WSX31 - Risk and return

Business plan
2025-2030

Wessex Water
YTL GROUP

FOR YOU. FOR LIFE.

WSX31 - Risk and return

CONTENTS

For annexes, see Supporting Document WSX32 – Annexes – Risk and Return

This supporting document is part of Wessex Water's business plan for 2025-2030.

Please see 'WSX00 – Navigation document' for where this document sits within our business plan submission.

More information can be found at wessexwater.co.uk.

1. Our Proposed Cost of Capital

1.1. Cost of Equity

The cost of equity set out in the final methodology does not present an investable proposal. The skew in risks associated with the PR24 programme make it, in our view, unlikely that an investor in an efficient company will earn a fair return. This is specifically driven by the increase in systematic risk caused by the large statutory investment programme, but also by the ODI framework, and the introduction of PCDs.

The KPMG *Estimating the Cost of Equity for PR24* report, attached as an annex, sets out what our view of a pure play water industry cost of equity should be, based on up-to-date market information and operational circumstances equivalent to what we have seen in the past. 2025-2030 will look markedly different.

This is specifically driven by the exceptional increase in the capital programme. It is clear to us that investors would expect such a programme to increase the systematic risk to the company. The analysis set out in section 2 sets out a range of ways to quantify the impact.

Based on the analysis, we are proposing an increase to the cost of equity, specifically an upward adjustment to the beta to reflect the increases in systematic risk.

We think that there is further mileage in developing ways to cross check these results, such as multi factor models and would encourage constructive engagement on this post submission.

We have included an allowance for aiming up of 15 bps, a reduction from that used by the CMA, to recognise the continued uncertainty in parameter estimation. Based on our submission we see no need for a further aiming up adjustment, however this is while considering our plan overall. If changes and interventions are made elsewhere that create a systematic change in the overall balance of risk and return, then further aiming up adjustments may be justified.

1.2. Cost of Debt

The cost of debt set out in the final methodology is now understandably out of date.

- The calculation of the embedded debt needs to be amended to correctly account for the use of swaps, and the new debt raised since the cut-off date needs to be incorporated,
- the proportion of new debt needs to be updated in light of the increasingly large capital programmes,
- the cost of new debt needs to be revisited, with recent evidence bringing into question the application of a halo, and
- the assumption around issuance and liquidity costs needs to be revisited given the scale of investment.

Given the scale of our capital programme, we are proposing a company specific ratio of new and embedded debt. With our proposed investment, this currently stands at 70:30 embedded to new, averaged over the period. We are also proposing that the issuance and liquidity costs are increased from 10bps to 25bps. This is consistent with Ofgem's recent decision and is consistent with a larger capital programme necessitating additional debt.

We are proposing a cost of new debt for the notional company of 6.05%, consistent with the average of A and BBB rated corporate bonds at the time of writing.

1.3. Notional Gearing

We are proposing to keep the notional gearing unchanged at 60%.

We attach as an annex to this section, a report by Frontier Economics, which concludes that there is no evidence to support a move away from this notional level.

It highlights that it is consistent with the credit ratings that are deemed appropriate for the notional company, the credit ratings observed in the industry, and much lower than the gearing that is observed to deliver large infrastructure development through project finance initiatives.

1.4. WACC Calculations

The proposals set out in section 1.1 and 1.2 above on cost of equity and cost of debt result in a CPIH real appointee WACC of 4.45% and a wholesale WACC of 4.39%. We have retained the retail margin reduction of 6bps, although we think that this should also be reviewed through the process in light of recent actual retail performance.

The full calculations are set out in tables RR25 and RR26 but are summarised in Table 1 below.

Table 1: Summary of WACC calculations

	Nominal	Real
Notional Gearing	60%	60%
Cost of Equity	8.36%	6.25%
Cost of Debt	5.31%	3.25%
Appointee WACC	6.53%	4.45%
Retail Margin	0.06%	0.06%
Wholesale WACC	6.47%	4.39%

2. Impact on Cost of Equity from PR24 Capital Programme

2.1. Summary

Water companies need to deliver much more to meet heightened Government and wider stakeholder expectations in relation to abstraction, leakage, pollution and other environmental and net zero ambitions.

Companies will need to significantly increase their investment over the PR24 period to meet these expectations. To fund this expenditure, water companies are likely to need to raise additional capital from their investors.

This significant increase in investment compared to historic norms implies an inflection in the risk profile of water companies, which in turn warrants a change in the expected return on capital to avoid the risk of underinvestment.

This is recognised by the CMA, noting in in its PR19 redetermination that a cost of equity should be set above the midpoint of the range of possible estimates to secure finance and promote investment in the long term, and that there was a material risk of underinvestment or an exit of capital from the sector if the cost of capital was set too low.[1]

In PR24, Ofwat determines an allowable return on capital, but has not currently taken the potential impact of this increased expenditure into account in its calculations. It has not assessed the relative risk faced by companies on a prospective basis in comparison to the risk faced by companies retrospectively. If it had done so, it would have assessed a higher allowed return on capital to compensate for the higher prospective risks.

In this section, we set out relevant context around the scale of planned capital programmes at PR24 and beyond for Wessex and across the wider water sector. We note that:

- PR24 will see **an unprecedented increase in capex over past levels**, to fund enhanced environmental and net zero commitments such as storm overflows and anti-pollution measures. Wessex Water's average annual level of capex represented around 7-8% of RCV over the last 15 years, in line with industry averages. It is now set to almost double to around 13% on average across the PR24 period.
- The sheer **scale of the capital programme over PR24** in itself, and relative to past levels, presents a step up in risk for Wessex's investors. In PR24 Wessex will need to fund over £3.8bn of new spend, representing a c60% increase in its RCV.
- The **nature of the capital programme** brings a step change increase in risk due to new and uncertain technologies being employed.
- At the same time, regulators are ratcheting up performance expectations and shifting more of the risks onto companies. Companies are more exposed to **systematic risks outside of their control, and asymmetric sector-specific downside risks that** that make it more likely that investors will not achieve a fair return on capital.
- A consequence of this unprecedented capital programme is that Wessex investors will be required to make a **significant equity injection** *and* face the prospect of **zero/depressed dividends** over next 15 years.

[1] Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, Final Report, CMA, paragraph 86.

- This represents a paradigm shift in expectations. **Regulatory precedent** and **market sentiment** suggests that the risks involved in undertaking significant and novel capital programmes, combined with **heightened political and regulatory risks**, require uplifts in allowed rates of return. In addition, research suggests that investors will require compensation for a change in dividend policy of this nature.

The CMA expressed concerns in its PR19 redetermination[2] around the need to promote investment and secure finance for the long term, in the light of the significant capital programme anticipated to be needed in the future. The CMA noted in particular:

- The need to promote investment and address the risk of an exit of capital from the sector if the cost of capital is set too low. CMA noted that despite uncertainty around the optimal level of investment, there is a material probability that companies will need to enhance capital programmes in coming periods, e.g. to meet the challenges raised by climate change. If investors do not expect to be compensated fully for future investments, they may be unwilling to invest. CMA recognised in its report that long term planning mechanisms do not address the underinvestment risks fully.
- The allowed return needs to be set in a way that encourages new investment. If the WACC is set too low, companies will not have the incentive to identify, develop, and implement new and often complex investment programmes. This risk was also identified in the UKRN report and previous studies.

  'In respect of incentives to identify new capital and grow RCV where it benefits customers, there remains a risk that a WACC that is too low will not provide these incentives. At the margin, owners and management will have some discretion in how appropriate capital projects are identified and designed, and that there needs to be sufficient financial incentives to ensure that this is done at a desirable level. This would be particularly required if Ofwat required a step change in investment to meet changing resilience requirements in the face of climate change challenges or other stresses.' If Investors choose to exit the sector or are unwilling to put in further capital, this could result in a higher cost of capital from new investors or a need to pay a premium in future price controls.'[3]

- In the longer term, wider social benefits of investment are lost, either because companies do not identify investments or put resources into planning for them, or because finance is unavailable. If water quality deteriorates as a result this could be more costly to address in the long run.
- Asymmetry of risk in the package, which should be considered as part of the overall balance of the price control.
- Scale of parameter uncertainty in estimating the CoE, particularly in the light of the sharp declines in equity returns since PR14.

In conclusion, **this not an investible proposition** under current Ofwat proposals. Our analysis suggests that an uplift is required to the rate of return of approximately 81 basis points above the mid-point currently of a pure play water competitor, as calculated by KPMG.

Given the size of the adjustment that we find to be necessary to properly compensate Wessex's investors for the risks it faces over PR24, we consider that Ofwat has made material omissions in its considerations and has materially underestimated the required rate of return. At currently proposed levels, the allowed return is insufficient to encourage new investment and keep existing investors in the sector.

[2] CMA: Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, Final report, March 2021
[3] paragraph 9.1391 of the CMA's Final Report

In this section, we assess the impact that the PR24 capital programme is likely to have on Wessex Water's risk profile and required return on capital. We do this by:

- setting out the context around the scale and nature of planned capital programmes at PR24 and beyond for Wessex and across the wider water sector;
- analysing the potential impact of the step change in the capital programme on risk exposure and risk dynamics; and
- estimating the potential impact that the planned capital programmes at PR24 could have on returns, based on notional modelling of the potential impact on projected cashflows, yields and payback periods, and through examination of relevant regulatory precedents.

We have not conducted an exhaustive analysis of the impact of the PR24 capital programme on returns. Whilst we have provided some initial estimates of the required uplift based on a range of approaches, including through consideration of the betas of water industry heavy construction companies, more empirical analysis could be done to explore the implications of significant and novel investment capex on beta across the stock market as a whole. For example, it would be possible to construct portfolios of firms that have invested more or less heavily in their asset bases over a given period, to explore any potential impact on beta whilst controlling for other factors. We believe that such analysis could help to augment an understanding of the systematic risks associated with such enhanced levels of investment capex.

While this section is informed by the cost of equity estimates developed in the *Estimating the Cost of Equity for PR24* report[4], the analysis in this section of the impact of the PR24 capital programme on Wessex Water's risk exposure and return on capital is not dependent on the conclusions reached by that report.

2.2. Scale and Nature of Capital Programme

In this section we set out details of the relative size and scale of the capital programme envisaged in PR24 compared to previous price control review periods, to illustrate the unprecedented increase in scale over past periods. We also set out details of the nature of the capital expenditure and explain why much of this programme is novel or unprecedented.

2.2.1. Unprecedented increase in size and scale of capital programme

To understand the scale of the PR24 capital programme, we have compared the anticipated level of capex in PR24 to historical levels. In doing do, we have focussed on the level of capital expenditure in relation to the RCV (we term this the 'capex ratio').

Average capex ratios across the industry have varied between 6.4% to 10.7% of RCV over the last 17 years between PR04 and the present day. Since PR09, they have not exceeded 8.3% of RCV. Across this whole period, Wessex's capex ratio has closely tracked the industry average.

Levels of capex over PR24 are expected to increase significantly over past levels, both in absolute terms and relative to the RCV. With the RCV forecast to grow by c.60% in real terms over the five years from 31st March 2025, increasing from £4.0bn to £6.5bn at 2022/23 prices.

This is significantly above expected average industry RCV growth over the same period of around 35%[5].

[4] KPMG Estimating the Cost of Equity for PR24.
[5] KPMG Estimating the Cost of Equity for PR24.

Relative to the RCV, the forecast average annual capex/RCV ratio over PR24 is 13%, over twice the rate seen in previous periods, and significantly above historical investment rates for larger water companies.

Wessex's capex/RCV ratio in 2025/26 is expected to be 15%. This declines steadily to 12% across the PR24 period due to growth in the RCV denominator as a result of the increased capex.

This is significantly higher than the industry annual capex/RCV ratio over PR24, estimated at around 10%[6].

The scale of this capital programme is highly significant and unprecedented in the industry. To illustrate, it is similar in scale in absolute terms to that faced by BAA in constructing Heathrow Terminal 5[7].

2.2.2. Significant levels of novel and unprecedented capex

Table 2 below sets out a high-level breakdown of the £3.5bn estimated total capex programme over PR24 into investment areas.

