UUWR_10

PR24 Draft Determination: UUW Representation

Area of representation: Storm Overflows

August 2024

This document sets out our view on the draft determination in relation to our proposed storm overflow enhancement programme, price control deliverable and the AMP8 performance commitment for average spills per overflow.

Reference to draft determination documents:
Storm overflows performance commitment definition
PR24 draft determinations: Price control deliverables appendix
PR24-draft-determinations-Expenditure-allowances-to-upload.pdf (ofwat.gov.uk) – storm overflow uncertainty mechanism

United Utilities

Water for the North West

1. Key points

- **Exogenous regional factors cause efficient costs to vary across the industry**: We present compelling evidence, based upon robust engineering rationale, that sets out why efficient costs will vary across different sites and company regions.
- **Ofwat makes very strong conclusions using weak methodological foundations:** Ofwat's implicit assumption that all companies are equally affected by exogenous regional cost drivers is demonstrably ill-founded.
- **Ofwat's approach disincentivises hybrid solutions.** Ofwat's assumption that a hybrid scheme can be delivered for the same unit rate as a grey-only scheme is not supported by good evidence.
- **Ofwat's benchmark is influenced by companies' choice of cost forecasting methodologies:** Ofwat appears to make inferences on model robustness that are primarily driven by company cost forecasting methodology rather than underlying engineering rationale.
- **The data underpinning Ofwat's benchmarking is inconsistent:** We are concerned that there are significant issues with the underlying data used by Ofwat. These issues are not acknowledged or considered as a mitigating factor by Ofwat.
- **Ofwat's choice of efficiency benchmark is inconsistent:** Ofwat adopts an upper quartile catch-up challenge for network storage costs but uses a median challenge for STW costs. Ofwat does not provide any justification for this inconsistency. Additionally, we do not consider that an upper quartile challenge is proportionate to the quality of the model used in Ofwat's benchmarking.
- **We have demonstrated our commitment to further efficiency in our revised business plan submission.** We are applying a £249m adjustment to costs on a site-specific basis, reflecting solution optimisation. We are also proposing to apply a further £250m efficiency challenge as a top-down adjustment. These efficiencies are not applied at a site by site basis but reflect an expectation that we will be able to identify some (as yet unidentified) efficiencies across the portfolio.
- **UUW provides compelling evidence to support a company-specific uplift to our storm overflow allowances:** UUW requests Ofwat increase our allowances by £1bn. This value is supported by robust cost modelling and deep dive evidence.
- **UUW believes Ofwat should revise its proposed PCD:** We consider that Ofwat's proposed PCD is inflexible and will compromise companies' abilities to innovate and find efficiencies where site-specific circumstances allow. We are concerned that this may also prejudice Ofwat's ability to identify efficient costs of storage solutions delivered in AMP8 and therefore set appropriate benchmarks at future price reviews. This means customers would not benefit from efficiencies identified in AMP8 in future AMPs.
- **UUW has concerns about Ofwat's proposed cap and collar:** We consider that Ofwat's proposal for a cap and collar set at 0.5% of RORE does not take into account exogenous factors outside of company control, therefore exposing companies to more financial risk as a result of extreme weather. UUW proposes a cap and collar set at +/- 30% and presents evidence as to why this is more appropriate.
- **Ofwat proposes an additional stretch within the PCL:** Although this makes the target even more stretching, we accept this challenge and agree that the company specific target presented at DD is appropriate.

Reducing the impact of storm overflows on the environment is a key strategic priority for UUW. We are committed to addressing customers' concerns that our legacy asset base is not delivering the outcomes that they expect. This document provides an account of our observations on the approach that Ofwat has taken to the Overflows programme in its draft determination, the changes it should make ahead of the final determination and the evidence supporting these changes. These changes are essential to enabling UUW to provide the improvements for customers and the environment that we want to deliver and stakeholders want to see.

1.1 Structure of this document

Section 1 provides a summary overview of the document.

In Section 2 we briefly summarise the approach adopted by Ofwat in its draft determination. In Section 3 we set out information and evidence on the exogenous drivers of costs for storm overflow investment. In Section 4 we review Ofwat's modelling approach and in Section 5 we show how these models can be improved, based on data sources that are already available.

Section 6 summarises additional evidence of UUW scheme level costs. In Section 7 we describe the approach we consider Ofwat should take regarding Price Control Deliverables for this programme. Section 8 sets out our views on setting the performance commitment level and caps and collars.

Section 9 provides views on the storm overflow uncertainty mechanism and Section 10 provides a brief summary of changes to our AMP8 programme.

1.2 Summary overview

Reducing the impact of storm overflows on the environment is a key strategic priority for UUW. We are committed to addressing customers' concerns that our legacy asset base is not delivering the outcomes that they expect.

The Environment Act 2021 set an expectation that all storm overflows should spill for a maximum of ten times a year, or two times a year where a storm overflow is near bathing waters. UUW's business plan included £3,059m[1] of expenditure that targeted improvements at 437 storm overflows. We sought to implement 'best-value' green or hybrid solutions where possible, in response to Environment Agency guidance. The majority of UUW's targeted spill reductions will be delivered through grey or hybrid storage solutions. Overall, the industry is proposing circa £10.6bn of storm overflow investment within AMP8.

There is significant scope to improve Ofwat's approach to storm overflow cost assessment

Ofwat's approach to assessing storm overflow cost was first revealed at Draft Determination[2]. Prior to this, Ofwat's engagement with the industry was primarily carried out through the query process, which limited the ability of companies to effectively contribute to the engineering justification underpinning any subsequent benchmark.

Perhaps as a result of this, Ofwat is relying on a simple econometric approach, which uses storage volume as the only explanatory variable. Strictly speaking, this approach assumes that the only cost driver of relevance is the volume of the tank. More loosely, the approach could be said to assume that any non-volume cost drivers will cancel out 'in-the-round' (i.e. a high cost site will be offset by a low cost one across the whole of a company's programme.) However, this approach rests on the assumption that exogenous factors are evenly distributed across the industry. We will present evidence that demonstrates UUW's region is characterised by an atypically high concentration of adverse exogenous regional factors. As such, Ofwat's simple model is currently mistaking UUW's higher efficient costs as 'inefficiency'.

Ofwat also uses forecast data as the basis of its benchmark. We acknowledge that using forecast AMP8 costs is legitimate. This is because the Environment Act 2021 has changed the regulatory framework surrounding storm overflows and is leading companies to intervene at overflows that were previously considered as non-cost beneficial. As such, forecast costs will better reflect cost pressures within AMP8.

However, this does mean that Ofwat must account for the other issues that using forecast costs creates. We have observed cases where there is some scope for Ofwat to reconsider the legitimacy of its analysis in this regard. In particular, companies' business plan data appears to inform Ofwat's interpretation of underlying engineering rationale, rather than (as is proper) underlying engineering rationale informing Ofwat's interpretation of

[1] Excluding Advanced WINEP, which is not forecast to address spill reduction in AMP8.

[2] The mechanics of Ofwat's calculations were not published until two weeks after the initial DD publication in 'PR24-DD-WW-Storm-overflows-econometric-model'

companies' data. Such an approach could be characterised as 'data fitting'. For example, in its response to OFW-IBQ-UUW-008, Ofwat states:

"Some companies have no outliers and therefore we infer that the model includes all costs relating to storage solutions, including a range of ground conditions and site constraints."

