risk factors for wholesale totex



Source: Economic Insight

We note that the various risk factors we have identified above are consistent with Ofwat’s PR19 methodology, where, in describing scenarios relating to totex risk, the

regulator states: “For totex, companies could need to consider, among other things, input price fluctuations and the scope for efficiencies.”⁷

2.2.2 Risk management responses

In developing totex risk scenarios, we think it is important to take account of (and provide good evidence on) the following potential risk management responses:

- **Forecast accuracy.** As described in relation to revenue risk, demand related totex impacts can be managed, in part, through increased forecast accuracy.
- **Cost risk management.** In relation to input price pressure in particular, management practices around (i) procurement; (ii) cost and best practice benchmarking; and (iii) forecasting of underlying inputs, are all likely to be relevant considerations.
- **Weather event preparedness.** The impact of material weather or environmental events can be mitigated by the extent to which companies have robust, and efficient, response strategies in place. This is likely to be an area of particular scrutiny by Ofwat, given its recently announced review of ‘freeze/thaw incidents’.⁸

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⁷ *‘Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return.’ Ofwat (December 2017); page 11.*

⁸ *‘Terms of reference of review of freeze/thaw incidents.’ Ofwat (March 2018).*

2.3 Residential retail costs

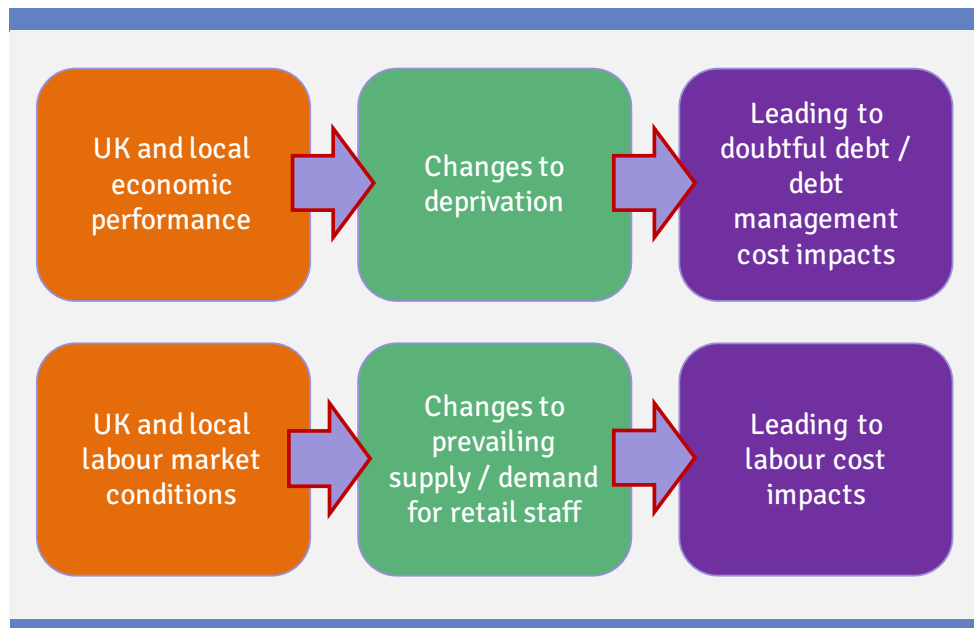
2.3.1 Risk factors

In relation to residential retail costs, the key risk factors to consider in RoRE risk analysis are as follows:

- UK and local economic performance.** It is well established that socioeconomic factors (and in particular, deprivation) can materially affect debt-related retail costs in a manner that is (mainly) outside of company management control. Relatedly, therefore, when thinking cost risk over time (i.e. over PR19) clearly variations in actual broader economic performance will directly affect debt-costs at the retail level. In addition, wider economic performance is, at present, highly uncertain. In particular, we note: (a) that the UK is currently experiencing its longest flatline in productivity performance in history; and (b) that considerable uncertainty continues to exist in relation to Brexit.
- Labour market performance.** Other than debt-related costs, the main material cost category within residential retail relates to ‘labour’. Unlike in the case of debt-related costs, however it is unclear as to the extent to which labour costs: (i) have an associated underlying causal ‘risk factor’; and / or (ii) could vary materially, particularly over the near-to-medium term. Notwithstanding this, is also the case that, over time, the labour costs incurred in residential retail will be a function of broader labour market performance. For example, as new staff are recruited, or at annual pay reviews, labour market conditions (and the resultant underlying labour cost inflation) will feed through to company costs.

The figure below summarises our recommended risk factors to be considered within any RORE scenario analysis.

Figure 5: risk factors for household retail



Source: Economic Insight

2.3.2 Risk management responses

When identifying scenarios that reflect the above risk factors for residential retail, obvious areas where you will need to assess management responses include:

- **Your approaches to debt management:** what would be the scope to mitigate the impact of any downturn in the UK economy, for example, by making efficiency gains in relation to debt management practices?
- **Your approaches to recruitment and pay:** here, issues to consider include: (i) the extent to which you benchmark pay rates against comparators; (ii) lengths of contracts; (iii) whether any contracts are implicitly tied to broader inflation measures and, if so: which measures; whether a symmetrical approach is applied; and whether the approach reflects UK, or more regional, labour market performance. Collectively, how might your approach ‘mitigate’ the impact of fluctuations in labour markets?

2.4 Business retail costs

This scenario is not relevant to Yorkshire at PR19.

2.6 ODIs

2.6.1 Risk factors

In relation to ODIs, we consider the key underlying risk factors to be as follows:

- **Performance related risk.** The main risk in relation to ODIs is a ‘performance one’. That is to say, your revenue varies from forecast because your delivered ODI performance is above or below your central expectations (typically the PC level). The wide variation in both the (i) performance levels; and (ii) rates of change, observed since PR14, might imply:
 - that performance is intrinsically volatile (i.e. there might be drivers of performance that are themselves volatile and outside of company control); and / or
 - that there is uncertainty as to which outcome ‘levers’ (within company control) are most effective at influencing outcome performance (i.e. companies are still ‘learning’ how best to effect performance change); and / or
 - that there is genuinely a wide spread in performance levels and gain across the industry (i.e. in which case the performance risk is simply a function of ‘how well’ Yorkshire as a company performs).

The above possibilities are not mutually exclusive. From a risk analysis perspective, the balance between them would determine one’s view on the underlying level of performance risk exposure, however.

- **Cost risk.** The rewards and penalties Yorkshire will receive in relation to ODIs will also be a function of its marginal cost associated with delivering the related outcomes (i.e. because this features in both the setting of the incentive rates, but also because you bear actual cost risk). In our experience, we consider that is likely to be a material degree of uncertainty regarding this.
- **Regulatory risk.** At PR19, Ofwat has removed the aggregate cap and collar on ODIs, which (at PR14) was set at +/- 2% RoRE. Instead, Ofwat has issued a guideline range of +/- 3% RoRE. Following from this, there is therefore a regulatory related risk concerning what might occur in instances where company performance fell outside of these ranges. For example, even within the current approach (where a cap applies) we note that Severn Trent has elected to ‘defer’ its outperformance awards in relation to wastewater. In our view, key regulatory risks are therefore:
 - in practice, given the pressure to depress bills in the short run, it seems plausible that (either implicitly or explicitly) companies are unlikely to benefit from material outperformance equivalent to >3% RoRE;
 - the regulatory risk is likely to be asymmetric, in that the regulator may be less interventionist in relation to ODI underperformance (i.e. should total underperformance be >3% RoRE).⁹

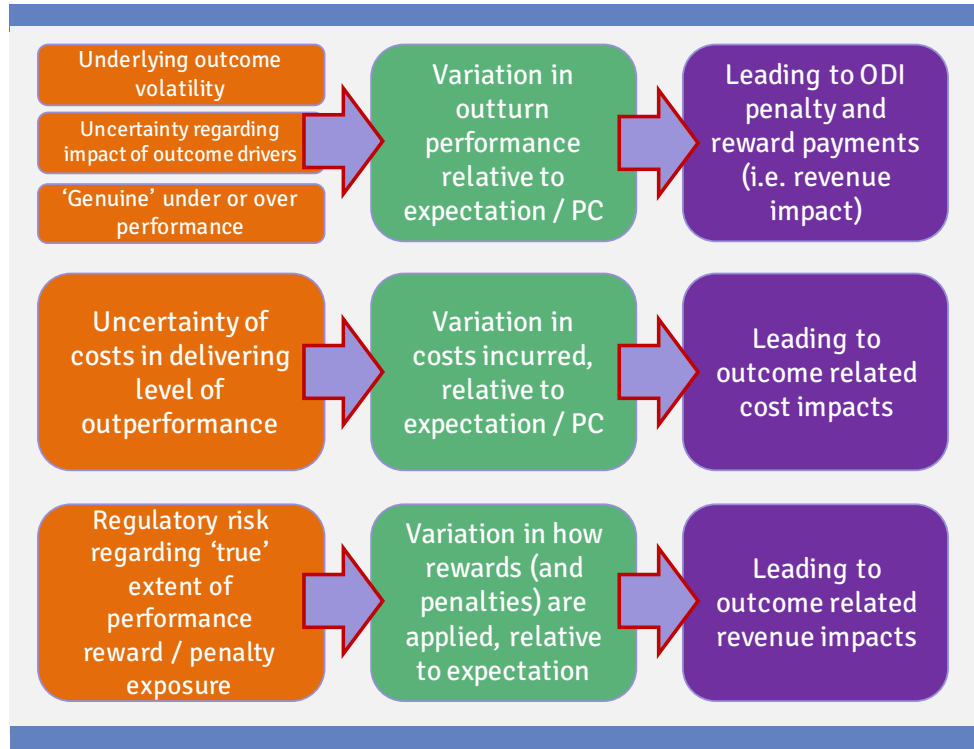
Finally, relating to the above, we cannot rule out the possibility of Ofwat making material interventions as regards companies’ ODI proposals (either relating to the

⁹ For example, this is consistent with Ofwat setting ‘enhanced’ ODI outperformance rates to apply only at the frontier, but for enhanced penalty rates to apply from the lower quartile.