This shows that, of the £3.5bn planned capital expenditure, c50% (£1.8bn) is in areas that are either novel or 'first of a kind' activities for Wessex and are likely to involve new, untested, unfamiliar and uncommon methods of investment, or expenditure is at an unprecedented scale compared to previous otherwise similar programmes undertaken by Wessex. The novelty, scale and often unclear legislation and guidance around these activities increases risks in several respects. These include:

- Phosphorus removal, where Wessex is being asked to achieve limits that are technically achievable in theory but which have not previously been reached. This will require a step increase in investment to meet the strictest possible treatment conditions in many locations, and there is a risk that planned interventions will not effectively meet targets. This investment is compulsory and is required to comply with UK government nutrient removal targets.8
- Bioresources, relating to the industrial emissions directive, environmental permits, and other novel areas for Wessex. Bioresource investments, for example, are subject to material risk and uncertainty due to the possibility of changes in EA guidance in the future to deal with nutrient run off into waterways.
- Smart metering rollout, a new activity for Wessex, which will also be potentially delivered on an unprecedented national scale.
- Considerable investment in enhanced storm overflow protection is required to meet government targets under the Environment Act as well as to install additional monitoring to demonstrate compliance with treatment works flow permits. Existing Wessex storm overflow programmes have involved capital expenditure in the tens of millions, rather than the £0.5bn planned for PR24. The nature of this large-scale investment requirement is inherently uncertain and creates a risk of misalignment between eventual needs and PR24 cost allowances. As noted in the KPMG report9, the deliverability of storm overflow investment programmes across the sector as whole is unclear and untested and gives rise to supply chain constraints with consequential delays and cost over-runs.

[6] KPMG Estimating the Cost of Equity for PR24.
[7] As per The BAA Terminal 5 Project, Case Study, National Audit Office, Heathrow T5 cost approx. £4.2bn.
[8] See for example Defra, May 2022, 'Consultation on environmental targets', p.17
[9] KPMG Estimating the Cost of Equity for PR24

Table 2: Summary of proposed capex programme

Capex type	£m	
Expenditure on novel activities, at unprecedented scale and unclear guidance		
Nutrient/Chemical Removal	1,000	Novel activities at unprecedented scale with unclear guidance
Storm Overflows	380	Unprecedented scale and some novel activities
Smart Metering & SROs	160	Unprecedented scale and novel activities
Bioresources Enhancement	180	Unprecedented scale and unclear guidance
Continuous water quality monitoring	90	Unprecedented scale and unclear guidance
More standard capital expenditure		
Capital maintenance	1,000	
Growth, resilience & new development	320	
Other Enhancements	360	
Total "riskier capex"	1,810	
Total Capex	**3,500**	

2.3. Increased Risks faced by Investors

In this section we set out evidence that the unprecedented scale and novel and untested nature of the capital programme over PR24 and beyond drives a material increase in risk and warrants an increase in the cost of capital over levels proposed by Ofwat in its draft methodology.

In this section, we explore the following risks faced by investors which have implications for the cost of capital:

- Risks arising from the nature of the capital programme including higher volatility of totex expenditure and higher likelihood of cost overruns,
- Asymmetric downside risks,
- Cash flow duration risk and longer equity payback period.

To support our analysis on the increased risk faced by investors, in this section we also discuss:

- How regulators have typically sought to compensate investors for the increased risk of large-scale capex programmes,
- Market sentiment on the relative risks faced by water companies.

2.3.1. Nature of increased risk and link with the rate of return

In corporate finance theory, systematic or market risk is considered to be that which relates to the market as a whole and is therefore undiversifiable. It is not controllable by firm management, meaning that all companies in a given sector would face similar exposures.

In theory, an increase in the cost of capital could be warranted if the water industry were expected to be more exposed to market risk than had been the case in the past. This would increase the beta over historic levels, meaning that historic beta estimates would be too low.

In addition, an increase in the cost of capital could be warranted to compensate for increased asymmetric risks in the price control package, which mean companies are more likely to underperform than outperform. If the regulatory regime makes it more difficult for companies to meet expectations, this could mean that the rate of return needs to

be increased to balance the price control package and ensure that companies have a reasonable expectation of earning their cost of capital.

It is important to note that there is a trade-off between arrangements within the overall price control package – the balance of risks and incentives provided – and the cost of capital. Whilst it could be argued that the cost of capital should be set purely to compensate investors for market or systematic risks, in practice the rate of return is often adjusted by regulators to compensate for project or industry wide risks that may have a component of systematic risk but are not necessarily entirely systematic in nature.

We present evidence in this section to demonstrate that risks are set to increase due to various factors, including due to heightened market risks, project and industry risks, as well as increased asymmetric downside risks. The key point being that the ability of companies to effectively manage these risks is limited, increasing exposure to systemic market wide factors.

In practice, regardless of the nature of risk, it is vital for the regulators to ensure an acceptable balance of risk and reward for the firm and its investors, to provide appropriate incentives for ongoing investment in the sector.

2.3.2. Risks arising from the nature of the capital programme

The AMP8 programme has a higher proportion of expenditure in non-business as usual and complex capex activities ("enhancement spend"), which are more volatile in nature than operational and maintenance activities ("base spend"). This increases total systematic risk exposure. In addition, there is a heighted risk of downwards asymmetry, due to the calibration of risk sharing mechanisms and ODIs/PCDs.

The key risk areas associated with increased enhancement expenditure in AMP8 are:

- *Scale and complexity of investment:* risks arising from expenditure in 'first of a kind' or novel activities involving new or untested solutions, as well as from uncertainty in the investment requirements. Further details on the uncertainties and risks associated with individual elements of Wessex's specific capital programme are discussed in Section 2 and include those associated with novel and unprecedented scale solutions around nutrient removal programmes, storm overflows, and water resource management. Managing a larger portfolio of capital programmes implies greater complexity. This includes coordinating multiple projects and programmes simultaneously, ensuring proper oversight of the supply chain, identifying and managing interdependencies and conflicts between projects.
- *Supply chain implications*: higher investment requirements for the water sector, as well as in other infrastructure sectors (e.g. HS2 and energy networks) could strain the capacity of suppliers, leading to price increases, delays and quality issues. Supply shortages could also arise on the market for specialist labour. This risk is highlighted in relation to the industry-wide storm overflow programme. There are known issues in relation to shortages of raw materials and high inflation in the construction industry, with the impact of global crises (the Ukraine War and Covid) set to continue. In addition, labour shortages are a grave concern in the construction industry, with around a quarter of a million workers having left the industry in the recent past according to New Civil Engineer[10]
- *Potential impacts on the cost-service relationship*: delivery risks on capital investment reflect on performance risks on service areas affected by the programme. This is heightened by the more stringent Performance Commitment Levels (PCLs) that Ofwat is likely to set for PR24, as well as the higher likelihood of unfunded costs. More demanding performance expectations (e.g. for phosphorus removal, or storm overflows) may cost more or take longer to achieve than envisaged due to unproven technology and

[10] New Civil Engineer: 7 issues that will affect supply chains in 2023

uncertainty as to exact requirements (e.g. impact of climate change on storm overflow requirements). It is well documented that infrastructure construction projects are more likely to over-run than not (see for example: ICE)[11].

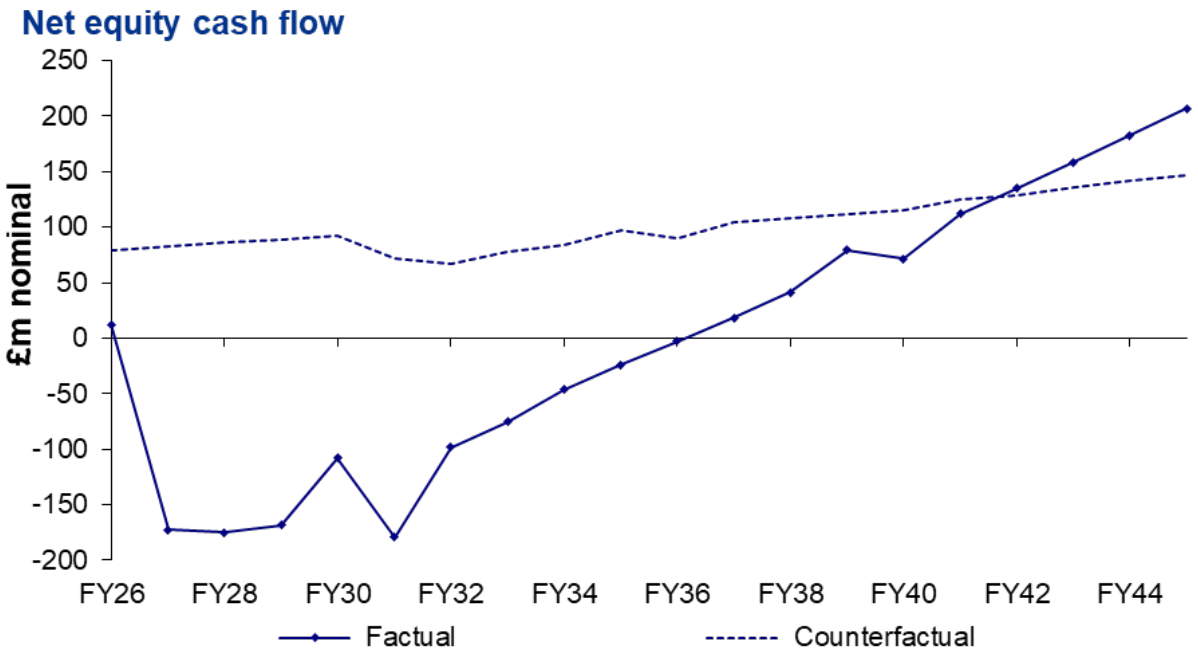
- *Input price risk:* cost increases not fully reflected in the CPIH inflation, such as energy costs and chemicals.
- *Regulatory and political risk:* in the current climate of high scrutiny of the water sector, there may be increased risk of interference from the regulator and the government if companies are unable to meet some of the investment and service improvement requirements.
- *Financing risk:* increased scale of debt and equity requirements to support the capital programme. On the equity side, investors are likely to face a prolonged period of negative cash flows, with remuneration shifting from dividend to value growth and moving to the latter part of the investment horizon. This change in the nature of investment in the water company is likely to increase risks and present challenges for the procurement of fresh equity.

2.3.3. Cash flow duration risk and longer equity payback period

The unprecedented scale of the capital programme will require shareholders to inject equity into the regulated company or forgo dividends to retain equity to ensure that it maintains a stable financing structure and remains financeable at an investment grade credit rating. This situation is likely to persist post-AMP8 given high levels of investment are expected to continue to be required.

Detailed modelling (see Figure 1 below) shows that investors could be required to inject around £1 bn of new equity into the company over a 10-year period between AMP8 and 9, with no prospect of recovery for many years.