Ofwat appears to suggest that the fact some companies have no outliers is evidence that its model is capturing all relevant cost drivers. However, Ofwat may wish to reconsider the direction of causality inherent within its statement - we are concerned that Ofwat may not appreciate that its inference is informed by the cost forecasting methodology employed by individual companies and, crucially, not the underlying engineering rationale.

We would consider a more appropriate statement to be that: the model appears to capture all relevant cost drivers because some companies have costed their schemes using a simple volumetric scale model – as such, mechanistically, these companies will not have any outliers if Ofwat also aligns its cost model to a simple volumetric scale model. We also question the internal coherency of Ofwat's statement – if the model does reflect a range of site-specific costs, then shouldn't we expect **all** companies to have a share of outliers? We will present evidence that other companies have employed simplistic cost forecasts that appear to lead Ofwat to wrongly conclude its simple model is robust.

UUW has developed more robust storm overflow benchmarking models

UUW has drawn upon robust engineering and operational rationale to properly consider the exogenous factors that drive differences in efficient site-specific costs and whether these factors are likely to vary materially across the industry. These exogenous factors are:

- **Urbanicity and rurality**. Engineering rationale suggests that sites in very urban and very rural areas will be associated with higher costs. This means there is a u-shaped relationship between cost and these factors.
- **Atypical environmental complexity.** Sites that are located in areas of atypical environmental complexity, such as Sites of Special Scientific Interest or National Parks, will be associated with additional mitigation and remediation measures.
- **Atypical planning complexity.** Planning complexity can add significant cost to a project. For example, projects near residential areas need to implement additional measures to mitigate the effect of on-site lighting and noise. Sites near to historical areas will require specialist investigation prior to construction activity commencing.
- **Atypical geological complexity.** Geological complexity will impact on the cost of delivering underground infrastructure. We present evidence that shows the geology of UUW's region is particularly adverse and is characterised by excessive ground hardness, extensive high rock cover and substantial reserves of groundwater.
- **Solution scope.** The scope of solution will determine efficient costs. For example, hybrid storage schemes will tend to cost more than a grey-only storage scheme.

In the short time available, we have been able to source data that would allow a subset of these exogenous factors to be incorporated into the storm overflow dataset used by Ofwat at DD. As we set out in section 5, the variables included in our model specifications perform well statistically and tend to improve the model fit. The number of outliers identified by Cook's Distance also reduces. This represents strong evidence that the outlier schemes are legitimate high-cost schemes that are inappropriately considered as 'inefficient' by Ofwat's simplistic modelled approach.

We note that the variables included within UUW's model specifications are a subset of the exogenous factors engineering rationale suggests will drive higher efficient costs in UUW's region. As such, the associated uplift in modelled cost is likely to be a conservative estimate of the costs UUW will face in AMP8.

We recognise that for various reasons Ofwat may be unwilling to make changes that result in a general industry uplift of storm overflow costs. However, we consider the evidence of exogenous regional factors presented in this representation will compellingly demonstrate that delivering storm overflow schemes in UUW's region will be associated with higher efficient costs. As such, we will request that Ofwat uplifts the allowance provided by its simple unit cost model to align with the average uplift implied by UUW's model specifications.

UUW has provided scheme-level evidence of cost efficiency at 90 AMP8 overflow projects

In recognition that Ofwat may require additional evidence, beyond UUW's model improvements, to provide evidence for an uplift of the cost allowance, we have also sought to provide Ofwat with additional assurance that the exogenous factors reflected within UUW's updated models are having an appreciable scheme-level impact on costs. In particular, we provide compelling evidence on how the factors included within our models manifest in site-specific cost pressures that align with engineering rationale. As part of this, UUW has provided additional detailed evidence on circa 90 schemes that are assessed using Ofwat's simple model approach. This is set out in documents '*UUWR_10.01*' to '*UUWR_10.90*' inclusive.

This evidence demonstrates how the exogenous regional factors highlighted within this representation manifest at a site-level. We provide this evidence for the 30 outlier schemes identified through OFW-OBQ-UUW-178, which Ofwat assesses as part of its deep dive. We also provide this evidence for an additional 60 schemes that are reflected within the scope of Ofwat's modelled assessment. This provides additional evidence that a large proportion of UUW's schemes are affected by adverse regional exogenous factors.

Ofwat should consider the additional 60 scheme-level documents as additional evidence that the modelled uplift proposed by UUW within this representation is appropriate and well-evidenced. Ofwat should take the scheme-level evidence provided on the outlier schemes into account when carrying out its deep dive assessments for FD. We discuss this in the next section.

We provide additional evidence to support Ofwat's deep dive assessment

Ofwat identifies outlier schemes using Cook's Distance[3]. This statistic revealed that 30 of UUW's schemes were considered as outliers. Ofwat sought additional information on the cost efficiency of these schemes within OFW-OBQ-UUW-178. UUW provided as complete a response as feasible within the tight turnaround time imposed by the query. This response was used by Ofwat to inform its deep dive assessments. None of our evidence was considered acceptable by Ofwat.

We now understand that Ofwat was looking for evidence that the site-specific factors at each site were not captured by its benchmarking model. We would query whether it was reasonable to expect companies to be able to answer this question without having visibility of Ofwat's model. Ofwat does not appear to have considered this issue as a mitigating factor in its assessment.

Where Ofwat considers a company has not provided robust evidence to support atypically high scheme costs, it provides an allowance for that site based on the modelled allowance. However, we note that the modelled allowance is calculated following the removal of outlier schemes. This appears internally inconsistent and would tend to systematically understate delivery costs at these outlier schemes.

We have sought to substantially expand the evidence we provided in response to OFW-OBQ-UUW-178 in this DD submission. We provide extensive bottom-up evidence of the exogenous cost drivers that are causing efficient costs at those schemes to increase. We relate these exogenous cost drivers to those identified within section 3 as being especially prevalent in UUW's region to demonstrate that these factors are not reflected within Ofwat's simple model. The additional evidence of cost efficiency at these schemes is set out within '*UUWR_10.01*' to '*UUWR_10.90*' inclusive.

We consider that this represents compelling evidence of cost efficiency across the schemes that Ofwat has considered as part of its deep dive. Additionally, we note that Ofwat's approach of excluding outlier schemes when calculating its modelled benchmark means that its models will not contain any implicit allowance for outliers. As such, we will request that Ofwat should allow the costs for these schemes in full.

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[3] We provide a general comment on Ofwat's approach to outliers in our response to Ofwat's econometric model consultation '*UUWR_27_Enhancement_modelling_consultation'*.

UUW's evidence on cost efficiency should be used to make a UUW-specific uplift to storm overflow enhancement allowances

UUW is proposing that Ofwat implement a UUW-specific uplift totalling £1bn. This uplift comprises two components:

(1) An uplift to modelled allowances in line with the mean of the range of allowances provided by UUW's proposed improved models. This is accompanied by a median catch-up challenge across network and STW sites. A median challenge reflects the fact that UUW's models only reflect a subset of the exogenous factors that compound to make UUW's region particularly adverse and therefore reflect a conservative estimate of the efficient costs of delivering storm overflow improvements in UUW's region. The uplifted modelled allowance should also apply to deep dive schemes in the event Ofwat does not accept the evidence of cost efficiency provided. This is set out in Table 1.