PCs and / or the incentive rates), as was the case at PR14. Were this to occur, clearly the ‘true’ risk exposure would be greater than implied by the RoRE range.

Following from the above, the next figure summarises our identified risk factors for ODIs.

Figure 6: risk factors for ODIs



Source: Economic Insight

2.6.2 Risk management responses

In relation to ODIs, key risk management responses we would expect Yorkshire to consider in developing its scenarios include:

- Performance delivery strategies.** As performance risk is the most material in relation to ODIs, we suggest that Yorkshire should have a set of well-developed plans, setting out ‘how’ target performance will be delivered ‘in practice’. In doing so, areas of uncertainty should be identified and responses established. For example, if delivery of target performance on leakage is contingent on 2 or 3 critical issues, Yorkshire should set out what risks exist around those issues and what it would do, in practice, were those risks to crystallise.
- Cost mitigation strategies.** In setting ODIs, PCs and incentive rates at PR19, Yorkshire will have needed to reach a view on related marginal costs and cost variability more broadly. Consequently, in instances of ‘underperformance’, the value impact will in part be a function of the extent to which costs are actually avoided as a result (i.e. ‘in the real world’). Relatedly therefore, in addition to the evidence and analysis used to infer incentive rates, we would recommend Yorkshire, for the more material ODIs / PCs, have clear practical plans as to how costs could be reduced in the event of underperformance. (The inverse would

apply in instances of outperformance, to ensure that any incremental costs incurred were ‘no more than necessary’).

2.7 WaterworCX

2.7.1 Risk factors

Ofwat has specified that companies provide P10/P90 scenarios relating to WaterworCX, and its two subcomponents: (i) C-MeX (the customer measure of experience); and (ii) D-MeX (the developer measure of experience).

- **C-MeX is an incentive mechanism focused on customer service (i.e. replaces the outgoing SIM).** C-MeX will further include a financial incentive element, based on: (i) a customer service satisfaction survey of customers who have contacted their companies – this will incentivise companies to improve their handling of customer contacts and complaints; and (ii) a customer experience satisfaction survey of customers selected at random.
- **D-MeX is an incentive mechanism targeting developer services.** It will be based on: (i) feedback from a regular qualitative satisfaction survey; and (ii) a quantitative measure of water company performance against a set of key metrics, based on Water UK’s existing measures of service levels for developer services customers.

One difficulty in reaching a view on relevant risk factors here is that they are both ‘new’ for PR19. Consequently, there is more limited information from which one can identify (or assess the magnitude of) risks.

In its methodology, Ofwat provides some information of relevance to the above, however. Specifically, in relation to C-MeX, Ofwat is explicitly allocating greater financial rewards / penalties to the mechanism than was the case under SIM. Specifically, Ofwat proposes to allocate payments based on a ranking approach whereby:

- the **top three** companies get a ‘high reward’ equal to 1.2% of residential revenues pa (6% over 5 years);
- the **top performing** company gets a ‘higher reward’ equal to 2.4% of residential revenues pa (12% over 5 years); and
- the **poorest performers** get a ‘penalty’ equal to 2.4% of residential revenues pa (12% over 5 years). Ofwat has not defined how the ‘poorest performers’ will be identified.

Ofwat is further proposing to draw on wider sector comparators when evaluating companies’ relative performance and establishing rankings.

In relation to D-MEX, Ofwat is proposing to rank companies annually, and apply financial performance (reward) payments of up to 2.5% of annual developer services revenue, with penalties of up to 5% of annual developer services revenues.¹⁰

¹⁰ All above information relating to C-MeX and D-MeX as reported in Ofwat’s PR19 Final Methodology.

Putting the inherent evidential limitations to one side, from first principles we consider the most relevant risk factors to be as follows:

- **Performance risk.** Assuming both incentives are calibrated appropriately, the primary risk type to capture in any scenarios is a ‘performance’ one. That is to say, the risk that Yorkshire’s performance deviates from the target level, such that financial rewards and penalties are triggered.
- **Cost risk.** As per ODIs more broadly, there will be uncertainty regarding the ‘costs’ Yorkshire incurs to deliver any given level of performance on both C-MeX and D-MEX. Here, key issues relate to ‘how variable’ costs are likely to be in these dimensions and whether cost variability is symmetric or not (i.e. costs may be incurred in order to increase performance, but may not necessarily be avoided symmetrically in line with decreases in performance).

2.7.2 Risk management responses

We think that the main risk management responses here will be consistent with those identified for ODIs – i.e. ‘performance delivery strategies’ and ‘cost mitigation strategies’. In practice, however, the ‘newness’ of C-MeX and D-MeX make these much more challenging than in the case of ODIs more broadly. This is because, of course, there is no actual data on which analysis can be based to help determine the likely effectiveness of cost mitigation (for example).

2.8 Financing performance (cost of new debt)

2.8.1 Risk factors

In relation to financial performance risks, Ofwat states: “we proposed that the performance against the cost of debt should consider the variation of the cost of new debt, taking account the range of expected performance against the proposed indexation mechanism.”¹¹

In relation to ‘new’ debt, Ofwat is proposing to move to an indexation approach, where allowed debt costs will be set with reference to the evolution of the iBoxx. Ofwat has further stated that: “We consider that a 50:50 mix of A and BBB rated indices reflects an appropriate range of credit profile for the notional company. We also believe that the iBoxx constitutes an appropriate reference point as a benchmark, representing a range of different companies and sectors. We also confirm that we will use our long term view of CPIH (2.0%) to derive real-terms inputs to our calculations from the index.”¹²

Ofwat will not mechanically apply an index that varies year-by-year. Rather, the regulator will set the cost of new debt using the above index and will then apply an ‘end of period’ reconciliation that adjusts for the difference between its ‘assumed’ cost of debt and the cost of debt actually implied by the index. Ofwat has further stated that:

- Adjustments for out / underperformance against the index will be made at the ‘end of period’, rather than in period.
- Ofwat’s initial assumptions at the start of PR19 will reflect the iBoxx A/BB 10 yrs - non-financials index – and will build in both expectations of interest rate movements in 10 and 20-year gilt yields – as well as Ofwat’s views on outperformance scope.
- Relating to the last point above, Ofwat has said: “For new debt, we consider that the persistent evidence of the ability of the sector to outperform the benchmark iBoxx index justifies an ex-ante assumption that the sector’s allowed cost of debt should outperform the iBoxx. For our early view, we have assumed an outperformance adjustment of 15 basis points.”¹³
- Finally, Ofwat’s approach includes an allowance for issuance and liquidity costs – where the regulator is allowing for a 10 basis point uplift to cover both.

In its methodology, Ofwat set out its provisional view on the cost of new debt at PR19, as follows:

- guideline nominal cost of new debt of 3.40%;
- a range for the real RPI cost of new debt of 0.21% to 0.65%; and
- an allowance of 0.1% for issuance and liquidity.

¹¹ [‘Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return.’ Ofwat \(December 2017\); page 11.](#)

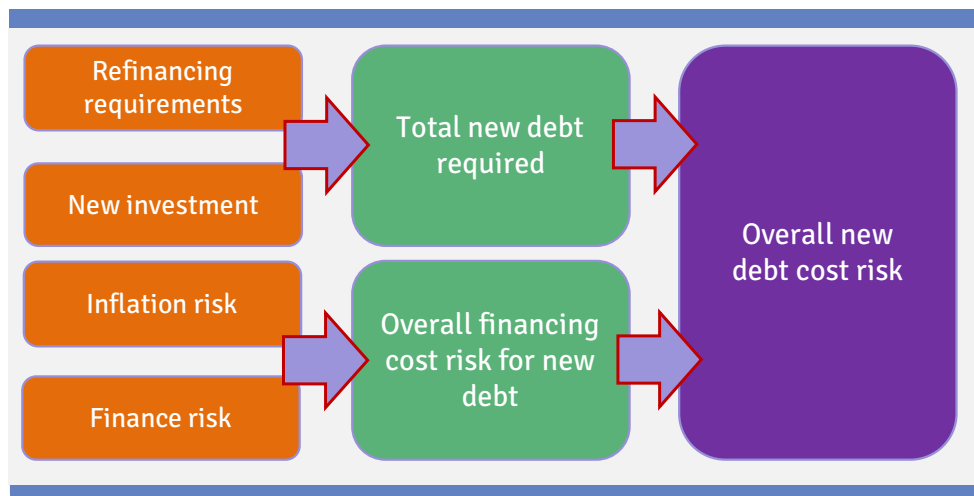
¹² [‘Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return.’ Ofwat \(December 2017\); page 72.](#)