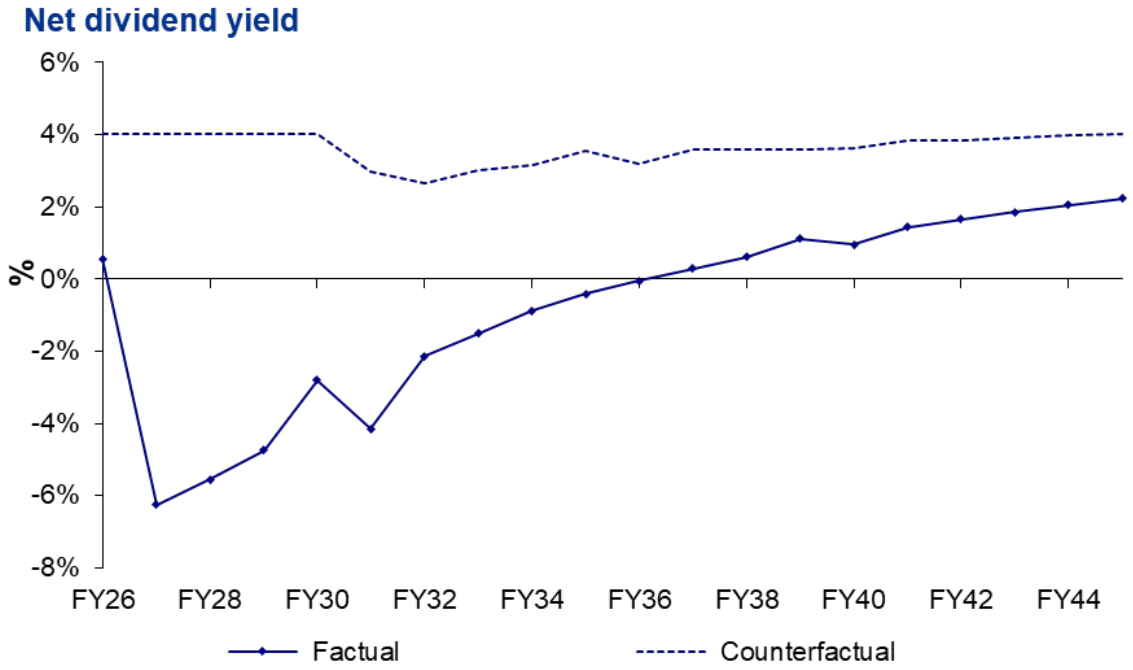
Figure 1: Net equity cash flow (counterfactual vs factual)



[11] ICE, 'Reducing the gap between cost estimates and outturns for major infrastructure projects and programmes', 16 May 2019, accessed 24 August 2023, https://www.ice.org.uk/news-insight/policy-and-advocacy/policy-engagement/reducing-the-gap-between-cost-estimates-and-outturns-for-major-infrastructure-projects-and-programmes

Modelling of dividend yields show that yields are unlikely to recover to historical levels of around 4% pa within the foreseeable future, and investors face the prospect of no dividend payments at all for around 10 years (see Figure 2 below). This is in sharp contrast to the consistent and relatively steady dividend profile that has attracted may investors to the water sector in the past.

Figure 2: Net dividend yield (counterfactual vs factual)



The protracted dividend holiday sharply increases the duration of equity cash flows (i.e. lengthens the payback period of equity investment). Shareholders need to hold the asset for significantly longer to recoup a reasonable return on their initial investment and therefore are subjected to interest rate risk and wider macroeconomic risks for a longer period of time. Furthermore, cash flows far away into the future are more difficult to predict and could be adversely affected by changes in the regulatory framework. Therefore the higher duration is associated with higher exposure to regulatory and political risk, which in turn could be exacerbated by macroeconomic headwinds.

Macroeconomic and regulatory risk cannot be diversified. Instead it is systematic in nature and therefore increased exposure to these risks should be priced into the cost of equity. We provide detailed modelling of the impact of cash flow duration risk on the cost of equity later in this document.

We summarise the key risks and links to systematic risk in Table 3 below.

Table 3: Summary of key risks and link to systematic risk

Risk description	Asymmetric component	Systematic component
Large and complex capital programmes, involving new, untested, unfamiliar, uncommon methods and technologies	Increased **risk of underperformance** against environmental targets and PCLs, and penalties applied in future price control settlements.	**Increased volatility** of outcomes and **uncertainty** regarding solutions and whether they will meet performance targets **Little opportunity to mitigate or manage risks** and reduced flexibility, implies more **exposure to macroeconomic risks** (e.g. supply chain/inflationary)
More stringent PCLs	Very stringent permit levels in 2030 gives v limited headroom. Very difficult/significantly harder to mitigate risk of failure against targets, **increasing likelihood of underperformance**.	**Increased regulatory risk**. Little flexibility, **and reduced ability to manage or mitigate risks** due to regulatory regime and more risks being put on firms. Increased **exposure to macroeconomic risks.**
Large portfolio of projects	Increased risks of overspend. Coordination and oversight risks.	Part of any overspend likely to have a systematic component to it
Supply chain risks, strained capacity in construction industry	Likely to lead to delays, quality issues, increased prices. **Increased risk of over-spend and underperformance** against targets.	Increased exposure to systematic and macroeconomic risks (e.g. supply chain/inflationary) not fully under management control, and which can't be fully mitigated
Input cost risks	Input cost inflation above CPIH exacerbates risk of underperformance	Power costs increasing in proportion to total costs and chemicals costs having a **clear systematic component**
Regulatory and government scrutiny of water sector	Increased risks of the regulatory regime moving in an unfavourable direction, meaning that companies are less likely to be able to earn a fair rate of return	**Increased exposure to systematic and macro risks**, not fully under management control. Regulatory regime becomes less likely to compensate firms for exposure to these risks.
Financing risk, duration of cashflows is increasing	N/A	Longer duration increases exposure to systematic risk

2.3.4. Regulatory precedent

In its PR19 redetermination, the CMA noted the risk, if the WACC is set too low, that owners and management do not have sufficient financial incentive to identify new capital and grow the RCV to meet benefits for customers and meet the challenges raised by climate change. This may lead to a higher WACC in subsequent price controls; higher costs of investment, and lost social benefits.

In this section, we consider some of the key regulatory precedents involving large and complex construction projects, demonstrating that regulators have typically acknowledged and made allowances to mitigate or compensate for the risks of such projects and thus encourage adequate investment and funding.

Where regulators have sought to compensate investors for higher investment risks, this has typically been reflected either by applying a higher beta for regulated companies undertaking large capital programmes, or by directly

adjusting the final WACC figure. Where an increased cost of capital is not provided, alternative arrangements to mitigate the risk may be implemented.

There are multiple precedents for regulators undertaking relative risk assessments to inform their determinations of allowed returns. We find that regulators have typically considered the following key types of risks associated with large capital programmes:

- asymmetric risks of overspend associated with construction;
- political and regulatory risk; and
- cash-flow duration risks.

A summary of key precedents has been set out in Table 4 below, followed by more detailed case studies on two significant decisions: PNGL and BAA.

Table 4: Summary of key regulatory precedents

Decision	High level summary
RIIO-1 (GD1/T1)[12]	Ofgem considered the relative risk differences between energy sectors when setting asset betas in RIIO-1 (GD1/T1). Ofgem compared the cash flow risks for GDNs and TOs, primarily based on the scale of investment and the degree of divergence between actual expenditure and allowances. Ofgem determined the highest asset beta for SHETL on the basis that its capex-RAV ratio exceeded that of NGET and other energy networks.
Openreach FTTP[13]	Fibre to the premise (FTTP) is in build phase, with lower revenues and substantial costs implying a higher operating leverage than FTTC and copper broadband. This was seen as potentially leading to higher systematic risk due to increased sensitivity to cash flows and macroeconomic shocks. Ofcom also carried out extensive relative risk analysis between BT/Openreach's broadband services (FTTP vs. FTTC). In WFTMR 2021161, Ofcom attributed the differences between the systematic risk exposure of the two services to (1) systematic demand risk; and (2) operating leverage. Ofcom determined the FTTP service to be riskier than FTTC/Copper-based service because of uncertainty in FTTP product pricing and significant upfront costs in rolling out FTTP networks.
Hinkley Point C[14]	Under the Hinkley Point C (HPC) deal, the private sector bears the risks of construction cost overrun. In the National Audit Office report comparisons are made between different funding arrangements and their required rate of return. Due to the innovative nature of the technology in the project the NAO highlighted risks that the project will be delayed or that there will be substantial cost overrun.

[12] Ofgem (2012), 'RIIO-T1: Final Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd | Ofgem', see https://www.ofgem.gov.uk/publications/riio-t1-final-proposals-sp-transmission-ltd-and-scottish-hydro-electric-transmission-ltd

[13] Ofcom (2020) 'Statement: Promoting investment and competition in fibre networks – Wholesale Fixed Telecoms Market Review 2021-26', see https://www.ofcom.org.uk/consultations-and-statements/category-1/2021-26-wholesale-fixed-telecoms-market-review

[14] NAO (2017) Hinkley Point C, https://www.nao.org.uk/reports/hinkley-point-c/, accessed 24 August 2023 and Construction News (2023) Hinkley costs set to hit £33bn, https://www.constructionnews.co.uk/civils/hinkley-costs-set-to-hit-33bn-20-02-2023/, accessed 24 August 2023.

Decision	High level summary
	As a result a 9% investor return was associated with the project, 7 percentage points above the 2% risk-free rate (equivalent to return on gilts). As some risks were still borne by the public sector, in a case where the private sector bore 100% of the risks, a hurdle rate of 12% was estimated. Construction cost was estimated as £18bn in 2015. The latest estimates of final cost range from £25bn to £32.7bn (2015 prices), representing cost overruns of 39%-82%.
Havant Thicket Reservoir[15]	Construction of the first reservoir in the South East since the 1970s, being a new reservoir to be developed by Portsmouth Water to supply Southern Water. Increased risks associated with construction of large infrastructure in the water sector with limited recent/prior experience. Scale of investment (at approximately £0.1bn) is small relative to WSX's capital programme, but similar to many of the individual construction projects. WACC uplifted by 0.2 percentage points. Economic profits on bulk supply to Southern Water to enhance returns to shareholders. Cost adjustment mechanisms linked to planning and procurement gateways were introduced to control cost uncertainty early in development.
Thames Tideway Tunnel[16]	Development of a large sewer across inner London. Current cost estimates over £4bn. Due to the complexity and scale of the project, its financing, development and operation were directly procured in a competitive process ran by Thames Water. Contingent financial support was provided to the infrastructure provider (Bazalgette Tunnel Limited) by HMG to mitigate risk, else private delivery was seen as unviable. Similarities due to the scale of investment (at approximately £0.5bn pa) and sector. Represents a complex and innovative construction project. The size of the project is larger relative to individual construction projects undertaken by WSX or other water and sewerage companies. Direct procurement, protecting the primary water and sewerage provider (Thames Water) from potential increases in borrowing costs. Cost of capital set by competitive process during construction period and initial development period. Reduced cashflow volatility for infrastructure provider during operation period.
Heathrow Terminal 5 and redevelopment of Terminal 2.[17]	The construction of Terminal 5 by Heathrow Airport Limited represented a high level of capital expenditure. The average CAPEX/RAB ratio of Heathrow Airport Limited over the CAA Q4 regulatory period (in which construction took place) was 15.6% per annum and represented a large expansion in the regulated asset base. The recommendation by the Competition Commission considered risk associated with construction delays and increased gearing, as well as asymmetric risks due to price controls. See below for more detail.
PNGL	Investment in gas distribution network in Northern Ireland. See below for more detail.

[15] Ofwat (2019), 'PR19 final determinations: Havant Thicket appendix', see https://www.ofwat.gov.uk/publication/pr19-final-determinations-havant-thicket-appendix/
[16] NAO (2017) Review of the Thames Tideway Tunnel, https://www.nao.org.uk/reports/review-of-the-thames-tideway-tunnel/, accessed 24 August 2023
[17] Competition Commission (2007), 'Heathrow Airport Ltd and Gatwick Airport Ltd price control review', see https://webarchive.nationalarchives.gov.uk/ukgwa/20140402194940/http:/www.competition-commission.org.uk/our-work/directory-of-all-inquiries/heathrow-and-gatwick-quinquennial-review/final-report-and-appendices-glossary

BAA/Heathrow Terminal 5 (2007)

In 2007, the Competition Commission ('CC') considered the rate of return that was required against a backdrop of BAA needing to undertake large capital expenditure programmes at both Heathrow and Gatwick airports.

The construction of Terminal 5 by Heathrow Airport Limited at a projected cost of £4.3 billion represented a very significant level of capital expenditure compared to the existing RAB, which also stood at £4.3bn at the outset of Q4. Terminal 5, along with other related capital projects, represented a CAPEX/RAB ratio of approximately 13% on average across the Q4/Q5 period.[18] This is comparable with the anticipated level of capex at Wessex.

In Q4, the CC recommended an overall WACC increase of 0.25 percentage points. As this applied to all three airports within the BAA group, this was equivalent to a 0.33 percentage point uplift applied only to Heathrow. This recommendation considered the risks associated with construction delays and increased gearing, and a specific uplift above the midpoint of the range for the Terminal 5 development.