Table 1: How Ofwat should uplift UUW's allowance for those schemes assessed by Ofwat's model

Value (£m, 2022-23 CPIH)	Network	STW	FTFT	Total
Ofwat DD	1,049	328	146	1,523
UUW DD adjustment	1,496	440	180	2,116
Increase	**447**	**112**	**34**	**593**

Source: UUW analysis based on Ofwat's dataset and publicly available data

(2) Full reflection of the costs assessed through Ofwat's deep dive in recognition that UUW has provided extensive and compelling additional evidence of cost efficiency for each scheme. This is set out in Table 2. We calculate the increase relative to the updated modelled allowance for the outlier schemes calculated as part of Table 1 to avoid a double count.

Table 2: How Ofwat should uplift UUW's allowance for those 30 schemes assessed by deep dive

Value (£m, 2022-23 CPIH)	Outliers
Ofwat DD – memo	*251*
UUW outlier modelled allowance	264
UUW representation	673
Increase	**409**

Source: UUW analysis based on Ofwat's dataset and publicly available data

Full details on the underlying calculations can be found in sections 5 and 6.

We do not believe the design of Ofwat's storm overflow PCD is supportive of efficiency, innovation or optimisation across a large and complex programme

We strongly disagree with the PCDs proposed by Ofwat within their draft determination. We believe that these would inhibit efficient delivery of a programme and significantly reduce scope for flexibility, opportunity for innovation or optimisation, all of which are essential for efficiency and efficacy when delivering a programme of the size and scale of UUW's AMP8 storm overflow programme.

We nevertheless recognise and support the inclusion of price control deliverables at PR24 and support Ofwat's ambition to streamline reporting of schemes where there is overlap with other regulators. This utilises, for example, our reporting of scheme delivery to the Environment Agency, where there are already measures in place to ensure that timeliness of delivery is measured.

In Section 7 we explain why the PCDs proposed by Ofwat are inappropriate. Including representations on time incentives, unlocking efficiency and flexibility and our alternative PCD proposal focussed on delivery of modelled spill reductions.

UUW proposed a PCD in line with Ofwat's request for outcome-based price control deliverables that reflect the expectation of customers. UUW's proposed PCD assessed the modelled spill frequency delivered within a financial year against the financial expenditure. This provided a clear link between performance and expenditure. Using modelled data also ensured that the output was not impacted by external factors such as rainfall and provides a clear link between delivery and expenditure.

The UUW proposed, outcome based, PCD also provided a level of flexibility within the delivery of the storm overflow programme to ensure that companies can optimise solutions, explore new/innovative technologies for delivery, and if required, reprofile delivery where a more accelerated delivery option is available, or delivery is not possible by the current proposed date. Changes to delivery profiles and solutions is inevitable within such a large programme and therefore it is important to ensure that customer outcomes are delivered. We believe that the PCD UUW proposed, is easy to understand, shows a clear link between delivery of statutory WINEP requirements and expenditure and easy to report progress against as the modelled spill reduction would be fixed for storm overflow.

Ofwat's storm overflows performance commitment level (PCL) & Outcome Delivery Incentive (ODI)

In section 8 we discuss Ofwat's approach to elements associated with performance commitments including the performance commitment level, ODI rate and the calculation of incentive payments, and the proposed caps and collar.

Performance commitment level: In our PR24 business plan submission document UUW64 Wastewater (Quality – Overflows) Enhancement Case, UUW provided compelling evidence as to why a company specific target was essential. We demonstrated that the performance commitment should reflect the impact of past and current regulatory frameworks on our current spill frequency, and account for scale of investment required to reduce spill frequency as a result of unique operating circumstances in the North West. We also demonstrated our commitment to the North West and reducing storm overflow discharges as soon as possible.

Application of a common performance target would therefore not be achievable for UUW. We support Ofwat's decision to apply a company specific target.

Delivery of long-term improvements in storm discharges is reliant upon delivery of our storm overflow enhancement programme. We have chosen to accelerate this programme as far as possible to ensure that we are delivering spill reduction improvements as early as possible in AMP8. In addition, we proposed an ambitious target, that went above and beyond our enhancement programme, to deliver spill reduction early in AMP8 whilst long-term solutions would still be under construction. Whilst we believe that our PCL proposal of a 27% reduction in AMP8 (FY25-FY30) was already very stretching, we accept the additional stretch reflected in Ofwat's PCL proposed at draft determination. This will require us to find additional performance improvements to reduce spills.

We accept the spill performance identified by Ofwat within PR24 Performance Commitment Model: PR24-DD-PCM-Storm-overflows-1, which is used within the PCL calculation but we have updated the number of storm overflows (used within the PCL normalisation) to reflect our best understanding of our network, the PCL shown in the table below accounts for an arithmetic update to take into account of the change in number of storm overflows from 2280 to 2267, this is also reflected within PR24 data tables OUT5 and OUT1.

Table 3: AMP8 Storm Overflow PCL including adjustment for change in number of storm overflows

Line description	Units	DPs	2025-26	2026-27	2027-28	2028-29	2029-30	PR24 BP reference
Average number of spills per overflow – monitored	Number	2	26.35	25.50	24.09	22.28	18.71	OUT5.74

Source: Table OUT5.74

Operability (uptime) within the ODI calculation: UUW supports Ofwat's proposal for incremental improvements in operability. However, we note that during the production of this representation we were unable to clarify the definition of the storm overflows performance commitment or the ODI calculations to be used within our representation, either through the draft determination or through the consultation query process[4]. We have therefore set out our assumptions regarding the proposal in order to complete the PR24 data tables and will consider the impact of any guidance subsequently given. We support Ofwat's revised ODI rate for storm overflows.

Caps and collars: We support the inclusion of a cap and collar for this measure. However, we do not consider Ofwat's proposal of +/- 0.5% RORE to be an appropriate measure and therefore we provide further justification within this representation for an alternative cap and collar of +/-30%, as proposed within our PR24 submission.

UUW proposed a cap and collar set at +/- 30% of the target based on historic modelled data, presented in UUW64 section 9.5 (p.82) and again identified though the query process in response to OFW-OBQ-UUW-147 (part 2). Within our assessment we took a small sample of high spilling storm overflows (82 in total) and ran hydraulic network models using 10 years of time series rainfall. This identified the spill frequency that would be expected over a 10-year period based on changes in rainfall. UUW then compared the annual modelled spill frequency to the average modelled spill frequency over the 10 years to identify the percentage variation from the average. Using the percentage variation enables storm overflows of different spill frequencies to be compared. The results identified that for the majority of sites assessed, the annual variation (percentage difference) from the average spill frequency was within +/-30% and therefore we proposed this to be a reasonable cap/collar. Spills significantly higher or lower than the proposed threshold may be due to extreme weather events and there it would not be reasonable to earn outperformance payments or underperformance payments on this performance.

