WSX-R02 – RoRE modelling

Response to Ofwat's PR24 draft determination

Wessex Water
YTL GROUP

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Representation reference: WSX-R02

Representation title: RoRE modelling

CONTENTS

1. Summary

As we set out in representation WSX-R05, significant equity investment is required in the sector. To attract investment, debt and equity investors need to earn a reasonable return that provides fair compensation for the risks associated with their investment. This requirement translates into two components: first, the base allowed return needs to reflect forward-looking risk exposure, and second, an efficient company needs to have a reasonable prospect of earning the base allowed return or, that is, an efficient company's expected return needs to equal the allowed return.

In the PR24 DDs, Ofwat stated: We have calibrated the risk and return package so that equity investors in an efficient company have a reasonable prospect of earning the base allowed return, while maintaining financial incentives to outperform cost and performance targets and penalties in case of underperformance. Underpinning this is RoRE analysis presenting a symmetric and balanced range of risk and reward.

However, the approach to RoRE modelling in the draft determination makes a lot of assumptions that diverge from what we expect when considering observed data and what is actually technically feasibility. There are significant improvements that can be made by considering the risks through the principles of engineering and asset management.

The analysis presented here sets out a range for the notional company that is based on the published DDs and actual levels of performance over 2020-25. It gives a more intuitive picture of the risks facing the industry in the draft determination, which are recognised by the wider investor community.

To understand what is driving the level of risk that the industry is facing, and how best to put in place mitigations we have decomposed the notional company's risk into risk arising from regulatory design, and risk arising from mis-calibration of the overall package. We set out a range by area in Table 1.

Table 1 – Decomposition of notional company risk in the draft determination.

	Risk arising from regulatory design			Risk arising from regulatory miscalibration			Notional Company		
	P10	P50	P90	P10	P50	P90	P10	P50	P90
Totex	-4.15%	-0.92%	2.00%	-0.79%	-0.95%	-0.95%	-4.93%	-1.88%	1.03%
Mex & ODI	-2.90%	-0.80%	0.82%	-0.79%	-0.92%	-0.74%	-3.68%	-1.72%	0.08%
Financing	-1.52%	0.03%	1.55%	-0.33%	-0.37%	-0.36%	-1.85%	-0.34%	1.19%
Revenue	-0.05%	-0.03%	0.00%	0.00%	0.00%	0.00%	-0.05%	-0.03%	0.00%
RoRE (additive)	-8.61%	-1.72%	4.36%	-1.91%	-2.25%	-2.06%	**-10.52%**	**-3.97%**	**2.30%**

Source KPMG report.

Key to this is the accurate specification of the notional company. This underpins the risk analysis and is required to produce meaningful RoRE risk ranges. No company achieved upper quartile performance across totex and ODIs consistently every year of AMP7: companies that performed strongly on totex exhibited weaker performance on ODIs, and *vice versa*. As a result, a company achieving median performance across all metrics levels in all years could be considered an upper quartile company with respect to overall performance achieved by its peers. The

calibration of the notional company based on median sector performance reflects an efficient company based on what has been achieved in the sector.

In this analysis the notional company's operational performance is calibrated based on the sector median performance in AMP7 across totex, ODIs and retail. This approach, grounded in historical data, implies that there is scope for regulatory miscalibration of performance that could be achieved by the notional company, which is a material contributor to the risk ranges for a notional company. This contrasts with the calibration of PCs and cost allowances in the DDs, which considered performance between median and upper quartile.

Excluding the risk from mis-calibration, results in a residual risk exposure of -3.97% at the P50 level. This is driven by penalty only ODIs with no deadbands, targets set at a level more stretching than those in submitted business plans, regulatory discretion in the application of clawbacks of totex allowances under PCDs, imbalance of penalty and rewards for timing of delivery of the enhancement programme, and under-funding of debt financing costs.

The identified gap between expected and allowed return could be addressed by either further regulatory mitigations at source, aiming up on the cost of capital or a combination of the two. UK regulatory guidance indicates a preference to address risks at source where possible. Risk mitigations at source can prevent customers from remunerating companies for risks that have not occurred while sufficiently protecting investors and attracting investment.

Accordingly, we are proposing to mitigate the risks observed in the draft determinations by:

- Appropriate funding of base costs to deliver stretching performance levels,
- Setting of PCLs at a level taking account of funding and current performance,
- Automatic ex ante indexation of retail costs,
- An uncertainty framework to fund efficient changes in enhancement costs,
- Dead bands and collars on PCs where there is significant exogenous risk,
- ODI rates set at a level which represents the value for customers and the environment, which likely means considerably below the level set in the draft determination (specifically, as set out in WSX-O01, we ask Ofwat to set our rates at the PR19 level, as these were calibrated using marginal benefit and cost estimates).
- Rebase C-Mex target on water sector median instead of using the UKCSI average given the median water company underperformed the UKCSI average.
- Recalibrating the allowed cost of debt for new and embedded debt consistent with water sector's actual financing terms and forward performance expectations.
- Modified application of non-delivery and delay PCDs to reduce regulatory discretion in application of allowance clawback for late delivery.
- Redesign the ODI aggregate sharing mechanism (ASM) and the totex ASM to more closely reflect the features of RAMs implemented by Ofgem. For example adding an upper threshold on the totex ASM with enhanced sharing rates.

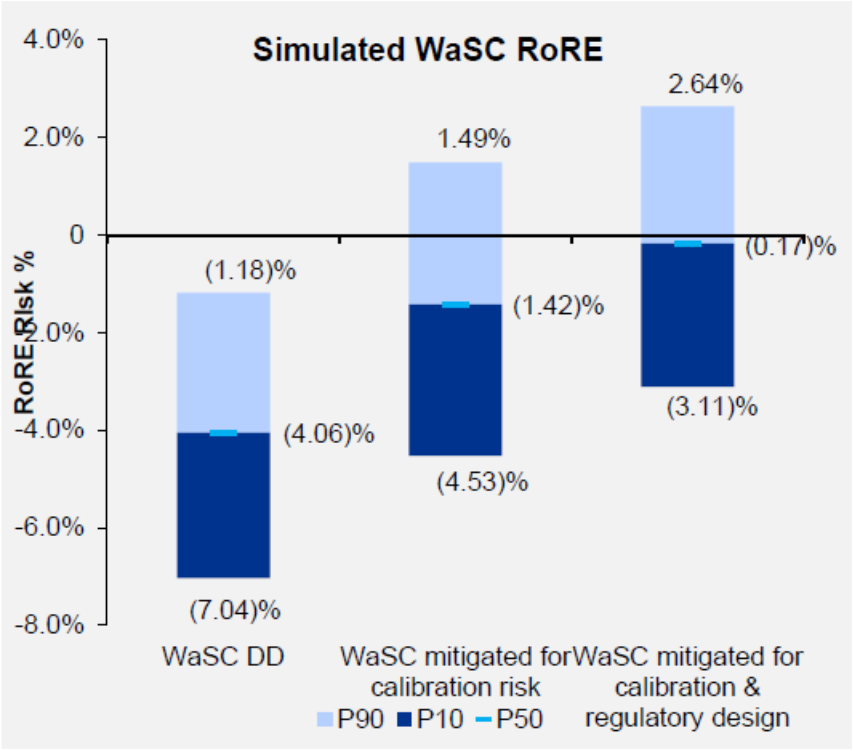
This creates a balanced package of risk and return, with the RoRE impacts set out in Table 2.

Table 2 – Mitigated additive RoRE range.

	P10	P50	P90
Totex	-2.39%	-0.05%	1.94%
ODIs & MeX	-2.81%	0.16%	2.76%
Financing	-1.89%	0.00%	1.97%
Revenue	-0.05%	-0.03%	0.00%
RoRE (additive)	-7.14%	0.09%	6.67%

Each of the components is the result of isolated Monte Carlo simulations, simulating all together results in a narrower range Figure 1 sets this out pre and post mitigations.

Figure 1 – Simulated notional WaSC RoRE range pre and post mitigations



Source: KPMG report.

2. Notional Company Modelling

The industry has engaged KPMG to set out a clear framework for modelling the RoRE range of the notional company considering the draft determination. This report, and the associated model is submitted alongside this representation. This has been used to populate table ADD18.

It sets out a detailed commentary of how modelling has been undertaken for the notional company. Table 3 sets out the key differences to the approach taken in the DD. Full results are available in the report.

Table 3 – Key differences in approach to RoRE modelling

Risk Driver	DD Methodology	Proposed Methodology
Historical data considered	2015-20	Generally 2020-24 with limited exceptions
Distribution types	Normal distribution for all risks	Distribution type determined by a statistical fit test of the historical performance data
Wholesale totex	• Considered totex as a whole in historical data • Calculated risk for time incentive PCDs based on WINEP delivery in 2020 – 2025 • No risk identified for non-delivery PCDs • No correlations specified	• Separated base totex from enhancement totex • Enhancement cost performance and delay risk based on the infrastructure Project Database34 • Time delay and non-delivery PCDs based on delay performance modelled • Correlation between cost and delay performance based on empirical data from Infrastructure Project Database
Retail	Considered retail totex	Considered retail net profit
Mex	• Calculated risk on the maximum and minimum penalty possible with P50 set to nil	• Simulated based on reweighted historical scores as a difference from sector median or UK CSI
ODI	• Calculated each ODI generally setting P50 at no out- or under-performance and using historical data to calibrate the P10 and P90 • No correlations specified	• Simulated each ODI with exceptions based on a baseline of average AMP7 performance multiplied by median business plan forecasts by PC and using historical data to calibrate the P10 and P90 • Correlations specified based on industry performance data collected on a monthly frequency • Simulated PCC and Business Demand based on industry forecast data considering the impact of Covid-19 against outturn performance
Financing	• Calculated interest rate risk on new debt issuance based on sector debt issuances performance vs iBoxx A/BBB non-financial 10 year+ index and calibrated allowance to deduct	• Simulated interest rate risk on new debt issuance based on sector debt issuances performance vs iBoxx A/BBB non-financial 10 year+ index • Simulated risk of embedded debt based on the sector's expected cost of debt performance on embedded debt vs allowance

	• The analysis excluded embedded debt as a risk • Calculated forward looking CPIH risk based on 8 years of CPIH index data • Calculated forward looking basis risk where CPIH indexed RCV is hedging RPI linked debt in the sector based • The analysis excluded basis risk on CPI-CPIH wedge as a conservative assumption that all index-linked debt was RPI-linked and the wedge was historically higher for RPI-CPIH	• Simulated forward looking CPIH risk based on 8 years of CPIH index data over a high and low inflation period applied to the notional company capital structure of 33% index-linked debt • Simulated forward looking basis risk where CPIH indexed RCV is hedging CPI linked and RPI linked debt in the sector based on 8 years of CPI and RPI indexes • Interrelationship between financing risks captured by time series analysis
Market based delivery	The analysis excluded market based delivery as a risk driver	• Considered a broad range of risks that can arise from market based delivery for the appointee • Simulated ranges reflect the risk of a CAP defaulting and the cost of tendering • Number of schemes for the notional company based on sector median number of market based delivery schemes in PR24 DDs • Probability of default for a CAP based on default study of construction companies

We set out the key considerations on the most material risk areas, ODIs, Totex, and financing below.

2.1. ODI Risk Modelling

There are two key assumptions implicit in the ODI RoRE modelling set out in the DD that need further consideration:

1. Proposed stretching targets by the industry are a P50, and
2. Performance is normally distributed.

First, it is clear from outturn performance on common measures in the current AMP that there is consistent and systematic underperformance. The DD represents further levels of stretch when compared to the PR19 targets. This results in a position that is far from expected actual median performance. This was recognised by the industry in its initial submission of plans where most companies set out that it did not expect the resultant RoRE range to be symmetric.

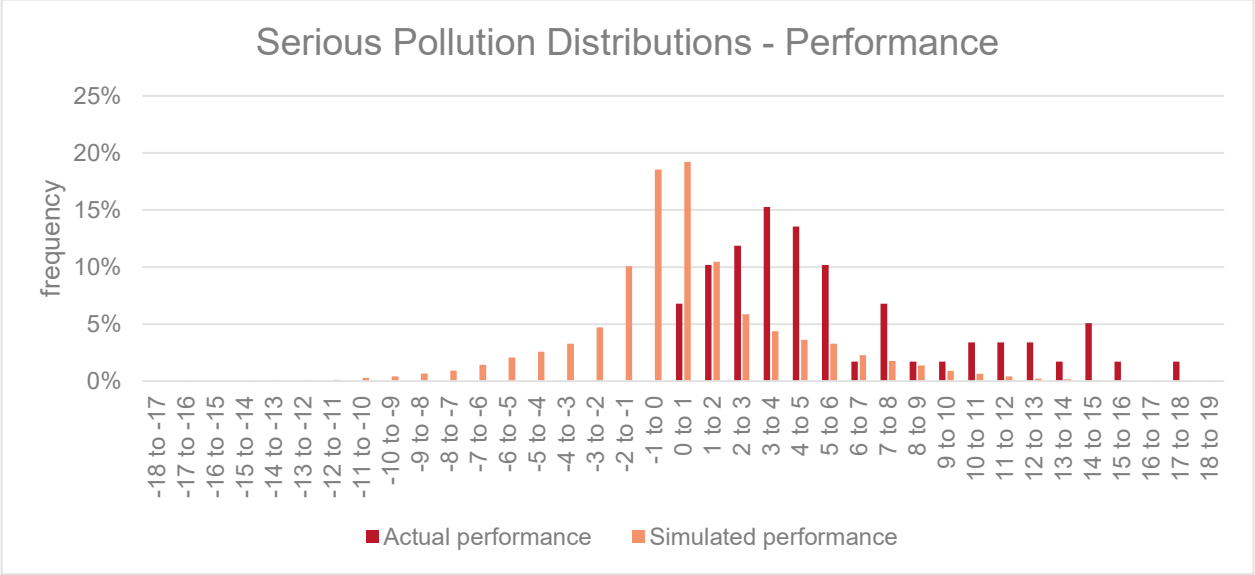
This issue is compounded with the proposed scale of cuts to totex. Often this is explicit, with reallocation of costs into base which are then assumed to be funded by looking across to the PR19 targets. This is conceptually at odds with the arguments, also explicitly, utilised elsewhere, that totex funds the average activity / performance over the modelled period (as set out in WSX-C04). Further the explicit activity-based claims of what must be delivered within base funding reduces the ability for companies to re-prioritise investment. This will make further reductions from base more challenging for fear of retrospective action in other areas.

Secondly, we can clearly see from the shapes of the distributions of actual performance set out in the following charts, that there are distributions that fit the observed data better than a normal distribution. Using such normal distributions does not take account of asymmetric tails of performance or recognise physical limits on performance, such as you cannot get better than zero serious pollution incidents, CRI or water supply interruptions. The effect of

this will be to consider a greater upside, and hence more symmetrical range than that supported by the evidence. This limitation in Ofwat's approach elsewhere has been identified by its independent consultants.[1]

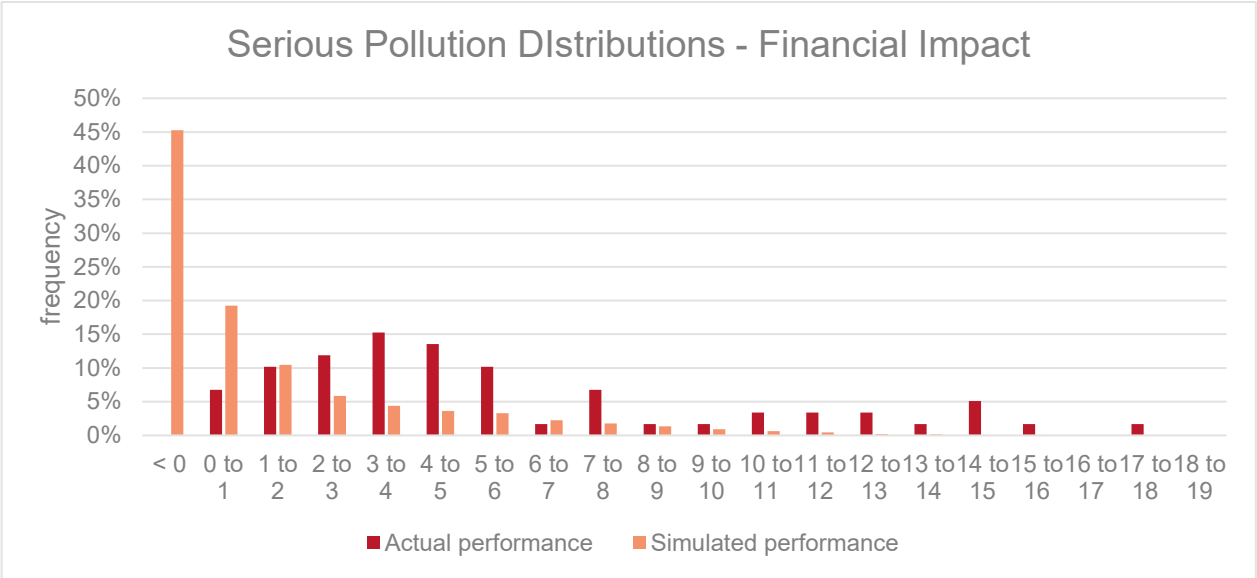
Figures 2 to 4 set out two examples, these are not unique, and it is a common issue across all measures.

Figure 2 – Serious pollution simulated vs actual performance.



When queried, Ofwat claim as an intermediary step this does not matter as they cap the financial impact at zero. This does however have a large distortive impact on the distribution of performance informing the financial impact.

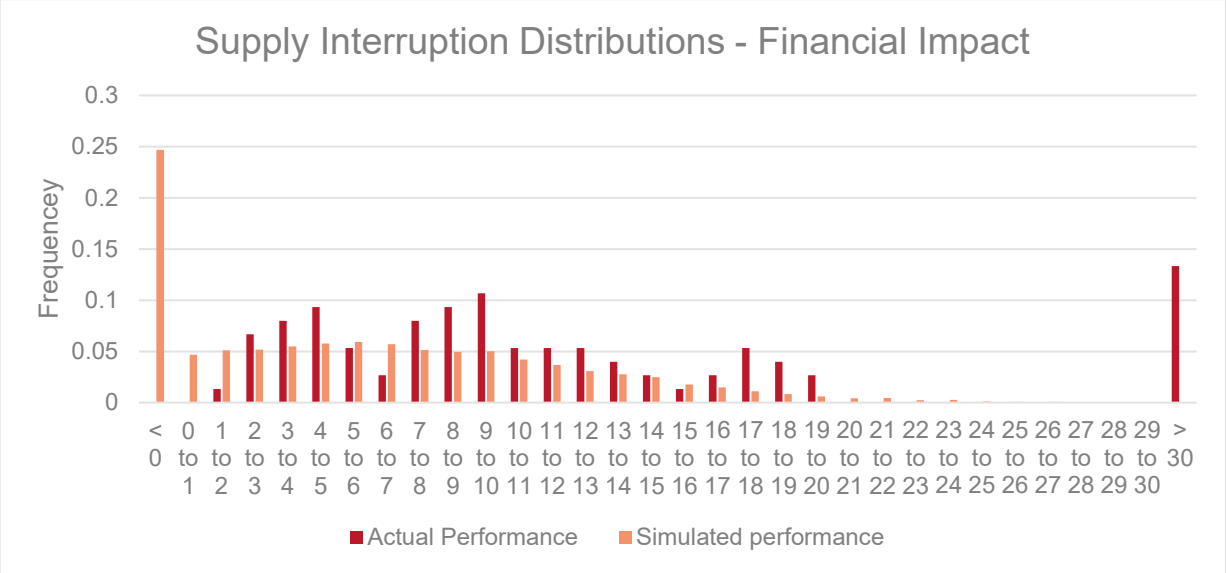
Figure 3 – Serious pollution simulated vs actual financial impact.



[1] See for example 5.4 of Grant-Thorntons-Review-of-Ofwats-approach-to-setting-ODIs-at-PR24-2.pdf

We see a similar picture when also considering the distortive impact of these assumptions on water supply interruptions, set out in Figure 4.

Figure 4 – Water supply interruptions simulated vs actual financial impact.