In the following regulatory period (Q5), the CC recognised the risks of Terminal 5's continuing development and Terminal 2's early operation as well as the construction risk and operation risk (due to construction happening in a 'live environment'). The CC adopted a WACC estimate 60 basis points higher than the midpoint of the range. The CC made explicit recognition of the inherent uncertainties in its estimates of the rate of return, the additional systematic risks associated with the capital programme not captured in the CAPM, and the importance of not allowing a rate of return that is insufficient to generate necessary new investment. It therefore recommended a cost of capital towards the top of the range, which was approximately 60 bps higher than the mid-point at both Heathrow and Gatwick.[19]

Furthermore, to help control for cost overruns of capital investment programmes, BAA was granted a 25 per cent allowance for contingencies over estimated project costs.

PNGL (2012)

In the Phoenix Natural Gas Limited ('PNGL') case (2012), the CC considered the higher risks faced by PNGL in the earlier years of its investment in the gas network in Northern Ireland and determined that the Utility Regulator was right to have applied a material project risk premium to the rate of return demanded by other more established British utilities.

Key justifications included:

- **Demand risk**, given the PNGL was building its customer base from zero.
- A high degree of **construction risk**, including a risk that capex projects were not successful or not achievable within the budget or timescale envisaged. This risk was particularly pronounced for PNGL given the greenfield status of the investment, but the principle can be generalized to any utility undertaking an unusually large capital programme.
- Risks associated with **uncertainty as to future regulatory environment and political uncertainty** in Northern Ireland at the time the initial agreement was struck.

The CC considered that PNGL faced non-trivial project specific risks as a result of the novel nature of the investments and the political and regulatory uncertainty, which collectively meant that PNGL, having invested

[18] Based on information presented in Appendix E of the above report, tables 2 and 3.
[19] See Competition Commission (2007), 'BAA Ltd: A report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd)', paragraphs 4.106-4.108 and 4.116.

considerable sums in building the network, might fail to recover the full value of its investments. The CC considered that such project specific risks may require compensation because investors may be exposed to asymmetry and will refrain from investing unless they receive a return over and above the WACC.

The CC also considered PNGL's cash flow profile, noting that it is not necessary that a mature utility would be consistently cash flow positive; however PNGL's lack of a track record of stable and predictable cash flow generation in contrast to many mature GB utilities, may have reduced its attractiveness to potential investors.

As a result of a combination of the above risks, the CC concluded that a 1.5% uplift to the rate of return was appropriate.

2.3.5. Market sentiment and risk

Market sentiment also corroborates the need to reward higher risks. Market commentary in relation to PR24 highlights increased risk due to higher capex without sufficient return for investors. Indeed, political and regulatory risk are highlighted by all three institutional authors (JP Morgan, Credit Suisse and Barclays); recent market statements are set out in Table 5 below.

Furthermore, comparisons with the energy sector are unfavourable in terms of political risk and allowed return. Political and regulatory risk leads to lower expected cash flows and higher cost of capital, as the risks are typically asymmetric (i.e. downwards biased). The upcoming general election in 2024 presents significant risks for private investors in the water industry, for example:

- Keir Starmer is reportedly being urged to revisit Labour's re-nationalisation policy in the wake of the Thames Water crisis.[20]
- Labour is reportedly planning a radical overhaul of water regulation.[21]
- YouGov reports that conservative as well as labour voters tend to be in favour of running water in the public sector.[22]

Such political and regulatory risks cannot always be captured by standard CAPM models and share price betas which capture only market risks, but they are systemic in the sense that they impact the utilities sector as a whole and have a clear impact on willingness to invest and investment uncertainty.

[20] Guardian, 'Labour MPs urge Keir Starmer to commit to nationalising water firms', 30 June 2023, see https://www.theguardian.com/politics/2023/jun/30/labour-mps-urge-keir-starmer-to-commit-to-nationalising-thames-water, accessed 25 August 2023

[21] Financial Times, Labour plans new water regulator for England and Wales', 5 May 2023, see https://www.ft.com/content/602a009b-6a41-4528-9804-22f7a5080cc3, accessed 25 August 2023

[22] YouGov, Most Britons believe that trains, water and energy should sit within the public sector, 19 October 2022, see https://yougov.co.uk/topics/politics/articles-reports/2022/10/19/most-britons-believe-trains-water-and-energy-shoul, accessed 25 August 2023

Table 5: Recent Market Statements Related to PR24

We believe investors will need to see regulatory and political support for higher bills to fund higher investment and higher returns before turning positive on the sector. *While we believe that the government and regulator acknowledge that higher investment in the sector will be needed, there are still risks to the sector that mean we are not yet outright positive on the outlook for the stocks themselves. Primarily, we believe that customers will push back on increasing bills, which would be needed to fund additional investment, which means more scrutiny on allowed returns.* **- UK Water: Too early to say implications of Thames failure on the rest of the sector, but limited direct impact today, JP Morgan (June 2023)**
The last time borrowing costs were as they are now, the allowed return was c6% CPIH real. We note electricity distribution – where RAB growth might be similar – got a c3.9% CPIH real return on capital in November 2022 (vs 2.9% for water in December 2019) with more extensive trackers on debt and equity costs. The 6.5% total market return and reluctance to 'aim up' is a limitation. Our view is that water has at least the same risk as distribution. **- UK Water: Thames issues and what they mean for the industry, Credit Suisse (June 2023)**
The risk is twofold: (i) companies end up investing substantially more without either a fair return, or under the totex sharing mechanism (where companies incur c50% of the cost); and (ii) fines could lead to financial pressure and de facto nationalisation of a private company with high leverage, especially if combined with Ofwat's agenda to replace debt with equity. *We view the cost of equity as elevated, and dividend flows in doubt. We would also argue that the allowed return needs to rise from the current 2.96% CPIH real (April 2020-March 2025) up to something closer to the 3.9% that electricity distribution earns (at the moment, Ofwat is at 3.29% and in particular is using a low beta).* *We are surprised that unlike in past situations – e.g. with Ofgem's TIRG in 2005 where there was a 200bps premium – there is not a higher return to ensure that the spend is undertaken.* **- UK Water: Cost of equity has moved higher, Credit Suisse (April 2023)**
We believe no other industry invests significant levels of capex at cost of capital, but at a hurdle rate incorporating a premium. We believe if capex levels are to rise then returns need to be commensurate with reduced FCF metrics and to ensure (efficient) companies are financeable – in line with one of Ofwat's legal duties. *We believe risk in power networks is lower than for water (less commodity price exposure, higher margins, less political risk), which should come through cost of capital calculations as either higher asset betas and/or lower leverage in water versus regulated power names. This is not the case. Ofwat used an asset beta of 0.33 versus Ofgem's 0.35 and despite lower risk, put the sector on a lower gearing assumption. These assumptions are inconsistent in our view.* *We also believe using the outdated Ofwat cost of capital numbers in the business plans is at best inaccurate and at worst could imply additional risk. Cost of capital has risen significantly since summer 2022 and using Ofwat's lower assumed cost of capital could lead to inaccurate assumptions of financeability, particularly if water company capex were to rise significantly from here.* Barclays is assuming an asset beta of 0.39 (versus the ED2 beta of 0.35). **- UK Water: positive hydrostatic pressure, Barclays (March 2023)**

2.4. Required Rate of Return

As discussed in the previous section, Wessex faces significantly increased project specific risks due to the scale and nature of the capital programme that it must undertake over PR24. To quantify the required uplift to the cost of equity to compensate for such risks, we have conducted preliminary analysis using five different approaches:

1. Analysis of regulatory precedents involving large capital projects in established RAB/WACC settings.
2. Beta recomposition, assuming that on a forward-looking basis a water company's beta would be the weighted-average of the business-as-usual beta and a beta which reflects the scale and complexity of construction activities and impacts on returns.
3. Option pricing to illustrate the rationale for an uplift to compensate for uncertainty.
4. Direct modelling of the impact of the larger capital programme on the volatility of returns
5. Modelling the change in duration of equity cash flows as a result of the larger capital programme.

In this section, we estimate the required uplift to the cost of equity following each of the above approaches.

2.4.1. Regulatory precedents

Based on the analysis of precedent cases discussed in Section 3 we observe that for large and complex construction projects, regulators have applied adjustments as a result of the higher risks faced in such projects. Regulators have typically either applied a higher beta for regulated companies undertaking large capital programmes, or directly adjusted the final WACC figure. The specific context and nature of these capital programmes means that it is difficult to find precisely comparable examples, nevertheless we consider that the Heathrow and PNGL precedents set out in section 3 provide a useful indication of an appropriate order of magnitude of an adjustment of this nature. However, given the greenfield nature of the PNGL investment and demand risk exposure, we have reduced the scale of the original PNGL uplift by 50%.

Based on these precedents we have modelled uplifts of 60 bps (based on Heathrow T5) and 75 bps (based on PNGL).

2.4.2. Beta Recomposition

The activities of UK construction and engineering firms specialising in infrastructure with direct exposure to the UK water sector could provide a close reflection of the nature and scale of construction activities that water companies are expected to undertake in PR24. The requirements and challenges faced by these firms in delivering infrastructure projects align closely with those faced by water companies, making their data relevant and valuable for assessing the pricing of associated risk factors in the water sector.

Under the Beta Recomposition approach, we calculate a forward-looking beta for Wessex based on a weighted-average of the business-as-usual beta and a beta which reflects the systematic risk of construction activities, based on a portfolio of 5 listed construction firms active in the UK water sector.

Based on the identified 5 listed 'pure play' construction comparators: Kier Group, Costain, Morgan Sindall, Renew Holdings and Galliford Try Holdings, we use an average 10-years unlevered beta of 0.623 in this weighted-average calculation.[23]

[23] See KPMG Estimating the Cost of Equity for PR24 for full details of the methodology.

- The weighting is done by reference to the proportion of Wessex's PR24 asset base that is made up of capex that is novel, or at an unprecedented scale, and so carries a higher risk profile.
- We apply an adjustment of 50% to this higher risk capex to account for the regulatory cost-sharing agreements that Wessex will benefit from, and construction firms would not have access to.
- This implies an 88/12 weighting of historic water beta to construction beta.

Table 6 below provides a summary of the approach to beta recomposition.

Table 6: Beta recomposition

	£m	Source
22/23 Closing RCV **(A)**	4,000	Wessex Historic RCV Data
PR24 Capex **(B)**	3,500	Capex breakdown as per Table 2
Total PR24 Asset Base (C)	7,500	A+B
Higher Risk Capex **(D)**	1,810	Capex breakdown as per Table 2
Cost Sharing Adjustment **(E)**	50%	KPMG assumption
Adjusted Higher Risk Capex (F)	905	D*E
Construction Beta Weighting (G)	12%	F / C
Historic Water Beta Weighting	88%	*1* - G

Applying the construction industry average 10-year's unlevered beta of 0.623, and a "pure play" water beta of 0.2924 and using the weighting from the previous calculations (88% water beta / 12% construction beta) we arrive at a recomposed unlevered beta of 0.33.

As per Table 7, based on the KPMG assessment of the cost of equity parameters, we estimate that the recomposed unlevered beta of 0.33 could drive an increase in cost of equity from 5.44% (at the lower 0.29 "pure play" water company beta) to 5.94%, or +50bps.

This corresponds to a 20bps uplift on the "industry average" cost of equity, reflecting the higher scale of Wessex's capital programme.

[24] Based on a comparator made up of United Utilities and Severn Trent (equally weighted) from October 2014 (the PR19 "structural break") to June 2023, plus an adjustment to capture the impact on Beta of including Pennon. This adjustment is estimated using data post-disposal of Viridor in July 2020, i.e. after Pennon would have become a pure play water company.

Table 7: Pureplay versus recomposed beta

	Water (pure play)	Recomposed Beta
Unlevered beta	0.29	0.33
Debt beta	0.10	0.10
Notional gearing	60%	60%
Equity beta	0.71	0.82
RFR	1.86%	1.86%
ERP	4.82%	4.82%
Aiming up for estimation uncertainty	0.15%	0.15%
Cost of Equity	5.44%	5.94%

Table 8 below sets out an estimate of Wessex's cost of equity in comparison to the Ofwat PR24 central view as per the PR24 final methodology; the KPMG estimate of the BAU water industry cost of equity (before considering the impact of the capital programme); and the KPMG estimate of the industry cost of equity (after taking into account the impact of the capital programme). This demonstrates the impact of applying a 50bps uplift to the BAU water industry cost of equity (before taking into account the impact of the capital programme), which results in a 20bps uplift to the mid-point of the range of the industry cost of equity (after taking into account the impact of the capital programme).