1.3 UUW's proposals for Final Determination

We have strong reservations about Ofwat's proposed approach to the economic regulation of storm overflow enhancement in AMP8. To address these reservations, we consider Ofwat should:

- Recognise that its model is not appropriately reflecting the exogenous factors that characterise UUW's region and provide an uplift to allowances for UUW schemes that were previously assessed using Ofwat's DD modelling approach. As discussed in section 5.5, we consider this uplift should be £593m (see Table 17).
- Based on the compelling evidence provided by UUW within this representation and associated appendices, accept the site-specific costs at UUW's "outlier" schemes in full. This results in a £409m uplift (see Section 6.5).
- Recognise that UUW has applied a £249m adjustment to costs on a site-specific basis, reflecting solution optimisation and is also proposing to apply a further £250m efficiency challenge as a top-down adjustment. These efficiencies are not applied at a site by site basis but reflect an expectation that we will be able to identify (as yet unidentified) efficiencies across the portfolio. Cost levels in Ofwat's assumed efficient frontier will likely be based on interventions that may offer short term cost saving opportunities by, for example, utilising some solutions that have both a lower cost and a lower expected lifespan. We will look to utilise such opportunities where they arise to reduce the overall cost in AMP8.
- Revise its PCD approach and align it to modelled spill reduction in each financial year in order to ensure that adjustments to the large and complex programme can be made during the AMP to facilitate efficient and effective delivery for customers
- Revise the cap and collar proposals so that they reflect operational uncertainties for this specific activity rather than a broad band of performance that is calibrated to the historic size of company capital programmes. We have provided substantial evidence about the extremes of performance that can be expected outside of management control with a 10 year historic analysis that shows a performance range of +/- 30% is to be expected.

[4] The response to the most recent query on this point - Query OFW-IBQ-UUW-037 – was issued on 23 August 2024. This meant we were unable to incorporate this into our representation.

- Ofwat should ensure that its reconciliation adjustment reflects the overflows we intend to address at Windermere and that are newly incorporated into the WINEP. These are an addition to our plan since our January submission and we have reported them on a freeform enhancement line in CWW3 for transparency (CWW3.185). If Ofwat does not reflect these costs within its reconciliation adjustment then it will result in an inappropriately low adjustment factor. See '*UUWR_75_Plan updates'*, '*UUWR_77_New WINEP*' and '*UUWR_78_Windermere*' for more details on our business case.
- We also propose that Ofwat should include additional investigations – where required – in the storm overflows adjustment mechanism. The mechanism should also explicitly reflect the outcome of AMP7 investigations to be applied in AMP8, and changes in requirements for schemes that are neither being added nor removed from the AMP8 programme, as set out in Section 9.

2. Ofwat's DD approach to storm overflows

2.1 Ofwat's approach to cost assessment

Ofwat assesses storm overflow enhancement costs using scheme-level data provided by companies through a series of queries. Ofwat takes a variety of approaches to assessing storm overflow costs:

- The majority of costs are assessed using a simple econometric model, which includes a single volumetric scale driver. Ofwat implements a linear and log-log functional form for network schemes and a log-log functional form for WwTW schemes. Ofwat states its use of a log-linear functional form reflects economies of scale and so is supported by engineering rationale but doesn't provide any further details on why an economies of scale assumption is reasonable: *"Engineering rationale suggests that average unit costs decrease due to economies of scale as scheme size (storage tank capacity) increases. We capture economies of scale by using loglog models to help set efficient allowances".* As we discuss in section 2, we have found evidence of diseconomies of scale in the data.
- Ofwat applies an upper quartile catch-up challenge to network storage costs and a median catch-up challenge to WwTW storage costs. It doesn't provide any rationale for this inconsistency and doesn't explain why the relatively poor model quality is able to support an upper quartile efficiency challenge.
- Where specific schemes are judged as outliers by Cook's Distance test, Ofwat assesses that scheme's cost as part of a deep dive. Ofwat requested additional information from companies through its query process to support this deep dive. Ofwat did not provide any contextual information that might have helped companies to provide targeted, high-quality evidence e.g. the benchmark used to assess a scheme as an outlier. If Ofwat does not accept the evidence provided to this deep dive process, it provides the modelled allowance for these schemes. The modelled allowance is calculated based upon a dataset that **excludes all outliers**.
- The ten-spill driver requires unprecedented tank volumes relative to those delivered in the past. In some cases, it is not feasible to deliver storage capacity to that degree due to local network complexity or physical engineering constraints. As such, companies are increasing their use of flow to full treatment (FTFT) solutions in AMP8. These mitigate the need for additional storage by enlarging the capacity of the downstream network. Ofwat recognises that these solutions tend to be more expensive and assesses them separately. It applies a high-level efficiency challenge that is based upon each company's efficiency score from the grey storage models.
- Where a company proposes a green solution, Ofwat generally passes these costs through in full. It also allowed UUW's Advanced WINEP costs in full.

Ofwat states that it crosschecks its assessment using historical costs provided by companies. However, it has not published this information and so we are unable to assess whether its approach is appropriate. We requested further details of this assessment in OFW-IBQ-UUW-008. However, the data provided by Ofwat was high-level, which restricted our ability to understand whether the historical unit costs used in its assessment are representative of our AMP8 schemes.

Ofwat's approach to cost assessment and the difference to UUW's business plan is set out in Table 4.

Table 4: Ofwat's approach to storm overflow cost assessment

			Network			*STW*				
	Green solutions	AWINEP and Eccles	Simple model	Outlier deep dive	Total	Simple model	Outlier deep dive	Total	FTFT	Total
UUW	19	263	389	340	729	1,638	401	2,039	263	3,312
Ofwat DD	19	263	223	106	329	904	145	1,049	146	1,792
£m delta	0	0	-167	-234	-400	-734	-256	-990	-117	1,520
% delta	0%	0%	-43%	-69%	-55%	-45%	-64%	-49%	-44%	-46%

Source: Ofwat's DD

3. The exogenous drivers of storm overflow costs

Storm overflow spill reductions are primarily delivered through major infrastructure schemes, which tend to require a substantial amount of plant, machinery and raw materials. It may be tempting to assume that these cost pressures will be common to all companies. However, the nature of storm overflow interventions mean that site-specific factors will also cause costs to vary from scheme to scheme. For example, the local geology will determine how complicated installing underground infrastructure will be.

In the case these factors are evenly distributed across the industry, then it is legitimate to assume they will broadly even out 'in-the-round'. This assumption is implicit in Ofwat's use of a simple volumetric model. However, if these factors are unevenly distributed across the industry, then efficient costs can be expected to vary from company to company. This section presents evidence that demonstrates UUW's region is characterised by an atypically high concentration of exogenous[5] factors:

- Urbanicity and rurality;
- Atypical environmental complexity;
- Atypical planning complexity;
- Atypical geological complexity; and
- Solution scope.

We have not identified any material offsetting factors that would reduce our efficient costs.

Without recognising the role these factors play, there is a clear risk that Ofwat's simplistic models are not identifying differences in efficiency. Instead, there is a risk Ofwat is identifying differences in the distributions of these exogenous characteristics between companies and misattributing them to inefficiency. This could result in an efficient company being unable to deliver its statutory obligations.

3.1 Urban or former industrial sites

Companies have limited control over the location of their storm overflow assets. This is because storm overflows are legacy assets and by their nature are located at low points in the network and adjacent to waterbodies. Delivering storm overflow improvements in heavily urbanised environments is associated with increased complexity and difficulty. This can be due to the urban environment itself or the tendency of urban environments to bear witness to a historical industrial legacy and the associated issues that come with this.

We will evidence a u-shaped relationship between urbanity and rurality (similar to Ofwat's assumption within water base cost assessment). We have split urbanicity and rurality into separate sections to enhance readability but we would like to make clear that we consider them as opposite ends of the same cost driver – location complexity.