Instead, distributions based on actual performance should be used to perform a notional company RoRE analysis, as set out in the KPMG report and model submitted alongside this representation. This gives the ODI range set out below. This analysis is conservative in that it doesn't acknowledge the ever-increasing stretch in performance demanded by Ofwat, and the further negative skew this represents.

2.2. Totex Risk Modelling

Base costs

Although the DD base costs represent an increase from the PR29 allowances, they still represent a real reduction in costs when compared to actual expenditure over 2020-24. The KPMG report sets out that when accounting for all efficiency challenges and growth in customer base the real increase over PR19 is 6%. Sector performance shows when accounting for timing differences and energy indexation a 19% overspend. This leaves a substantial funding gap across the industry, and hence an asymmetric skew to the RoRE modelling.

Enhancement costs

The scale and complexity of the capital programme at PR24 is unprecedented for the sector and drives a significant amount of risk in the notional company. This was recognised by Ofwat and addressed to some degree in the DDs, however material enhancement totex risk remains and arises from both the design of the regulatory framework and potential miscalibration of regulatory parameters. There are two key risks included in simulation to capture the enhancement totex RORE ranges: cost performance and delay risk.

Firstly, cost performance risk inherent in construction projects in the infrastructure sector is driven by the following risk drivers: scope change, design change, input price changes and ex ante budget mis-forecasting risk. Scope changes and design changes also materially impact delay risk as well as the knock on impact of higher costs. Cost and delay performance is highly interrelated given the shared risk drivers between the two.

An efficient notional company is exposed to scope change, design change and input price changes. An efficient company can also be exposed to ex ante budget mis-forecasting where projects are higher in complexity or involve new or untested technology, as a large portion of the PR24 programme is. This creates an asymmetry of information risk for companies.

These lead to a well-established understanding of delivery risk. With wide acknowledgment of the asymmetric profile.

"There is a demonstrated, systematic, tendency for project appraisers to be overly optimistic. To redress this tendency appraisers should make explicit, empirically based adjustments to the estimates of a project's costs, benefits, and duration. " HM treasury, Green Book supplementary guidance: optimism bias 21 April 2023

This creates another negative skew to the RoRE modelling and results.

Retail

We think there are two key drivers of risk on retail that also create a systematic downward skew that aren't acknowledged in the assessment set out in the DD.

1. Lack of automatic indexation of costs – as set out in the DD commentary of financing risk, there is a greater chance of a higher five-year average inflation, and therefore greater upward pressure on costs.
2. Potential upward pressure on bad debt – through continued impact of the ongoing cost of living crisis, currently not included in the retail cost assessment. Or the impact of continual negative coverage of the industry, by Ofwat and the press, triggering payment strikes.

Given all this it shows a likely downward skew in retail RoRE.

2.3. Financing Risk

Risk arises from two key macroeconomic factors (1) non-inflationary interest rate risk and (2) inflationary rate risk. Recent market volatility following the COVID-19 pandemic, the Russia-Ukraine war and "Trussonomics" highlights the importance of an appropriately set allowance. Increased volatility increases the risk to which the sector and its stakeholders are exposed.

Key contributors to the negative risk exposure in the base-case scenario is performance of the notional company against the allowances on embedded and new debt. This is because DD allowance for the cost of embedded debt is lower than the all-in cost of embedded debt for the median company in the sector. At the same time, the cost of new debt allowance, based on the iBoxx A/BBB indices, is significantly below the cost of new debt issuance achieved by water companies over the last 12 months.

Inflationary risk is present in the Draft Determination framework because the notional company is not fully protected against (1) deviations between the observed CPIH index and the assumed level, and (2) basis risk as a result of the efficient notional company having to issue index linked debt linked to non-CPIH benchmarks, i.e. resulting in an RPI-CPIH or CPI-CPIH "wedge", when income through RCV and customer bills are linked to CPIH.

3. Mitigations

Without mitigations, analysis indicates notional company AMP8 performance (1) has a negative P50, suggesting the allowed return will not be earnt, (2) is asymmetric, with more scope for downside scenarios than upside, and (3) exhibits a high level of variance, with a wide range between best-case and worst-case scenarios.

Mitigations to the risk identified in the Draft Determination can be decomposed into two categories:

- Mitigations addressing risk relating to the calibration of the notional company,
- Mitigations addressing risk relating to the asymmetry of regulatory mechanisms.

The KPMG report sets out a full analysis of potential mitigations, below we focus on the critical ones we are proposing to ensure that our plan sets an appropriate balance of risk and return.

3.1. Mitigations addressing risk relating to the calibration of the notional company

Appropriate Base Funding – set out in WSX-C01

Appropriate base allowances mitigate the base costs risks set out above. It reduces the downside P50 and overall RoRE variance implied by AMP7 performance.

Appropriately calibrated PC targets – set out in WSX-O01

Appropriate PC targets will mitigate in part the ODI risk set out above. It reduces the downside P50 and overall RoRE variance.

Uncertainty framework – set out in WSX-M07

Re-openers for enhancement (for costs and incentives) areas with material scope uncertainty will reduce the potential downside in enhancement risk set out above. It will reduce the downside P50 and the asymmetric skew of overall totex RoRE.

Appropriately calibrated cost of debt allowance - set out in WSX-R01

KPMG's Cost of Debt report demonstrates the median company cost of debt is higher than the allowed cost of embedded debt and that it cannot issue at the allowed cost of new debt. It also demonstrates basis risk exposure due to the RPI-CPIH and CPI-CPIH wedge. Financing underperformance therefore occurs, which is remedied through provision of sufficient allowances.

3.2. Mitigations addressing risk relating to the asymmetry of regulatory mechanisms

Automatic ex ante indexation of retail costs – set out in WSX-C19

This will mitigate the retail risks set out above, reducing the downside P50 and reduce the residual range, both up and down.

Dead bands and collars on PCs where there is significant exogenous risk – set out in WSX-O01

This will reduce the asymmetry arising from penalty only ODIs and reduce the impact of asymmetric distributions in the overall ODI RoRE range.

Recalibrated ODI rates – set out in WSX-O01

Set ODI rates at a level which represents the value for customers and the environment. This will reduce the overall volatility in RoRE range.

Rebase C-Mex target – Set out in WSX-O03

Rebasing the C-Mex target to the water sector median instead of using the UKCSI. This will return a symmetrical RoRE impact, reducing the negative skew the proposal creates given the median water company underperformed the UKCSI average.

Modified application of non-delivery and delay PCDs – set out in WSX-O02

This will reduce regulatory discretion in application of allowance clawback for late delivery, reducing the punitive element of delayed or non-delivery. This will reduce the overall asymmetry arising from this punitive element.

4. Actual Company Impact

The analysis set out here is for a notional company, with our proposed investment plan and as set out, this creates an appropriate balance of risk and return with the mitigations set out.

However, the specifics of our proposed investment programme, driven to a much greater degree, by statutory investment mean that we do not think that the above proposals completely mitigate the specific risks faced by Wessex Water.

Analysis from the DD shows that for Wessex Waters capital programme is larger than average. Given the recognition of the potential impact on systematic risk that this has, from other regulators, and in the analysis set out in the DD, we are proposing a further mitigation to risk set out in WSX-R01. We are proposing to pick a spot estimate towards the top end of the range set out for beta when setting out our view on the appropriate cost of capital.

It is also important to consider the impact on the actual company. After submitting our initial plan we engaged Economic Insight to review our company specific RoRE analysis, this is included as an annex to this representation. It found general support for the range we set out.

As we have better information now, on expectations of the capital programme and mechanisms set out in the DD, we would welcome further engagement on this through the query process.

Annex 1 – Economic Insight independent review of actual company RoRE

14 June 2024

Economic Insight Ltd

Independent RoRE risk assessment for Wessex Water

Company-specific RoRE risk at PR24

CONTENTS

1 Executive summary

In this report, we present our independent assessment of the RoRE risk faced by Wessex Water (Wessex) over PR24, based on the Business Plan that Wessex has put forward under their view of notional gearing (60%). Based on the results of our analysis, we consider that between –4.72% (P10) and 1.37% (P90) of Wessex's RoRE could be at risk at PR24.[1] For Wessex to be financeable over PR24, we therefore consider that the cost of equity would need to be increased compared to current proposals in order to compensate for the materially higher downside risk. This is consistent with Wessex's own view.

1A. Introduction and context

Using Ofwat's PR24 methodology, companies are required to submit RoRE risk ranges for their Plans. In addition, undertaking risk analysis is intrinsically valuable for both water companies and Ofwat, for a number of reasons:

- For Ofwat, risk analysis is crucial to ensure that the proposed design of the price control meets its financing duty; which is to "*secure that water companies can (in particular through securing reasonable returns on capital) finance the proper carrying out of their statutory functions*".[2] Specifically, risk analysis is a necessary input for Ofwat to ensure the incentives it sets are calibrated such that they result in a 'balanced package'. By this, we mean the package allows efficient companies, with a notional capital structure, to have a reasonable prospect of achieving a return commensurate with the base allowed equity return.

- For companies, it is crucial to understand the risks that they face over PR24, under Ofwat's method and subsequent determinations. Specifically, it is in companies' interests to understand the '*spread*' of possible financial performance, and the '*most likely*' financial performance they can expect over PR24 as a result of Ofwat's policy decisions. This is because:

[1] *This risk range has been calculated using a Monte Carlo model to aggregate each individual risk area (such as totex, retail costs, and financing costs etc), and is therefore not directly comparable to the range Ofwat will use from table RR30. Adopting a simple aggregation approach across each risk area similarly to Ofwat produces a risk range of between -7.74% (P10) to 4.49% (P90).*

[2] *Please see: https://www.ofwat.gov.uk/about-us/our-duties/*

- The expected equity return is central to determining whether companies are financeable on an actual and notional basis; and, as such, it is necessary to inform Board assurance regarding the financeability of Company Business Plans.
- Since company Business Plans represent the company's own view of what is achievable if they are 'efficient', risk analysis is necessary to inform whether they deem Ofwat's policy proposals and determinations for PR24 to be acceptable.

In developing their Business Plan, Wessex Water have undertaken their own RoRE risk analysis, which has been submitted as part of the regulatory process. However, given the importance of risk analysis as outlined above, Wessex have asked us to conduct our own independent assessment of the company-specific RoRE risk they face over PR24 to act as a cross check to this analysis.

In this report, we therefore provide our own view on the risk faced by Wessex over PR24, based on the Business Plan that Wessex has put forward.

1B. Our approach

In broad terms, across the price control areas, RoRE risk is a function of: (a) the allowances or targets that Ofwat sets (e.g. how much totex it allows, or the performance commitment levels (PCLs) Ofwat set on outcomes); and (b) company performance ex-post (e.g. how efficient Wessex is at performing within its allowances, or achieving its targets).

In this context, no two price controls are identical (i.e. both Ofwat's method, and company plans, vary over time). However, at each price control, in principle Ofwat is *endeavouring* to set the 'right' allowances and target levels; and companies are *endeavouring* to perform within them. Historical data can therefore be interpreted as providing information on the risk of companies over/underperforming due to *both* regulatory forecast error *and* company performance.

Given this, to the extent that the scope for both measurement error and variation in company performance at PR24 is similar to the past, an analysis of historical outturn data can provide a useful indication of potential future risk.

However, in certain instances, historical performance analysis may not be the most suitable approach to assessing the risk faced by Wessex at PR24. This could be for a number of reasons, such as: (i) where there is minimal historical data to rely upon to conduct an assessment; and (ii) where we have reason to believe that the past may not be reflective of the future. Therefore, across a number of risk areas, we have either taken a slightly different approach to estimating RoRE risk, or conducted supplementary analysis to stress test the forward-looking risk ranges suggested by historical analysis.

The specific approaches taken for each of the risk areas are summarised in the subsections below.

Totex

At PR24, the nature of investment is expected to differ from the past. Specifically, Wessex expects significant changes to both: (i) the scale of its investment programme; and (ii) the nature of its investment programme. Regarding (i), it should be noted that capital enhancement expenditure is expected to increase to an unprecedented scale, from £509m at PR19[3] to £2,343m at PR24,[4] which could result in increased supply chain risk. Regarding (ii), a higher proportion of projects are expected to be new and innovative. Both of these changes could affect totex risk, by plausibly affecting the variation in company performance against their allowances.

This is because, intuitively, companies could be at greater risk of overrun on new, innovative, and large-scale capex projects, relative to familiar and smaller scale projects. Therefore, if the proportion of the former type of project increases relative to the latter, the extent of downside risk at PR24 may increase relative to what has been observed in the past.

The implication of this is that relying solely on historical performance (and specifically performance on totex as a whole) may fail to capture the effect of these expected changes to investment, and as a result potentially understate the extent of the downside risk facing firms at PR24. Therefore, in addition to historical performance analysis on totex as a whole, we also undertake two supplementary analyses which look to understand past performance in relation to enhancement spend. We consider this to be the best available indicator of the nature of capital projects that Wessex is expecting to undertake at PR24. However, it is not entirely reflective of it, because it doesn't necessarily relate to projects of similar scale or complexity than have been proposed at PR24. Because of this, we also undertake a further two analyses that draw on performance observed on projects outside of the water industry.

The five methods we have therefore used to understand the totex risk that Wessex could face over PR24 can be summarised as follows:

- **Method 1: Historical totex performance analysis**. We analyse companies' historic outturn totex performance against their allowances, before using this to infer the expected range of Wessex's totex performance over PR24.
- **Method 2: Historical base-enhancement performance variability analysis**. We establish whether there is any difference in the average variability of performance against base allowances versus enhancement allowances, by analysing the standard deviation from the industry mean level of performance for each type of expenditure. We are then able to understand whether the change in the proportion of base versus enhancement expenditure is expected to be accompanied by any 'widening' or 'narrowing' of the risk range at PR24 compared to the past.

[3] *Please see PR19 final determinations: securing cost efficiency technical appendix, Ofwat (December 2019), pages 165-167.*

[4] *Please see Wessex PR24 Business Plan data tables CW1 and CWW1, in file 'wsx46-data-tables'.*

- **Method 3: Historical base-enhancement performance analysis, considering correlations**. We analyse companies' historic outturn base and enhancement performance against allowances separately, and use this to generate separate risk ranges for base and enhancement. To aggregate these risks into an overall totex risk range, we run a Monte Carlo simulation that accounts for the negative correlation between performance against base and enhancement allowances.

- **Method 4**: **Greenbook optimism bias analysis**. For this method, we construct a risk range for the proportion of totex accounted for by opex and base capex (which can be taken as 'business as usual' expenditure) using the same approach as Method 1. For enhancement capex, we use the Greenbook's optimism bias range for 'non-standard civil engineering' to estimate the risks of outturn costs being above projected allowances. The risk range estimated for opex and base capex, and for enhancement capex are aggregated using a Monte Carlo model.

- **Method 5**: **AACE cost estimate accuracy analysis**. For this method, we also construct a risk range for the proportion of totex accounted for by opex and base capex using the same approach as Method 1. For enhancement capex, we use the AACE's range of cost accuracy estimates to estimate the risks of outturn costs being above or below projected allowances. As for Method 4, the risk range produced for opex and base capex, and for enhancement capex are aggregated using a Monte Carlo model.

Retail costs

Similarly to totex RoRE risk, retail cost risk at PR24 captures the likelihood of Wessex's retail cost expenditure being above or below the allowances Ofwat sets.

Our approach to considering retail cost risk therefore closely follows our main approach to considering totex risk – we use historical performance to assess the forward-looking risk since historical performance captures both, any regulatory forecasting error, and company performance.

Retail costs at PR24 are not expected to be subject to the same scale of change anticipated for totex, though some companies consider that there may be some impact on bad debt costs as a result of higher average bills,[5] and therefore we consider a historical performance analysis sufficient to inform our view. We do not supplement this view with alternative approaches.

[5] *For example, Wessex Water notes that "upward pressure on bills will continue to increase these [retail] costs. Please see: 'Business Plan 2025-30: WSX41 – RoRE commentary and analysis', Wessex Water (October 2023), page 7.*

Revenue incentive mechanisms

The revenue incentive mechanism has been designed with the objective of incentivising companies to accurately forecast their own revenue. Revenue incentive mechanism risk is therefore a function of company performance with regard to revenue forecasting.

Given that there is no reason to believe that Wessex's ability to forecast revenues will change significantly compared to the past, we consider that historical outturn performance provides the most appropriate indicator of potential future risk. We have therefore grounded our risk assessment for this area in historical analysis. In addition, due to company performance likely being a function of internal processes (including data collection and analysis), we consider that company-specific historical performance, rather historical performance across the industry, will best indicate likely future performance for any one company. As a result, to construct a Wessex-specific risk range for revenue incentive mechanism risk, we have used data regarding Wessex's own past performance.

Financing

Broadly, there are two different areas of risk to consider when modelling financing cost risk:

- **First, there are inflationary risks regarding embedded debt**. Embedded debt at PR24 (outstanding debt that will have been issued before April 2025) can be comprised of both index-linked and fixed-rate debt. A proportion of Wessex's RCV is funded by fixed-rate debt, for which the interest costs will remain constant. However, the RCV on which it is applied may change based on inflation. This implies that company performance against the allowed cost of debt is subject to inflation risk, and is therefore driven by the share of fixed-rate debt that the company has, as well as the level of outturn inflation.

- **Second, there are risks relating to the cost of financing new debt**. At PR24, Ofwat will set an allowance for the cost of new debt based on a trailing average of two indices; the iBoxx 10+ A; and BBB (as published by IHS Markit). This index is then adjusted to take into account that, historically, the water sector has been able to issue debt below the rates implied by the index. Specifically, the average derived from the benchmark will be discounted by 15 basis points.[6] Therefore, the RoRE risk facing Wessex over PR24 in relation to the financing of new debt is a function of whether it is able to issue new debt at a rate above or below this adjusted index.

In line with Ofwat's methodology for undertaking a risk analysis of financing costs, we model the risks set out above, relating to both: (i) the inflationary risk of embedded debt; and (ii) performance against the cost of new debt allowance.

With regards to (i), base our assessment on Ofwat's analysis, which broadly estimates the embedded debt risk range assuming that inflation will vary between +/-1% around

[6] *'Creating tomorrow, together: Our final methodology for PR24 – Appendix 11: Allowed return on capital, Ofwat (2022), page 58.*

the 2% inflation target. In our analysis, we flex a number of Ofwat's assumptions. These include:

- Ofwat's inflation assumptions, generating our own inflation assumptions based on the latest OBR inflation forecasts.
- Ofwat's assumption regarding the proportion of index-linked debt, which we base on the latest data for Wessex since we are estimating the risk range for the actual firm, rather than Ofwat's view for the notional firm.
- Ofwat's gearing assumption, which we base on Wessex's view of the notional level of gearing as put forward in their Business Plan, rather than using Ofwat's view.

With regards to (ii), we model the cost of new debt risk using information regarding how Ofwat has set the cost of new debt allowance. Specifically:

- Ofwat has set the allowance based on an average of two indices: the iBoxx 10+ A-; and BBB (as published by IHS Markit). Ofwat then proposes to apply a 15-basis points discount off the average derived from its benchmark above.[7] This is because the regulator considers the evidence to be consistent with companies being able to issue new debt below the rates implied by said benchmark.
- We consider that the iBoxx indices as stated represent the most likely reflection of the rates at which water companies will be able to issue new debt. This is because, if Ofwat believes that these indices are truly representative of water companies' debt costs, there is no reason to believe that water companies can consistently beat the market. Therefore, to generate our risk range, we have accounted for this being a 'more stretching' allowance, by adjusting expected performance levels downwards by 15-basis points.

Outcomes

Outcome delivery incentives (ODIs) are designed to align the interests of companies and investors with those of their customers. ODIs work such that companies are exposed to penalties and rewards based on outturn performance relative to PCLs, thereby incentivising companies to deliver 'good' performance for customers. Outcomes risk is therefore a function of Wessex's performance for each of its performance commitments (PCs) relative to the PCLs set, as well as Ofwat's ODI rates.

We primarily rely on historical data (of past performance relative to targets) to calculate an ODI RoRE risk range. We consider a company's past performance to be a useful indicator of future performance because, for any individual ODI, a company's performance on a PC is an extension of its performance in the previous year. For example, the level of leakage is unlikely to drastically change between years, as it is

[7] *'Creating tomorrow, together: Our final methodology for PR24 – Appendix 11: Allowed return on capital, Ofwat (2022), page 58.*

partially a function of company-specific factors that remain relatively constant over a short time horizon, such as the condition or length of pipes.