This reflects the very large size of the capital programme in relation to Wessex's RCV, in comparison with industry averages.

Table 8: Comparison of approaches to the cost of equity

	Ofwat PR24 central view*	KPMG 'BAU' water industry (before impact of capital programme)	KPMG water industry (after impact of capital programme)	Wessex CoE (after impact of capital programme)
Notional gearing	55%	60%	60%	60%
RFR	0.47%	1.86%	1.86%	1.86%
TMR	6.46%	6.39-6.96%	6.39-6.96%	6.39-6.96%
ERP	5.99%	4.53%-5.10%	4.53%-5.10%	4.53-5.10%
Observed gearing	53.35%	52.20%	50.74%-49.27%	52.20%
Unlevered beta	0.28	0.29	0.31-0.33	0.33
Debt beta	0.10	0.10	0.10	0.10
Equity beta	0.61	0.71	0.75-0.79	0.82
Aiming up for estimation uncertainty	N/A	0.15%	0.15%	0.15%
Cost of Equity	4.14%	5.44% (Range 5.24%-5.65%)	5.74% (Range 5.42%-6.06%)	5.94% (Range 5.71% to 6.17%)

2.5. Option pricing

Wessex is set to lose valuable real options to delay investment in PR24, which have not been adequately compensated. This is because where there is uncertainty over future payoffs, the option to delay investment has value, in the same way that a call option on a stock has value.

Wessex's investors are facing unprecedented uncertainty, including due to the untested technologies it needs to deploy to meet some of the performance and net zero requirements, and due to heightened political and regulatory risk. The implementation of innovative technologies is associated with material uncertainties and produces real options for investors. As the technology matures, the uncertainty associated with investments is reduced. This may be done through the use of limited scale initial rollouts, adopting a test and learn approach.

For a rational investor to invest now, the allowed rate of return needs to include some uplift to compensate for the removal of this option value. Whilst modelling the option value precisely is difficult, the concept is important, and supports the rationale for a material uplift to the cost of capital to compensate for uncertainty.

A stylised example is set out in Figure 3 below.

Figure 3: Stylised real-option example

- Suppose Wessex has a base RCV at the outset of PR24 of £10bn and the cost of capital is 5%.
- It has the option to invest in upgrading the network where three states of the world are possible: 0, A or B, depending on how well costs are able to be controlled. State A is most likely. The uncertainty will be resolved at the end of the price control period.
- The returns to upgrading are:
    - State 0 [large win] (25%) : The implementation of the technology was highly successful, with higher than standard reward £1bn
    - State A [tech success] (50% likelihood): The implementation of the new technology was successful, standard profitability. NPV £0.25bn.
    - State B [tech failure] (25% likelihood): The new technology requires substantial redesign and losses are realised. NPV -£1bn
    - Expected value of upgrading the network this period: £0.125bn (50% x £0.25 bn)
- The real option is for a delay until the technology, and the costs, are better understood in five years' time, so that the company knows with certainty what the costs will be. In this case if the company knows that the project is going be high cost, it will not undertake the project. It will also not benefit from outperformance.
    - State 0 [large win] (25%): Implement the technology, with updated cost estimates: gain £0.25bn
    - State A [tech success] (50% likelihood): Implement the technology with a five year delay: £0.25bn
    - State B [tech failure] (25% likelihood): Do not implement technology. £0
    - Expected value of real option: £0.1875bn, discounted £0.1469bn due to five year delay.

2.6. Direct Volatility Modelling

We undertake risk analysis to model the volatility of total expenditure ('totex') performance and associated RoRE outcomes in PR24 and assess the impact on the distribution of equity returns of the increased size and complexity of the PR24 capital programmed with respect to PR19.

On that basis, we explore the likely impact on systematic risk faced by equity investors and provide estimates of the required uplift on the cost of equity to compensate for changes in systematic risk.

Table 9 below shows total expenditure over the PR24 period in the "factual" (as per current Wessex Water Business Plan view) and "counterfactual" (based on expenditure at PR19 levels) expenditure scenarios for PR24. This is aggregated into "Base" and "Enhancement" spend and allocated to "Water" (sum of "Water Resources and Water Network" controls) and "Wastewater (sum of "Wastewater Network" and "Bioresources" controls) sub-sectors.

"Base" expenditure is made up by opex and the proportion of capex (around 50%) that has been identified as maintenance and business-as-usual expenditure. Conversely, "enhancement" represents capex spend to deliver more complex and innovative activities.

As shown in the table, not only does the PR24 plan more than double expenditure commitments with respect to PR19, but also features a higher degree of complex activities (around 40% enhancement spend, as opposed to 15%).

The standard deviations of totex performance estimated over PR19 sector data shows that performance on "enhancement" expenditure has been more volatile than performance on "base". It follows that in PR24 companies will be exposed to a wider range of outcomes on totex, as a result of the increased enhancement spend.

Table 9: Total expenditure (counterfactual versus factual)

Expenditure	Sub-sector	Counterfactual (£m real 2022/23)	Factual (£m real 2022/23)	Standard Deviation (%)
Base	Water	706.2	972.3	15%
	Wastewater	1,349.3	2,485.6	22%
	Total	2,055.5	3,457.9	-
Enhancement	Water	31.4	481.9	27%
	Wastewater	350.9	1,984.0	30%
	Total	382.3	2,466.0	-
Total		2,437.8	5,923.8	-
% enhancement		15.7%	41.6%	-

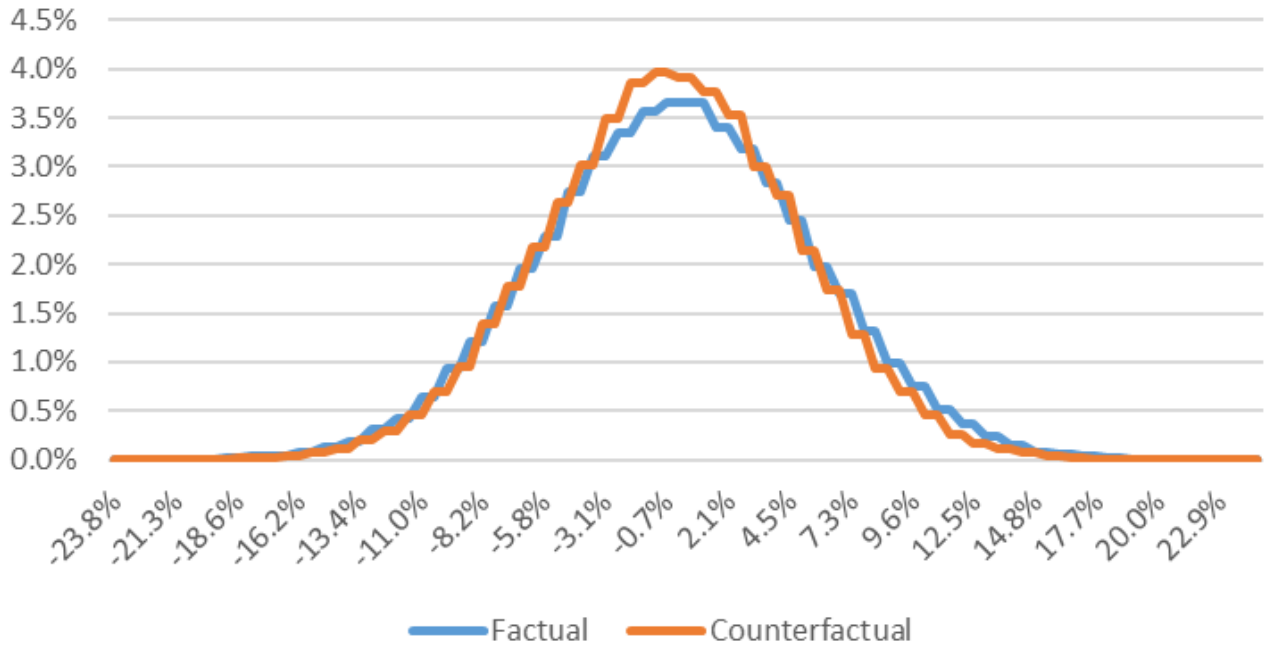
We define four normal probability distributions for performance on "base" and "enhancement" expenditure in the "water" and "wastewater" subsectors, with standard deviations (as per the above) estimated on historic PR19 sector performance data.

We use these probability distributions in a Monte Carlo analysis to simulate totex performance and associated RoRE outcomes in the "factual" and "counterfactual" expenditure scenarios for PR24. The resulting probability distributions of totex performance and RoRE impact are shown below.

The totex performance distribution is "post-sharing mechanism", hence it takes into account that only 50% of overspend/underspend on totex will be allowed/disallowed and ultimately have an impact on RoRE.

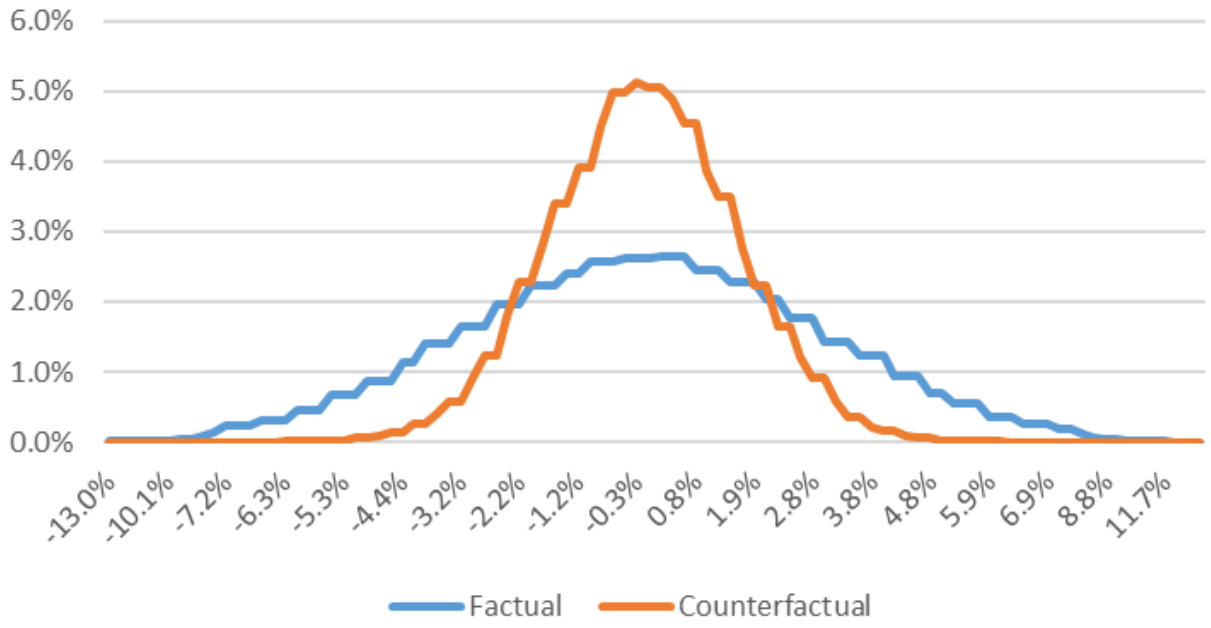
Although the shape of the totex performance distribution is fairly similar, the more than twofold increase in the expenditure programme contributes to widen the risk exposure of RoRE to totex performance in the “factual” scenario, as illustrated by the increased RoRE range below.

Figure 4: Totex performance - normalised



Item	Counterfactual	Factual
P(10)	-6.7%	-7.3%
P(50)	-	-
P(90)	6.7%	7.3%
Standard deviation	5.3%	5.6%

Figure 5: RoRE – normalised



Item	Counterfactual	Factual
P(10)	-2%	-4%
P(50)	-	-
P(90)	2%	4%
Standard deviation	1.60%	3.10%

It should be noted that although we have simulated totex performance on the basis of normally distributed probability functions, it is likely that totex performance in PR24 will be asymmetrically distributed, with higher probability of underperformance than overperformance.