Highly urban locations

Installing storage solutions in highly urban environments significantly increases the complexity of a solution. This is because:

- The space available to develop solutions is likely to be extremely limited. This leads to a more complex solution design. For example, the tank location may be constrained by existing structures, which could compel a company to pick a sub-optimal location, with additional installation and connection costs.
- Working in a busy and built-up environment restricts the delivery of plant, machinery and materials. It also makes the movement of on-site plant and machinery more complicated due to heightened risk to the public and a more restricted working area.

[5] Exogenous means the factor is outside of management control. In such circumstances, the factor forms part of the efficient cost of service delivery.

- Additional care needs to be taken to maintain the integrity of existing assets such as building foundations. This can require specialist digging techniques.
- There is less space available for site welfare and office units. This could mean it is necessary to lease adjacent land for the duration of the construction. This can be associated with significant additional cost especially when working in the most urban environments e.g. city centres.
- Limited on-site storage space will complicate the logistics of raw material delivery. This will require additional coordination to ensure that deliveries arrive at the right time. The increased risk associated with such 'just-in-time' delivery could lead to unanticipated delays.
- It is more likely that areas will need to be closed to the public and/or traffic. This can lead to additional compensation costs.
- Planning restrictions can lead to reduced working hours which increases the time taken to deliver a project and associated costs.
- Urban working sites are at a heightened risk of theft.
- Reinstatement is more complicated and costly.

Figure 1: illustrates the delivery of a network storage scheme in a highly urban area (Bredbury, Stockport). The location of the overflow meant the only feasible location for the tank was underneath the car park of a nearby supermarket. This meant a substantial section of the car park was closed for an extended period of time, requiring compensation payments. The use of heavy plant and machinery close to the general public required significant extra risk mitigation. This solution was not one that we would have opted for if any other had been available, given the logistical, contractual and cost implications and the disruption to local people and businesses. However, there was no local alternative available, meaning that the storage solution in this case - whilst high cost - was nonetheless efficient.

Figure 1: Storage solution delivered in a supermarket car park (Bredbury, Stockport)

Contaminated ground

Contaminated ground can be caused by a number of different factors but tends to be associated with old industrial waste. Experience has shown that it is much more prevalent in the areas of UUW's region that are classed as 'post-industrial', due to, for example, the presence of old slag heaps and other industrial waste. In many of our heavily urbanised regions, the only land available for our projects is that previously not thought fit to build on due to these types of issues, such as old gas works or refuse sites.

Proximity to transport infrastructure

Proximity to transport infrastructure such as roads, railways, airports or canals will drive additional costs due to the associated complexity in delivery (e.g. due to traffic management) and the need for the solution to be designed to complement existing nearby assets. This can drive significant additional complexity into a programme. For example, proximity to a Network Rail asset would require extensive coordination and liaison between the two organisations to develop and agree asset protection agreements, permissions and so on.

Proximity to existing utility assets

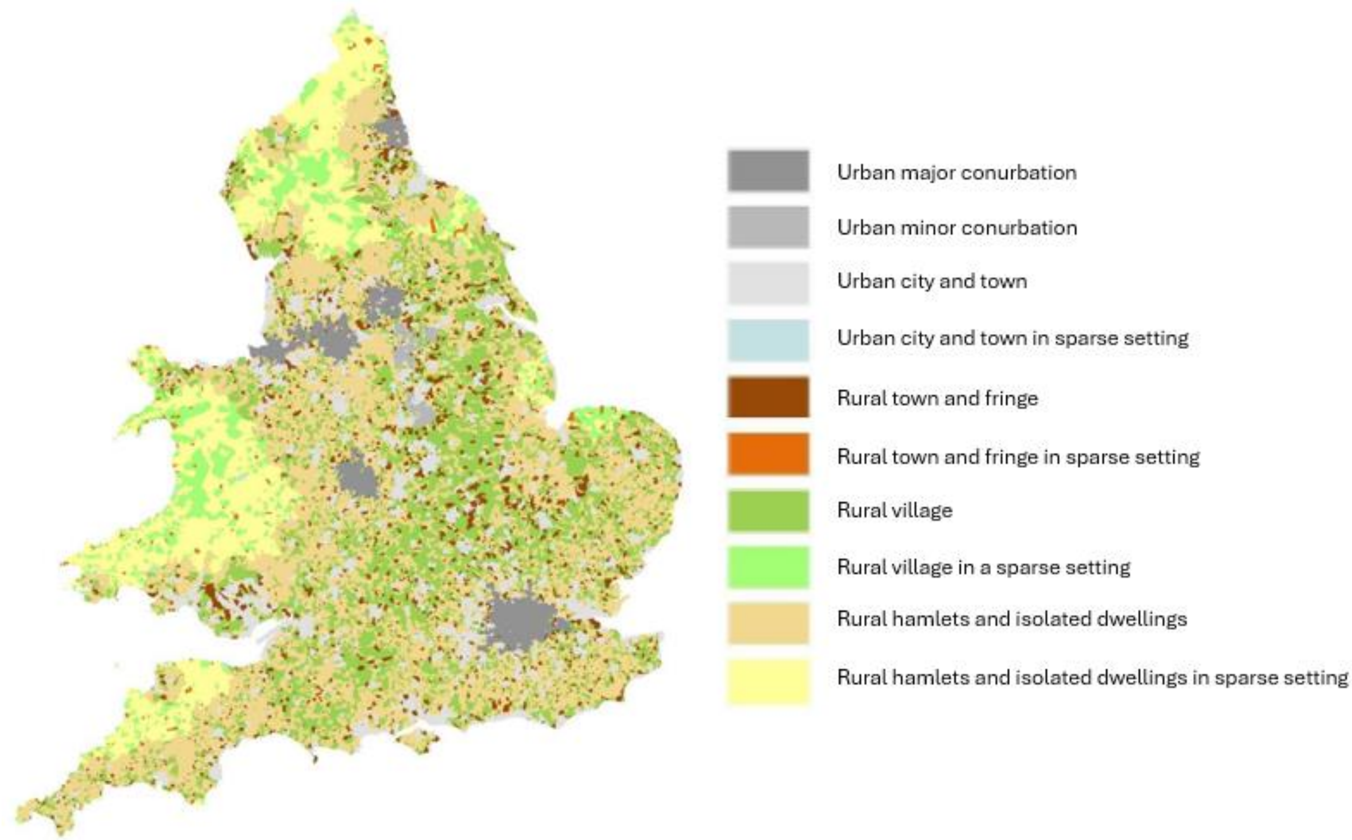
Urban areas are associated with a higher risk that an infrastructure project encounters existing utilities assets. In the most urban areas, these assets are likely to be highly concentrated and so will be associated with significant additional risk mitigation and/or service diversion costs.

For example, at our Church Lane project, the only feasible location for the overflow is underneath overhead power lines. Scottish Power is carrying out the diversion at a cost of £77,000.

Is UUW uniquely affected by these factors?

The Office for National Statistics (ONS) publishes the Rural Urban Classification (RUC). This provides an indication of the land coverage in a local area. We have provided a description of the RUC in our business plan submission[6]. Figure 2 illustrates the distribution of RUC across England and Wales. The unique nature of UUW's region can be clearly seen with a heavily urbanised south (around Liverpool and Manchester) and a very rural north. No other company has this range of RUC. We discuss rurality in section 3.2. Overflows in more urban areas are more likely to be affected by the urbanicity cost drivers set out above.