¹³ [‘Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return.’ Ofwat \(December 2017\); page 75.](#)

Overall, Ofwat’s revised approach at PR19 means that financing out and underperformance risk is likely to be significantly reduced, relative to previous price controls. Nonetheless, companies will continue to face some risks in this area. Accordingly, we consider risk factors Yorkshire should consider in developing its P10/P90 scenarios are as follows:

- **Issuance requirements.** Clearly, variation regarding the cost of new debt only arises to the extent that Yorkshire expects there to be a need to issue new debt over PR19. Ofwat’s estimated overall cost of debt at PR19 assumes a 70%/30% split between ‘*embedded*’ and ‘*new*’ debt. In practice, however, individual requirements could vary by company and may depend on factors which are themselves uncertain. For example, factors Yorkshire will need to consider include: (i) the extent to which existing debt needs to be refinanced over PR19; and (ii) the extent to which new capital enhancement spend over PR19 might require additional debt finance.
- **Financing cost risk.** Whilst your allowed debt costs will reflect movements associated with Ofwat’s index (variation adjusted for end-of-period) you will continue to face financing cost risk (i.e. the extent to which the cost of any new finance raised is above or below the index). There are two elements of this:
 - » Inflation related risk – where we note that in making reconciliation payments, Ofwat is intending to apply a rate based on long-term CPIH (2.0%). Consequently, if companies raise debt over PR19 they are exposed to variations between assumed and actual inflation.
 - » Financing cost performance risk – i.e. putting inflation to one side, whether companies are able to raise debt above / below the assumed level.
- **Actual issuance cost risk.** Whilst Ofwat’s approach includes an allowance of 10 basis points for issuance, Yorkshire bears actual cost risk in this regard. Consequently, you will need to consider, within your scenarios, likely variations in issuance costs and factor this into your analysis.

Figure 7: risk factors for the cost of new debt



Source: Economic Insight

2.8.2 Risk management responses

We think that high quality evidence on risk management in relation to financing costs will need to address:

- **The optimality of your refinancing profile.** That is to say, on what basis have you determined ‘which’ debt to refinance and ‘when?’ Over what time period are you seeking to optimise costs and how has this been determined?
- **Your choice of debt instruments.** Companies have a range of debt instruments at their disposal – including: fixed rate bonds; index-linked corporate bonds; swaps and so on. Given the change in methodology towards an index based approach to setting the cost of debt, it will be important to explain how your overall strategy around debt instrument choice has been configured in light of this.
- **Your hedging strategy.** You should provide evidence as to how your overall finance strategy appropriately hedges for inflation and interest rate related risk.

2.9 Water trading

2.9.1 Risk factors

Bulk water trading in the sector has been persistently low, both before and after privatisation. Indeed, over time, trading for the industry as a whole has remained flat, at around just 4%-5% of distribution input.¹⁴ Given this, overall financial risk exposure for companies pertaining to water trading is likely to be low at PR19.

Following from the above, to the extent that risk arises at all, this is very much dependent on the extent to which a company is currently (or intends to be) engaged in water trading. In Yorkshire’s case, Ofwat’s latest published bulk supply register lists two trades (exports) by Yorkshire; to Anglian and Severn Trent respectively.¹⁵

Table 2: Yorkshire’s bulk supply agreements (water trades)

Trade	Volume (m3 15/16)	Revenue forecast 17/18 (£s)
YKYBWE1 – ANH (Anglian)	99,049	£108,479.37
YKYBWE2 – SVT (Severn Trent)	422	£574.26

Source: Ofwat bulk supply register (2017/18)

The above indicates that Yorkshire generates <£110k pa from water exports, indicating that total value ‘at risk’ via trading is likely to be very low. Similarly, the company’s latest Annual Performance Report (APR) shows total bulk supply exports and imports to be 54.5 Ml/d, relative to a total distribution input of 1,261.3 (i.e. trades are just 4.3% of distribution input for Yorkshire).¹⁶

In our view, relevant risk factors Yorkshire should consider when developing scenarios pertaining to water trading include:

- **Volume risk.** We understand that Yorkshire’s existing trades are priced such that there is both a ‘standing charge’ element and a ‘volumetric charge’ element. As such, the company faces some minor revenue risk regarding fluctuations in water supplied (relative to its central expectation) multiplied by the relevant volumetric rate. In addition, volume risk will also flow through to costs (i.e. the ‘variable’ element of cost). Volume risk could be either demand or supply related.
- **Cost risk.** We understand that the nature of the agreements means that Yorkshire bears actual cost risk relating to the water delivered (i.e. there is no mechanism whereby cost variation automatically flows through to prices charged). As such, to the extent that the costs of trades is below / above the expected level, then so too will Yorkshire’s ‘profit’ from trades vary accordingly.

‘Total value ‘at risk’ via trading is likely to be very low.

¹⁴ ‘Delivering Water 2020: Our final methodology for the 2019 price review Appendix 5: Water resources control.’ Ofwat (December 2017); page 50.

¹⁵ We are further aware that Yorkshire’s Special Agreement Register for 2016/17 also lists bulk supply to Business Stream and Peel Holdings. See ‘2016-17 Special Agreement Register: Yorkshire Water Services Ltd.’

¹⁶ ‘Delivering our commitments: Annual Performance Report 2016/17.’ Yorkshire Water.

In principle, it is possible that Yorkshire could face ‘contract related’ risk. However, given our understanding of the nature of the company’s existing trades (which are long-term in nature, the Anglian one predating privatisation and being ‘in perpetuity’) in practice such risk is unlikely to be relevant to PR19.

Finally, we note that the creation of a separate price control for water resources at PR19 is intended, in part, to help facilitate the growth of bilateral competition (i.e. competition ‘in the market’). To the extent that this were to occur, Yorkshire might additionally face ‘competition’ related demand risk. In practice, however, we consider it unlikely that this will occur, to any meaningful degree, over PR19. This due both to the economic fundamentals of water resources, coupled with the residential retail market not being open to competition. As such, we do not think it appropriate for Yorkshire to overlay any additional risk relating to this when developing its RoRE scenarios.

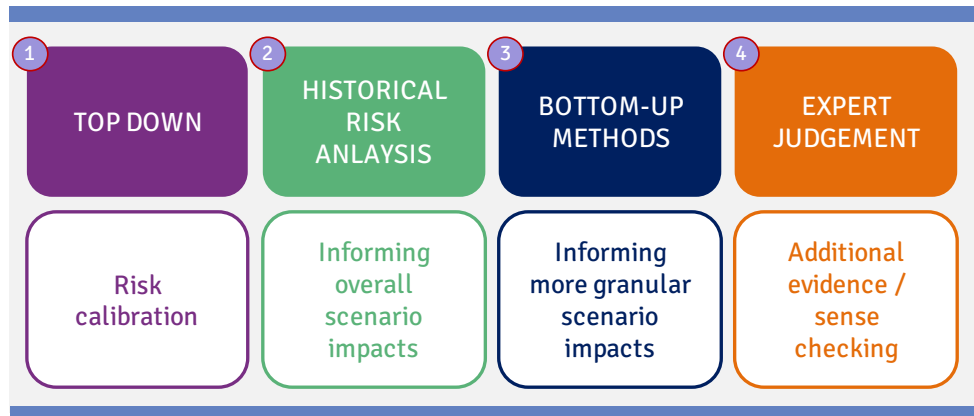
3. Developing evidence to support risk scenarios

In this chapter we provide our views on the main *types* of evidence and analysis Yorkshire should draw on when developing its RoRE risk analysis at PR19. We firstly set out an overview of the key methods, before providing further detail on each in turn, highlighting the circumstances under which Yorkshire should utilise them.

3.1 Overview of approaches to risk analysis

In our view, there are four main analytical techniques that companies can use to inform their P10 and P90 scenarios, which we summarise in the following figure. We consider that a best practice approach would be one that sought to utilise all of these methods, to ensure that the evidence on which scenarios are based is as rich as possible. This is consistent with Ofwat’s guidelines, which emphasise a need for companies to consider a broad range of evidence. In the following passages we briefly expand on our definitions of the below approaches and how we envisage them being applied.

Figure 8: risk factors for the cost of new debt



Source: Economic Insight

3.2 Top-down analysis

One way of informing P10 and P90 scenarios is to ‘start from’ an implied RoRE risk range, and then ‘back out’ plausible changes to baseline cost and revenue projections. Here, we should highlight that Ofwat has been clear that it does not want companies to determine their risk scenarios using this approach. We agree with Ofwat in this regard. However, we nonetheless think that ‘top down’ analysis has a helpful role to play, if used appropriately. Specifically, we recommend that Yorkshire use top-down RoRE information to:

- **Inform the overall calibration of risk in its plan.** That is to say, Yorkshire can compare the RoRE risk ranges implied by risk scenarios (using other methods, as shown in the previous figure) against indicated RoRE risks ranges (e.g. Ofwat’s guidelines at PR19 and / or those at PR14). Where there are very large

differences, this might raise questions as to whether Yorkshire has appropriately calibrated risk across its Plan. For example, if Yorkshire’s scenario analysis implies materially more downside in a particular area than indicated in Ofwat’s guidelines, does that reflect a ‘conscious’ choice by Yorkshire to set ambitious targets in that area? Or, has risk been mis-calibrated?