Of course, the usefulness of past performance (relative to targets) will depend in part upon whether the level of stretch of the targets set by Ofwat is consistent over time. A significant increase in the stretch of the targets for any individual PC between price control periods may result in the risk ranges calculated using this historical method being conservative.

For the purposes of this analysis, we use Wessex-only historical performance to capture Wessex-specific risk, and take Wessex's PCLs and ODI rates are taken as given (as Wessex has used the indicative rates set by Ofwat in its Business Plan).[8]

Whilst this is our preferred approach, it is not feasible to robustly perform historical analysis for every PC. For certain PCs (e.g. customer contacts, unplanned outage etc.), we have only limited past performance data. Therefore, for these PCs, our historical analysis is supplemented with expert judgement of Wessex's likely performance over AMP8. For other PCs still, several of which are new at PR24, there is no reasonable basis to accurately forecast performance using a bottom-up approach (Greenhouse Gas Emissions being one example). In this case, we use a top-down approach, allocating a % RoRE to each PC, calculated from Ofwat's collaborative customer research.[9]

Measures of experience

Ofwat plans to include three measures of experience at PR24: (i) Customer measure of experience (C-MeX); (ii) Developer services measure of experience (D-MeX); and (iii) Business customer and retailer measure of experience (BR-MeX) – a new measure at PR24.

At PR19, MeX payments were calculated based on companies' relative performance. Therefore, at PR19, MeX risk was a function of both Wessex's own performance and the performance of other companies.

We expect that the MeX methodologies will change significantly from PR19 to PR24.[10] There is currently uncertainty around precisely what these changes will be, such as (i) the proportion of regulatory equity that the maximum and minimum payments will be based on; and (ii) the use of cross-sector benchmarks. Therefore, Wessex's MeX risk at PR24 also depends on the choices that Ofwat will make concerning the MeX methodologies.

We do not attempt to model the risk surrounding Ofwat's methodological choices around MeX. Instead, we assume that the methods used for C-MeX and D-MeX follow the PR19 method, with MeX payments depending on the relative performance between companies. We use a combination of Wessex's own historical performance and the industry performance to capture the risk of Wessex's performance differing from the

[8] *'WSX47 – Outcomes tables commentary', Wessex Water (October 2023), page 189.*
[9] *'PR24: Using collaborative customer research to set outcome delivery incentive rates', Ofwat (2023), page 44.*
[10] *'Consultation on the measures of experience performance commitments at PR24', Ofwat (2023).*

industry median, since performance relative to the industry median was the determinant of MeX payments at PR19.

BR-MeX is new at PR24, so there is no historical data on which to rely, and no details of the BR-MeX method have been published. Therefore, a top-down approach is taken for this MeX, based on Ofwat's target incentive range.

While we believe that this combination of historical and top-down approaches is the most suitable method to capture MeX risk, our results are only indicative given the lack of information available about MeX incentives at PR24. Furthermore, our results are likely a **conservative estimate of MeX risk**, since we have not considered any method-related risk within our analysis. It is plausible that Ofwat will strengthen the power of these incentives at PR24, as this has not yet been finalised.

Price control deliverables

At PR24, Ofwat has introduced a new type of incentive, Price Control Deliverables (PCDs), into the Outcomes framework. Ofwat intends for PCDs to be used for investments where the outputs do not map neatly to performance commitments and further states that the purpose of PCDs is "*to protect customers if companies do not deliver the improvements that customers have paid for*".[11] PCDs are intended to work to ensure that customers are compensated for more than the allowed cost of any under-delivered / late enhancement projects, reflecting foregone benefits.

As a result, companies will be worse off if they fail to deliver the total funded improvement within AMP8. Specifically, if companies fail to deliver improvements (both outcomes measured through ODIs and outputs through PCDs), then the PCD payment (together with any related ODI payment) requires firms to return to customers *more* than the allowed cost of the enhancement.

PCDs are a new area of downside risk as they are 'downward only' adjustments, which return more than the funding allowances to customers.[12] We note that this downside risk has not been captured in Ofwat's RoRE method, nor its indicative risk ranges. The exclusion of PCDs in its RoRE risk calculation risks Ofwat underestimating the risk that companies face at PR24.

A further area of concern regarding PCDs is that if PCDs are too extensive, they risk 'locking in' companies to certain options/outputs, even if they are inconsistent with what is best for customers and the environment. Whilst Ofwat aims to guard against this by stipulating that PCDs ought to be more outcomes than output-focused, widespread use of PCDs will inevitably limit the flexibilities that companies have.

Due to the nature of PCDs being newly introduced at PR24, we have not been able to draw on Wessex (or industry-wide) historical data in our analysis. As a result, we have

[11] *'In 23/05 Further guidance on price control deliverables for PR24'. Ofwat (July 2023). Available here: Ofwat.*

[12] *Currently, PCDs are designed as a penalty only mechanism, although we note that Ofwat has stated that it will "consider the extent to which incentives for early delivery will be required as part of the determination process". 'In 23/05 Further guidance on price control deliverables for PR24'. Ofwat (July 2023), page 10. Available here: Ofwat.*

drawn upon third-party data from Cornerstone.[13] This data reveals the distribution of delay durations (as a percentage of forecasted duration) which have occurred in projects in the construction industry. Specifically, in 2022, professionals in the UK construction industry were asked to complete a survey about their experiences of delays in major construction projects. The survey found that delays impacted over 85% of those in the construction industry, leading to longer delivery times.

We have limited information regarding which firms were included in the survey and therefore, are not able to assess whether they are appropriate comparator firms to the water industry, and Wessex specifically. The survey does, however, provide information on the reasons for the reported construction delays. 'Poor/unrealistic planning' was reported as the most significant reason, followed by: resource issues; information issues; changes to specifications; resource productivity; finance hold-ups; and the weather. We expect similar contributing factors to lead to delays and delivery challenges in enhancement projects in the water industry.

Aggregating the risks

To produce our final Plan-wide risk range, we make use of Monte Carlo simulations. There are two key reasons for using Monte Carlo simulations to aggregate the results:

- Firstly, this method reflects the fact that it is highly unlikely that Wessex will experience the extreme ends of all risks simultaneously – i.e. it is unlikely to perform at the P10 on each risk area at the same time. A Monte Carlo model therefore builds in a more realistic range of possibilities.

- Secondly, the output of the Monte Carlo simulation is not simply a range of two numbers, but a distribution of possible values of an aggregated outcome. This allows us to gather more information about expected RoRE (e.g. most likely value), than we could gain from a simple aggregation approach.

We should note that Ofwat do not use a Monte Carlo approach to aggregate across the individual risk areas. Therefore, we also present the overall risk range produced when simply aggregating the results, as this is directly comparable to the risk range Ofwat would obtain from Wessex's RR30 table.

1C. Summary of our results

In the table overleaf we present the results of our independent RoRE assessment for Wessex, alongside Wessex's own view of risk (as reported in its Business Plan), and Ofwat's view for the notional firm.

[13] *'Delays in the Construction Industry: 2022 Survey'. Cornerstone (January 2023). Available here: Cornerstone.*

Table 1: Wessex RoRE risk range summary

Risk area	Ofwat FM RoRE range (notional risk under notional capital structure)		Wessex BP RoRE range (actual risk under notional capital structure)		EI independent view of Wessex RoRE range (actual risk under notional capital structure)	
	P10	P90	P10	P90	P10	P90
Totex	-1.00%	1.00%	-4.23%	2.17%	-2.67%	1.91%
Retail costs	-0.20%	0.30%	-0.12%	0.10%	-1.25%	0.37%
Revenue incentive mechanism	-0.05%	0.00%	-0.05%	0.00%	-0.03%	0.00%
Financing	-0.65%	0.70%	-1.09%	0.84%	-1.32%	2.30%
ODIs	-2.00%	2.00%	-1.74%	0.77%	-1.64%	0.07%
MeX	-0.65%	0.50%	-0.58%	0.54%	-0.27%	0.25%
PCDs	N/A	N/A	-0.32%	-0.15%	-0.55%	-0.41%
Total (simple aggregation)	**-4.55%**	**4.50%**	**-8.13%**	**4.28%**	**-7.74%**	**4.49%**
Total (Monte Carlo aggregation)					**-4.72%**	**1.37%**

Sources: 'Creating tomorrow, together: Our final methodology for PR24 – Appendix 10: Aligning risk and return', Ofwat (2022), page 10-12; Wessex PR24 Business Plan data table 'wsx46-data-tables'; and Economic Insight analysis.

As shown, we consider that (when aggregating using a Monte Carlo approach) between -4.72% (P10) and 1.37% (P90) of Wessex's RoRE could be at risk over PR24. The range is between -7.74% (P10) and 4.49% (P90) when using a simple aggregation approach. The risk facing Wessex over PR24 is materially skewed to the downside. This is consistent with Wessex's view. The largest driver of this downside skew is totex risk, which, based on a historical analysis, results in a P10 of -2.67% of RoRE. We consider this to be a conservative estimate, with alternative methodologies indicating that this could reach up to -6.95% of RoRE. This is consistent with Wessex's results, with -4.23% falling comfortably within this range. This is therefore also consistent with the starting

point of Wessex's calculation of the cost of equity uplift required to compensate for changes in systematic risk (P10 on totex of -4%).[14]

Below, we comment on the results produced for each individual risk area.

- **Totex**: In the preceding table, we present the results of our historical performance analysis with regards to totex. All of the five analytical approaches we have taken indicate risk exposure that is skewed to the downside. The results of each of these approaches is summarised in the following table.

  Table 2: Totex risk ranges for PR24

	M1: standard historical analysis	**Methods that consider the potential change in risk profile at PR24**			
		M2: Difference in base-enhancement variability	**M3**: Base-enhancement Monte Carlo	**M4**: Green Book optimism bias	**M5:** AACE cost estimate accuracy
P10	-2.67%	-3.44%	-2.89%	-6.95%	-2.48%
P90	+1.91%	+2.46%	+1.13%	-2.36%	+1.12%

  Source: Economic Insight analysis.

  As shown, of the four approaches designed to capture the effect of expected changes to investment at PR24 relative to the past, we find that one indicates that the risk exposure could be greater (the risk range wider) than is suggested by relying on historical performance against totex allowances alone; and the remaining three indicate that the risk exposure is more negatively skewed than suggested by historical performance analysis. Given this, the extent of the downside risk facing Wessex on totex at PR24 could in fact extend to as far as -6.95%, depending on the extent of innovation involved in the scope of Wessex's capital programme at PR24. As stated previously, this is consistent with Wessex's results, with -4.23% falling comfortably within the range of results included in the above table. It is also consistent with the -4% P10 on totex used by Wessex to calculate the cost of equity uplift required to compensate for changes in systematic risk.[15]

- **Retail costs**: As shown in Table 1, we consider that between -1.25% (P10) and 0.37% (P90) of Wessex's RoRE could be at risk over PR24 due to retail costs. This negatively skewed risk range reflects the fact that, across the industry, companies have tended to overspend against their allowances. Specifically, the P10 level of performance over PR14 and PR19, across the industry, is a 35.4% overspend against allowances, while the P90 level of performance has been a 10.4% underspend.

[14] *'Business Plan 2025-2030: WSX31 – Risk and Return', Wessex Water (October 2023), pages 22-27.*
[15] *"Business Plan 2025-2030: WSX31 – Risk and Return', Wessex Water (October 2023), pages 22-27.*

- **Revenue incentive mechanism**: We consider that between -0.03% (P10) and 0.00% (P90) of Wessex's RoRE could be at risk due to the revenue incentive mechanism at PR24. The P90 of 0.00% reflects that this incentive mechanism is penalty-only, and therefore that there is no possibility of earning a positive return. The narrow range reflects that, historically, Wessex has performed within, or very close to, the deadband of 2% revenue forecasting error.

- **Financing**: As shown by in the preceding table of results, our view is a wider and more positively skewed range than that of Ofwat (in relation to the notional firm), and Wessex in relation to the company-specific performance they can expect over PR24. This is predominantly driven by the inflationary risk on the cost of embedded debt. Specifically, over the past 10 years, we have observed inflation levels that vary significantly above and below the 2% target. Should we continue to see similar levels of volatility in the coming years, there is a wide range of possible performance that Wessex could achieve – explaining the wide risk range observed. Assuming that the future will look like the past (with inflation tending above the 2% target), results in a positively skewed risk range. This is because the value of the RCV funded by fixed debt would rise faster than the cost of interest on this debt.

- **Outcomes**: Our results show that between -1.64% (P10) and 0.07% (P90) of Wessex's RoRE could be at risk at PR24. This implies that Wessex is more likely to receive net penalties rather than rewards during AMP8. We consider that this negative skew is driven by a number of factors, including: (i) the removal of caps, collars, and deadbands on certain PCs; (ii) a reduction in the number of bespoke ODIs at PR24; and (iii) the presence of penalty-only incentives.

- **Measures of experience**: We consider that between -0.27% (P10) and 0.25% (P90) of Wessex's RoRE could be at risk at PR24 due to MeX, which is a relatively narrow, symmetric range. We believe that our results are a conservative estimate of MeX, since they do not capture any method-related risk associated with Ofwat increasing the power of MeX incentives at PR24. Therefore, in practice, the true RoRE risk range associated with MeX could be wider.

- **Price control deliverables**: We consider that RoRE risk on PCDs is skewed to the downside. This reflects the fact that PCDs are a penalty-only incentive. As shown, our risk range is wider than the range estimated in Wessex's Business Plan. This is driven by the difference in our estimates (compared to Wessex's estimates) of actual PCD units delivered (outturn units) in PR24. Specifically, we have used Cornerstone data to infer the outturn units under three scenarios: (i) the best case scenario of 0% delay; (ii) the most likely scenario of a delay of 25.5%; and (iii) the worst case scenario of a delay of 55.5%.

1D. Conclusions

We consider that Wessex faces a risk range that is materially skewed to the downside over PR24, and that in order to be financeable over PR24, the cost of equity would need to be increased relative to current proposals in order to compensate for the materially

higher downside risk. This is consistent with Wessex's own view, as expressed in its PR24 Business Plan.

1E. Structure of this report

The remainder of this report is structured as follows:

- First, we detail the methodologies used and results produced for each individual risk area, in turn.
- We then set out how we have aggregated individual risks to generate our overall risk range, making use of Monte Carlo models.

2 Totex RoRE risk

In this chapter, we present our assessment of the RoRE risk exposure on totex for Wessex at PR24. Based on the industry's historical performance on totex, we consider that between -2.67% (P10) and +1.91% (P90) of Wessex's RoRE could be at risk at PR24. However, the results of supplementary analysis, which has been designed to capture the effect of changes to the capital programme over PR24 compared to the past, suggest that the downside risk could be even higher (up to -6.95%). This is consistent with the -4% (P10) downside on totex used by Wessex as the start point to calculate the cost of equity uplift required to compensate for changes in systematic risk, which falls comfortably within our range of results.[16]

2A. Introduction and overview of our results

Context

The totex RoRE risk at PR24 captures the likelihood of Wessex's total expenditure being above or below the allowances Ofwat sets. Totex risk is therefore both a function of: (a) the allowances Ofwat sets (i.e. how much totex it allows); and (b) company performance ex-post (i.e. how efficient Wessex is, over PR24).

Approach

In the above context, no two price controls are identical (i.e. both Ofwat's method, and company plans, vary over time). However, at each price control, in principle Ofwat is *endeavouring* to set the 'right' efficient cost (subject to measurement error); and companies are *endeavouring* to be efficient. Historical data can therefore be interpreted as providing information on the risk of companies over/underperforming due to *both* regulatory forecast error *and* company performance.

Given this, to the extent that the scope for measurement error and variation in company performance at PR24 is similar to the past, an analysis of historical outturn data

[16] *Please see: 'Business Plan 2025-2030: WSX31 – Risk and Return', Wessex Water (October 2023), pages 22-27.*

provides a useful indicator of potential future totex risk. We therefore consider historical performance analysis to be the most suitable approach to assessing risk at PR24.

However, it is important to note that at PR24, the nature of investment is expected to differ from the past. Specifically, Wessex expects significant changes to both the scale of its investment programme (capital enhancement expenditure is expected to increase to an unprecedented scale, from £509m at PR19[17] to £2,343m at PR24[18]), and the nature of this investment programme (a higher proportion of projects are expected to be new and innovative). This could affect totex risk, by plausibly affecting (b) above – the variation in company performance. This is because, intuitively, companies could be at greater risk of overrun on new, innovative, and large-scale capex projects, relative to familiar and smaller scale projects. Therefore, if the proportion of the former type of project increases relative to the latter, the extent of downside risk at PR24 may increase relative to what has been observed in the past. In addition, the increase in scale of the investment programme could also apply greater pressure to the supply chain, increasing supply chain risk.

This is consistent with experience captured in academic and grey literature. For instance, multiple academic papers have been written on the link between the size of a capital project and the risk of cost overrun.[19] Likewise, experience on large-scale infrastructure projects in the UK and elsewhere suggests that cost overruns are common. It is estimated that more than 98% of construction projects worth over $1 billion are late or over budget, with the average delay being nearly two years, and the average cost overrun being 80%.[20]

The implication of this is that relying solely on historical performance (and specifically performance on totex as a whole) may fail to capture the effect of these expected changes to investment, and as a result potentially understate the extent of the downside risk facing firms at PR24. Therefore, in addition to our historical performance analysis, we have undertaken four supplementary analyses to better understand the possible risk exposure.

Our five methods can be summarised as follows:

- **Method 1: Historical totex performance analysis**. We analyse companies' historic outturn totex performance against their allowances, before using this to infer the expected range of Wessex's totex performance over PR24.

[17] *Please see PR19 final determinations: securing cost efficiency technical appendix, Ofwat (December 2019), pages 165-167.*
[18] *Please see Wessex PR24 Business Plan data tables CW1 and CWW1, in file 'wsx46-data-tables'.*
[19] *'What Causes Cost Overrun in Transport Infrastructure Projects?' Flyvbjerg, B; et al. Transport Reviews, 24:1, 3-18 (2004).*
[20] *Please see https://www.economist.com/britain/2018/12/08/britains-engineering-reputation-goes-down-the-tube.*

- **Method 2: Historical base-enhancement performance variability analysis**. We establish whether there is any difference in the average variability of performance against base allowances versus enhancement allowances, by analysing the standard deviation from the industry mean level of performance for each type of expenditure. We are then able to understand whether the change in the proportion of base versus enhancement expenditure is expected to be accompanied by any 'widening' or 'narrowing' of the risk range at PR24 compared to the past.

- **Method 3: Historical base-enhancement performance analysis, considering correlations**. We analyse companies' historic outturn base and enhancement performance against allowances separately, and use this to generate separate risk ranges for base and enhancement. To aggregate these risks into an overall totex risk range, we run a Monte Carlo simulation that accounts for the negative correlation between performance against base and enhancement allowances.

- **Method 4**: **Greenbook optimism bias analysis**. For this method, we construct a risk range for the proportion of totex accounted for by opex and base capex (which can be taken as 'business as usual' expenditure) using the same approach as Method 1. For enhancement capex, we use the Greenbook's optimism bias range for 'non-standard civil engineering' to estimate the risks of outturn costs being above projected allowances. The risk range produced for opex and base capex, and for enhancement capex are aggregated using a Monte Carlo model.

- **Method 5**: **AACE cost estimate accuracy analysis**. For this method, we also construct a risk range for the proportion of totex accounted for by opex and base capex using the same approach as Method 1. For enhancement capex, we use the AACE's range of cost accuracy estimates to estimate the risks of outturn costs being above or below projected allowances. As for Method 4, the risk range produced for opex and base capex, and for enhancement capex are aggregated using a Monte Carlo model.

Overview of results

Below, we present a summary of the RoRE risk range produced when undertaking an analysis of companies' historical performance against their totex allowances (M1, highlighted in purple), as well as the four additional ranges that have been calculated using methods designed to capture the effect of a change in the nature of investment at PR24 (M2 to M5).