Figure 2: Rural Urban Classification across England and Wales



Source: Office for National Statistics[7]

We matched location data included within WaterUK's storm overflow dataset to the schemes included within Ofwat's dataset (we provide more details of the approach in section 5), which allowed us to supplement Ofwat's dataset with the RUC data set out in Figure 2. This demonstrated that UUW is working on an above average number of overflows in the most urban classification of RUC (Urban major) and the most rural classification of

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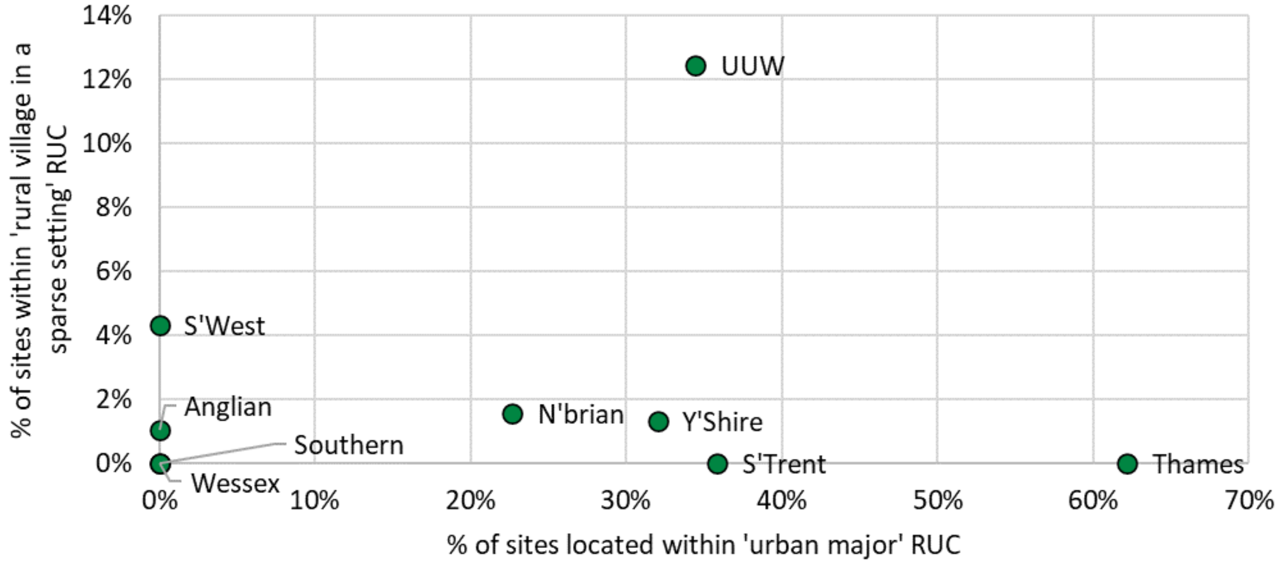
[6] UUW44 (2023) *Drainage cost adjustment claim, Appendix F.* Available here: https://www.unitedutilities.com/globalassets/z_corporate-site/pr24/supplementary-documents/uuw44r.pdf

[7] ONS [Online] *RUC user guides*. Available at: https://www.ons.gov.uk/methodology/geography/geographicalproducts/ruralurbanclassifications/2011ruralurbanclassification

RUC (rural sparse), as illustrated in Figure 3. Where a company has a zero value it indicates it is not working on any overflows within the most urban or most rural classifications of RUC.

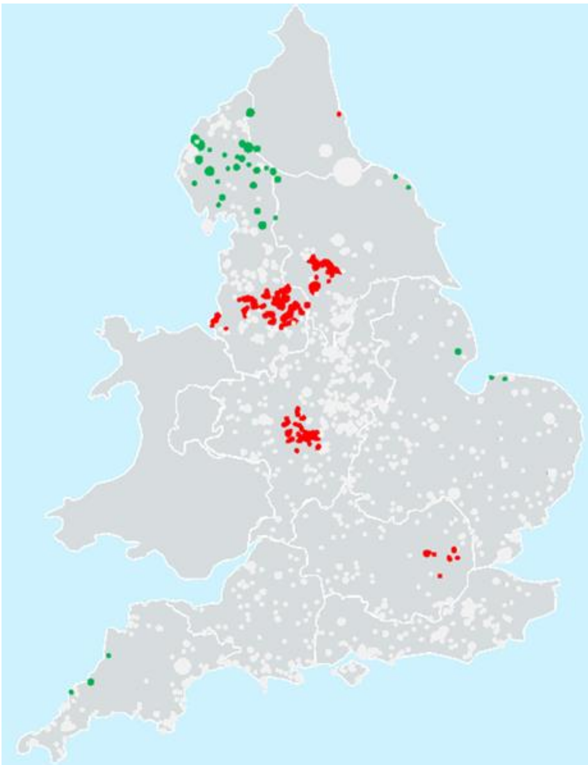
Figure 3: RUC data indicates that UUW is working on an above average number of overflows in the most urban classification and most rural classification of RUC



Source: UUW analysis

Figure 4 provides an alternative view. Red indicates overflows located in the most urban classification of RUC, while green indicates overflows in the most rural classification. It's clear that UUW is an outlier in having a large number of overflows in its heavily urbanised south and very rural north.

Figure 4: Overflows located in the most rural (green) and the most urban (red) Rural Urban Classification



Source: UUW analysis

Are the consequences of 'urban or formerly industrial sites' likely to be reflected in Ofwat's model?

It's clear that UUW is a significant outlier on the number of its storm overflows that are located in the most complex areas likely to be associated with significant additional cost. No other company has the mix of sites in complex locations that UUW does. As such, there is a distinct lack of opportunity for UUW to take advantage of any offsetting effects that a company with, for example, a high number of urban sites but a low number of rural sites may be able to achieve. As such, we do not consider that Ofwat's model appropriately captures UUW's circumstances.

3.2 Rurality

Working in very rural areas is associated with significant additional costs.

Access challenges

Access is often along small narrow lanes. This increases travel time substantially for large vehicles and will tend to require the reinforcement of existing roads and tracks or the installation of new ones. It also adds to the complexity of coordinating large vehicles moving into and from the site.

Ecology factors

Ecology requirements tend to be more stringent in rural areas. For example, more rural areas are likely to require habitat surveys. In addition, the loss of biodiversity is likely to be greater in rural areas, which can lead to significant extra mitigation to ensure there is an overall biodiversity net gain as a result of the project. This is associated with additional time, complexity and cost.

Labour and welfare costs

Contractors' labour rates tend to be higher for more rural schemes, which are far from major population centres. This is because longer travel time and enhanced welfare requirements become a major factor, which usually makes overnight accommodation necessary. This is particularly the case for specialist contractors that work nationwide.

Logistical complexity

More rural sites tend to be located away from major logistical hubs. This increases travel time with associated higher costs. It is also especially challenging to coordinate the delivery of plant and materials to site. This leads to more complex logistics and therefore increases the associated cost.

Land access and purchase challenges

Land purchase is more complicated. Within less rural areas, land tends to be owned by the Local Authority. However, in rural areas it tends to be privately owned. This leads to more complex, site-specific negotiations.