- **Cross checking of other risk analysis.** Related to the above, by ‘backing out’ implied impacts from RoRE ranges, you have a further piece of information with which you can ‘sense check’ the scenarios you have developed.

For reference, the table below summarises Ofwat’s latest guidance on RoRE ranges across key PR19 areas and compares them to those assumed (for Yorkshire) at the PR14 Final Determination.

Table 3: Summary of Ofwat guideline RoRE ranges

	Ofwat PR19 guidelines		Yorkshire PR14 Final Determination	
	Downside RoRE (%)	Upside RoRE (%)	Downside RoRE (%)	Upside RoRE (%)
Totex	-2.00%	2.00%	-1.90%	2.20%
ODIs	-2.00%	2.00%	-1.20%	0.40%
C-MeX / SIM	-0.50%*	0.50%*	-0.10%	0.20%
Financing	< -0.10%	< 0.10%	-0.40%	0.40%

Source: Ofwat (*includes D-Mex)

When using top down information to help check your risk calibration and / or cross check evidence from other sources, it is important to keep in mind that there are two key reasons why you would expect RoRE risk ranges in your Plan to deviate from the above.

- **Firstly, your RoRE ranges will depend specifically on how you have calibrated risk in your base case.** That is to say, if – for example – Yorkshire intentionally sets itself a very challenging base Plan, it might be that risk is asymmetric and greater on the downside. For example, on totex, if your starting point is one of (relatively) high efficiency, overlaid with further demanding efficiency savings, the scope to outperform is clearly less, relative to a more ‘balanced’ base case assumed by a less ambitious company.
- **Secondly, your RoRE ranges will depend, in part, as to whether the regulator’s assumptions for key price control parameters are themselves calibrated such that upside and downside are symmetrical** – or, whether risk is skewed to the upside or downside.

Building on the above, we think that, when you have developed your risk scenarios, it will be important to compare the implied RoRE ranges to the above figures. You should then ask yourself whether any differences are due to: (i) your intentional decision to calibrate your Plan risk in a particular way; and / or (ii) your own views as to how risk is calibrated within the PR19 framework. To the extent that differences

are not due to these issues, this would then point to a possible need to revisit your evidence and revise your risk scenario analysis.

3.3 Historical risk analysis

By historical risk analysis, we mean analysing actual variation on key performance measures in the past and using this to explicitly calculate the P10 and P90 values required for the risk scenarios. The main advantage of this approach is, of course, that it is rooted in hard data on the actual volatility faced by the industry. Equally, the limitations of this type of approach are that:

- it may not reflect the extent to which the total amount of risk, or balance of risk, has been changed at PR19 relative to prior controls;
- it may not fully reflect company specific Plan risk (depending on whether the data used is company specific, or industry wide); and
- it invariably implies some level of ‘aggregation’, as historical data may not be available in relation to price control areas / incentive mechanisms that are new for PR19.

Relating to the above, we think that this type of approach can be very valuable when assessing the ‘overall’ impacts as defined across Ofwat’s scenarios. For example, it can be used to estimate P10 and P90 values for overall % totex cost impacts. As such, we strongly recommend Yorkshire makes use of this type of approach in developing its risk scenarios – and indeed, we provide some preliminary evidence using this approach in the next chapter of our report.

When applying this approach, Yorkshire will need to consider the extent to which ‘aggregated’ analysis can be used to inform risk scenarios at a more granular level. For example, and as we subsequently set out, it is possible to assess overall totex cost risk at the level of (i) wholesale water; and (ii) wholesale wastewater using this method (i.e. to calculate P10 and P90 values for percentage cost out and performance). Drawing on this, Yorkshire could then:

- apply the cost uplift and down lift percentages for *wholesale water* to both *water network plus* and *water resources* to generate the implied £m values for the risk scenarios in those price control areas (i.e. App26, Section C, rows 23 and 27); and similarly
- apply the cost uplift and down lift percentages for *wholesale wastewater* to both *wastewater network plus* and *bioresources* to generate the implied £m values for the risk scenarios in those price control areas (i.e. App26, Section B, rows 31 and 34).

In practice, of course, the extent to which it is appropriate to utilise aggregated analysis to inform more granular scenarios will turn on the extent to which:

- Yorkshire expects the overall risk profile to be broadly similar across the more granular areas – noting that Ofwat is applying a common WACC across wholesale price control areas (if risk profiles are broadly similar, then the % uplift and down lifts are also likely to be similar, and can just be applied to the relevant base case numbers);
- there is alternative evidence that Yorkshire can draw on; and

THE ADVANTAGE OF HISTORICAL RISK ANALYSIS IS THAT YOU CAN EXPLICITLY CALCULATE P10 AND P90 VALUES, USING ACTUAL DATA. WE SET OUT ANALYSIS USING THIS APPROACH IN CHAPTER 4.

- finally, the relative strengths and weaknesses of the alternative evidence (i.e. noting that as above, the main strength of this method is that it is rooted in actual hard data on volatility).

3.4 Bottom up risk analysis

The third main type of analysis Yorkshire could explore is ‘bottom up’ developed evidence. By this we mean:

- Starting from the key risk drivers (as per our framework and / or Ofwat’s specified scenarios).
- Developing evidence / views as to how those drivers could plausibly vary in a P10 to P90 case.
- Calculating the implied % and then £m impacts that would follow from those changes in drivers.

The main advantages of this kind of approach are that: (i) by starting from a risk framework, it ensures that all relevant risk factors are captured; and (ii) it allows risk analysis to be undertaken at a very granular level (and as such, can clearly be applied to every risk scenario specified by Ofwat).

The main limitations of this method are typically that:

- there is often a lack of data on which to base the assumed variation in the drivers; and / or
- the impact of the change in drivers on the scenario of interest may also be ambiguous and hard to identify with analysis.

Consequently, this approach typically requires a number of assumptions to be made.

Overall, we recommend that Yorkshire uses bottom up analysis as one source of information in developing its risk scenarios. Specifically, Yorkshire should use this method where: (i) the scenario in question has an associated balance of risk that is likely to be materially different from the past; and / or (ii) where historical information is insufficiently granular to inform the scenario; and / or (iii) where Yorkshire believes that plausible input data and assumptions can be developed; and finally; (iv) where it is proportionate to do so. As we subsequently explain, we think this approach is particularly useful in relation to ODIs.

3.5 Expert judgement

In developing its risk analysis, we think it will be important for Yorkshire to draw on its own ‘expert judgement’ to inform the setting of plausible P10 and P90 scenarios. There are three main dimensions to this:

- Firstly, expert judgement can be an additional source of evidence in of itself. That is to say, people working in the business may have views as to what they consider plausible high and low case risk scenarios are likely to be – and those views should be given weight, alongside analytical methods.

- Secondly, as previously described, bottom up methods will invariably require assumptions to be made in order to derive the required inputs. Those assumptions, in turn, are likely to be based on expert judgement.
- Thirdly, following our recommended approach, we would expect Yorkshire to have a range of evidence and methods from which to derive its risk scenarios. As such, the company will need to triangulate across these – where again, expert judgement will be required.

4. Initial evidence on RoRE risk analysis

In this chapter, we provide some *initial* evidence on input assumptions for the P10/P90 scenarios specified by Ofwat. This is not intended to be the ‘final word’ on such matters; but, rather, to provide Yorkshire with an early steer, which it can then feed into its own evidence and analysis.

This analysis is primarily based on the second main category of methodologies described in the previous chapter – i.e. *historical risk analysis*. That is to say, we have sought to identify P10 and P90 values based on an analysis of past risk observed across the industry in the areas of relevance to Ofwat’s scenarios. As previously explained, the main advantage of this approach is that it is rooted in hard data on the actual volatility faced by the industry. Equally, the limitation of this approach is that it may not always be suitable to inform the more granular scenarios.

In the following we set out our analysis in relation to:

- revenue, totex and retail cost risk;
- ODIs;
- C-MeX; and
- financing costs (cost of new debt).

We have not addressed business retail, nor have we considered D-MeX, at this stage.

Having set out our risk analysis in relation to the above, we then provide a summary of the implications for RoRE impacts and compare these to Ofwat’s guidelines as a point of reference.

4.2 Revenue, totex and retail cost risks

To apply a ‘historical’ risk analysis to inform the above scenarios, our approach was to calculate the ‘variation’ between actual revenue, totex and retail costs and those allowed for at PR14, by company for 2015/16 and 2016/17 (inclusive). The logic of this being that, if one interprets the PR14 allowances as a ‘central expectation’ or ‘base case’, then variance around this can be interpreted as ‘risk’.

As previously described, Ofwat’s scenarios ultimately require companies to assess the above impacts at quite a granular level (for example, both revenue and totex, risks must be reported by each price control area at PR19; and impacts must also be shown separately for water trading incentives). By definition, a ‘historical’ approach cannot provide outputs at this level. However, our approach does allow P10 and P90 impacts to be evaluated in relation to:

- overall revenue (wholesale controls);
- overall revenue (retail controls);
- overall totex risk (water wholesale);
- overall totex risk (wastewater wholesale); and
- overall residential retail cost risk.