This asymmetry relates to Ofwat's position stated in the Final Methodology to apply Price Control Deliverables (PCDs) in PR24 on a larger scale than in PR19 and on enhancement expenditure in particular. PCDs are asymmetric mechanisms by design, with limited or no scope for overperformance but unlimited scope for underperformance.[25]

Under a PCD, Ofwat would clawback funding for under or non-delivery of outcomes associated with enhancement expenditure, irrespective of the actual delivery of the capital project and performance on allowed cost. PCDs would also reduce the company's flexibility to reallocate outperformance across a portfolio of projects.

[25] "Companies are expected to develop price control deliverables (PCDs) for material investment that would not be adequately protected using PCs [(performance commitments)] and ODIs [(outcome delivery incentives)]. Companies that over promise and under deliver will be worse off as a result" (Ofwat, PR24 Final Methodology).

Our current assessment does not model the potential asymmetry in the distribution of totex outcomes (and the associated RoRE range) from the implementation of PCDs and therefore is likely to understate the overall risk exposure of equity investors to the PR24 capital programme.

Having obtained the "factual" and "counterfactual" RoRE distributions, the analysis proceeds by translating changes in the distributions into changes in risk exposure and, finally, into a corresponding impact on the required cost of equity.

We explore two aspects of risk:[26]

***Systematic risk exposure*:** this measures the additional risk premium associated with the increase in volatility of equity returns.

We measure it by translating the change in standard deviation of RoRE distribution from "counterfactual" to "factual" scenario into an impact on equity beta, hence on the cost of equity. The change in equity beta is measured by the impact on the regulated company's volatility, as a percentage of the volatility of the water sector comparator used in the equity beta estimation. The change in equity returns volatility is weighted to consider the proportion of totex in the full RoRE range.

$$\Delta CoE = \Delta\beta_E \cdot ERP = \left(\beta_E \cdot \frac{\Delta\sigma_{WSX}}{\sigma_{sector}}\right) \cdot ERP$$

$$\Delta\sigma_{WSX} = \left(\sigma_{RoRE,f} - \sigma_{RoRE,c}\right) \cdot w$$

Value at risk: this measures the additional risk premium associated with the increase in likelihood of severely bad outcomes.

We measure it as the decrease (in absolute value) in the P(10) RoRE in the "factual" scenario, as a result of the increase in size and riskiness on the expenditure programme with respect to the PR19-based "counterfactual". Systematic risk exposure does not specifically capture changes to the tail of the distribution, therefore "value at risk" is an additional risk component.

It is calculated as the variation in P(10) RoRE (in absolute value), weighted by the proportion of totex in the full RoRE range:

$$\Delta CoE = \left[P(10)_{RoRE,\,f} - P(10)_{RoRE,\,c}\right] \cdot w$$

We provide more detail on the two risks below.

2.6.1. Systematic risk exposure

The impact on the volatility of RoRE from totex performance is measured by the differential in standard deviation between the "factual" and "counterfactual" RoRE probability distributions.

[26] A third, additional aspect is risk asymmetry, which would likely emerge if the impact on PCDs on totex performance was captured in the probability functions. This is not covered under the current assessment.

As totex is only one of the potential risk drivers of company's equity returns in PR24 (alongside, for example, ODIs, C-Mex and financial performance), the distribution standard deviation differential is weighted by the proportion of totex in the full RoRE range.

We test systematic risk exposure under a "low", "medium" and "high" totex weighting in the RoRE range:

"Low" (20% weight) is based on Ofwat's Final Methodology RoRE range in the Final Methodology,[27] with +/- 1% RoRE exposure to totex.

"High" (40% weight) is obtained by applying to the Ofwat range a "conservative" +/- 3% totex exposure (the average of the 2% and 4% P(10) values in the "counterfactual" and "factual" RoRE distributions).

Medium (30% weight) is the average of "low" and "high".

Therefore, the 1.5% increase in standard deviation in the "factual" case results in an overall impact on PR24 equity return volatility between 0.30% and 0.60%. This is summarised in Table 10 below and the estimated impact on the cost of equity is set out in Table 11.

Table 10: Systematic risk exposure

Item	Calculation	Low	Medium	High
Totex SD – count.	$\sigma_{RoRE,c}$	1.60%	1.60%	1.60%
Totex SD – factual	$\sigma_{RoRE,f}$	3.10%	3.10%	3.10%
Weight in RoRE range	w	20.00%	30.00%	40.00%
PR24 SD increase	$\Delta\boldsymbol{\sigma_{WSX}} = \left(\boldsymbol{\sigma_{RoRE,f}} - \boldsymbol{\sigma_{RoRE,c}}\right) \cdot \boldsymbol{w}$	0.30%	0.45%	0.60%

The standard deviation increase from the higher capital programme is compared against the standard deviation of the "pure play" water company market yields (estimated on data for the UUW/SVT comparator).

This results in a 0.04 – 0.09 impact on equity beta (depending on the assumed weight of totex in the RoRE range) and in 21-41bps uplift on the cost of equity.

[27] [1] Ofwat, PR24 Final Methodology, Appendix 10 – Aligning risk and return (Figure 2.1 and Table 2.1).

Table 11: Estimation of the impact on cost of equity

Item	Calculation	Low	Medium	High
PR24 SD increase	$\Delta\sigma_{WSX}$	0.30%	0.45%	0.60%
Sector SD	σ_{sector}	5.16%	5.16%	5.16%
Impact on Equity Beta	$\Delta\boldsymbol{\beta_E}$	0.04	0.06	0.09
Equity Risk Premium	ERP	4.82%	4.82%	4.82%
CoE uplift	$\Delta\boldsymbol{CoE} = \Delta\boldsymbol{\beta_E} \cdot ERP$	0.21%	0.31%	0.41%

2.6.2. Value at risk

The impact on the cost of equity is measured by the change in equity return at P(10), weighted for the assumed proportion of totex volatility on total price control volatility.

The “low” and “high” weighting correspond to a 40-80bps cost of equity uplift, in addition to the uplift for increase in systematic risk exposure.

This is summarised in Table 12 below. Table 13 provides a summary of the uplifts on cost of equity from direct volatility modelling; overall, the direct volatility modelling, as impact on systematic risk exposure and value at risk, yields a total cost of equity uplift in the range of 61-121bps.

Table 12: Value at risk

Item	Calculation	Low	Medium	High
P(10) RoRE – count.	$P(10)_{RoRE,\,c}$	-2.00%	-2.00%	-2.00%
P(10) RoRE – factual	$P(10)_{RoRE,\,f}$	-4.00%	-4.00%	-4.00%
Weight in RoRE range	w	20.00%	30.00%	40.00%
CoE uplift	$\Delta\boldsymbol{CoE} = \left[\boldsymbol{P(10)_{RoRE,\,f}} - \boldsymbol{P(10)_{RoRE,\,c}}\right] \cdot \boldsymbol{w}$	0.40%	0.60%	0.80%

Table 13: Summary of uplifts on cost of equity from direct volatility modelling

Item	Low	Medium	High
Systematic risk exposure	0.21%	0.31%	0.41%
Value at risk	0.40%	0.60%	0.80%
Total CoE uplift	0.61%	0.91%	1.21%

2.7. Duration of cashflows

Detailed modelling of cashflows shows that investors could be required to inject about £1bn of new equity into the company over a 10-year period between AMP8 and 9 with no prospect of recovery for many years.

Modelling of dividend yields indicates they are unlikely to recover to the historic 4% level pa within the foreseeable future.

Duration of cashflow analysis, based on the Xia-Brennan model, considers how shifting dividends to future periods impacts on the equity payback period and equity value.

Xia and Brennan (2004[28] and 2006[29]) found that the return required by investors is a function of the duration of cash flows, where shifting cash flows into the future increases the duration of cash flows and exposure to systematic risk. The authors observe that "growth stocks, which have long-duration cash flows, tend to have lower returns than value stocks, which tend to have short-duration cash flows". Investors in securities with higher duration and lower expected returns will require a higher cost of capital.

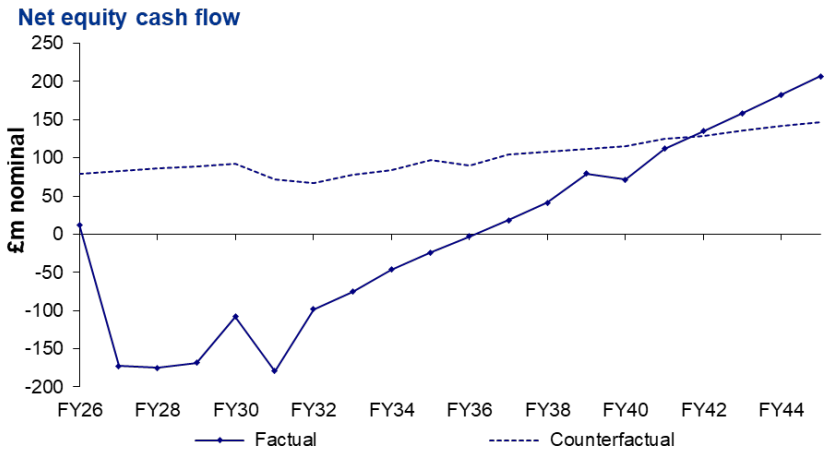
This is consistent with Dechow et al. (2004),[30] which found that equity duration is positively correlated to underlying share price volatility, meaning that a higher duration of cash flows leads to higher volatility and therefore a higher cost of capital required by investors.

Overall, academic literature suggests that extending duration of cash flows could lead to an increase in an asset's risk exposure resulting in a higher cost of capital requirement.

Based on the Xia-Brennan approach, we assess the impact on the cost of equity of changes in the duration of cash flows from the AMP8 capital programme, against a counterfactual based on a plan in line with AMP7 expenditure:

First, we model the notional company equity cash flows in the "factual" and "counterfactual" scenarios, then we estimate the impact on cash flow duration and hence on the required equity return (see Figure 6 below).

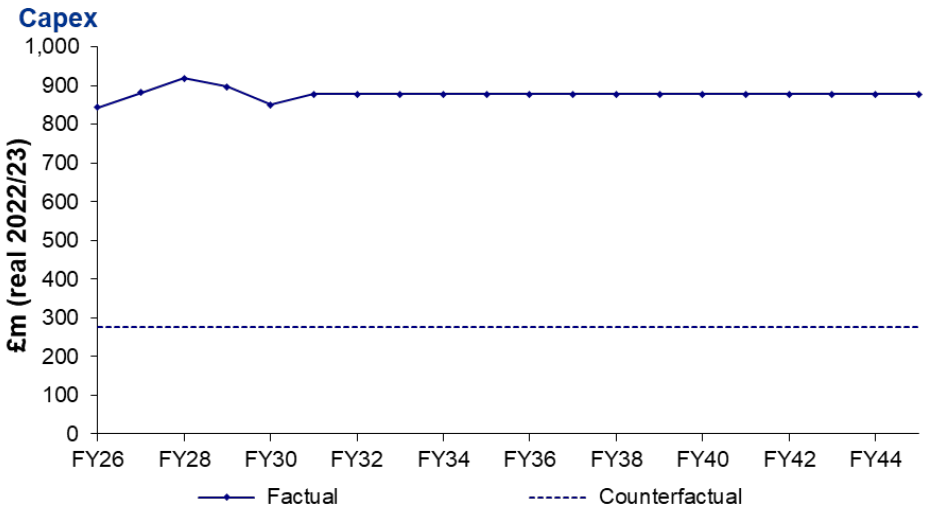
Figure 6: Net equity cash flow (counterfactual vs factual)



[28] Brennan, M. and Xia, Y. (2004), "Estimation and Test of a Simple Model of Intertemporal Capital Asset Pricing"
[29] Brennan, M. and Xia, Y. (2006), "Risk and Valuation under an Intertemporal Capital Asset Pricing Model"
[30] Dechow et al. (2004), "Implied Equity Duration: A New Measure of Equity Risk"

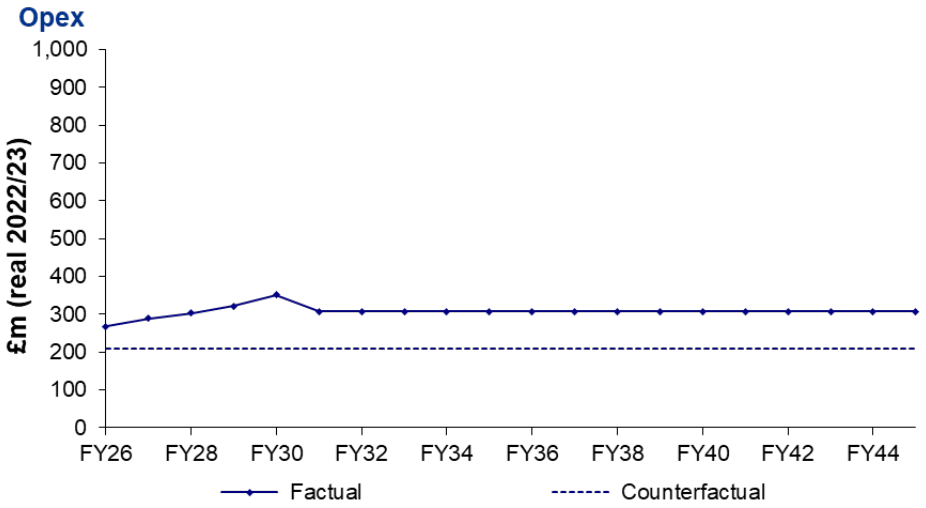
Notional modelling of the “Factual” scenario assumes a total capex of £4.4bn in AMP8 (as per latest Wessex view) and annual capex constant at the AMP8 average of around £880m thereafter.