Table 3: Totex risk ranges for PR24

	M1: standard historical analysis	**Methods that consider the potential change in risk profile at PR24**			
		M2: Difference in base-enhancement variability	**M3**: Base-enhancement Monte Carlo	**M4**: Green Book optimism bias	**M5:** AACE cost estimate accuracy
P10	-2.67%	-3.44%	-2.89%	-6.95%	-2.48%
P90	+1.91%	+2.46%	+1.13%	-2.36%	+1.12%

Sources: Economic Insight analysis.
Notes: M1 stands for Economic Insight Method 1, and so on.

As shown, **all of the analytical approaches we have taken indicate risk exposure that is skewed to the downside**. Of the four approaches designed to capture the effect of expected changes to investment at PR24 relative to the past:

- the first (EI M2) indicates that the risk exposure is greater (the risk range is wider) than is suggested by relying on historical performance against totex allowances alone (EI M1); and
- the remaining three (EI M3-5) indicate that the risk exposure is more negatively skewed than suggested by historical performance analysis (again, relative to EI M1).

Implications

Taking this evidence in the round, we consider that the balance of risk Wessex faces on totex at PR24 is skewed to the downside. We also consider that, while the range produced by considering historical performance alone, of between -2.67% to +1.91%, is an indicator of the likely risk that Wessex will face over PR24, we expect it to be conservative regards the extent of the downside risk. Specifically, our analysis suggests that the downside risk facing Wessex at PR24 could in fact extend to as far as -6.95%, depending on the extent of innovation involved in the scope of Wessex's capital programme at PR24. This is consistent with the -4% (P10) downside on totex used by Wessex as the start point to calculate the cost of equity uplift required to compensate for changes in systematic risk, which falls comfortably within our range of results.[21]

Structure of this chapter

In the remainder of this chapter, we:

[21] *Please see: 'Business Plan 2025-2030: WSX31 – Risk and Return', Wessex Water (October 2023), pages 22-27.*

- First, detail the historical totex performance analysis conducted to arrive at our headline company-specific risk range for Wessex (Method 1).
- Second, detail the four additional analyses we have conducted in order to capture the changing nature of capital investment at PR24 (Methods 2 to 5).

2B. Method 1: Historical totex out- and under-performance analysis

In high-level terms, this method analyses companies' historic outturn totex performance against their allowances, before using this to infer the expected range of Wessex's totex performance over PR24. To implement this method, we undertake the following steps:

a. First, we calculate each company's historical out- or under-performance against their wholesale totex allowances over each price control, expressing this performance as a percentage variation above/below the allowance. The data we have gathered allows us to do this from PR99 to PR19, however, the final range we present is the results produced using PR14 and PR19 data only (our reasoning for this is explained below).

b. We then pool the industry-wide performance data, before taking the 10th and 90th percentile to generate a P10 to P90 performance range on which our final risk range is based. Again, at this stage, the P10 and P90 are expressed as a percentage variation from the totex allowance.

c. We then multiply these figures by Wessex's expected totex allowance at PR24[22] such that the P10 and P90 are now expressed as £s values.

d. Finally, we apply the cost sharing rate, before converting to a % of RoRE using Wessex's forecast RCV for PR24, along with Wessex's view of notional gearing (60%).[23]

It is worth noting here that there are two analytical choices we have taken to inform our view. These include both the choice regarding whether we use Wessex-only or industry-wide data; and the choice of time period, as alluded to above. We discuss these choices in more detail below.

The use of Wessex-only, or industry-wide data

There is a question regarding whether Wessex's historical performance is more reflective of its own future performance than the industry-wide historical performance. There are arguments in favour of both approaches. Specifically, company-specific past performance may be more indicative of future performance if company-specific characteristics, or past operational/investment decisions are expected to result in unique risk profiles in this particular risk area for each company. On the other hand, industry-wide historical performance may be more indicative of possible future

[22] *Please see Wessex PR24 Business Plan data tables CW1 and CWW1, in file 'wsx46-data-tables'.*
[23] *Please see Wessex PR24 Business Plan data table RR30, in file 'wsx46-data-tables'.*

performance due to the greater number of observations provided by companies offering similar services, within the same industry, and subject to the same regulation.

While Wessex has previously had a tendency to outperform, the nature of investment at PR24 may mean the scope for this might be less going forward. Or, put another way, it seems unreasonable that the P10 position for Wessex at PR24 would be an outperformance, as its historical performance would suggest. Therefore, in this case, we have chosen to use industry-wide performance data.

The time period included in the analysis

There is no 'right' answer in terms of the time period to use within this analysis. There is a tension between having a large sample size (i.e. including as many years as possible to maximise the number of observations on which the results are based); and including only the data that is expected to have strong predictive power (i.e. excluding earlier years that may be less reflective of the future). We have therefore conducted sensitivity testing to understand the extent to which the RoRE range may change according to the time period chosen, and to therefore help inform the most appropriate time period to use.

The inclusion of PR19

Firstly, we have conducted sensitivity testing to investigate whether it is appropriate to include PR19 data within our analysis. As the most recent price control period, its inclusion is desirable given that it may be most reflective of the future. However, as we are only midway through the period, one potential drawback of using this data is that we are relying on 3-year-worth of data to represent totex performance for the full price control. Doing so could skew our results, *if* there is reason to believe that companies either front-load or back-load their expenditure. For example, if there is a tendency for firms to *overspend* at the start of a price control and *underspend* at the end, then using only 2020-23 data would produce more negatively skewed results than we would see if we had 5 years of data.

Our sensitivity tests show that this is not the case: firm spending is relatively consistent throughout price controls, with a slight tendency for higher spending at the end of the period. This is true for both Wessex and the wider industry, as illustrated below:

Table 4: Average proportion of total spending in each year of a price control (PR99-PR14)

	Year 1	Year 2	Year 3	Year 4	Year 5
Industry average	19.41%	19.87%	20.11%	20.36%	20.25%
Wessex	19.60%	19.84%	19.88%	20.34%	20.34%

Source: Economic Insight analysis

We consider that this strongly supports the inclusion of PR19 data within the analysis, as we gain the benefit of a more recent view of performance, and if anything, the results

produced including PR19 data could result in an *underestimation*, or conservative view of the future downside risk.

The exclusion of early price control periods

Having established that it is appropriate to include PR19 data in the analysis, we must then decide how many price control periods prior to this, if any, should be included. To inform this decision, we conducted a further series of sensitivity checks, in order to establish the extent to which the risk range produced varies according to the time period chosen.

As shown in the table below, we set out the results obtained when we include the full period, (from PR99 to PR19); and then when we begin limiting the price control periods used – beginning with the exclusion of PR99 alone, right up to excluding all price controls up to and including PR14.

Table 5: Totex risk ranges produced by varying the time period included in the analysis

	PR99-PR19	PR04-PR19	PR09-PR19	PR14 – PR19	PR19 only
P10	-1.75%	-1.95%	-2.36%	-2.67%	-5.70%
P90	+2.32%	+2.31%	+2.35%	+1.91%	+1.15%

Source: Economic Insight analysis.
Note: These results are produced after cost sharing is applied.

As shown, the totex risk range becomes increasingly negatively skewed the closer one gets to the current price control period, or in other words, the downside risk to firms on totex has been persistently increasing over time.

On this occasion, and reflecting the increasingly stretching nature of subsequent price controls, we consider that it is appropriate to take the results produced using PR14-PR19 historical totex performance data (the results highlighted in purple in the table above). This is because this choice of time period balances including a greater number of observations (than would be included if we used data from PR19 alone), with the likelihood that the most recent performance will be the best predictor of the future.

However, given the trend observed in the data, the -2.67% to +1.91% risk range based on PR14-PR19 data could represent a conservative view of the risk facing firms over PR24. As shown by the results, the extent of the downside at PR24 could plausibly account for up to -5.70% of RoRE.

2C. Supplementary methods 2 to 5: Capturing the changing nature of investment at PR24

In this section, we detail the four additional analyses we have conducted in order to capture the changing nature of capital investment at PR24, and highlight key advantages and disadvantages of each approach.

Method 2: Historical base-enhancement performance variability analysis

Method 2 overview

Risk range: -3.44% (P10) to +2.46% (P90).

Implication: The risk range faced by Wessex at PR24 is expected to be wider than that suggested by Method 1.

Pros: This method is grounded in historical performance data.

Cons: Risk ranges provide information regarding two important aspects of risk. First, the 'width' of the range provides information regarding how much variance there is between all of the different possible outcomes. Second, the 'skew' of the range provides information regarding the likelihood of the possible outcome being positive, or negative. This methodology is only capable of providing additional evidence regarding the expected width of the risk range over PR24. It is not capable of providing any additional information over and above that provided by Method 1 regarding 'skew', as by design the range produced will have the same 'skewness' as Method 1.

Similar to Method 1, this method also analyses companies' historic outturn totex against their allowances. However this time, we consider base and enhancement performance separately. This is because, at PR24, a greater proportion of expenditure relates to new and innovative capital projects. To the extent that the nature of these capital projects are akin to the capital projects historically covered within enhancement expenditure, by establishing whether there is any difference in the 'riskiness' of base versus enhancement expenditure, we can understand whether the change in mix of expenditure expected at PR24 will likely be accompanied by any change in risk compared to the past.

The specific steps taken to implement this method are as follows:

a. First, we calculate each company's historical out- or under-performance against their wholesale base and enhancement allowances separately, over the first 3 years of PR19. As for Method 1, we express this performance as a percentage variation above/below the allowance.

b. Next, for both base and enhancement expenditure, we calculate the standard deviation of performance. That is to say, in the case of base expenditure:

   (i) we calculate the mean level of performance against base allowances across the industry (expressed as a percentage variation above/below the allowance);

   (ii) we then take the difference between each company's performance in each year and the mean level of performance; and finally

(iii) we take the average of these differences, or in other words, the standard deviation.

We repeat these three steps for enhancement expenditure. This allows us to understand how much performance across the industry has varied with regards to base and enhancement expenditure. We find that the standard deviation of base performance is 0.153, which means that, on average, company performance falls 15.3% above or below the mean level of performance. On the other hand, we find that the standard deviation of enhancement performance is 0.416, which means that, on average, company performance on enhancement falls 41.6% above or below the mean level of performance. Therefore, enhancement is typically 'riskier', with a wider range of performance outcomes observed historically than is true for base expenditure.

c. Next, we calculate a weighted average of the base and enhancement standard deviations for PR19, weighting each by the proportion of totex they account for. We do the same for PR24, using the base-enhancement split in Wessex's PR24 Business Plan.

(i) At PR19, base expenditure accounted for 76.8% of Wessex's totex, with enhancement accounting for the remaining 23.2%.[24]

(ii) According to Wessex's PR24 Business Plan, base expenditure is expected to account for 51.1% of totex, with enhancement accounting for the remaining 48.9%.[25]

d. We then calculate the percentage increase from PR19 to PR24 of these weighted averages. This can be interpreted as the percentage increase in totex risk (or widening of the risk range) at PR24 relative to PR19, that arises from having a higher proportion of enhancement spend. Using data for all companies, we find that the totex risk range is expected to be 29% wider at PR24 than at PR19, owing to the change in mix of expenditure.

e. Finally, we apply this percentage increase to the RoRE risk range calculated using Method 1, to obtain a new risk range.

As for Method 1, there are certain analytical choices that we have taken to inform our view. The key decision taken here is the choice of companies used in our analysis, which we detail below.

The choice of companies included in our analysis

The choice of firms is relevant here because some firms may have historical enhancement spend that is very different to that planned by Wessex over PR24. If this is the case, including these firms in the analysis may result in a risk range that is not representative of the risk faced by Wessex at PR24.

[24] *Please see PR19 final determinations: securing cost efficiency technical appendix, Ofwat (December 2019), pages 165-167.*

[25] *Excluding third-party and developer services; and retail costs. Please see Wessex PR24 Business Plan data tables CW1 and CWW1, in file 'wsx46-data-tables'.*

Possible options to ensure that we capture firms that are more closely aligned with Wessex's plans for the future include:

- Excluding companies with enhancement spend that fell below £50m over PR19, as these smaller enhancement programmes may be less comparable to ambitious programmes planned over PR24. This is consistent with the experience captured in academic and grey literature, where there have been shown to be links between the size of a capital project and the risk of cost overrun.[26]
- Excluding water only companies (WoCs), as the enhancement spend of water and wastewater companies (WaSCs) is likely to better align with Wessex (as WaSCs are likely to implement a variety of different projects to WoCs, with the risk profile of each potentially differing).

The results produced by these two choices are included in the table below.

Table 6: The percentage increase in totex risk range as a result of considering the base-enhancement split

	All companies	Excluding companies with PR19 enhancement spend < £50m	Excluding WoCs
% increase in totex risk	29%	17%	41%
Implied risk range	-3.44% to 2.46%	-3.12% to 2.23%	-3.76% to 2.69%

Source: Economic Insight analysis

These results indicate that the risk range faced by companies over PR24 could plausibly be between 17% to 41% wider than suggested by the results produced by Method 1. In our summary results, we choose the range produced when including all companies within our analysis. This is because, while water only companies, or companies with smaller enhancement programmes *may* be less comparable to Wessex, we do not have sufficient evidence to justify this analytical choice.

Method 3: Historical base-enhancement performance analysis, considering correlations

Method 3 overview

Risk range: -2.89% (P10) to +1.13% (P90).

[26] *'What Causes Cost Overrun in Transport Infrastructure Projects?' Flyvbjerg, B; et al. Transport Reviews, 24:1, 3-18 (2004).*

Implication: The risk range produced by Method 1 is likely to be conservative regarding the extent of downside skew faced by Wessex at PR24.

Pros: This method is not constrained to applying a symmetrical adjustment to the risk range produced by Method 1, and therefore allows us to examine *both* the 'width' as well as the 'skewness' of the risk range we expect Wessex to face over PR24, independently from the results produced using Method 1. Like both Method 1 and 2, this method is also grounded in historical water sector performance data.

Cons: Only data from PR19 is used to inform the historical performance level for each company, and therefore the triangular probability distribution is only constructed using one data point for each company.

Alternatively, we can generate a risk range by analysing historical industry performance against base allowances and enhancement allowances separately, and use this to infer Wessex's expected range of performance on base and enhancement over PR24. The key complication introduced by this method is that we find a negative correlation between base and enhancement expenditure (companies that have overspent on base tend to have also underspent on enhancement and vice versa) that must be taken account of when aggregating these risks into an overall totex risk range.

To implement this methodology, we undertake the following steps:

a. We calculate each company's historical out- or under-performance against their base and enhancement allowances separately, for the first three years of PR19. As for Method 1, we express this performance as a percentage variation above/below the allowance.

b. We then pool the industry-wide data, and calculate the industry minimum, mean, and maximum performance, using these as parameters to construct two simple triangular distributions for base and enhancement expenditure respectively.

c. We then aggregate these two triangular distributions using a Monte Carlo simulation, considering: (i) the correlation between base and enhancement spend; and (ii) the relative proportion of base and enhancement spend in Wessex's Business Plan. This produces an overall totex distribution of percentage over/underspend. Note that:

   - Correlations are considered here because there is an observable negative relationship between enhancement performance and base performance at PR19: companies that have overspent on base tend to have also underspent on enhancement and vice versa. Therefore, running our model without considering correlations results in an overestimation of totex risk.

- To implement correlations in our model, the correlation coefficient between base and enhancement variation is calculated from the PR19 data (-0.27). This correlation is then introduced into the Monte Carlo using the Cholesky Decomposition.[27]

d. Each value in the distribution produced by the Monte Carlo simulation is then multiplied by Wessex's forecast totex allowance, before the cost sharing rate is applied, in order to convert the values from being expressed as a percentage over/underspend to a £s figure. These values are then expressed as a % RoRE by dividing by Wessex's forecast regulatory equity.

e. Finally, the P10 and P90 are taken from this distribution to form our risk range.

The RoRE risk on totex produced by this method ranges from -2.89% (P10) to +1.13% (P90). This range is more skewed to the downside than that produced by Method 1, indicating that the range produced by Method 1 is most likely conservative regarding the extent of the downside skew.

Method 4: Considering the Green Book optimism bias

Method 4 Overview

Risk range: -6.95% (P10) to -2.36% (P90).

Implication: The risk range produced by Method 1 is likely to be conservative regarding the extent of downside skew faced by Wessex at PR24.

Pros: This method follows Government guidance on optimism bias to estimate a risk range, which has been developed based on findings from a comprehensive review of large public procurement in the UK.

Cons: The 'best case' or P90 scenario produced by this method is an overspend, and therefore this methodology is incapable of taking into account the propensity for underspend. As such the results produced may overstate the extent of downside risk skew. In addition, the projects used to develop the optimism bias estimates may not be comparable to the projects planned for the water industry over PR24.

This method also looks to capture the greater risks associated with new and innovative, large capital projects, but this time, uses Government guidance rather than historical analysis to arrive at a risk range.

Specifically, the Government has produced guidance for project appraisers on how to effectively estimate project costs, benefits and duration, where there is an absence of prior primary evidence. This guidance is therefore particularly relevant and applicable to estimating the risks around the PR24 capital programme, given that we expect the PR24 capital programme to be different in both scale and complexity to the past.

[27] *See for example: 'Correlated Monte Carlo Simulation using Cholesky Decomposition', Burgess (2022), Said Business School.*

The Green Book states that "*there is a demonstrated, systematic tendency for project evaluations to be overly optimistic. To redress this tendency, appraisers should make explicit, empirically based adjustments to the estimates of a project's costs, benefits and duration.*"[28] The Green Book provides the following adjustment percentages for generic project categories that should be used in the absence of more robust evidence:

Table 7: Recommended adjustment ranges

Project Type	Optimism Bias (%)			
	Works Duration		Capital Expenditure	
	Upper	Lower	Upper	Lower
Standard Buildings	4	1	24	2
Non-standard Buildings	39	2	51	4
Standard Civil Engineering	20	1	44	3
Non-standard Civil Engineering	25	3	66	6
Equipment / Development	54	10	200	10
Outsourcing	N/A	N/A	41	0

Source: 'Supplementary Greenbook Guidance – Optimism Bias', HM Treasury (2013).

We have used these optimism bias figures to consider the risk for two subcomponents of totex separately, looking at: (i) opex risk and base capex risk; and (ii) enhancement capex risk, before aggregating these risks to produce an overall totex risk range. Specifically, based on the Green Book guidance, we do the following:

- To estimate the risk of over- or under-spend on opex and base capex, we implement our Method 1 on the proportion of totex expected to be accounted for by these categories of expenditure. This is because opex and base capex can be considered 'Business As Usual' expenditures, for which we consider that robust historical evidence exists regarding likely performance, negating the need to use the optimism bias adjustment ranges. Our calculations relating to these categories of expenditure are as follows:
  - In Wessex's PR24 Business Plan tables (CW1 and CWW1),[29] opex and base capex are expected to account for 30% and 21% of totex respectively. We therefore construct a risk range in the same way as Method 1, by simply applying industry historical performance ranges to 51%, rather than 100% of projected allowed costs for Wessex at PR24.

[28] *'Supplementary Greenbook Guidance – Optimism Bias', HM Treasury (2013), page 1.*

[29] *Please see Wessex PR24 Business Plan, file 'wsx46-data-tables'.*

  - As for Method 1, the cost over- or underestimate is converted to a proportion of RoRE by applying the cost sharing rate and then using PR24 forecast regulatory equity figures. This provides a RoRE risk range on opex and base capex of between -1.36% (P10) and 0.97% (P90).

- To estimate enhancement capex risk, we use the Greenbook's optimism bias figures for 'non-standard civil engineering'. This is because, the definition of this category of projects is: *"(a) it is innovative (b) it has mostly unique characteristics; or (c) construction involves a high degree of complexity and/or difficulty"*,[30] which we consider to best describe the types of projects that are expected to be undertaken as enhancement capex projects at PR24. Our calculations relating to this category of expenditure is as follows:
  - In Wessex's Business Plan tables, enhancement capex is expected to account for 49% of total projected totex.[31] We therefore apply the upper and lower optimism bias bounds for 'non-standard civil engineering' to this proportion of totex.
  - Specifically, we calculate a cost overestimate on this proportion of totex of 66%, and take this to be the 'worst case' or minimum level of performance; and calculate a cost underestimate of 6%, taking this to be the 'best case' or maximum level of performance.
  - As before, we then apply the cost sharing rate, and divide by Wessex's forecast regulatory equity (calculated using Wessex's projected RCV, and view of notional gearing)[32] to convert this to a % RoRE. This provides a RoRE risk range of between -6.47% (P10) to -2.39% (P90).
- Finally, we aggregate these two separate risk ranges using a Monte Carlo model. This provides a total totex RoRE risk range of between -6.95% (P10) and -2.36% (P90).