Following from the above, for each scenario our approach was as follows:

- We collected outturn data from company regulatory accounts for 2015/16 and 2016/17.
- We similarly collected data on the corresponding ‘allowed’ values assumed at the PR14 determinations.
- We then calculated, for each company, the percentage ‘variation’ between the actual and allowed values in both years.
- Not all of the above variation will reflect ‘risk’, but rather, will reflect the fact that companies might choose to profile bills and costs in a particular way over the duration of an AMP. We therefore adjusted the variation to reflect the profiling implied by company K factors.
- We then calculated the P10 and P90 percentage variations for each scenario. Finally, we then adjusted these to reflect a ‘symmetrical’ distribution of risk. This does not imply that we necessarily consider risk to be symmetrical. Rather, we intuitively think this is a *reasonable starting assumption* at this stage in the work in relation to: revenue, totex and retail costs risks. Subsequent to this, consideration will need to be given to the specific calibration of risk in Yorkshire’s Plan. By expressing the P10 and P90 values as percentages, relative to a base case £ amount, Yorkshire can:
 - readily apply them to its base case numbers within its Plan as they emerge; and
 - can apply ‘aggregate’ P10 and P90 values to more disaggregated scenarios (where appropriate).

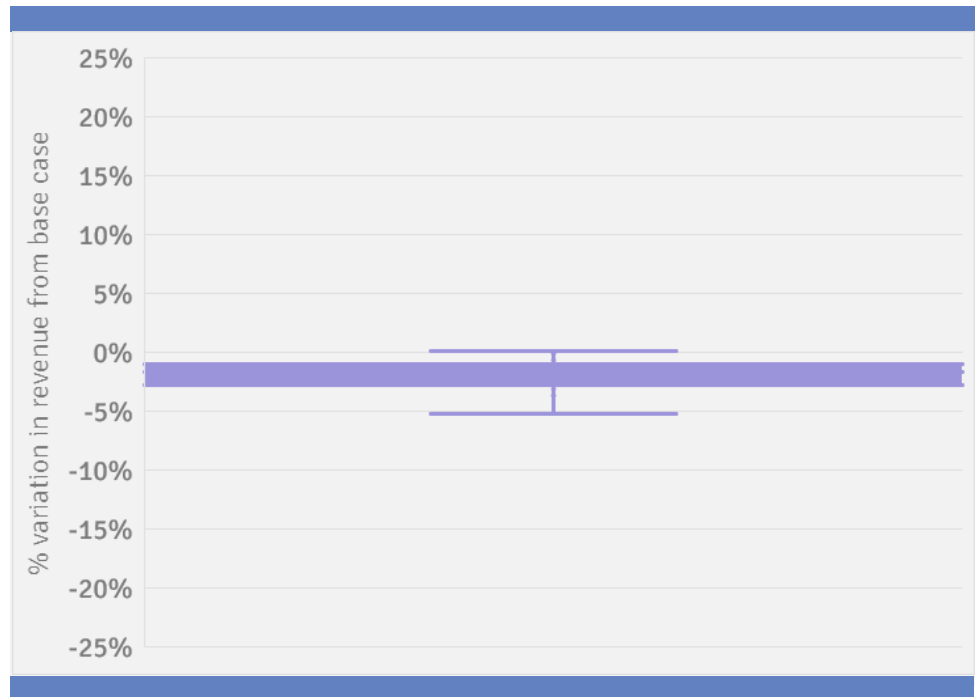
Consequently, the outputs of our analysis can be used as one helpful source of evidence for populating data table App26.

4.2.1 Revenue risk analysis

4.2.1.1 Wholesale revenue

Following the above methodology, the figure below shows a ‘box and whisker’ chart relating to **wholesale** revenue (see the following figure overleaf for more information on how to interpret these). Unsurprisingly, given the ‘total revenue’ nature of water regulation, we find relatively limited variation, with an interquartile range of just 1.43% (relative to base case wholesale revenues).

Figure 9: Wholesale revenue box and whisker chart



Source: Economic Insight

The following table shows the implied P10 and P90 values. These are expressed as a % variation from the base case. Specifically, this means that in the **low** case, wholesale revenues would be 1.4% **lower** than whatever £m numbers were assumed in the base case; and in the **high** case, wholesale revenues would be 1.4% **higher**.

Table 4: P10 and P90 values (wholesale revenue)

	P10 (low case)	P90 (high case)
Unadjusted (% variation relative to base case)	-3.3%	-0.5%
Symmetrical (% variation relative to base case)	-1.4%	1.4%

Source: Economic Insight

The above figures could be used to inform Yorkshire’s population of rows: 1, 4, 7 and 8 within Section A of data table App26 (and the countervailing rows in relation to the low case, set out in Section B).

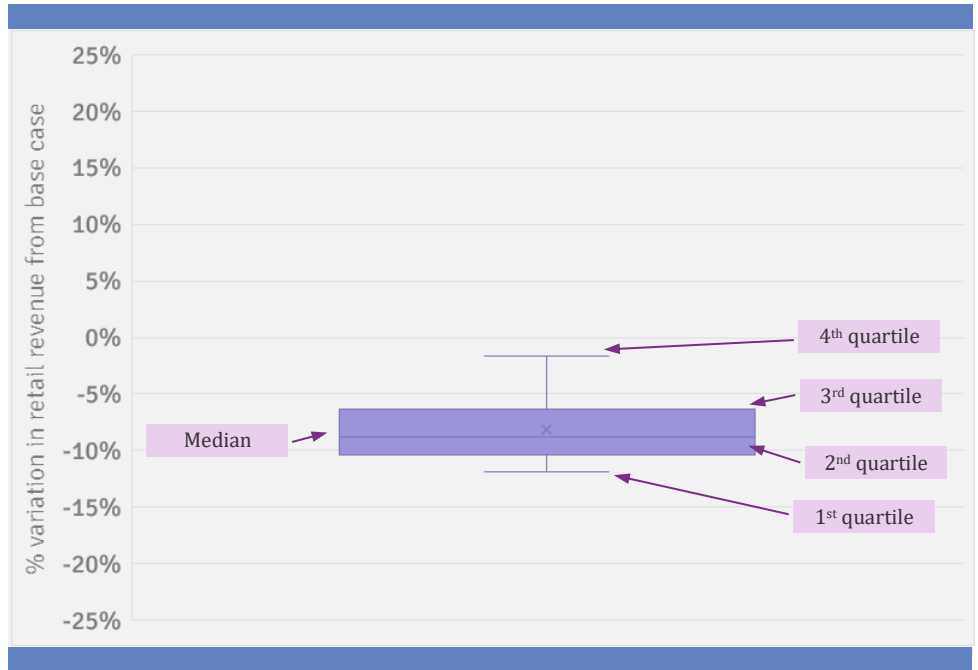
‘Unsurprisingly, given the ‘total revenue’ nature of water regulation, we find relatively limited variation [in wholesale revenues], with an interquartile range of just 1.43%

Note, in its methodology, Ofwat defines the P10 as being the high case and the P90 as being the low case (where the regulator is specifically referring to the £m high and low case figures to be entered into table App26). In our analysis, which of the P10 or P90 is the ‘low case’ varies, depending on whether an increase relative to the case is ‘good’ or ‘bad’. So, in this example, to populate the low case in App26, one would multiply base revenue by -1.4% and enter the implied negative £m figure.

4.2.1.2 Retail revenue

Using the same approach as above, the next figure shows a ‘box and whisker’ chart relating to **retail** revenue. Consistent with intuition, we find a slightly higher level of variation here (compared to wholesale revenue), with an interquartile range of 2.57%.

Figure 10: Retail revenue box and whisker chart



Source: *Economic Insight*

The following table shows the implied P10 and P90 values – as before, these are expressed as a % variation from the base case (i.e. % of retail revenues). Here, the raw data implies risk is skewed more to the downside – but we think the symmetrical figures provide a more reasonable view for business planning purposes.

Table 5: P10 and P90 values (retail revenue)

	P10 (low case)	P90 (high case)
Unadjusted (% variation relative to base case)	-11.5%	-2.5%
Symmetrical (% variation relative to base case)	-4.5%	4.5%

Source: *Economic Insight*

The above figures could be used to inform Yorkshire’s population of row 10 within Section A of data table App26 (and row 21 within Section B for the low case).