For example, in an AMP7 project the existing access road was not wide enough to service the construction works. Rather resort to the more expensive option of widening the existing access road, UUW identified a temporary access route through adjacent farmland and following positive landowner discussions, proceeded on the basis that construction vehicles would use the farmland for access. However, at the last minute, the landowner refused to sign the agreement and offered an alternative option, which was not suitable due to highway safety concerns and customer impact.

Therefore, we had to resort to widening the existing access track which required planning permission and was contentious in the community due to potential impact on a significant tree. The planning approval for the access widening took over 8 months, which is a lot longer than the statutory 8-to-13-week period (recent experience suggests such delays can be expected as the norm). This adds to project costs due to contractor delays if they have been mobilised. We may then need to accelerate works if the regulatory date is put at risk through delayed planning permission. In this example, the cost to UUW was circa £550k for the access itself, planning permission/associated surveys, design and mitigation, utility diversions and delay to the contractor. This is in addition to the land purchase cost itself for the widened track.

Planning constraints

Infrastructure projects in very rural areas are more likely to run into planning-related problems. This is due to a lack of agreed conventions/approaches relative to working in more built-up areas. Local residents also tend to be more engaged with the planning process, which can lead to delays.

Prevalence of water courses

Rural land tends to feature a large amount of water courses. Additionally, rainfall does not drain to the sewer network. Both of these factors mean that it is necessary to use more expensive construction techniques such as secant piling and will also mean a significant amount of dewatering activity is required.

Is UUW uniquely affected by these factors?

RUC data indicates that UUW is intervening at the highest proportion of overflows located in the RUC category of 'rural village in a sparse setting' - the most rural category. This was illustrated in Figure 3. Please see section 3.1 for more details.

Is 'remote location' likely to be reflected in Ofwat's model?

It's clear that UUW is a significant outlier on the number of its storm overflows that are located in the most complex areas likely to be associated with significant additional cost. No other company has the mix of sites in complex locations that UUW does. As such, there is a distinct lack of opportunity for UUW to take advantage of any offsetting effects that a company with, for example, a high number of urban sites but a low number of rural sites may be able to achieve. As such, we do not consider that Ofwat's model appropriately captures UUW's circumstances.

3.3 Atypical environmental complexity

Environmental complexity can lead to additional costs due to the need for mitigating measures. We have not been able to acquire data in the time available. However, we have carried out visual analysis that suggests UUW's region is likely to be affected by additional atypical environmental complexity relative to other regions. Our deep dive evidence will show that a substantial number of our sites are affected by atypical environmental complexity.

Environmental designations

Working in areas with environmental designations such as a Site of Special Scientific Interest (SSSI) requires additional mitigation measures in scheme delivery to minimise the impact of construction and ongoing operation of the site. This increases the complexity and cost of scheme delivery.

Figure 5 illustrates the distribution of SSSI sites in England (Wales is excluded from the data). It is clear that the North-West contains an atypically high number of SSSI sites. We also note that a large number are situated on the North-West's coast – this will compound the complexities already inherent in delivering wastewater enhancements close to bathing waters e.g. enhanced quality requirements.

Figure 5: Sites of special scientific interest, England only (SSSI)

Source: Natural England[8]

National Parks

Similar to areas with environmental designations, working in National Parks is associated with additional requirements and higher complexity. For example, solutions need to be sensitive to the local environment and landscape, which can lead a storm tank having to be sited below ground. It also requires careful reinstatement and appropriate construction of access roads.

Figure 6 shows that UUW's region spans three National Parks: the Lake District; the Yorkshire Dales; and the Peak District. Only Welsh Water serves a region that spans this many.

[8] Available at: https://naturalengland-defra.opendata.arcgis.com/datasets/f10cbb4425154bfda349ccf493487a80/explore?location=52.891678%2C-2.804895%2C6.94

Figure 6: National Parks within Great Britain

Source: National Parks UK[9]

Is UUW uniquely affected by these factors?

We consider that Figure 5 and Figure 6 illustrate that UUW's region is likely to be particularly affected by atypical environmental complexity. In particular, we note that no other company appears to be affected by both a high prevalence of SSSI sites and National Parks.

Is 'atypical environmental complexity' likely to be reflected in Ofwat's model?

Ofwat's model will reflect industry average environmental complexity that companies have encountered in the delivery of their historic schemes. However, it will not reflect an above average level of environmental complexity. We note that environmental designation and National Parks are likely to be correlated with rurality. We discuss rurality in section 3.2.

3.4 Atypical planning complexity

Planning complexity can add significant cost to a project. Planning restrictions tend to be driven by proximity to residential areas or areas that are sensitive for other reasons. We consider the scale of work UUW is carrying out in urban environments increase the likelihood that its programme is likely to be more affected planning complexity than other companies. For example, projects near residential areas need to implement additional

[9] Available at: https://www.nationalparks.uk/app/uploads/2020/10/Map-NationalParks-names-2016.pdf

measures to mitigate the effect of on-site lighting and noise. Sites near to historical areas will require specialist investigation prior to construction activity commences.

For example, our Nuttall Park scheme required a team of archaeologists to excavate a historical area surrounding a mill prior to construction. Following construction, we were required to reinstate our new asset sensitively to the aesthetic of the mill. This drove additional cost relative to a typical scheme.

Is UUW uniquely affected by these factors?

We consider that there is evidence to suggest that UUW is carrying out an above average amount of work in the most urban areas and the most work in the most rural areas (Figure 3). This suggests that UUW is more likely to be affected by atypical planning complexity.

Is 'atypical planning complexity' likely to be reflected in Ofwat's model?

Ofwat's model likely reflects (at most) industry average planning complexity. However, we have presented evidence that suggests UUW will incur above average costs in the delivery of its storm overflow programme. As such, we do not consider that Ofwat's simple model will appropriately reflect the efficient cost of UUW's storm overflow programme.

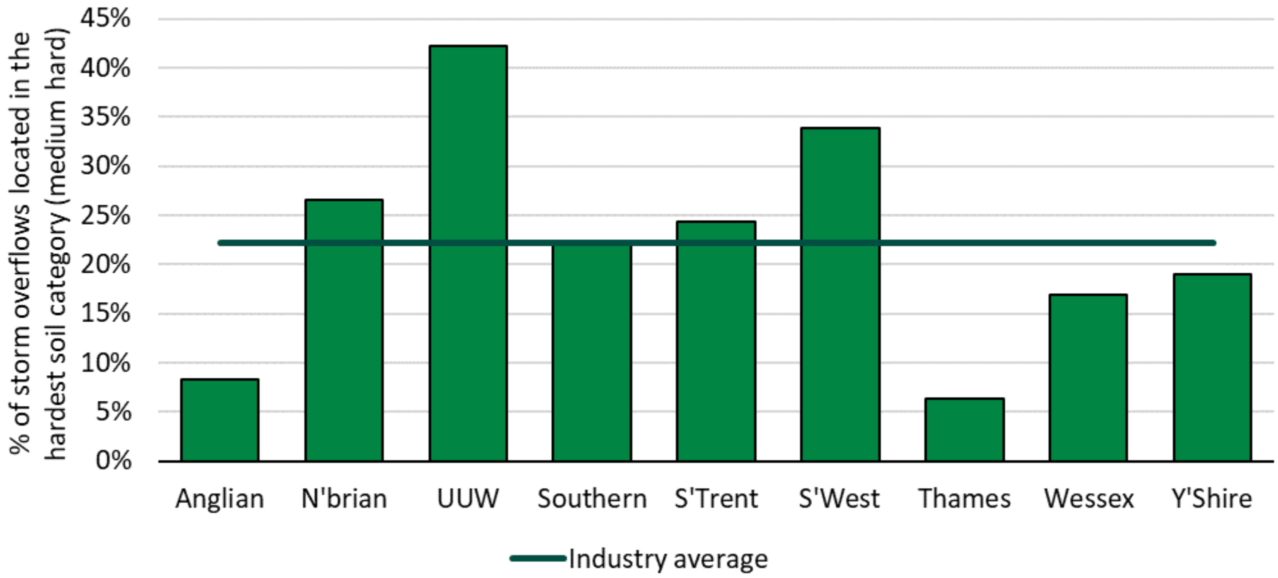
3.5 Atypical geological complexity

Delivering storage solutions is associated with digging into the ground. As such, ground conditions play an important role in determining the efficient cost of a storage solution.