This range is far more skewed to the downside than that produced by Method 1, again adding to the evidence base that suggests that the range produced by Method 1 is most likely conservative regarding the extent of the downside skew.

Method 5: AACE Cost Estimate Accuracy

Method 5 Overview

Risk range: -2.48% (P10) to 1.12% (P90).

Implication: The risk range produced by Method 1 is likely to be conservative regarding the extent of downside skew faced by Wessex at PR24.

Pros: This method follows AACE guidance on cost estimate accuracy. Explicit reference has been made to the applicability of these estimates to utility sector projects. The

[30] *'Supplementary Greenbook Guidance – Optimism Bias', HM Treasury (2013), page 2-4.*
[31] *Please see Wessex PR24 Business Plan tables CW1 and CWW1, file 'wsx46-data-tables'.*
[32] *Please see Wessex PR24 Business Plan data table RR30, in file 'wsx46-data-tables'.*

AACE also provides estimates of the extent to possible underspend compared to cost estimates, and is therefore less likely to overstate the downside skew compared to Method 4.

Cons: We have had to make relatively broad brush assumptions regarding how Wessex's totex spend ought to be split across the AACE's project categories.

This method is similar to Method 4, in that it makes use of guidance developed for capital project cost estimation. Specifically, we use the guidance developed by the AACE for cost estimation in "*engineering, procurement, and construction in the process industries*". This guidance provides an expected accuracy range for cost estimates, based on the completeness of the project's engineering and design. For instance, projects at the 'concept screening' stage, whose engineering and design can be categorised as between 0% to 2% complete, have a far lower expected accuracy regards their cost estimates compared to a project whose engineering and design is classed as 50% to 100% complete. The project categories and their associated cost estimate accuracy is included in the table overleaf.

Table 8: AACE cost estimate classification matrix

	Primary Characteristic	*Secondary Characteristic*			
Estimate Class	**Level of project definition** (expressed as a % of complete definition)	**End usage** (typical purpose of estimate)	**Methodology** (typical estimating method)	**Expected accuracy range** (typical variation in low and high ranges)	**Preparation effort** (typical degree of effort relative to least cost index of 1)
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgement, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored, or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorisation, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid / Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid / Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Source: 'Cost estimate classification system – as applied in engineering, procurement, and construction for the process industries', AACE (February 2005).

Regarding the applicability of these cost estimate accuracy ranges to the water industry, we note that the guidance does explicitly address this:

"*Estimates for process facilities center on mechanical and chemical process equipment, and they have significant amounts of piping, instrumentation, and process controls involved. As such, this addendum may apply to portions of other industries, such as*

pharmaceutical, utility, metallurgical, converting, and similar industries. Specific addendums addressing these industries may be developed over time [emphasis added]."[33]

As a result, while the estimates may only be partially applicable to projects in the water sector, rather than wholly applicable, we consider this to be a helpful alternative source of guidance to the Greenbook, where the applicability is somewhat less clear.

In terms of implementing this method, we undertake the following steps:

- To estimate the risk of over- or under-spending on opex and base capex, we implement the exact same calculations as for Method 4 above. Please refer to page 29 for details. As in method 4, this produces a RoRE risk range on opex and base capex of between -1.36% (P10) and 0.97% (P90).

- To estimate enhancement capex risk, we use the conservative 'low' and 'high' accuracy ranges as an estimate for the over- or under-spend of enhancement capex projects that fall into either class 4 or 5. This is based on the classifications used by Wessex in their PR24 Business Plan.[34] We have made the assumption that 50% of Wessex's enhancement capex would constitute a class 4 project and the other 50% would constitute class 5. Therefore, in order to estimate Wessex's over- and under-spend minimum and maximum risk, we have used the average of the conservative class 4 and 5 'low' and 'high' accuracy ranges. This results in a 'best case', or maximum performance level of -17.5% (17.5% underspend) and a 'worst case', or minimum level of performance of 25% (25% overspend).

- As before, we then apply the cost sharing rate, and divide by Wessex's forecast regulatory equity (calculated using Wessex's projected RCV, and view of notional gearing)[35] to convert this to a % RoRE. This provides a RoRE risk range of between -1.91% (P10) to 0.98% (P90).

- Finally, we aggregate these two separate risk ranges using a Monte Carlo model. This provides a total totex RoRE risk range of between -2.48% (P10) and 1.12% (P90).

Similarly to the previous two methods, this range is also more skewed to the downside than that produced by Method 1. Again, this indicates that the range produced by Method 1 is most likely conservative regarding the extent of the downside skew.

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[33] *'Cost estimate classification system – as applied in engineering, procurement, and construction for the process industries', AACE (February 2005).*

[34] *'Business Plan 2025-2030: WSX41 – RoRE commentary and analysis', Wessex Water (October 2023), page 8.*

[35] *Please see Wessex PR24 Business Plan data table RR30, in file 'wsx46-data-tables'.*

3 Retail cost risk

In this chapter, we present our assessment of the RoRE risk exposure on retail costs for Wessex at PR24. Based on the industry's historical performance on retail costs, we consider that between -1.25% (P10) and 0.37% (P90) of Wessex's RoRE could be at risk at PR24. This negatively skewed range reflects the fact that, historically, companies across the industry have tended to over- rather than under-spend against their retail cost allowances.

3A. Introduction and results summary

Context

Similarly to totex RoRE risk, retail cost risk at PR24 captures the likelihood of Wessex's retail cost expenditure being above or below the allowances Ofwat sets. It is therefore both a function of: (a) the retail cost allowances Ofwat sets; and (b) company performance ex-post (i.e. how efficient Wessex is with respect to retail costs, over PR24).

Approach

Our approach to considering retail cost risk therefore closely follows our approach to considering wholesale totex risk – we use historical performance to assess the forward-looking risk since historical performance captures both, any regulatory forecasting error, and company performance.

Retail costs at PR24 are not expected to be subject to the scale of change anticipated for totex, and therefore we consider a historical performance analysis sufficient to inform our view. We do not supplement this view with alternative approaches.

Retail cost risk results

In the table overleaf, we present the results of our RoRE risk assessment on retail costs for Wessex.

Table 9: Retail cost RoRE risk range

	Ofwat FM view	Wessex BP view	Economic Insight view
P10	-0.20%	-0.12%	-1.25%
P90	0.30%	0.10%	0.37%

Source: Creating tomorrow, together: Our final methodology for PR24 – Appendix 10: Aligning risk and return', Ofwat (2022), page 10-12; Wessex PR24 Business Plan data table 'wsx46-data-tables'; and Economic Insight analysis.

As shown, we consider that between -1.25% (P10) and 0.37% (P90) of Wessex's RoRE could be at risk over PR24. This negatively skewed risk range reflects the fact that, across the industry, companies have tended to overspend against their allowances. Specifically, the P10 level of performance over PR14 and PR19, across the industry, is a 35.4% overspend against allowances, while the P90 level of performance has been a 10.4% underspend.

In the remainder of this chapter, we detail the methodology used to arrive at these results.

3B. Details of our methodology

In order to construct a risk range for retail costs, we implement a very similar methodology to that used to construct our risk range for totex. Specifically, we undertake the following steps:

a. First, we calculate each company's historical out- or under-performance against their retail cost allowances over each price control, expressing this performance as a percentage variation above/below the allowance. The data available allows us to do this from PR14 onwards, including the full PR14 price control period and the first three years of PR19.[36]

b. We then pool the industry-wide performance data, before taking the 10th and 90th percentile to generate a P10 to P90 performance range on which our final risk range is based. Again, at this stage, the P10 and P90 are expressed as a percentage variation from the totex allowance.

c. We then multiply these figures by Wessex's expected retail cost allowance at PR24[37] such that the P10 and P90 are now expressed as £s values.

[36] *Ofwat's 2019-20 SDR and 2021-22 WCPR.*
[37] *Please see Wessex PR24 Business Plan data table RR7, in file 'wsx46-data-tables'.*

d. Finally, we convert these figures to a % of RoRE using Wessex's forecast RCV for PR24, along with Wessex's view of notional gearing (60%).[38]

Similar to our totex analysis, we have made choices regarding the time period to include, and whether we use industry-wide or Wessex-only data. We have aligned our methodology for retail costs to be consistent with our methodology for totex, using the time period from PR14-PR19; and industry-wide (rather than Wessex-only) data to construct the range.

[38] *Please see Wessex PR24 Business Plan data table RR30, in file 'wsx46-data-tables'.*

4 Revenue incentive mechanism risk

In this chapter, we present our assessment of the RoRE risk exposure resulting from the revenue incentive mechanism for Wessex at PR24. Based on a historical analysis of Wessex's revenue incentive mechanism performance, we consider that between -0.03% (P10) and 0.00% (P90) of Wessex's RoRE could be at risk at PR24. This narrow and (slightly) negatively skewed range reflects that: (i) the incentive mechanism is downside only; and (ii) Wessex has historically performed within, or very close to, the deadband set by Ofwat.

4A. Introduction and results summary

Context

The revenue incentive mechanism has been designed with the objective of incentivising companies to accurately forecast their own revenue. Revenue incentive mechanism risk is therefore a function of company performance with regard to revenue forecasting.

Approach

Given that there is no reason to believe that Wessex's ability to forecast revenues will change significantly compared to the past, we consider that historical outturn performance provides the most appropriate indicator of potential future risk. We have therefore grounded our risk assessment for this area in historical analysis. In addition, due to company performance likely being a function of internal processes (including data collection and analysis), we consider that company-specific historical performance, rather than historical performance across the industry, will best indicate likely future performance for any one company. As a result, to construct a Wessex-specific risk range for revenue incentive mechanism risk, we have used data regarding Wessex's own past performance.

Revenue incentive mechanism results

In the table overleaf, we present out assessment of the RoRE risk exposure that Wessex faces as a result of the revenue incentive mechanism at PR24.

Table 10: Revenue incentive mechanism RoRE risk range

	Ofwat FM view	Wessex BP view	Economic Insight view
P10	-0.05%	-0.05%	-0.03%
P90	0.00%	0.00%	0.00%

Source: Creating tomorrow, together: Our final methodology for PR24 – Appendix 10: Aligning risk and return', Ofwat (2022), page 10-12; Wessex PR24 Business Plan data table 'wsx46-data-tables'; and Economic Insight analysis.

As shown, we consider that between -0.03% (P10) and 0.00% (P90) of Wessex's RoRE could be at risk due to the revenue incentive mechanism at PR24. The P90 of 0.00% reflects that this incentive mechanism is penalty-only, and therefore that there is no possibility of earning a positive return. The narrow range reflects that, historically, Wessex has performed within, or very close to, the deadband of 2% revenue forecasting error.

In the remainder of this chapter, we detail the methodology we have used to arrive at this view.

4B. Methodology

As set out above, to estimate revenue incentive mechanism risk, we have made use of historical data to estimate the likely range of performance Wessex can expect within over PR24 with respect to the incentive, before calculating the financial implications of this range of performance expressed as a percentage of regulatory equity. Specifically, to implement this method:

a. We first collect data on allowed and recovered revenues from 2015/16 onwards for Wessex,[39] in order to calculate the percentage revenue forecast error in each year of PR14 and PR19 so far. As set out above, for this risk area we use Wessex-only data because we consider that Wessex's ability to forecast revenue going forward is best informed by its own past performance, rather than that of the industry as a whole.

b. We take the minimum, maximum and mean level of performance over this period, in order to construct a simple triangular distribution of Wessex's performance. For Wessex, the minimum forecast error was 0.17% over the period, the mean forecast error was 1.35%, and the maximum forecast error was 3.95%.

[39] *Wholesale Revenue Forecasting Incentive Mechanism model for Wessex Water, available here: https://www.ofwat.gov.uk/regulated-companies/price-review/2019-price-review/final-determinations/pr19-blind-year-reconciliation-final-decisions/ ; and 2021, 2022 and 2023 Annual Performance Reports, tab 2M – Revenue reconciliation.*

c. We convert this performance distribution from being expressed in terms of the percentage revenue forecast error, to the financial implication (or in other words penalty) that Wessex would face as a result of this level of performance. We do this by using both Wessex's own projections of its revenue allowances for PR24; and details regarding how the incentive is intended to work at PR24. Specifically, by:

   – applying a penalty where actual revenues differ from allowed revenues by ±2%; and

   – using a penalty rate of 3% (that applies to the actual revenue that falls outside of the ±2% threshold).[40]

   This allows us to calculate that, should Wessex perform with a forecast error of 0.17% in each year of PR24, it would expect to receive no revenue incentive mechanism penalty. Conversely, should Wessex perform with a forecast error of 3.95% in each year of PR24, it would expect to receive a total penalty of £4.1m (net present value).

d. Finally, we convert this distribution of financial penalties to a % of RoRE using Wessex's forecast RCV for PR24, along with Wessex's view of notional gearing (60%),[41] before taking the P10 and P90 from this distribution as our final risk range for this risk area. This provides us with the range of between -0.03% (P10) and 0.00% (P90).

It should be noted that the approach taken here to arrive at the P10 and P90 levels of risk differs from that used for totex and retail costs. Specifically, for totex and retail costs, we use the P10 and P90 historical levels of performance across the industry, and take these levels of performance forward as the parameters of our risk range. In contrast, here we use the minimum, mean and maximum level of performance to construct a simple triangular probability distribution, from which we infer the P10 and P90 performance levels expected over PR24. Details to explain why we have taken these differing methodological approaches are set out in Chapter 9.

[40] *'A consultation on the Revenue Forecasting Incentive.' Ofwat (July 2023), page 7.*
[41] *Please see Wessex PR24 Business Plan data table RR30, in file 'wsx46-data-tables'.*

5 Financing cost risk

In this chapter, we present our assessment of the RoRE risk exposure on financing costs for Wessex at PR24. Using an approach that is consistent with Ofwat's calculations of the financing risk range facing the notional firm, we consider that between -1.32% (P10) and 2.30% (P90) of Wessex's RoRE could be at risk at PR24. This relatively wide and positively skewed range predominantly reflects the high levels of inflation observed in recent years, and the positive impact this can have in relation to the returns on fixed embedded debt.

5A. Introduction and results summary

Context

Broadly, there are two different areas of risk to consider when modelling financing cost risk:

- **First, there are inflationary risks regarding embedded debt**. Embedded debt at PR24 (outstanding debt that will have been issued before April 2025) can be comprised of both index-linked and fixed-rate debt. A proportion of Wessex's RCV is funded by fixed-rate debt, for which the interest costs will remain constant. However, the RCV on which it is applied may change based on inflation. This implies that company performance against the allowed cost of debt is subject to inflation risk, and is therefore driven by the share of fixed-rate debt that the company has, as well as the level of outturn inflation.

- **Second, there are risks relating to the cost of financing new debt**. At PR24, Ofwat will set an allowance for the cost of new debt based on a trailing average of two indices; the iBoxx 10+ A; and BBB (as published by IHS Markit). This index is then adjusted to take into account that, historically, the water sector has been able to issue debt below the rates implied by the index. Specifically, the average derived from the benchmark will be discounted by 15 basis points.[42] Therefore, the RoRE risk facing Wessex over PR24 in relation to the financing of new debt is a function of whether it is able to issue new debt at a rate above or below this adjusted index.

Approach

In line with Ofwat's methodology for undertaking a risk analysis of financing costs, we model the risks set out above, relating to both: (i) the inflationary risk of embedded debt; and (ii) performance against the cost of new debt allowance.

With regards to (i), we jump off of Ofwat's analysis, which broadly estimates the embedded debt risk range assuming that inflation will vary between +/-1% around the 2% inflation target (please see page 43 for further detail). In our analysis, we flex a number of Ofwat's assumptions. These include:

- Ofwat's inflation assumptions, generating our own inflation assumptions based on the latest OBR inflation forecasts.
- Ofwat's assumption regarding the proportion of index-linked debt, which we base on the latest data for Wessex since we are estimating the risk range for the actual firm, rather than Ofwat's view for the notional firm.
- Ofwat's gearing assumption, which we base on Wessex's view of the notional level of gearing as put forward in their Business Plan, rather than using Ofwat's view.

With regards to (ii), we model the cost of new debt risk using information regarding how Ofwat has set the cost of new debt allowance (please see page 44 for further detail). Specifically:

- Ofwat has set the allowance based on an average of two indices: the iBoxx 10+ A-; and BBB (as published by IHS Markit). Ofwat then proposes to apply a 15-basis points discount off the average derived from its benchmark above.[43] This is because the regulator considers the evidence to be consistent with companies being able to issue new debt below the rates implied by said benchmark.

[42] *'Creating tomorrow, together: Our final methodology for PR24 – Appendix 11: Allowed return on capital, Ofwat (2022), page 58.*

[43] *'Creating tomorrow, together: Our final methodology for PR24 – Appendix 11: Allowed return on capital, Ofwat (2022), page 58.*

- We consider that the iBoxx indices as stated represent the most likely reflection of the rates at which water companies will be able to issue new debt. This is because, if Ofwat believes that these indices are truly representative of water companies' debt costs, there is no reason to believe that water companies can consistently beat the market. Therefore, to generate our risk range, we have accounted for this being a 'more stretching' allowance, by adjusting expected performance levels downwards by 15-basis points, i.e. by reversing Ofwat's assumption.

Financing cost risk results

In the table below, we present the results of our RoRE risk assessment on financing costs for Wessex.

Table 11: Financing cost RoRE risk range

	Ofwat view	Wessex BP view	Economic Insight view
P10	-0.65%	-1.09%	-1.32%
P90	0.70%	0.84%	2.30%

Source: Creating tomorrow, together: Our final methodology for PR24 – Appendix 10: Aligning risk and return', Ofwat (2022), page 10-12; Wessex PR24 Business Plan data table 'wsx46-data-tables'; and Economic Insight analysis.

As shown in the above table, our view is a wider and more positively skewed range than that of Ofwat (in relation to the notional firm), and Wessex in relation to the company-specific performance they can expect over PR24. This is predominantly driven by the inflationary risk of the cost of embedded debt. Specifically, over the past 10 years, we have observed inflation levels that vary significantly above and below the 2% target. Our view is that, should we continue to see similar levels of volatility in the coming years, there is a wide range of possible performance that Wessex could achieve – explaining the wide risk range observed. Assuming that the future will look like the past, the risk range is positively skewed as inflation has tended above the 2% target over the last 10 years. This would result in the value of the RCV funded by fixed debt rising faster than the cost of interest on this debt.

In the remainder of this chapter, we detail the methodology used to arrive at these results.

5B. Details of our methodology

In order to construct a risk range for financing costs, we calculate a risk range for both the: (i) inflationary risk on embedded debt; and (ii) the performance risk on the cost of new debt. We then aggregate these two risk ranges using a simple aggregation

approach.[44] In the subsections below, we detail our calculations in relation to constructing each range in turn.

The inflationary risk on embedded debt

Ofwat calculates the risk around the cost of embedded debt by implementing the following calculation:

$$Risk\ on\ the\ cost\ of\ embedded\ debt = inflation * \%\ fixed\ debt * \frac{gearing}{1 - gearing} * tax\ rate$$

To obtain a risk range, Ofwat assumes inflation may vary between +/-1% around the 2% inflation target.

Our methodology for calculating risk ranges remains the same as Ofwat's, however, we flex:

- **The inflation assumptions used**. Specifically, rather than using +/-1% variation around the 2% central case in line with Ofwat, we update our inflation expectations for PR24 to be based on the last 10 years of data collected by the OBR.[45] The OBR data shows that inflation has dipped as low as 0.32% (1.68 percentage points below the target of 2%), and as high as 5.04% (3.04 percentage points above the target of 2%).
- **The % of fixed debt used**. Specifically, rather than assuming that the % of fixed debt is 67% in line with Ofwat, we instead use data extracted Wessex's Business Plan,[46] which is that approximately 62% of debt will be fixed debt at the PR24.
- Similarly to the rest of our analysis, we use the **level of notional gearing** specified in Wessex's Business Plan of 60%.

In the table overleaf, we present the assumptions and calculations used by Ofwat to arrive at the risk range presented in its Final Methodology, alongside our own.