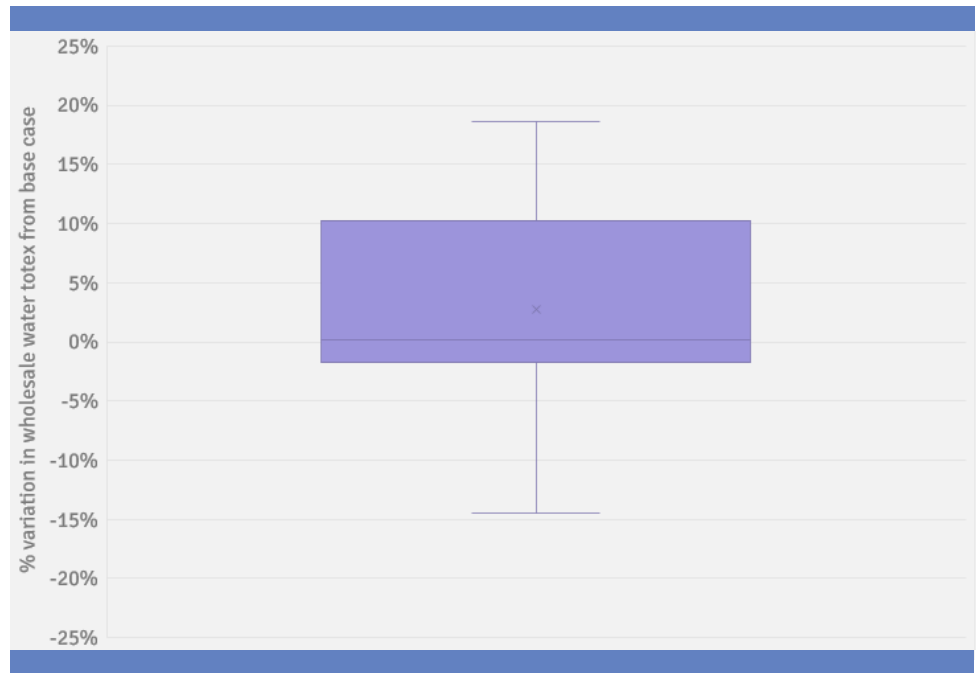
IN THIS SECTION WE USE ‘BOX & WHISKER’ DIAGRAMS TO PROVIDE A VISUAL OVERVIEW OF THE EXTENT OF RISK FOR EACH SCENARIO. THESE DIAGRAMS DISPLAY THE MEDIAN AND QUARTILE RANGES IN THE DATA.

4.2.2 Totex risk analysis

4.2.2.1 Wholesale water totex

As before, below we show a ‘box and whisker’ chart relating to **wholesale water totex**. Reflecting the price control approach in the water industry, we find totex risk to be much greater than revenue risk, with an interquartile range of 10.03%.

Figure 11: Wholesale [water](#) totex box and whisker chart



Source: *Economic Insight*

The following table shows the implied P10 and P90 values – again, these are expressed as a % variation from the base case (i.e. % of wholesale water totex). Here, the raw data implies risk is skewed more to the downside (note, here the P90 is the low case, as ‘overspend’ on totex is detrimental)

Table 6: P10 and P90 values ([water](#) totex)

	P10 (high case)	P90 (low case)
Unadjusted (% variation relative to base case)	-4.6%	14.4%
Symmetrical (% variation relative to base case)	-9.5%	9.5%

Source: *Economic Insight*

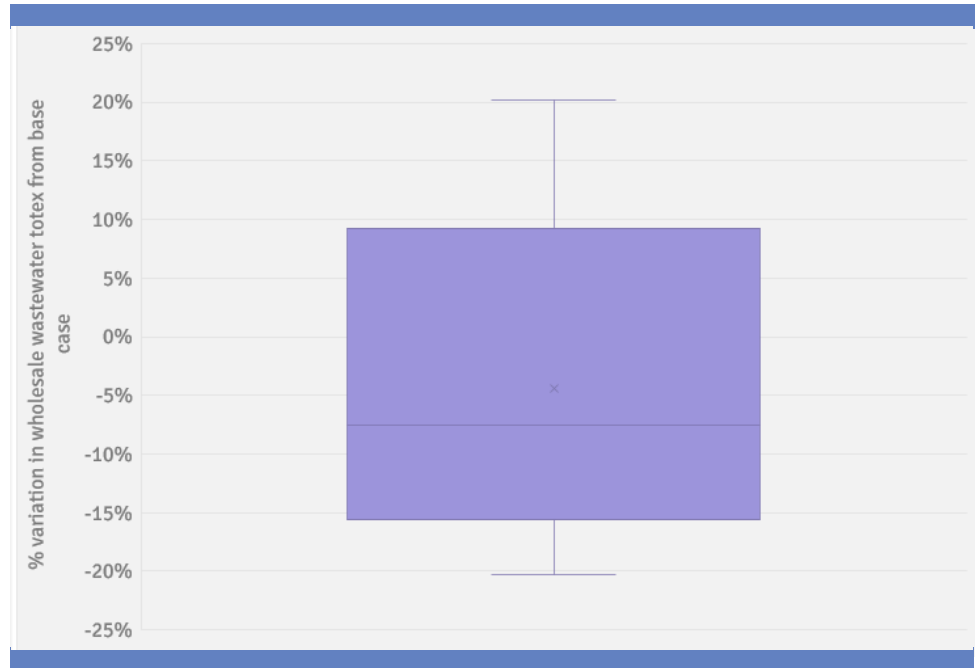
The above figures could be used to inform Yorkshire’s population of rows: 23 and 27 within Section C of data table App26 (and the corresponding rows within Section D). As noted above, care must be taken to interpret the P10 and P90 values correctly.

AS ONE WOULD EXPECT, WE FIND TOTEX RISK TO BE MUCH GREATER THAN REVENUE RISK.

4.2.2.2 Wholesale wastewater totex

Below we show a ‘box and whisker’ chart relating to **wholesale wastewater totex**. We find totex risk to be greater on the wastewater side, with an interquartile range of 17.54%

Figure 12: Wholesale **wastewater** totex box and whisker chart



Source: *Economic Insight*

The following table shows the implied P10 and P90 values for wholesale wastewater totex – as before these are expressed as a % variation from the base case (i.e. % of wholesale wastewater totex). Consistent with the above, we find a much wider P10 and P90 case for wastewater, relative to water (again, note the interpretation of the high and low cases).

Table 7: P10 and P90 values (**wastewater** totex)

	P10 (high case)	P90 (low case)
Unadjusted (% variation relative to base case)	-20.0%	18.4%
Symmetrical (% variation relative to base case)	-19.2%	19.2%

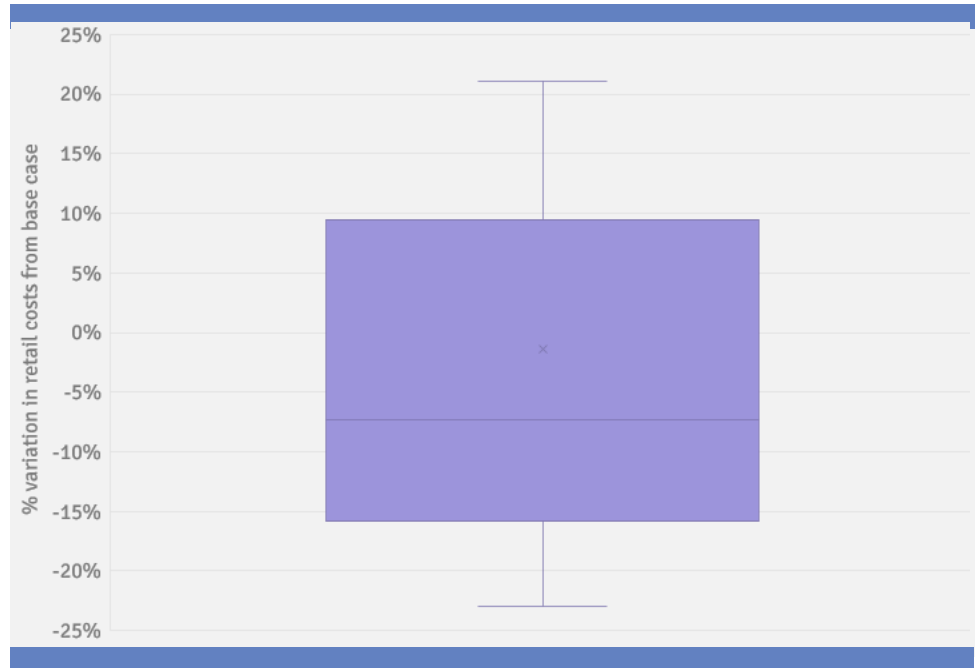
Source: *Economic Insight*

The above figures could be used to inform Yorkshire’s population of rows 31 and 34 within Section C of data table App26 (and the corresponding rows within Section D).

4.3 Residential retail cost risk analysis

Finally, below is a ‘box and whisker’ chart relating to **residential retail costs**. Consistent with intuition, we find the most volatility here, with an interquartile range of 22.42%

Figure 13: Residential retail costs box and whisker chart



Source: *Economic Insight*

The following table shows the implied P10 and P90 values – as before these are expressed as a % variation from the base case (i.e. % of residential retail cost). We find a relatively even distribution of risk here.

Table 8: P10 and P90 values (residential retail costs)

	P10 (high case)	P90 (low case)
Unadjusted (% variation relative to base case)	-19.6%	18.9%
Symmetrical (% variation relative to base case)	-19.2%	19.2%

Source: *Economic Insight*

The above figures could be used to inform Yorkshire’s population of rows: 57 and 59 within Section E of data table App26 (and the corresponding rows within Section F).

4.4 ODIs

In relation to ODIs we have similarly developed a ‘historical risk analysis’ approach to provide initial evidence to Yorkshire of potential low and high case scenarios. Here, our general view is that historical analysis may be somewhat less suitable in relation to ODI related risk analysis because:

- the relative recentness of ODIs means that the related data is intrinsically less robust and less stable – it is questionable, therefore, as to what extent variation in historical data truly captures ‘risk’; and
- the value at risk in Yorkshire’s Plan at PR19 will intrinsically depend on how the company calibrates its ODIs alongside other parameters – which will inform its incentive rates and PC levels – in principle, this could differ materially from the risk implied by an analysis of historical data.