Figure 7: Capex (counterfactual vs factual)



Opex is assumed at £1.5bn in AMP8 (as per latest Wessex view) and at around £305m (the AMP8 annual average) thereafter.

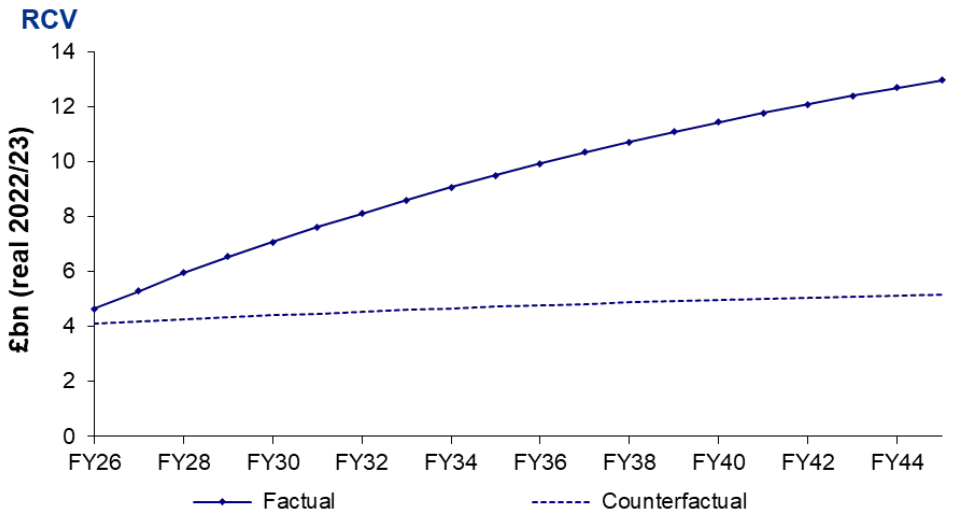
Figure 8: Opex (counterfactual vs factual)



This compares with annual counterfactual capex and opex of £280m and £210m, equal to the PR19 annual average expenditure.

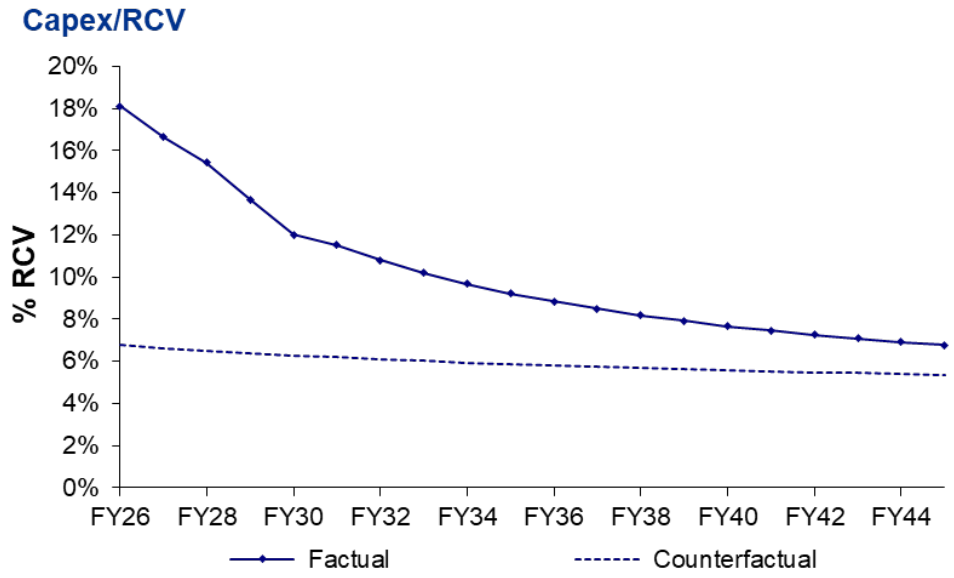
Whilst “counterfactual” RCV has real slow growth from £4.1bn to £5.3bn by 2050, “factual” RCV trebles from £4.6bn to 14.2bn.

Figure 9: RCV (counterfactual vs factual)



The “counterfactual” expenditure results in a stable capex / RCV ratio consistent with historical sector trends, while the proposed PR24 expenditure programme (assumed to be carried forward post-AMP8) would result in 18% capex/RCV ratio at the start of AMP8, gradually converging towards 6% as RCV grows over time.

Figure 10: Capex / RCV ratio (counterfactual vs factual)



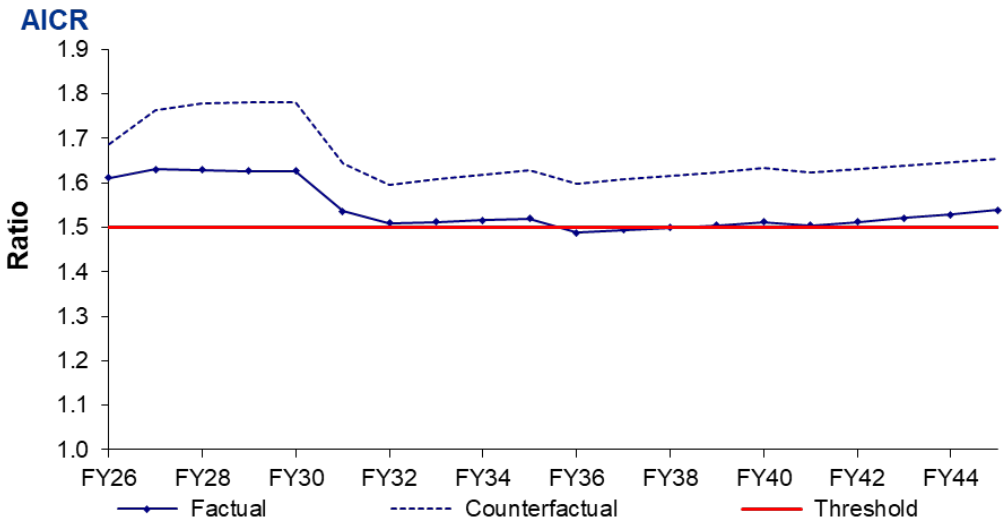
We assume 4% base dividend yield and 55% target gearing in both scenarios.

Under the “factual” scenario, the delivery of the higher expenditure programme under a stable and financeable structure at investment grade credit rating (55% gearing and AICR > 1.5x) requires shareholders to bear negative equity cashflows through AMP8 (£612m) and AMP9 (£423m). In the remainder of the investment horizon, the achieved dividend yield converges towards 2%.

Under the lower, “counterfactual” scenario, the capital programme is delivered while equity investors can achieve the 4% base dividend in AMP8 and yields above 3% in the remainder of the investment horizon.

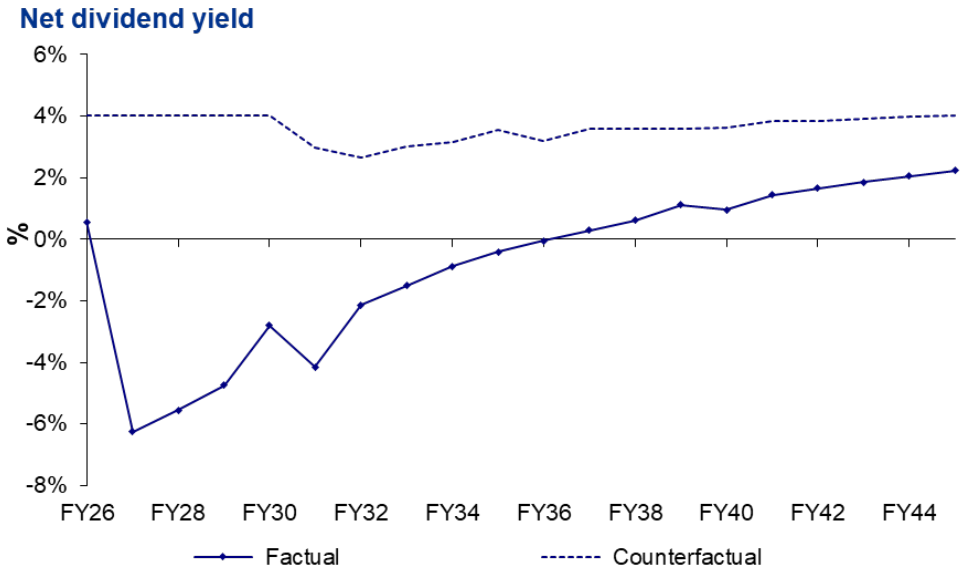
The 55% notional gearing is achieved with a higher headroom on the AICR ratio (AICR > 1.6).

Figure 11: AICR (counterfactual vs factual)



The modelling of equity cash flows for the Wessex Water notional company has shown that under the current AMP8 expenditure plans (also assumed to carry forward into the subsequent control periods) equity shareholders would commit to a dividend “holiday” in AMP8 and AMP9 and payments well below the assumed base dividend yield in the remainder of the 20 years investment horizon.

Figure 12 Net dividend yield (counterfactual vs factual)



The Xia-Brennan approach can now be applied to assess the change in cash flow duration with respect to the counterfactual scenario where, under expenditure commitments consistent with AMP7, shareholders would be able to achieve a steady dividend cashflow of 4% on regulated equity in AMP8 and 3-4% in AMP9 to AMP11.

Table 14: Summary of net equity cash flow and dividend yield positions

Item	Scenario	Unit	AMP8 2026-30	AMP9 2031-35	AMP10 2036-40	AMP11 2041-45
Net equity cash flow (AMP total)	Factual	£m nominal	(612)	(423)	208	795
	Counterfactual	£m nominal	430	398	531	697
Dividend yield (AMP average)	Factual	% regulated equity	-3.8%	-1.8%	0.6%	1.8%
	Counterfactual	% regulated equity	4.0%	3.1%	3.5%	3.9%

Under the Xia-Brennan model, the reduced equity cash flow would result in:

- An increase in duration of equity cash flows (i.e. the payback period of equity investment), under the assumption that the dividend reduction in the "factual" scenario with respect to the counterfactual is "reimbursed" to shareholders on an NPV neutral basis at the end of the investment horizon as part of the "terminal value".
- An increase in systematic risk as a result of the higher duration, to reflect that equity investors will have to hold the asset for a longer period of time to recoup the initial investment, therefore will be subjected to the non-diversifiable interest rate risk for longer.
- Accordingly, investors would require an increase in the equity remuneration to compensate for the increased systematic risk ("term premium"). The term premium is proxied by the impact on the risk-free rate from "moving" to a higher tenor in the yield curve and, under the CAPM framework, the impact on the investors' discount rate is essentially the change on the risk-free rate, minus the reduction in the remuneration of the risk premium:

$$\begin{aligned} Discount\ rate &= RfR + \beta \cdot (TMR - RfR) \quad \Rightarrow \quad \Delta Discount\ rate \\ &= \Delta RfR - \beta \cdot \Delta RfR \quad \Rightarrow \quad \Delta Discount\ rate = (1-\beta) \cdot \Delta RfR \end{aligned}$$

- The evaluation of equity cash flows at a higher discount rate leads to a loss in NPV.
- The uplift on the cost of equity is the compensation required to offset the loss in NPV.
- Table 15 and the points below provide a summary of the steps to calculate the uplift on the cost of equity:
  - The reduction in dividend payments in the "Factual" scenario increases the payback period, as measured by the Macauley duration, from 15 years to 25 years ("Step 1").
  - The term premium from the higher duration is calculated as the differential in yield between the RfR[31] at 15 years and 25 years tenor, resulting in a term premium of 18bps ("Step 2") and discount rate uplift of 7bps, from 6.09% to 6.16% ("Step 3").
  - The loss in NPV (£36m) from the higher discount rate would require a 12bps uplift on the cost of equity, from 6.09% to 6.22% ("Step 4").
  - It should be noted that the estimate of the uplift is significantly affected by the shape of the yield curve. Therefore the 12bps uplift is likely to be an underestimate, due to the current atypically flat shape of the yield curve in the relevant range (between 15 and 25 tenor).