[44] *This is because we consider it plausible for a company to perform at the 'extreme' ends of both of these ranges simultaneously, and therefore do not deem the use of a Monte Carlo simulation to aggregate finance risks appropriate.*

[45] *Please see: https://obr.uk/forecasts-in-depth/the-economy-forecast/inflation/#CPI*

[46] *Wessex PR24 Business Plan data tables 'wsx46-data-tables', table 'RR24'.*

Table 12: Calculating the inflationary risk on embedded debt

	Ofwat view of notional company risk range			EI view of Wessex risk range		
Component	**Calculation**	**P10**	**P90**	**Calculation**	P10	P90
Inflation	*+/-1% variation around 2% central case*	-1%	+1%	*2012-2022 (last 10 years - more recent outturn data) variation around 2% central case*	-1.68%	3.04%
% fixed debt	*1-33%*	67%	67%	*Company-specific percentage extracted from data table 'RR24'*	62%	62%
Notional gearing	*55%/(1-55%)*	1.22	1.22	*60%/(1-60%)*	1.50	1.50
Tax rate	*1-25%*	75%	75%	*1-25%*	75%	75%
Embedded debt risk range	***Multiplication of the above components, rounded***	**-0.60%**	**+0.60%**	***Multiplication of the above components, rounded***	**-1.17%**	**2.11%**

Sources: 'Creating tomorrow, together: Our final methodology for PR24. Appendix 10 Aligning risk and return.' Ofwat (December 2022); page 16; and Economic Insight analysis.

As shown in the above table, our view is that the risk facing Wessex over PR24 is more positively skewed in relation to embedded debt than Ofwat's view for the notional firm. This is predominantly due to the fact that, over the past 10 years, we have observed high levels of inflation. Should this trend continue to be observed over the coming price control, we would expect Wessex to benefit from the value of the RCV funded by fixed debt rising faster than the cost of interest on this debt.

The performance risk on the cost of new debt

Ofwat's approach

Ofwat sets the allowed cost of new debt based on an average of two indices: the iBoxx 10+ A; and BBB (as published by IHS Markit). For the purpose of publishing its early view, Ofwat has applied a 1-month trailing average period. Ofwat proposes to then apply a 15-basis points discount off the average derived from its benchmark. Adjusting

for inflation, this gives a cost of new debt allowance of 3.28%, as shown in the table below.[47]

Table 13: Ofwat's 'early view' cost of new debt

Component	The industry value proposed by Ofwat
iBoxx A-/BBB 10+ yield (nominal, 1 month trailing) average to 30/09/2022	5.49%
Discount of benchmark	-0.15%
Allowed cost of new debt (nominal)	5.34%
Allowed cost of new debt (real, CPIH)	3.28%

Source: 'Creating tomorrow, together: Our final methodology for PR24. Appendix 11 Allowed return on capital.' Ofwat (December 2022); page 79.

Ofwat's risk range

To estimate the cost of new debt **risk**, Ofwat analyses a sample of 60 fixed-rate issuances, which it states gives a P10 to P90 range of 0.3% to -0.7% compared with the allowed return on new debt of 3.28% (i.e., the P90 performance level would be allowed return on new debt of 3.28% less 0.7%; and the P10 performance level would be the allowed return of 3.28% plus 0.3%). Ofwat states that when converted into a RoRE range (using the notional gearing ratio of 55%; assumed share of new debt of 17%; and tax rate of 75%), the above equates to -0.05% and 0.10%. These calculations are summarised in the table overleaf.

[47] *'Creating tomorrow, together: Our final methodology for PR24. Appendix 11 Allowed return on capital.' Ofwat (December 2022); page 79.*

Table 14: Ofwat's view of the cost of new debt RoRE range

	Calculation	P10	P90
Inferred performance level	*0.30% to -0.70%*	0.30%	-0.70%
Notional gearing	*55%/(1-55%)*	1.22	1.22
Share of new debt	*17%*	17%	17%
1 – corporation tax rate	*(1-25%)*	75%	75%
Ofwat's view of the cost of new debt risk range facing the notional firm	***Multiplication of the above components, rounded***	**-0.05%**	**+0.10%**

Source: 'Creating tomorrow, together: Our final methodology for PR24. Appendix 10 Aligning risk and return.' Ofwat (December 2022); page 16-17.

Ofwat justifies its 15 bps adjustment on the cost of new debt allowance by stating that there is evidence that is consistent with companies being able to issue new debt below the rates implied by the iBoxx indices.[48]

Economic Insight's view

However, we consider that the iBoxx indices as stated represent the most likely indication of the rates at which water companies will be able to issue new debt. Given this, performance against Ofwat's cost of new debt over PR24 will likely be lower as a result of the adjustment made.

Therefore, to generate our company-specific risk range, we have simply accounted for this being a 'more stretching' allowance, and recalculated the range using data extracted from Wessex's Business Plan. Our calculations are summarised in the table overleaf.

[48] *'Creating tomorrow, together: Our final methodology for PR24. Appendix 11 Allowed return on capital.' Ofwat (December 2022); page 58.*

Table 15: Calculating the risk of new debt

	Calculation	P10	P90
Ofwat's inferred performance level	*0.30% plus 15 bps; -0.70 less 15 bps*	0.45%	0.55%
Notional gearing	*60%/(1-60%)*	1.50	1.50
Share of new debt	*The cumulative share of new debt over PR24, from BP table RR24*	*31%*	*31%*
1 – corporation tax rate	*(1-25%)*	*75%*	*75%*
Our view of the cost of new debt risk range facing Wessex	***Multiplication of the above components, rounded***	**-0.16%**	**+0.19%**

Source: Economic Insight analysis.

Specifically, we adjust the 'inferred' P10 and P90 performance levels downwards, and recalculate the risk ranges using the values provided in Wessex's Business Plan data tables.

As shown, our view of risk facing Wessex in relation to the cost of new debt is less positively skewed than the view put forward by Ofwat for the notional firm.

By simply aggregating the risk range produced for the cost of new debt, and embedded debt, we arrive at the -1.32% (P10) to 2.30% (P90) range presented in Table 11. We do not use a Monte Carlo model here as we consider it plausible that Wessex may perform at the extreme ends of these distributions simultaneously.

6 Outcomes risk

In this chapter, we present our assessment of the RoRE risk exposure from Outcome Delivery Incentives (ODIs) for Wessex at PR24. Based on Wessex's historical performance, and supplemented with expert judgement and top-down analysis, we consider that between -1.64% (P10) and 0.07% (P90) of Wessex's RoRE could be at risk at PR24. This negatively skewed range reflects that (i) there is a greater likelihood of under-performance than outperformance for Wessex, given its historical performance; and (ii) (in any case) Ofwat's design of the outcomes package[49] ensures that it is difficult for *any* firm to have a symmetrical outcomes-related risk range.

6A. Introduction and overview of results

Context

Outcome delivery incentives (ODIs) are designed to align the interests of companies and investors with those of their customers. ODIs work such that companies are exposed to penalties and rewards based on outturn performance relative to performance commitment levels (PCLs), thereby incentivising companies to deliver 'good' performance for customers. Outcomes risk is therefore a function of Wessex's performance for each of its PCs relative to the PCLs set, as well as Ofwat's ODI rates.

Approach

We primarily rely on historical data to calculate an ODI RoRE risk range. This is because for any individual ODI, performance on a PC is an extension of the performance in the previous year. Therefore we would expect Wessex's past performance to be an appropriate indicator of future risk. For example, the level of leakage is unlikely to drastically change between years, as it is partially a function of company-specific factors that remain relatively constant over a short time horizon, such as the condition or length of pipes.

[49] *Such as the removal of deadbands, caps, and collars; the reduction in number of bespoke incentives; and the presence of penalty only incentives.*

We acknowledge that efficiency gains and prior investments may make higher performance levels more achievable over time, so consider past performance relative to targets rather than in absolute terms, to account for these improvements. Of course, the usefulness of past performance relative to targets will depend in part upon whether the level of stretch of the targets set by Ofwat is consistent over time. A significant increase in the stretch of the targets for any individual PC between price control periods may result in the risk ranges calculated using this historical method being conservative.

Furthermore, we consider that company-specific factors are an important driver of performance on individual PCs. Therefore, we use Wessex-only historical performance rather than industry-wide performance, to capture Wessex-specific risk. For the purposes of this analysis, Wessex's PCLs and ODI rates are taken as given, as Wessex has used the indicative rates set by Ofwat in its Business Plan.[50]

Whilst this is our preferred approach, it is not feasible to robustly perform historical analysis for every PC. For certain PCs (e.g. customer contacts, unplanned outage etc.), we have only limited past performance data. Therefore, for these PCs, our historical analysis is supplemented with expert judgement of Wessex's likely performance over AMP8. For other PCs still, several of which are new at PR24, there is no reasonable basis to accurately forecast performance using a bottom-up approach. In this case, we use a top-down approach, allocating a % RoRE to each PC, calculated from Ofwat's collaborative customer research.[51]

Outcomes risk results

In the table below, we present the results of our RoRE risk assessment on ODIs for Wessex.

Table 16: Outcome delivery incentive RoRE risk range

	Ofwat FM view	Wessex BP view	Economic Insight view
P10	-2.00%	-1.74%	-1.64%
P90	2.00%	0.77%	0.07%

Source: Creating tomorrow, together: Our final methodology for PR24 – Appendix 10: Aligning risk and return', Ofwat (2022), page 10-12; Wessex PR24 Business Plan data table 'wsx46-data-tables'; and Economic Insight analysis.

Our results show that between -1.64% (P10) and 0.07% (P90) of Wessex's RoRE could be at risk at PR24. This implies that Wessex is more likely to receive net penalties rather than rewards during AMP8. We consider that this negative skew is a function of the following:

[50] *'WSX47 – Outcomes tables commentary', Wessex Water (October 2023), page 189.*
[51] *'PR24: Using collaborative customer research to set outcome delivery incentive rates', Ofwat (2023), page 44.*

- **The removal of caps, collars, and deadbands on certain PCs**. Ofwat will use caps and collars on a limited basis for individual performance commitments and proposes the removal of deadbands on all but one PC.[52] This increases the exposure of companies to significant levels of under-performance on individual PCs.

- **A reduction in the number of bespoke ODIs at PR24.** Companies historically have been more likely to underperform on common ODIs, but have tended to outperform on bespoke ODIs. In previous price controls, this had the effect of balancing out the rewards and payments received on ODIs. The removal of bespoke ODIs at PR24 therefore has the effect of shifting the likely distribution of rewards and payments to the downside.

- **The presence of penalty-only incentives.** Some PCs, such as the Compliance Risk Index (CRI), offer no possibility of outperformance under Ofwat's methodology, with targets set at the maximum achievable level. But, since there is a non-negative chance of underperforming, the expected payments for these PCs, and therefore the overall payment distribution, are skewed to the downside. There is an absence of reward-only incentives that may work to balance this.

- **The scope for large under-performance is greater than that of large over-performance for several PCs.** Historically, Wessex has not consistently underperformed on all PCs in a single year. Instead, Wessex has outperformed on some and underperformed on others. However, the magnitude of the under-performance on PCs where Wessex has missed its targets has generally been larger than the magnitude of outperformance on PCs where Wessex has hit its targets. There are a few potential reasons for this:

  (i) Under-performance might be more susceptible to shocks that impact performance (e.g. extreme weather) compared to over-performance; and

  (ii) Large increases in performance might be hard to achieve, particularly for PCs with targets set near the upper bound of feasible performance, such as serious pollution incidents.[53]

  The use of collars and deadbands could prevent this from being an issue. However, since Ofwat plans to only make targeted use of collars and remove all but one deadband, this results in a negatively skewed ODI risk range at PR24.

[52] *'PR24 Final Methodology Appendix 8, Outcome Delivery Incentive's, Ofwat (December 2022), page 62.*

[53] *Wessex proposes a serious pollution target of one incident per year. Wessex can only outperform by one unit on this PC, but there is no such constraint on underperformance.*

Ofwat proposes outperformance-only enhanced incentives on selected PCs, which theoretically could help to balance the outcomes risk package. However, Wessex has indicated that the step change in performance required to receive enhanced incentives is not conducive to its proposed Plan, so does not propose any enhanced incentives.[54] Nevertheless, our analysis finds that including enhanced incentives in the Plan would not have had a material impact on the calculated ODI RoRE risk range, since the probability of meeting the enhanced thresholds on any PC is very low.[55]

In the remainder of this chapter, we detail the methodology used to arrive at these results.

6B. Details of our methodology

In order to construct a risk range for ODIs, we consider the RoRE risk for each PC, and then aggregate each risk range to produce an overall range. There are three methods we use to calculate a PC-specific RoRE risk range, where the method used depends on the availability of historical data for that PC.

Method 1: historical data only

Method 1 Overview

Used for the following PCs: Water supply interruptions; CRI; Internal sewer flooding; Discharge permit compliance; Serious pollution incidents; Leakage; PCC; Total pollution incidents; and Mains repairs.

Rationale: These PCs have at least 5 years of historical outturn data, as shown in Table 17. Therefore, we believe that historical data alone is sufficient to construct a robust view of performance on each of these PCs.

Below, we step through the process by which we generated a risk range for the PCs that use method 1.

a. **Estimate the minimum, maximum and most likely performance on each PC in each year of AMP8**, using historical data. To do so, we calculate the percentage of under / outperformance relative to the PCL for Wessex in each year for which data is available. Yearly data is used as most ODI payments are 'in-period' – they will get recovered from each company every year during AMP8.[56] We then take the minimum, maximum and most likely (calculated as the mean) performance level from this, also as a % of the PCL.

[54] *'WSX47 – Outcomes tables commentary', Wessex Water (October 2023), page 189.*
[55] *Enhanced thresholds are calculated as the proposed PCL × Common improvement factor, where the common improvement factor is calculated as the average frontier firm performance (as a percentage of its PCL) over the years 2020-2023.*
[56] *See for example:, In-period ODI determinations, Ofwat. Accessed on 06/02/24.*

b. **Calculate a triangular distribution of performance**, based off the performance parameters from step a. The minimum, maximum, and most likely performance levels, measured as a % of the PCL are taken as inputs to generate triangular distributions for each PC, for each year of AMP8.

c. **Convert the values of the triangular distribution from a percentage to a 'pounds' figure.** The following formula is applied to each value of each triangular distribution to accomplish this, using the relevant PCL, and the relevant ODI rate calculated by Ofwat. The relevant PCLs are reported for each year of AMP8 in Wessex's Business Plan.[57] Care has been taken to ensure that the PCL is in the units on which the incentive rate applies.

$$expected\ performance\ (\%) \times PCL \times ODI\ rate = expected\ reward\ or\ penalty\ (£)$$

d. **Apply caps, collars, and deadbands, where appropriate**. Ofwat has indicated in its Final Methodology the PCs that will have a cap, collar, or deadband applied to them,[58] details of which can be found in Table 17. Caps and collars are reported as a percentage of either water or wastewater regulatory equity.

e. **Finally, we convert this distribution of financial penalties to a % RoRE** using Wessex's forecast RCV for PR24, along with Wessex's view of notional gearing (60%).[59]

Method 2: weighted average of historical data and expert judgement

Method 2 Overview

Used for the following PCs: Customer contacts; External sewer flooding; Business demand; Bathing water quality; Storm overflows; Unplanned outage; and Sewer collapses.

Rationale: These PCs have either (i) less than 5 years of outturn data; or (ii) were not targeted in previous years, whether through ODIs or other mechanisms (e.g. EPA targets). This means that a robust risk range cannot be constructed using historical data alone, so our historical analysis is supplemented with expert judgement.

The process for establishing a risk range for PCs under method 2 follows the same process as method 1, except for the generation of the performance distributions, which now rely on expert judgement in addition to historical data. Below, we set why and how we include expert judgement alongside historical data in this method.

Why do we use expert judgement?

[57] *WSX46 – Data tables, OUT1, Wessex Water (October 2023).*
[58] *'PR24 Final Methodology, Appendix 8: Outcome Delivery Incentives', Ofwat (2022), page 63.*
[59] *Please see Wessex PR24 Business Plan data table RR30, in file 'wsx46-data-tables'.*

- Historical data is preferred as an indicator of future performance, since it represents the performance levels that Wessex has actually achieved.
- However, in this situation, historical data is either limited in terms of (i) the number of data points; or (ii) relevance to future performance – as performance on PCs that have not previously been incentivised might not represent the performance a company could achieve if was financially motivated. Therefore, historical data alone is insufficient to produce robust estimates of performance for these PCs.
- Industry experts at Wessex Water have provided us with their view of the 10th percentile, 90th percentile, and 'most likely' performance levels for Wessex on each PC. These experts have internal visibility of Wessex's business so are able to produce realistic performance estimations.

How we use expert judgement

- Despite the drawbacks of historical evidence for these PCs, they do still provide some indication of likely performance. Therefore, we use a weighted average of historical analysis and expert judgement to generate our performance distributions.
- We use a 2/3 weighting on historical analysis for these PCs and 1/3 weighting on expert judgement, which reflects our view of the relative strength of these two sources of evidence.
- In practice, this involves determining the parameters for the triangular distributions separately using historical analysis and expert judgement, then calculating a weighted average of these parameters, from which the triangular distributions are generated.

Once the likely performance distributions have been calculated, these are converted to a risk range using Wessex's past and predicted future PCLs, and Ofwat's indicative ODI rates, as explained in steps c-e of Method 1.

Note that for some PCs (e.g. Bathing water quality) that have not previously been incentivised with ODIs (but have had some target attached to them), we use a 'Proxy PCL' from which to derive a theoretical past target. These Proxy PCLs have been taken from Ofwat's top-down ODI calculation models.

Method 3: a top-down approach, based on a % RoRE

Method 3 Overview

Used for the following PCs: River water quality; Biodiversity; Greenhouse gas emissions (water); and Greenhouse gas emissions (wastewater).

Rationale: For these PCs, there is a high level of uncertainty surrounding the likely performance in AMP8, so we cannot generate a robust risk range using either

historical analysis or expert judgement. Instead, a top-down approach is taken, based on the information Ofwat has provided around the expected risk range for these PCs.

To determine a RoRE risk range using method 3, we assume that Ofwat will correctly align its ODI rates to its target RoRE allocation for each PC. Therefore, we assign Ofwat's targeted % RoRE to each of these PCs.

- For river water quality, the % RoRE is taken from Ofwat's 'collaborative customer research',[60] set at **0.5% wastewater RoRE**.
- Operational greenhouse gas emissions (water and wastewater) and Biodiversity were not included in the customer research, so the standard RoRE allocation of **0.5% water or wastewater RoRE** is used for these PCs.[61]

Aggregating our results

- **We then aggregate each PC's RoRE risk range using a Monte Carlo Model.** Details of our approach to, and rationale for, using Monte Carlo simulations can be found in Chapter 9. The Monte Carlo is applied separately for water and wastewater PCs. This is necessary so that the aggregate sharing mechanism can be applied separately for water and wastewater. Where a PC is allocated to multiple price controls, its % RoRE distribution is apportioned to each Monte Carlo in accordance with that PC's allocation to the water and wastewater price controls. For example, Biodiversity has an 80% allocation to the water resources price control and a 20% allocation to wastewater network plus.[62] Therefore, the biodiversity RoRE distribution is scaled by 80% and included in the water Monte Carlo, and also scaled by 20% and included in the wastewater Monte Carlo.
- **Next, the aggregate sharing mechanism is applied.** This mechanism provides protection to both customers and companies from instances of very high outperformance or underperformance. It applies separately for water and wastewater PCs, once certain thresholds are met. These are set at $\pm$ 3% and $\pm$ 5% of regulatory equity for both the water and wastewater price controls, as set out by Ofwat in its Final Methodology.[63]
- **Finally, Wessex's outcome risk range, measured as a % RoRE can be derived**. The outputs of the water and wastewater Monte Carlos are summed, to produce an overall outcomes RoRE distribution. Taking the 10th and 90th percentiles of this produces the P10 and P90, given as -1.64% and +0.07% respectively. This result, alongside PC-specific risk ranges, is shown in Table 17.