Notwithstanding the above, we consider that historical analysis remains a helpful source of evidence that Yorkshire should consider alongside other sources. Here, our approach was as follows:

- We calculated, for each company, the % difference between actual outcome performance and the associated PC in 2014/15 and 2015/16, using the ODI data published by Ofwat.
- We then calculated the P10 and P90 values associated with this.
- Finally, we then calculated the ODI penalties and rewards companies would receive, *if their level of performance deviated from their PCs in line with the calculated P10 and P90 values* (i.e. we multiplied the P10 and P90 performance levels by each company’s incentive rates, as per PR14).

As shown in the table below, we find that the performance risk, based on the PR14 data, is relatively symmetrical (i.e. the unadjusted and adjusted figures are very similar).

Table 9: P10 and P90 values (ODIs)

	P10 (low case)	P90 (high case)
Unadjusted (% variation relative to PC level)	-23.0%	25.4%
Symmetrical (% variation relative to PC level)	-24.2%	24.2%

Source: *Economic Insight*

It is important, however, to note that the interpretation of this table is different to those shown previously, in that the % values are relative to ODI PC levels, not a £m base case. In fact, because: (i) companies had more penalty ODIs than rewards; and (ii) penalty rates can be higher than reward rates, symmetrical performance risk does not translate into symmetrical financial risk. Indeed, and as shown in the table below, the £m P10 value for Yorkshire (i.e. the downside) is considerably higher than the upside.

Table 10: P10 and P90 values (ODIs – financial impact in £m annual)

	P10 (low case)	P90 (high case)
£m financial impact	-£43.39	£23.29

Source: Economic Insight

The above information could be used to inform Yorkshire's evidence in relation to rows: 65-70 in Section I of table App26 (and the corresponding rows in Section J). In relation to ODI scenarios, we think this approach is perhaps most helpful as a 'cross check' on more granular bottom up risk analysis (such as monte carlo modelling).

4.6 C-MeX

For C-MeX we have similarly developed a historical analysis based approach to give an indicative view of P10 and P90 scenarios. We described Ofwat’s proposed approach for C-MeX previously in this report, whereby companies can face financial penalties or rewards of between +/- 2.4% of retail revenues. However, at this time there is considerable uncertainty regarding how it will function in practice – which limits the nature of analysis that can be undertaken. Specifically:

- it is not clear ‘how’ poor performing companies will be identified; and
- precisely what / how wider benchmarks will be used in ranking companies in order to determine who qualifies for rewards.

Given this, for simplicity our approach has been as follows:

- We collected industry SIM scores for three years from 2014/15-2016/17 inclusive.
- We then assumed that companies’ base case C-MeX performance (and associated rewards / penalties) would reflect their average rank over that period – where we further assumed that:
 - no firm qualifies for the ‘enhanced’ reward (as we assume this requires overperformance relative to a wider benchmark, which we consider unlikely);
 - the top 3 ranking firms on SIM are assumed to qualify for the standard reward rate; and
 - the bottom 4 ranking firms on SIM are assumed to qualify for the penalty rate.
- For each company, we then assumed that their P10 was their lowest rank on SIM during the three year-period and their P90 was their highest rank on SIM. Accordingly, for Yorkshire, the table below summarises the results.

Table 11: P10 and P90 values for C-MeX (£m annual)

	Base	P10 (low case)	P90 (high case)
C-MeX payments as % of residential retail revenues (%)	0.0%	0.0%	1.2%
C-MeX payments (£m)	£0.0m	£0.0m	£9.0m

Source: *Economic Insight*

4.7 Financing risk analysis

In relation to financing risk, we again adopted a ‘historical analysis’ approach to provide Yorkshire with initial evidence to inform its RoRE risk scenarios. Here our approach was as follows:

- We collected data on Yorkshire’s existing bonds, as listed in its 2016/17 Annual Report and calculated a nominal yield for all index-linked debt.
- We then estimated an issuance date for each bond, based on the bond’s listed expiry date. Specifically, we assumed the issuance date was either 10, 20, 30, 40, or 50 years *before* the expiry date (we applied the minimum number of years, such that the implied issuance date was 2017 or earlier).
- We then estimated what Ofwat’s indexed cost of new debt would have been historically. To do this, we calculated the wedge between Ofwat’s cost of new debt, based on the iBoxx as per its Final Methodology, and the risk-free rate, and then assumed this wedge held over time.
- We then calculated the difference between our estimate of Ofwat’s indexed cost of debt (nominal) and Yorkshire’s nominal cost of new debt. We then applied an adjustment so that, on average over time, the actual cost of new debt was equal to the index. This reflects Ofwat’s expectation that, controlling for persistent overperformance, companies are not expected to either systematically out or underperform the index. This then left us with a measure of the variance only.

Using this approach, we found the P10 and P90 values to be +/- 0.4% respectively. In turn, this implies a financial impact +/- £0.9m on an annual basis, as summarised in the table below.

Table 12: P10 and P90 values (cost of new debt)

	P10 (high case)	P90 (low case)
Cost of new debt +/- % relative to base case cost of new debt (basis points)	-0.4%	0.4%
Financial impact – based on value of bonds due to be refinanced over PR19 @ £1.23bn	-£4.9	£4.9
Financial impact – based on refinancing requirement over PR19 using net debt * 30% @ £1.13bn	-£4.5	£4.5
Financial impact pa (£m)	-£1.0m	£1.0m

Source: *Economic Insight*

The above calculation may somewhat understate the implied £m impact of our P10 and P90 values, as it does not take into account additional debt financed investment over PR19.

4.8 Implied RoRE ranges

4.8.1 Summary

Drawing the above together, we have further calculated the RoRE ranges implied by our initial analysis. These are summarised in the table below alongside the equivalent Ofwat reported values.¹⁷

Table 13: Summary of RoRE range impacts and comparison to Ofwat’s PR19 guidelines and reported PR14 RoRE range for Yorkshire at the Final Determination

	EI indicative		Ofwat PR19 guidelines		Ofwat PR14	
	Downside	Upside	Downside	Upside	Downside	Upside
Revenues (wholesale)	-0.51%	0.51%				
Revenues (retail)	-0.11%	0.11%				
Totex	-2.22%	2.22%	-2.00%	2.00%	-1.90%	2.20%
Residential retail cost risk	-0.21%	0.21%				
ODIs	-1.73%	0.93%	-2.00%	2.00%	-1.20%	0.40%
C-MeX / SIM	0.00%	0.36%	*-0.50%	*0.50%	-0.10%	0.20%
Financing (new debt)	-0.04%	-0.04%	< -0.50%	<0.50%	-0.40%	0.40%
Total risk exposure	-4.82%	4.30%	-5.00%	5.00%	-3.60%	3.20%
Risk exposure (comparable metrics only)	-4.20%	3.68%	-5.00%	5.00%	-3.60%	3.20%

Source: Economic Insight analysis and Ofwat (*includes D-MeX)

Key points to note are as follows:

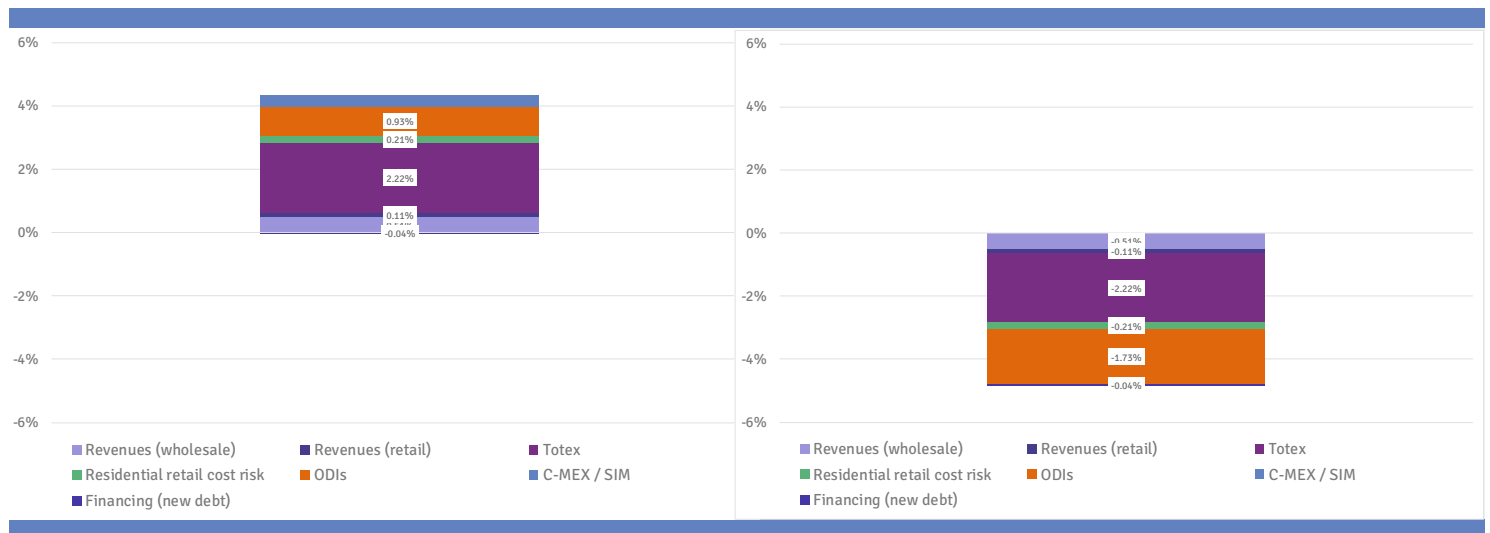
- In relation to revenue risk exposure, we find the RoRE range to be +/- 0.51% (for wholesale) and +/- 0.11% for retail. It is possible that the wholesale risk exposure may be over-stated using our method, as our approach may not have fully captured the extent to which the observed variance was due to profiling issues over time.
- In relation to totex risk, overall our analysis implies a similar range to that indicated in Ofwat’s guidelines. However, as per the previous section of this report, we find risk is greater for wastewater than for water.