[31] Measured by the index-linked gilt UK nominal spot curve, with an averaging period of 5 years and cut-off date at 30th September 2022, consistent with Ofwat's PR24 Final Methodology.

Table 151: Steps to calculate uplift on cost of equity

Item	Scenario	Value
Step 1: Cash flow duration calculation		
Cash flow duration	Counterfactual (dividend at PR19 totex)	15
	Factual (dividend at PR24 totex)	25
	Differential	10
Step 2: Risk free rate and term premium calculation		
Implied RfR yield	Counterfactual (15yr tenor)	1.36%
	Factual (25yr tenor)	1.54%
Term premium		0.18%
Step 3: Discount rate uplift		
Equity beta (Ofwat PR24 Final Methodology)		0.61
Implied uplift on discount rate		0.07%
Discount rate at 15yr duration (Ofwat PR24 FM CoE)		6.09%
Discount rate at 25yr duration (Ofwat CoE + uplift)		6.16%
Step 4: Impact on NPV and cost of equity		
Equity cash flow NPV at initial discount rate		£2,207m
Equity cash flow NPV at uplifted discount rate		£2,171m
NPV loss due to term premium		£36m
Uplift on cost of equity (to compensate NPV loss)		**0.12%**

2.8. Summary of impact of additional risk on cost of equity

Figure 13 and Table 15 below set out the results of the analysis that we have conducted,[32] to arrive at an indicative required uplift to the baseline cost of equity in basis points.

[32] Note: We have not derived a precise result from the option pricing analysis, so this has not been included in the table. The PNGL uplift of 1.5% has been reduced by 50% to take account of the difference in scale and nature of the construction programme in Wessex's case, compared to that of PNGL.

We estimate that the appropriate cost of equity for a "pure play" water company is 5.44%, while for the average water company in PR24 ("forward looking") is 5.74% (as per KPMG's report on *Estimating the Cost of Equity for PR24*), with the 30bps differential reflective of the impact of the increased capital programme across the industry in PR24.

Based on an average of the uplifts estimated under the various approaches taken ("Beta recomposition", "Direct volatility modelling" and "Regulatory precedents"), a Wessex-specific uplift of around 69 basis points on the 5.44% "pure play" water company cost of equity could be appropriate to compensate for increased risks associated with the scale of the construction risk. This is 39bps higher than the average industry uplift, reflecting the larger size of Wessex's capital programme.

The 69bps uplift for increased construction risk is combined with an additional uplift of 12 basis points to compensate for the increased duration of cash flows. The total required uplift is therefore in the order of 81 basis points, which added to the 5.44% appropriate cost of equity for the "pure play" water company results in a Wessex-specific total cost of equity of 6.26%.

Figure 131: Cost of equity

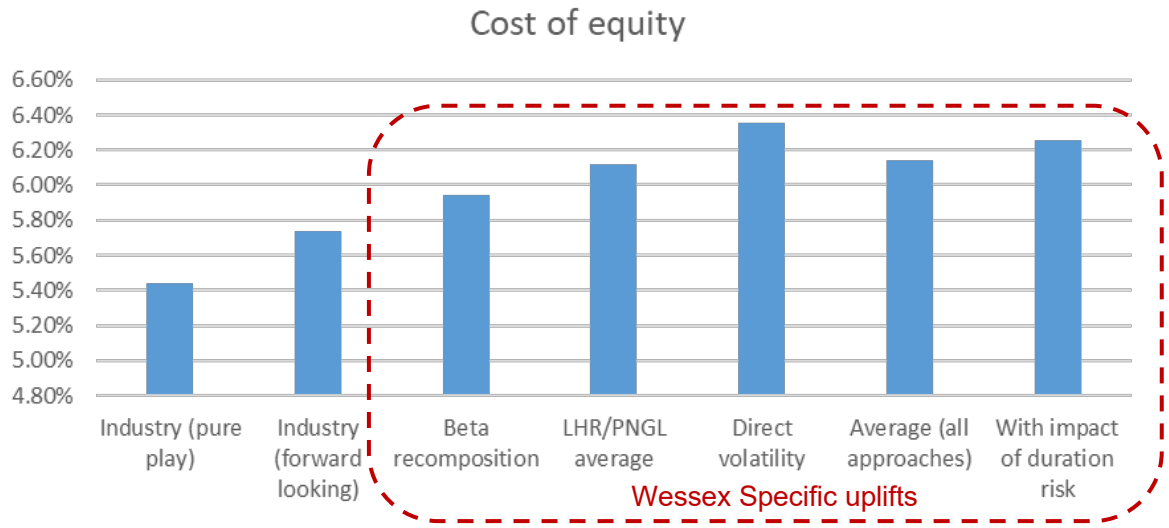


Table 15: Uplifts to the cost of equity

Category	Description	Indicative uplift to CoE in basis points (bps)
Uplift for Increased Construction Risks:	Beta recomposition	50
	Direct volatility modelling	91
	Regulatory precedents:	
	- PNGL	75
	- LHR/LGW	60
	Simple average	**69**

Uplift for Duration Risk:	Duration of cashflows	12
Total Uplift:	**Total Uplift**	**81**

3. Uncertainty mechanisms

The only uncertainty mechanism we propose at PR24 is a re-opener for the bioresources price control. This reflects the significant risks we (and the sector) face, due to: (a) the Farming Rules for Water (FRfW), and (b) the implications of IED legislation. We therefore propose a bioresources-reopener for these specific FRfW and IED risks, triggered by a change in costs that exceeds 10% of our AMP8 bioresources totex allowance.

In section 3.1, we outline in further detail the uncertainties we face around the FRfW and IED. In summary:

- For the FRfW, there is a risk that changes in public perception and legislation will rapidly reduce land bank availability (i.e. the amount of land we can dispose sludge via agriculture). If this occurs, we will need to pursue other (more costly) disposal routes; namely, landfill and incineration, which will increase our total efficient sludge disposal costs.
- For IED, there are uncertainties associated with: (i) the required scope of upgrades we have proposed in our cost adjustment claim to make our digestion sites IED-compliant;[33] and (ii) there may be unknown changes in IED legislation and/or its interpretation in the future that result in further costs of upgrading our sites, and potentially carrying out other works.

As we set out in section 3.1, these costs: (i) fall outside of our management control; (ii) are potentially highly material; and (iii) are not in the scope of the costs we propose at PR24. As such, an uncertainty mechanism should be in place to accurately account for the efficient costs of delivering these changes, should they be realised. In practice, we would apply to Ofwat in one of the application windows in AMP8, explaining why our efficient costs have changed (and by how much), with Ofwat having the discretion to accept or reject our application.

We consider that a materiality threshold of 10% of our bioresources totex allowance is appropriate for the following reasons.

- First, a 10% threshold is used by Ofwat to trigger an interim determination (i.e. 10% of turnover).[34] However, keeping a re-opener specific to the bioresources sector: (i) reflects the fact that the key uncertainties we face at PR24 relate to bioresources; and (ii) is consistent with Ofwat's desire to set separate price controls.
- The threshold strikes a balance between being sufficiently high, such that smaller changes in costs do not trigger a re-opener and the resultant regulatory burden that Ofwat faces; and being sufficiently low, such that the efficient costs for legislative changes outside of our control are reflected in our allowances – both so that we are adequately funded for the efficient costs we require when they increase, and our customers can benefit when our efficient costs decrease. This is particularly important in bioresources, as there is no cost sharing.

[33] See WSX09, CAC5.
[34] https://www.ofwat.gov.uk/regulated-companies/price-review/interim-determinations/

- We also note that a similar re-opener has been adopted in the past by Ofgem, to cater for changes in environment legislation, with a zero materiality threshold.[35]

3.1. Uncertainties facing the bioresources sector

3.1.1. Farming Rules for Water (FRfW)

As explained in the bioresources narrative on FRfW in WSX18 – Bioresources Strategy and Investment, we will likely experience a reduction in future land bank availability due to the changes in FRfW. A national land bank assessment undertaken by Grieve Strategic concluded that the changes in FRfW will most likely result in insufficient land bank to recycle all biosolids on a national level by 2035. The most likely scenario by 2035 according to the model is that we will need 6 times more land bank to recycle all our biosolids and travel 3 times further to access available land bank. Therefore, we will likely be competing against South West Water, Severn Trent Water and Dŵr Cymru Welsh Water for available landbank.

We have proposed building additional storage barns as a temporary solution to avoid costlier disposal routes for sludge – namely incineration and landfill. However, it is possible that public perception will impact land bank availability at a rapid pace at AMP8, such that we will need to pursue costlier disposal routes in the short term. Depending on the pace that public perception changes, this may also be accompanied by legislation that further restricts land bank availability.

Sludge disposal costs are a component of bioresources base costs. Ofwat's base models therefore fund the efficient costs of sludge disposal (the majority of which comes from costs of farmland for all water companies). However, this does not capture the net increased costs that we face if sludge is disposed of via costlier routes.

The diversion of sludge to other (costlier) disposal routes is material in terms of our costs. Currently (in 2022-23) our cost of disposal to farmland is £89 per tds of raw sludge. To pursue landfill and incineration, this unit cost will increase by £153/tds and £366/tds respectively.[36] To illustrate this impact, a full shift of disposal to landfill and incineration would result in an increase of costs, per year, of £10.6m and £25.3m respectively.[37]

3.1.2. Industrial Emissions Directive (IED)

We have set out, in our cost adjustment claim for IED costs,[38] the efficient costs that we require to comply with the IED legislation. However, material uncertainties exist at AMP8, with respect to both (i) the scope of our proposed upgrades to comply with IED, and (ii) future IED legislation:

- The **scope of upgrades** we have proposed in our cost adjustment claim is based on our interpretation of what is required to comply with IED legislation. This scope of upgrades could change when the EA provide more clarity, or when they issue our IED permits (which will state the compliance requirements for each site). For example, if required, we may need to fully enclose our sludge barns at each site, which would result in a material increase in costs we require to comply with IED, over and above what we have originally

[35] See https://www.ofgem.gov.uk/sites/default/files/2022-11/RIIO-ED2%20Final%20Determinations%20Core%20Methodology.pdf, p.57.
[36] We estimate that the unit cost of disposal to landfill is £242 per tds of raw sludge, and £455 per tds of raw sludge for disposal via incineration.
[37] Based on the projected annual raw sludge production of 69,180 tds in 2029/30.
[38] See WSX09, CAC5.

proposed in our cost adjustment claim. Conversely, if the EA determines that the full list of upgrades we have proposed could be reduced, this reduction in costs should be passed on to our customers.

- There may be **further changes in IED legislation**, which are currently unknown. Given the magnitude of required upgrades and associated costs to comply with the current IED legislation (as we have included in our plan), any future legislative change is clearly a large industry-wide risk, and we may require a material change in efficient costs to comply with these changes.

In addition, as we have outlined in our cost adjustment claim, IED costs are outside of our management control and are not within the existing scope of costs that we have proposed, beside the CAC, at PR24. These costs are material – our current TOTEX estimate for IED compliance is c. £200m. It is therefore important that an uncertainty mechanism is in place to ensure that this figure is accurate, give the uncertainties highlighted above.