[60] *'PR24: Using collaborative customer research to set outcome delivery incentive rates', Ofwat (2023), page 44.*
[61] *'PR24 Final Methodology, Appendix 8: Outcome Delivery Incentives', Ofwat (2022), page 65.*
[62] *Please see Wessex PR24 Business Plan data table OUT7, in file 'wsx46-data-tables'.*
[63] *'PR24 Final Methodology, Appendix 8: Outcome Delivery Incentives', Ofwat (2022), page 66.*

Table 17: Method and results for individual PCs

	Years of historical data available	Data used	Cap (% RoRE)	Collar (% RoRE)	Deadband	P10 (% RoRE)	P90 (% RoRE)
Water Supply Interruptions	9 years	Historical data		0.5%		+0.01%	+0.03%
CRI	6 years	Historical data			CRI score of 1.5	-0.02%	-0.01%
Leakage	6 years	Historical data	1%			-0.09%	+0.03%
Per Capita Consumption	9 years	Historical data	1%			-0.26%	-0.04%
Mains Repairs	12 years	Historical data	0.5%	0.25%		-0.03%	+0.07%
Discharge Permit Compliance	12 years	Historical data				-0.05%	+0.06%
Internal Sewer Flooding	8 years	Historical data				+0.05%	+0.08%
Serious Pollution Incidents	12 years	Historical data				-0.15%	+0.00%
Total Pollution Incidents	8 years	Historical data				-0.19%	0.00%
Customer Contacts	3 years	Historical data and expert judgement				-0.03%	+0.01%
Business Demand	3 years	Historical data and expert judgement	0.5%	0.5%		-0.08%	+0.01%

Unplanned Outage	3 years	Historical data and expert judgement	0.5%	0.25%		+0.02%	+0.07%
External Sewer Flooding	3 years	Historical data and expert judgement				-0.38%	-0.01%
Bathing Water Quality	7 years	Historical data and expert judgement	0.5%	0.5%		-0.36%	+0.32%
Storm Overflows	3 years	Historical data and expert judgement	0.5%	0.5%		-0.36%	-0.23%
Sewer Collapses	3 years	Historical data and expert judgement	0.5%	0.25%		0.00%	+0.03%
Greenhouse Gas Emissions (water)	N/A	Top-down approach	0.5%	0.5%		-0.14%	+0.14%
Greenhouse Gas Emissions (wastewater)	N/A	Top-down approach	0.5%	0.5%		-0.36%	+0.36%
River Water Quality	N/A	Top-down approach	0.5%	0.5%		-0.36%	+0.36%
Biodiversity	N/A	Top-down approach	0.5%	0.5%		-0.18%	+0.18%
Total (Simple Aggregation)						-2.96%	+1.47%
Total (Monte Carlo)						-1.64%	+0.07%

Source: 'PR24 Final Methodology, Appendix 8: Outcome Delivery Incentives', Ofwat (2022), and Economic Insight analysis.

7 Measures of experience (MeX) risk

In this chapter, we present our assessment of the RoRE risk exposure on MeX for Wessex at PR24. Based on Wessex's historical performance on MeX, supplemented with top-down analysis, we consider that between -0.27% (P10) and 0.25% (P90) of Wessex's RoRE could be at risk at PR24.

7A. Introduction and results summary

Context

Ofwat plans to include three measures of experience at PR24: (i) Customer measure of experience (C-MeX); (ii) Developer services measure of experience (D-MeX); and (iii) Business customer and retailer measure of experience (BR-MeX) – a new measure at PR24.

At PR19, MeX payments were calculated based on companies' relative performance. Therefore, at PR19, MeX risk was a function of both Wessex's own performance and the performance of other companies.

We expect that that the MeX methodologies will change significantly from PR19 to PR24.[64] There is currently uncertainty around precisely what these changes will be, such as (i) the proportion of regulatory equity that the maximum and minimum payments will be based on; and (ii) the use of cross-sector benchmarks. Therefore, Wessex's MeX risk at PR24 also depends on the choices that Ofwat will make concerning the MeX methodologies.

Approach

We do not attempt to model the risk surrounding Ofwat's methodological choices around MeX. Instead, we assume that the methods used for C-MeX and D-MeX follow the PR19 method, with MeX payments depending on the relative performance between companies. We use a combination of Wessex's own historical performance and the industry performance to capture the risk of Wessex's performance differing from the

[64] *'Consultation on the measures of experience performance commitments at PR24', Ofwat (2023).*

industry median, since performance relative to the industry median was the determinant of MeX payments at PR19.

BR-MeX is new at PR24, so there is no historical data on which to rely, and no details of the BR-MeX method have been published. Therefore, a top-down approach is taken for this MeX, based on Ofwat's target incentive range.

While we believe that this combination of historical and top-down approaches is the most suitable method to capture MeX risk, our results are only indicative given the lack of information available about MeX incentives at PR24. Furthermore, our results are likely a **conservative estimate of MeX risk**, since we have not considered any method-related risk within our analysis. It is plausible that Ofwat will strengthen the power of these incentives at PR24, as this has not yet been finalised.

MeX risk results

In the table below, we present our assessment of the RoRE risk exposure that Wessex faces as a result of MeX at PR24.

Table 18: measures of experience RoRE risk range

	Ofwat FM view	Wessex BP view	Economic Insight view
P10	-0.65%	-0.58%	-0.27%
P90	0.50%	0.54%	0.25%

Source: Creating tomorrow, together: Our final methodology for PR24 – Appendix 10: Aligning risk and return', Ofwat (2022), page 10-12; Wessex PR24 Business Plan data table 'wsx46-data-tables'; and Economic Insight analysis.

As shown, we consider that between -0.27% (P10) and 0.25% (P90) of Wessex's RoRE could be at risk at PR24, which is a relatively narrow, symmetric range. However, as explained above, we believe that our results are a conservative estimate of MeX, since they do not capture any method-related risk associated with Ofwat increasing the power of MeX incentives at PR24. Therefore, in practice, the true RoRE risk range associated with MeX could be wider.

7B. Details of our methodology

This section outlines the methods used to calculate MeX risk. Since C-MeX and D-MeX were both present at PR19, we use a historical method to calculate risk for these, but since BR-MeX is new at PR24, and thus there is no historical data, we take a top-down approach.

C-MeX and D-MeX method

To construct a risk range for C-MeX and D-MeX we undertake the following steps:

a. **Calculate Wessex's minimum, maximum, and most likely performance levels** on each MeX, based on historical data. This is equivalent to calculating the minimum, maximum, and most likely MeX scores for Wessex.

   – We assume that Wessex's most likely score in AMP8 is its average performance in AMP7. Therefore, we calculate Wessex's average score over the time period for which there is data (2019-2023). Yearly data is used rather than data at a price control level, because the MeX scores and incentive payments were determined yearly in AMP7.

   – We assume that Wessex's minimum and maximum possible scores are the average industry minimum and maximum scores in AMP7. Therefore, we calculate the average of the lowest (highest) industry scores across each year for which there is data. We use industry-wide scores rather than Wessex-only scores here for two reasons: (i) since there are only four years of data, it is unlikely that Wessex's past scores alone represent the full range of feasible scores for Wessex in AMP8, and (ii) it is feasible that Wessex could be either the best or worst performing firm in a single year of AMP8.

b. **Create a triangular distribution of performance on each MeX,** using the parameters calculated in the previous step.

c. **Calculate the *industry* minimum, maximum, and median performance levels** on each MeX, based on historical data. The industry minimum and maximum have already been calculated in step a, and the overall industry median is calculated as the average industry median across the four years of data.

d. **Convert the values of the triangular performance distribution from MeX scores to penalty/reward payments.** Using the figures calculated in the previous steps, the PR19 MeX formulas can be used to convert the performance distribution to a 'pounds' distribution.[65] The median, maximum, and minimum all refer to industry scores, and the 'score' refers to Wessex's score.

$$(i)\ if\ score > median\text{:}\quad (score - median)/(maximum - median)$$

$$(ii)\ if\ score < median\text{:}\quad (score - median)/(median - minimum)$$

$$(iii)\ if\ score = median\text{:}\quad 0$$

   – **C-MeX**: The result of this calculation is then multiplied by 18% of Wessex's annual allowed residential revenue, where 18% is the provisional retail revenue adjustment set out by Ofwat in its MeX consultation.[66]

[65] *'PR19 final determinations: Wessex Water outcomes performance commitment appendix', Ofwat (2019), page 45.*

[66] *'PR24 Final Methodology, Appendix 8: Outcome Delivery Incentives', Ofwat (2022), page 45.*

- **D-MeX:** If performance is above the median, the result of this calculation is multiplied by 6% of Wessex's annual actual developer services revenue, if performance is below the median, the result is multiplied by 12%. These are the percentage adjustments used at PR19, since Ofwat has given no further guidance on the scale of this incentive mechanism.

- While Ofwat plans to set the magnitude of MeX payments with reference to regulatory equity at PR24,[67] we do not know how it will do so. Therefore, we continue to use the PR19 method, rather than making assumptions over how Ofwat will do this.

e. **Finally, we convert this distribution of financial penalties to a % RoRE** using Wessex's forecast RCV for PR24, along with Wessex's view of notional gearing (60%).[68]

BR-MeX method

We use a top-down approach is used to estimate BR-MeX risk. We have little indication of how Ofwat plans to implement BR-MeX at PR24. However, we know that it is expected to have a potential impact of between -0.10% and +0.05% RoRE.[69] We therefore assume the BR-MeX impact on Wessex is uniformly distributed between -0.10% and +0.05% RoRE, as we have no indication of the relative likelihood of performance within this range.

Aggregating our results

To aggregate the risks across all MeX, we use a Monte Carlo simulation. This aggregates the triangular distributions for C-MeX and D-MeX, alongside the uniform distribution of BR-MeX, producing an overall MeX penalty/reward distribution. Further detail regarding our approach to using Monte Carlo simulations can be found in Chapter 689.

Wessex's forecast P10 and P90, calculated as a % RoRE, can then be determined from the output of the Monte Carlo simulation, shown in

Table 19.

Table 19: RoRE risk ranges for each MeX, aggregated using a Monte Carlo

	C-MeX	D-MeX	BR-MeX	Total (Monte Carlo Aggregation)
P10	-0.21%	-0.06%	-0.09%	-0.27%
P90	+0.28%	+0.03%	+0.03%	+0.25%

Source: Economic Insight analysis.

[67] *'Consultation on the measures of experience performance commitments at PR24', Ofwat (2023), page 2.*
[68] *Please see Wessex PR24 Business Plan data table RR30, in file 'wsx46-data-tables'.*
[69] *'PR24 Final Methodology, Appendix 8: Outcome Delivery Incentives', Ofwat (2022), page 54.*

8 PCD risk

In this chapter, we present our assessment of the RoRE risk exposure resulting from Price Control Deliverables (PCDs) for Wessex at PR24. Based on our analysis using the Cornerstone construction delay dataset, we consider that between -0.55% (P10) and -0.41% (P90) of Wessex's RoRE could be at risk in PR24. This negatively skewed range reflects that PCDs are, in the main, a penalty-only incentive that has not been captured in Ofwat's RoRE method, nor indicative risk ranges.

8A. Introduction and results summary

Context

At PR24, Ofwat has introduced a new type of incentive, Price Control Deliverables (PCDs), into the Outcomes framework. Ofwat intends for PCDs to be used for investments where the outputs do not map neatly to performance commitments and further states that the purpose of PCDs is "*to protect customers if companies do not deliver the improvements that customers have paid for*".[70] PCDs are intended to work to ensure that customers are compensated for more than the allowed cost of any under-delivered / late enhancement projects, reflecting foregone benefits.

As a result, companies will be worse off if they fail to deliver the total funded improvement within AMP8. Specifically, if companies fail to deliver improvements (both outcomes measured through ODIs and outputs through PCDs), then the PCD payment (together with any related ODI payment) requires firms to return to customers *more* than the allowed cost of the enhancement.

PCDs are a new area of downside risk as they are 'downward only' adjustments, which return more than the funding allowances to customers.[71] We note that this downside risk has not been captured in Ofwat's RoRE method, nor its indicative risk ranges. The exclusion of PCDs in its RoRE risk calculation risks Ofwat underestimating the risk that companies face at PR24.

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[70] *'In 23/05 Further guidance on price control deliverables for PR24'. Ofwat (July 2023). Available here: Ofwat.*

[71] *Currently, PCDs are designed as a penalty only mechanism, although we note that Ofwat has stated that it will "consider the extent to which incentives for early delivery will be required as part of the determination process". 'In 23/05 Further guidance on price control deliverables for PR24'. Ofwat (July 2023), page 10. Available here: Ofwat.*

A further area of concern regarding PCDs is that if PCDs are too extensive, they risk 'locking in' companies to certain options/outputs, even if they are inconsistent with what is best for customers and the environment. Whilst Ofwat aims to guard against this by stipulating that PCDs ought to be more outcomes than output focussed, widespread use of PCDs will inevitably limit the flexibilities that companies have.

Approach

Due to the nature of PCDs being newly introduced in PR24, we have not been able to draw on Wessex (or industry-wide) historical data in our analysis. As a result, we have drawn upon third-party data from Cornerstone.[72] This data reveals the distribution of delay durations (as a percentage of forecasted duration) which have occurred in projects in the construction industry. Specifically, in 2022, professionals in the UK construction industry were asked to complete a survey about their experiences of delays in major construction projects. The survey found that delays impacted over 85% of those in the construction industry, leading to longer delivery times.

We have limited information regarding which firms were included in the survey and therefore, are not able to assess whether they are appropriate comparator firms to the water industry, and Wessex specifically. The survey does, however, provide information on the reasons for the reported construction delays. 'Poor/unrealistic planning' was reported as the most significant reason, followed by: resource issues; information issues; changes to specifications; resource productivity; finance hold ups; and the weather. We expect similar contributing factors leading to delays and delivery challenges in enhancement projects in the water industry.

PCD risk results

In the table below, we present our assessment of the RoRE risk exposure that Wessex faces as a result of the PCDs in PR24.

Table 20: PCD RoRE risk range using Monte Carlo aggregation

	Ofwat FM view	Wessex Business Plan view	Economic Insight view
P10	N/A	-0.32%	-0.55%
P90	N/A	-0.15%	-0.41%

Source: 'Creating tomorrow together: Our final methodology for PR24 – Appendix 10: Aligning risk and return', Ofwat (2022), pages 10-12; Wessex PR24 Business Plan data table 'wsx46-data-tables'; and Economic Insight analysis.

[72] *'Delays in the Construction Industry: 2022 Survey'. Cornerstone (January 2023). Available here: Cornerstone.*

A breakdown of the individual PCD risk ranges (prior to Monte Carlo aggregation) is set out at the end of this chapter.

As expected, the RoRE risk is skewed to the downside. This is because: (a) PCDs are a penalty-only incentive; and (b) the Cornerstone data, from which our delay distributions are inferred, illustrates a 'best case' delay of 0% (i.e. it does not record any early delivery construction projects) and, therefore, the upside risk is capped at 0%.

Our risk range is wider than the range estimated in Wessex's Business Plan. This is driven by the difference in our estimates (compared to Wessex's estimates) of actual PCD units delivered (outturn units) in PR24. Specifically, we have used the Cornerstone data to infer the outturn units under three scenarios: (i) the best case scenario of 0% delay; (ii) the most likely scenario of a delay of 25.5%; and (iii) the worst case scenario of a delay of 55.5%.

In the remainder of this chapter, we provide detail on the methodology used to arrive at the results presented above.

8B. Details of our methodology

In order to construct a risk range for PCDs, we undertake the following steps:

a. The Cornerstone data was reported in grouped intervals of 10%. For example, a delay was reported as a "1% - 10% delay" rather than the specific delay percentage. We made the assumption that each observation in the respective intervals was equal to the midpoint of that interval. Therefore, in our example, all observations reported as "1% - 10% delay" were converted to a 5.5% delay.

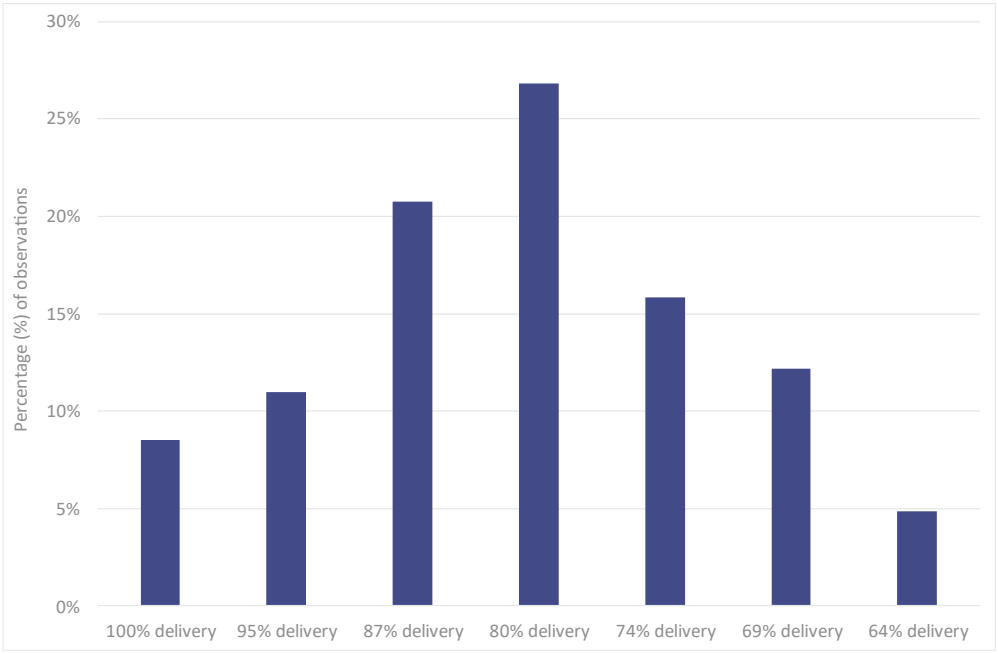
b. We convert the Cornerstone data from duration of delay (% of projected duration) to delivery rate. For example, if a one-year project experiences a delay of 100% then it will take twice as long (200% of the forecast project duration) to deliver the same number of units and therefore only 50% of the forecasted units will be delivered in the one year period. Alternatively, if a one-year project experiences a delay of 20% then it will take 1.2 times as long (120% of forecast project duration) to deliver the same amount of units and therefore only 83% of the forecasted units will be delivered in the one-year period.[73] We set out the formula to convert the delay duration to the delivery rate below.

$$Delivery\ rate = \frac{1}{1 + delay\ duration\ \%}$$

c. We construct the distribution of delay rates from the converted Cornerstone data. This is illustrated in the figure below.

[73] *It is worth noting that a 20% delay does not equal a delivery rate of 80%.*

Figure 1: Distribution of delivery rates



Source: Economic Insight analysis of Cornerstone data

d. We then calculated the minimum, most likely, and maximum delivery rates. These are 64.3%, 79.7% and 100%, respectively.

e. For each PCD, we calculated the annual estimated outturn units under each of the three scenarios (best case; most likely and worst case) by multiplying the forecasted PCD unit in each year by the corresponding delivery rate. This resulted in three sets of outturn units per year (best case; most likely and worst case), for each PCD. An illustrative example is provided in the below table for one PCD in the first year in AMP8.

Table 21: Outturn unit calculation example for PCDW10 (Leakage) and PCDW15 (Lead).

	PCD
Delay duration (%)	X%
Delivery rate (%)	Y% = 1/(1+X%)
Forecast PCD units in year 1 of PR24	U
Outturn PCD units in year 1 of PR24	Z = U * Y%

Source: Economic Insight analysis

f. For each of the outturn units estimated in the best case, most likely case, and worst case scenario (for each year in PR24), we input these into Wessex's PCD model to calculate the proposed revenue adjustment penalty rate for each PCD under the three scenarios. We consider it is important to use Wessex's PCD model put forward in its Business Plan as Wessex have developed their own approach to deriving PCD rates and therefore the pound value of the adjustment may differ slightly from that estimated by Ofwat's model. The main difference between Wessex's PCD model and Ofwat's model is that Wessex separately calculates revenue and RCV adjustments in the event that one or more of its PCDs are not fully delivered or are delivered later than expected. However, in the main, the design principles of Wessex's model are in line with those set out by Ofwat in its guidance. This is set out in Wessex's Business Plan, specifically[74]:

   - Each PCD has a specified delivery metric and an expected schedule for the delivery across AMP8.
   - Each PCD has an amount of ex-ante totex allowance that is directly linked to the delivery of that PCD.
   - If a PCD is delivered in line with the expected delivery schedule, there is no PCD adjustment to be made.
   - Any PCD adjustment is adjusted for the time value of money.
   - The model applies a further uplift (in addition to the time value of money) to account for any foregone benefits in addition to the allowed cost of enhancement.
   - The model assumes a totex sharing rate of 50%.

g. Wessex's PCD model returns a revenue adjustment penalty for delay and non-delivery separately. Therefore, for each PCD, and under the three scenarios, we calculated the revenue adjustment penalty as the sum of the delay revenue adjustment and non-delivery revenue adjustment.