¹⁷ Note, the RoRE ranges implied by our risk analysis are indicative. They are calculated by dividing the £m impacts reported here by Yorkshire’s regulated equity for 2018/19 (RCV * 1-60%). No adjustments have been made for RCV run off impacts.

- For ODIs, our analysis suggests somewhat lower risk exposure than indicated by Ofwat for PR19. This most likely reflects the ‘historical’ nature of our analysis (i.e. companies are being encouraged to place more value at risk in ODIs at PR19 relative to PR14 – and as such, historical analysis is perhaps less informative). In practice, and as previously explained, it this is an area where it will be particularly important for Yorkshire to utilise ‘bottom up’ analysis, so that the value at risk accurately reflects its specific proposals. Interestingly, and consistent with the PR14 Final Determination for Yorkshire, our analysis suggests risk is skewed to the downside. We consider this to be highly likely in relation to ODIs.
- In relation to C-MeX, we find upside risk to be around 0.36% of RoRE, which is lower than that indicated by Ofwat in its PR19 Final Methodology. We note, however, that our figure is consistent with a report by E&Y, which states that *“available upside only appears to be worth 0.35% of RoRE.”*¹⁸
- In relation to financing costs (new debt) consistent with Ofwat’s revised approach at PR19, we find a material reduction in risk exposure relative to PR14 – with RoRE impacts reducing from +/- 0.4% to just +/- 0.04%. Ofwat has not explicitly stated what it expects the RoRE impact to be under its new approach. However, from the stacked RoRE charts in the Final Methodology document, we infer that Ofwat anticipates the range being < +/- 0.5% RoRE.

Annex A contains additional information regarding Ofwat’s views on RoRE ranges. Annex B contains a table setting out further details of the data and calculations used to derive the RoRE ranges quoted here. The figure below summarises the RoRE risk range implied by our analysis for Yorkshire.

Figure 14: EI indicative RoRE range for Yorkshire using historical risk analysis



Source: Economic Insight analysis

¹⁸ ‘Balancing Risk & Reward at PR19: A report for United Utilities Water Limited.’ E&Y (2017).

5. Recommendations and next steps

Drawing on the various analyses and views set out here – and consistent with our overarching objective of providing assurance support to Yorkshire in this area – our recommendations are as follows:

- Yorkshire should ensure that its approach to developing risk scenarios **starts form a careful consideration and identification of all relevant risks** (as per our risk frameworks set out here). Yorkshire should similarly ensure that its scenarios explicitly take into account relevant risk management actions – and that its supporting evidence is clear about how this has been done.
- **Yorkshire should draw on a combination of four methodologies when developing its supporting evidence for RoRE risk analysis.** This should include: (i) top-down analysis; (ii) historical risk analysis; (iii) bottom-up risk analysis; and (iv) expert judgment.
- Recognising that the above approaches have relative advantages and disadvantages, Yorkshire should take care to consider which approaches are likely to be most suitable for the specific risk scenarios under consideration.
- **The historical risk analysis set out here provides one source of evidence – and it would be appropriate for Yorkshire to draw on this** (alongside other information) in defining its P10 and P90 scenarios. Regarding this, we further suggest:
 - this evidence is perhaps most robust in relation to the totex risk scenarios and the residential retail cost analysis;
 - the evidence is also informative in relation to the revenue scenarios – but is perhaps more robust for retail than for wholesale revenue; and
 - this analysis is arguably least robust for ODIs, as risk exposure for these will fundamentally turn on the extent of value Yorkshire attaches to these in its PR19 Plan, and the underlying volatility of performance relating to them (both of which may differ markedly from at PR14).
- **For specific subparts of the scenarios, such as those relating to the impact of incentive mechanisms or uncertainty mechanisms, we recommend Yorkshire develops bottom-up approaches.** These should start from collecting data and information on the underlying risk factors of relevance – and impacts should then be derived by applying calculations that accurately reflect the way said mechanisms function in practice.
- Similarly, **to better reflect price control specific risk, Yorkshire may also wish to develop bottom up analyses that are control specific** (e.g. to recognise that revenue risk may be greater in, say, bioresources than in wastewater network plus). However, equally Yorkshire should be proportionate, noting that Ofwat is applying a common cost of capital across the wholesale controls.

- **For the ODI scenarios, again we recommend a bottom-up approach should be applied.** Here, we note that Ofwat’s guidelines suggest techniques such as monte carlo modelling / taking covariance into account. We are developing a model that addresses this requirement as part of our broader support for Yorkshire at PR19.
- **In relation to financing risk, there would seem to be merit in obtaining expert views from finance professionals** regarding the likely scope to out/under-perform against the iBoxx. This is because historical data will be inherently coloured by the industry’s previous approaches to financing.
- **In considering whether risk (for specific scenarios, or more broadly) is ‘symmetrical’ or is ‘skewed’ to either upside or downside,** Yorkshire should be explicit regarding:
 - » **The level of risk exposure inherent in its base case.** That is to say, in broad terms, the more ‘stretching’ or ‘ambitious’ Yorkshire’s Plan is, the more limited any remaining upside would be (i.e. the greater the extent to which risk would be skewed to the downside).
 - » The extent to which it regards **Ofwat’s central assumptions** for key price control parameters (or relative incentive mechanisms) themselves represent a ‘balanced’ position, or whether they might also result in risk being skewed one way or another (for example, most likely ODIs will be skewed to the downside for this reason).

6. Annex A – Ofwat’s indications on RoRE ranges at PR19

In this Annex we briefly summarise Ofwat’s latest views on indicative RoRE ranges at PR19. These are set in in the following bullets:

- **Totex:** *“We estimate a reasonable upper and lower RoRE range for totex would be around $\pm 2\%$, as in the consultation, based on 10% cost out/underperformance against our benchmark”¹⁹*
- **ODIs:** *“For ODIs, we have used a stylised, illustrative RoRE example of $\pm 2\%$ – the midpoint of the indicative range. It is unlikely that companies will achieve upper quartile performance across all ODIs for the full duration of the price control and so achieve the full 3% upside stated in our guidance.”²⁰*
- **Financing:** *“Reduced scope for both under- and outperformance as the allowance for the cost of new debt is indexed.”²¹ Ofwat’s RoRE range charts²² indicate $< 0.1\%$ RoRE range for financing. This is materially lower than the assumed $\pm 0.4\%$ at PR14.*
- **C-MeX / D-MeX:** *“The overall impact of C-MeX and D-MeX combined is around $\pm 0.5\%$ RoRE.”²³*

¹⁹ *‘Delivering Water 2020: Our final methodology for the 2019 price review.’ Ofwat (December 2017); page 164.*

²⁰ *‘Delivering Water 2020: Our final methodology for the 2019 price review.’ Ofwat (December 2017); page 167.*

²¹ *‘Delivering Water 2020: Our final methodology for the 2019 price review.’ Ofwat (December 2017); page 166.*

²² *‘Delivering Water 2020: Our final methodology for the 2019 price review.’ Ofwat (December 2017); page 167.*

²³ *‘Delivering Water 2020: Our final methodology for the 2019 price review.’ Ofwat (December 2017); page 165.*

7. Annex B: details of our calculations

Figure 15: Summary of risk analysis and RoRE impacts

Risk scenario	Price control area	P10 - low case risk exposure (% of base case £m figures)	P90 - high case risk exposure (% of base case £m)	Base case (reg accounting values for 2016/17 £m)	Assumed customer sharing rate where applicable (% customer share)	P10 low case (£m impact in year)	P90 high case (total £m impact in year)	Regulated equity (2017/18 RCV * 1-gearing)	Low case P10 RoRE impact (% pa)	High case P90 RoRE impact (% pa)
Revenue	Wholesale controls	-1.4%	1.4%	£908		-£12.8	£12.8	£2,502	-0.51%	0.51%
Revenue	Retail controls	-4.5%	4.5%	£61		-£2.7	£2.7	£2,502	-0.11%	0.11%
Totex	Water controls	-9.5%	9.5%	£329	50%	-£15.6	£15.6	£2,502	-0.62%	0.62%
Totex	Wastewater controls	-19.2%	19.2%	£418	50%	-£40.0	£40.0	£2,502	-1.60%	1.60%
Residential retail (overall retail cost risk)	Residential retail	-19.2%	19.2%	£54	50%	-£5.2	£5.2	£2,502	-0.21%	0.21%
ODIs	Appointee level indicator					-£43.4	£23.3	£2,502	-1.73%	0.93%
WaterworCX - C-MEX	Residential retail					£0.0	£9.0	£2,502	0.00%	0.36%
Financing (cost of new debt)	Appointee level indicator					-£1.0	-£1.0	£2,502	-0.04%	-0.04%

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