For each PCD, we then convert the distribution of PCD revenue adjustments (financial penalties) to a percentage RoRE using Wessex's forecast RCV for PR24, along with Wessex's view of notional gearing (60%),[75] before taking the P10 and P90 from the individual PCD distribution as our final risk range for the specific PCD. A breakdown of the individual PCD risk ranges (prior to Monte Carlo aggregation) is set out at the end of this chapter.

h. We then run all the individual PCD RoRE risk distributions through a Monte Carlo model to estimate the overall risk range for this area to reflect the fact that it is unlikely for Wessex to perform at the extreme ends of the distribution for all PCDs simultaneously. This provides us with a risk range of between -0.55% (P10) and -0.41% (P90).

[74] *'WSX26 – Price control deliverables (PCDs), Business Plan 2025-2030. Wessex Water, page 35.*
[75] *Please see Wessex PR24 Business Plan data table RR30, in file 'wsx46-data-tables'.*

8C. Individual PCD risk results

Table 22: Individual PCD risk ranges prior to Monte Carlo aggregation

	P10	P90
Investigations - PCDW8 - Low complexity	-0.001%	0.000%
Investigations - PCDW8 - Medium complexity	-0.002%	-0.001%
Investigations - PCDW8 - High complexity	-0.008%	-0.002%
Leakage - PCDW10	-0.015%	-0.004%
Supply Side Improvements - PCDW11	-0.022%	-0.006%
Smart metering - PCDW12 - Household customers' new meter installed (existing households)	-0.015%	-0.005%
Smart metering - PCDW12 - Business customers new meter install	0.000%	0.000%
Smart metering - PCDW12 - Household customers replacement	-0.028%	-0.009%
Smart metering - PCDW12 - Business customers replacement	-0.003%	-0.001%
Smart metering - PCDW12 - Delivery of infrastructure	-0.004%	-0.001%
Raw water quality deterioration - PCDW14	-0.005%	-0.002%
Lead - PCDW15	-0.008%	-0.002%
Cyber and SEMD - PCDW17 (CAF)	-0.008%	-0.003%
Cyber and SEMD - PCDW17 (PLC)	-0.004%	-0.001%
PCDWW4 - Increase flow to full treatment	-0.029%	-0.009%
Spill reductions - PCDWW5 - High harm	-0.132%	-0.040%
Spill reductions - PCDWW5 - bathing waters	-0.029%	-0.009%
Spill reductions - PCDWW5 - less than 10 spills	-0.019%	-0.005%
Nitrogen removal - PCDWW9 - Maiden Bradley	-0.001%	0.000%
Nitrogen removal - PCDWW9 - Blackheath	-0.002%	-0.001%

Nitrogen removal - PCDWW9 - Dorchester	-0.005%	-0.002%
Nitrogen removal - PCDWW9 - Collingbourne Ducis	-0.001%	0.000%
Phosphorus removal - PCDWW10 - band A	-0.008%	-0.002%
Phosphorus removal - PCDWW10 - band B	-0.016%	-0.004%
Phosphorus removal - PCDWW10 - band C	-0.110%	-0.032%
Phosphorus removal - PCDWW10 - band D	-0.076%	-0.023%
Investigations - PCDWW18 - Low	0.000%	0.000%
Investigations - PCDWW18 - Medium	0.000%	0.000%
Investigations - PCDWW18 - High	-0.007%	-0.002%
Sludge storage - PCDWW24	-0.017%	-0.005%
Growth at sewage treatment works - PCDWW27	-0.052%	-0.016%
Reduced flooding risk - PCDWW28 - capacity	-0.017%	-0.005%
Reduced flooding risk - PCDWW28 - internal/external	-0.034%	-0.010%
Pollutions - PCDWW35	-0.050%	-0.015%
Simple aggregation	**-0.731%**	**-0.218%**

Source: 'Creating tomorrow together: Our final methodology for PR24 – Appendix 10: Aligning risk and return', Ofwat (2022), pages 10-12; Wessex PR24 Business Plan data table 'wsx46-data-tables'; and Economic Insight analysis.

9 Aggregating the risks: our use of Monte Carlo models

In this chapter, we set out: (i) why we use Monte Carlo simulation models to aggregate across risk ranges; (ii) the details of how we implemented the Monte Carlo models; and (iii) the choices we have made in generating the probability distributions that input into the Monte Carlo models.

9A. Our use of Monte Carlo simulations

Monte Carlo simulations are used at several points in our analysis, both to aggregate risks within specific risk areas (such as aggregating the risk ranges for multiple PCs, to produce a single outcomes risk range), and to aggregate the risks across all risk areas, to produce our overall risk range.

There are two key reasons for using Monte Carlo simulations to aggregate the results:

- Firstly, this method reflects the fact that it is highly unlikely that Wessex will experience the extreme ends of all risks simultaneously – i.e. it is unlikely to perform at the P10 on each risk area at the same time. A Monte Carlo model therefore builds in a more realistic range of possibilities.
- Secondly, the output of the Monte Carlo simulation is not simply a range of two numbers, but a distribution of possible values of an aggregated outcome. This allows us to gather more information about expected RoRE (e.g. most likely value, P10, P90), than we could gain from a simple aggregation approach.

9B. Details of our methodology

To aggregate risk ranges using a Monte Carlo, we undertake the following steps:

a. **Generate a performance distribution for each risk area**. We estimate the minimum, most likely, and maximum performance level at PR24 for each risk area, and use these as parameters from which to construct a triangular distribution of performance for each area. Details of the choices we have made to establish the minimum, most likely, and maximum performance levels used to generate these distributions are set out in section 9C.

b. **Set the 'seed'**. The Monte Carlo model relies on selecting random numbers. When using random numbers for analysis, it is best practice to set a 'seed'. A seed allows you to select the same set of random numbers upon re-running the Monte Carlo simulation, thereby ensuring that the outputs of the simulation will be replicable.

c. **Set a number of simulations**. The Monte Carlo model relies on using many simulations of outcomes that could result based on the underlying distributions. The more simulations that the Monte Carlo uses, the more accurate its final output will be; and thus the less sensitive to the choice of seed. We use 10,000 simulations for our Monte Carlo models.

d. **Run the model**. The Monte Carlo model selects a random number from each of the underlying performance distributions and sums them, repeating this 10,000 times. This produces a distribution of aggregated results, with 10,000 observations.

e. **Calculate percentiles**. The output of the Monte Carlo model is a distribution of potential outcomes. Taking the 10th and 90th percentile of this distribution produces the desired P10 to P90 risk range.

9C. Our choice of performance distributions

We generally use a triangular distribution to describe performance on specific risk areas, as is common for Monte Carlo simulations where data is sparse.[76] To construct a triangular distribution, we require the following three parameters: (i) the mode, or the most likely level of performance; (ii) the lower limit of performance; and (iii) the upper limit of performance.

The following subsections explain how we arrived at each of these three parameters, and used them to generate triangular distributions for use in our Monte Carlo simulations.

Assessing the 'most likely' value

Given the sparsity of the historical water industry performance data we have relied upon for our risk analysis, it has not been feasible to accurately calculate the 'most likely' performance level for each risk area how one typically would – by calculating the 'mode', or the most frequently achieved level of performance.

Therefore, we typically take the *mean* value from our historical performance data and use this to represent the 'most likely' performance level, as a proxy for the mode. The implication of this is that we are assuming that all risk ranges are centred around the mean level of performance, or in other words, that the 'most likely' performance level is the average level of performance observed in the past. Exceptions to this include:

[76] *Using triangular distributions for Business and Finance Simulations in Excel, Fairchild, Misra, and Shi (2016) vol 42, no.3-4.*
We use a uniform distribution rather than triangular distribution for BR-MeX, as explained in section ***Error! Reference source not found.***.

- **Where we use expert judgement within our ODI risk analysis**. In this instance, Wessex have provided its own view of the 'most likely' performance level it will achieve over PR24.

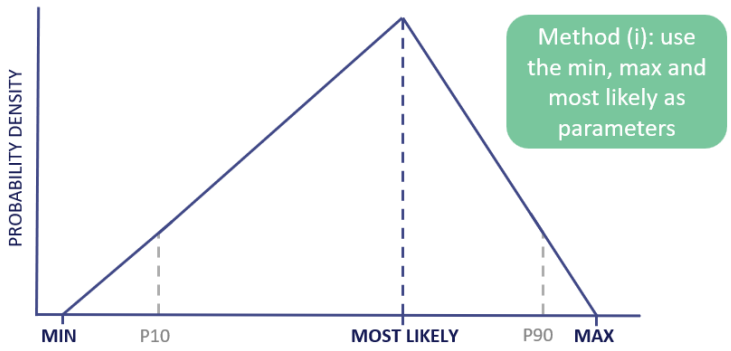
- **Our cost of new debt analysis.** Here, we use the midpoint between our P10 and P90 estimates, due to a lack of data availability regarding 'most likely' performance.

Establishing the 'upper' and 'lower' bounds

As set out above, alongside the 'most likely' value, we also require estimates of an upper and lower performance limit in order to generate the triangular distributions that feed into our Monte Carlo simulations. There are two ways of identifying the upper and lower performance limits:

(i) We can take the *minimum* and *maximum* performance values, as given by the historical performance data. By using these values alongside the 'most likely' value, we obtain a triangular distribution as illustrated by the blue lines in the diagram below. From this distribution, we are then able to *infer* the P10 and P90 levels of performance, as illustrated by the grey dotted lines. These P10 and P90 levels are used to define our risk range for the risk area in question.

Figure 2: Method (i) for constructing a triangular performance distribution from historical data

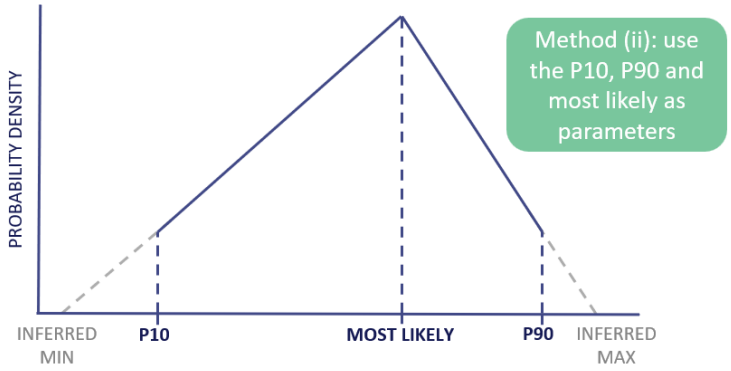


Source: Economic Insight

This method is appropriate if we believe that the extreme values observed in the underlying data reflect a performance level that Wessex could feasibly achieve over PR24. For instance, if Wessex has been shown to achieve similar levels of performance in the past, we would want to ensure this level of performance is used to construct the probability distribution.

(ii) We can take the *10th percentile (P10)* and *90th percentile (P90)* values, as given by the historical performance data. By using these values alongside the 'most likely' value, we obtain a triangular distribution as illustrated by the blue lines in the diagram below. These P10 and P90 values are used to define our risk range for the risk area in question. We then use these data points to *infer* the minimum and maximum levels of performance, as shown by the dotted grey lines, to generate the full triangular distribution we require to feed into our Monte Carlo models.

Figure 2: Method (ii) for constructing a triangular performance distribution from historical data



Source: Economic Insight

This method is more appropriate if we believe that the extreme values observed in the underlying data used **do not** reflect a performance level that Wessex could feasibly achieve over PR24. For instance, if we consider that the most extreme performance values within the dataset in question relate to anomalies, we consider it appropriate to instead rely on the P10 and P90 historical performance levels to construct the probability distribution.

The implication of using these different methods is that they can result in slightly different-looking performance distributions, even when based on the same underlying data. This is because method (i) uses the *most extreme results* as parameters for the probability distribution, whereas method (ii) does not – it infers the expected minimum and maximum performance values from the 10th and 90th percentiles of the data. Therefore, when the minimum and maximum values in the observed data are particularly extreme, method (ii) has the effect of limiting the tails of the triangular distribution. Conversely, when all of the performance data is bunched quite closely together, using method (ii) can have the effect of lengthening the tails of the distribution.

Given this, we consider that the underlying data dictates which method it is most appropriate to employ, and for each risk area we choose the method that produces the performance distribution we think *best reflects Wessex's likely performance at PR24*. For example, we use method (i) when constructing a performance distribution for revenue incentive mechanisms. This is for two key reasons.

- First, because we use Wessex-only data for this risk area. This means that the extreme (minimum and maximum) levels of performance observed represent a level of performance that Wessex has in fact achieved in the past. Since this performance was feasible previously, we have no evidence to suggest that such a performance level would no longer be achievable for Wessex at PR24.
- Additionally, using Wessex-only data limits the number of data points we have available from which to construct a distribution. Therefore, it is difficult to conclude whether the minimum and maximum performance levels are anomalous results.

However, for other risk areas, such as retail costs, we use method (ii). This is because:

- For this risk area, we use industry-wide historical performance data. As a result, the extreme (minimum and maximum) levels of performance might not represent feasible retail cost performance levels *for Wessex specifically*. Company-specific factors might influence performance on retail costs, and therefore, the most extreme levels of performance achieved by other companies may not be considered feasible for Wessex.

In addition, the use of industry-wide performance data means that our dataset consists of many more observations than it would were we to use Wessex-only data. Due to this increase in data, we are better able to understand whether the 'extreme' values in the distribution represent anomalous results. For retail costs, the minimum level of performance observed across the industry is a 60.4% overspend against allowances. In contrast, the P10 level of performance is a 35.4% overspend against allowances. Given the large difference between the minimum and P10 performance levels, we can assume that the minimum level of performance represents an anomalous result, and therefore, we would want to use the P10 level to construct our triangular distrib ution.

Table 23 overleaf illustrates which method we have employed to construct the performance distributions for each individual risk area.

Table 23: Details of the data and method used for individual risk areas

Risk area		Data used to establish expected performance levels	Method used to generate the triangular distribution	Reasoning	Risk area specific Monte Carlo used?
Totex	Method 1: standard historical analysis	Industry-wide historical performance data.	Method (ii) – we take the mean, 10th percentile, 90th percentile levels of historical performance.	We use industry-wide historical performance data, which provides sufficient observations for us to establish that the 'tails' of the distribution are very long – indicating that the 'extreme' (minimum and maximum) values may be anomalies.	No.
	Method 2: difference in base-enhancement variability	Industry-wide historical performance data.	Method (ii) – we take the mean, 10th percentile, 90th percentile levels of historical performance.	We use industry-wide historical performance data, which provides sufficient observations for us to establish that the 'tails' of the distribution are very long – indicating that the 'extreme' (minimum and maximum) values may be anomalies.	No.
	Method 3: base-enhancement Monte Carlo	Industry-wide historical performance data.	Method (i) – we take the mean, minimum and maximum levels of historical performance.	We only use data from PR19 on the split of base and enhancement allowances and expenditures. Since there are such few data points, we cannot conclude whether the minimum and maximum observed values are anomalies or represent feasible performance levels for Wessex, so include these in our analysis.	Yes – to aggregate base and enhancement risk ranges.
	Method 4: Green Book optimism bias	Industry-wide historical performance data and Green Book optimism bias estimates.	When using historical performance data to construct a risk range for opex and base capex, we use Method (ii) – we take	We use the recommended upper and lower capital expenditure adjustment ranges set out in the Supplementary Green Book Guidance to estimate the best and	Yes – to aggregate opex & base capex, and enhancement capex risk ranges.

			the mean, 10th percentile, 90th percentile levels of historical performance. For enhancement capex, we use (i) the upper and lower levels of capital expenditure underestimate set out in the Government's Green Book Guidance; and (ii) the mean of the upper and lower values.	worst case overspend for enhancement capex. These are the only data points available and therefore, we apply these as our minimum and maximum underspend in our analysis.	
	Method 5: AACE cost estimate accuracy	Industry-wide historical performance data and AACE cost accuracy estimates.	When using historical performance data to construct a risk range for opex and base capex, we use Method (ii) – we take the mean, 10th percentile, 90th percentile levels of historical performance. We use the class 4 and class 5AACE cost estimate accuracy ranges to estimate the risk range for enhancement capex. For the maximum underspend, we use the average of L1 and L2; for the minimum, we use the average of H1 and H2; and for the mean, we use the average of the two means for class 4 and class 5.	We use the 'low' and 'high' accuracy estimates which result in the narrower underspend/overspend range. By using the narrower range we are reducing the outlier risk and as these are the only available data points, we apply these as our minimum and maximum underspend in our analysis.	Yes – to aggregate opex & base capex, and enhancement capex risk ranges.
Retail costs		Industry-wide historical performance data.	Method (ii) – we take the mean, 10th percentile, 90th percentile levels of historical performance.	We use industry-wide historical performance data, which provides sufficient observations for us to establish that the 'tails' of the distribution are very long – indicating that the 'extreme' (minimum and maximum) values may be anomalies.	No.
Revenue incentive mechanisms		Wessex-only historical performance data.	Method (i) – we take the mean, minimum, maximum levels of historical performance.	We use Wessex-only historical performance data, which means that we have relatively few observations compared with if industry-wide data was used. In addition, each of the observations used represents historical levels of	No.

				performance that Wessex has previously achieved.	
Financing	Embedded debt	Quarterly OBR inflation data over the past 10 years.	Method (ii) – we take the 10th percentile, and 90th percentile, and for the 'most likely' scenario, we assume that inflation lies at the 2% target.	To avoid relying on 'extreme' results, we use the P10 and P90 levels of inflation observed over the past 10 years.	No.
	New debt	Ofwat view of the cost of new debt risk range.	Method (ii) – we take the 10th percentile, 90th percentile, and the midpoint between the P10 and P90 as the 'most likely' scenario.	We adjust the risk range identified by Ofwat to reflect what we consider to be a more realistic range of performance. Given this, we use the parameters provided by Ofwat to calculate the triangular distribution (i.e. the P10 and P90).	
Outcomes		Primarily Wessex-only historical performance data, supplemented with expert judgement.	Where we use historical performance data, we use method (i) – we take the mean, minimum, and maximum levels of historical performance Where we use expert judgement, we take the 'most likely', P10 and P90 values provided to us by Wessex to construct the triangular distribution, using Method (ii) – inferring the 'tails' of the distribution.	We use Wessex-only historical performance data for each PC, which means that we have relatively few observations compared with if industry-wide data was used. In addition, each of the observations used represents historical levels of performance that Wessex has previously achieved. Experts have provided the P10, 'most likely', and P90 values only, for each PC. Therefore we use Method (ii) for expert judgement.	Yes – to aggregate risk ranges for each of the individual PCs.
Measures of experience		Industry-wide levels of historical performance to inform the upper and lower bounds, Wessex-only data to	Method (i) – we take the mean, minimum, and maximum levels of historical performance.	Our method for MeX uses relative performance between companies rather than absolute performance to calculate a risk range.	Yes – to aggregate risk ranges for each of the individual MeX.

	inform the 'most likely' performance level.		Since we believe it is feasible for Wessex to be both the best and worst performing firm in a single year of PR24, we use the MeX scores corresponding to the worst industry position (17th) and best industry position (1st) as parameters to construct our performance distribution.	
Price control deliverables	Cornerstone survey data on delay durations in large-scale construction projects in the UK in 2022.	We take the mean, minimum and mode duration of construction delay.	The survey data is reported in duration bands (of 10%) rather than specific durations per observation. In our analysis, we have assumed all observations recorded in each range as the midpoint of that range. The outlier risk is therefore mitigated by using the midpoint of the maximum and minimum ranges as well as the fact that these ranges have a reasonable number of observations expected in a normal distribution.	Yes – to aggregate across all PCDs.

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