Soil hardness

Different soil types are associated with different levels of complexity. Data from the British Geological Survey suggest that UUW has the largest percentage of its overflow programme located in areas of harder soil type. This is illustrated in Figure 7. This creates additional complexity, requires more specialist machinery and leads to higher costs.

Figure 7: Percentage of companies' storm overflows located in the medium and medium-hard soil categories (the hardest soil types)



Source: British Geological Survey

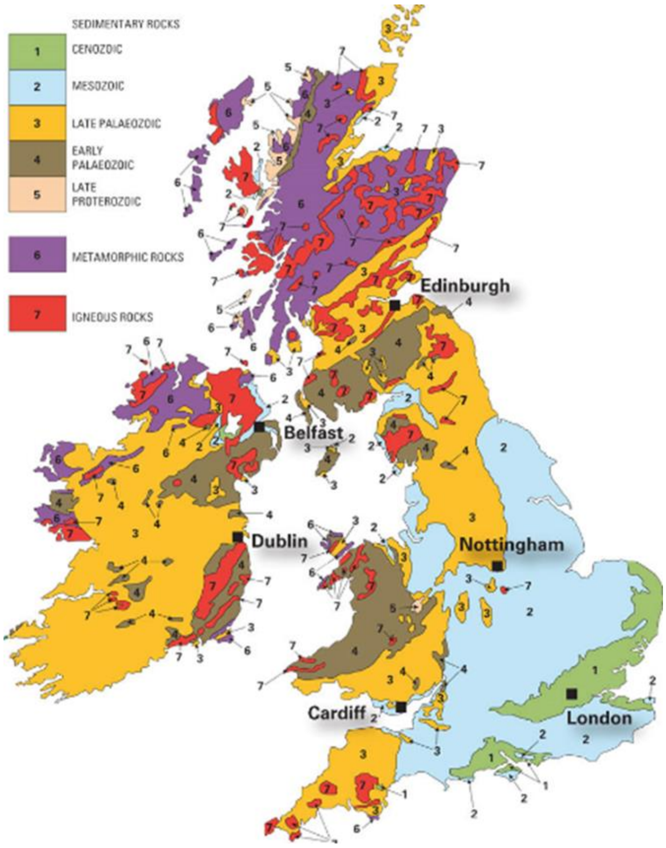
Geology

Rock type also influences costs. Different rocks are associated with different complexity and digging techniques. Figure 8 illustrates the different rock types found across England and Wales. We provide a brief description of each major rock type below, along with engineering rationale that informs the different levels of complexity inherent in working with each:

- **Cenozoic**. Comprising interbedded Mudstone, Siltstones and Sandstone these rocks are generally very weak to moderately strong rock and are variably weathered and fractured. These rocks are typically encountered at shallow to moderate depths, covered by weaker soils. Standard equipment can be used for excavation of these materials.
- **Mesozoic**. Comprising interbedded Mudstone, Siltstones and Sandstone and Chalk these rocks are generally very weak to moderately strong rock and variably weathered and fractured. These rocks are typically encountered at moderate depths, covered by weaker soils. Standard equipment can be used for excavation in these materials.
- **Palaeozoic (early to late).** These form the majority of rocks that underlie the Northwest of England and are some of the oldest rocks in the country. Comprising interbedded Sandstones, Siltstones and Mudstones they have been extensively metamorphosed and are typically strong to very strong rock. These rocks lie at shallow depth and specialist techniques, such as hard ripping and blasting, are required for excavation which are costly and time consuming to implement.
- **Igneous rocks**. Underlying much of the Lake District are strong to very strong igneous rock. These rocks lie at shallow depth or are exposed and specialist techniques, such as extremely hard ripping are required for excavation. Given the environmental sensitivity of the area blasting is not permitted so excavation costs and programme times are significantly increased.

It's clear from Figure 8 that much of the North-West is comprised of more challenging rock types relative to the rest of the industry. These rock types also tend to lie closer to the surface, which means they are encountered at shallower depths. This tends to increase the complexity and cost of storage solutions.

Figure 8: Geology across Great Britain, Northern Ireland and the Republic of Ireland

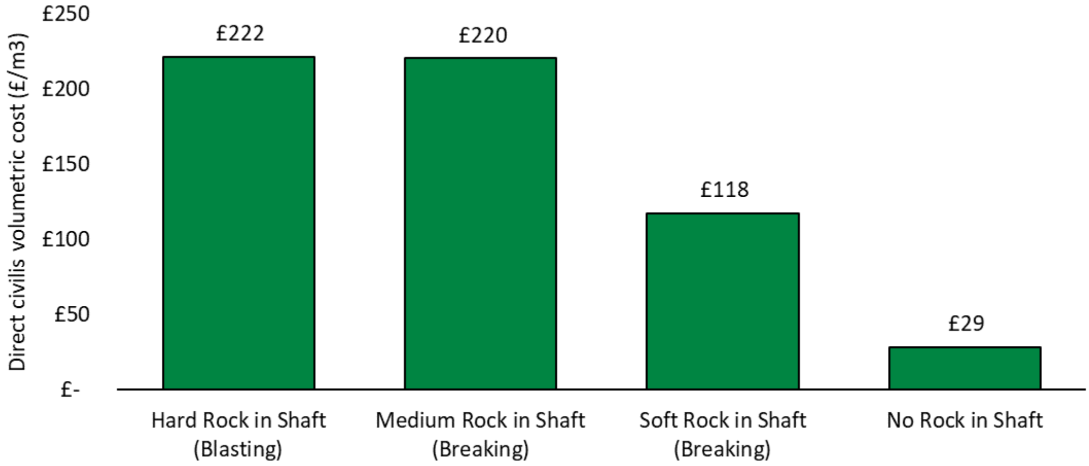


Source: British Geological Survey[10]

[10] Available at: https://www.bgs.ac.uk/discovering-geology/maps-and-resources/maps/colour-in-geology-map/

Figure 9 shows engineering estimates relating to the excavation of different rock types. It's clear that there is a significant step up in cost when medium and hard rock is present within the excavation area. As such, storm overflows expenditure can be expected to be higher in areas where medium to hard rock is present. Predominantly this relates to the areas of early to late Palaeozoic and igneous rocks illustrated in Figure 8.

Figure 9: Engineering estimates of unit cost of excavating different types of rock

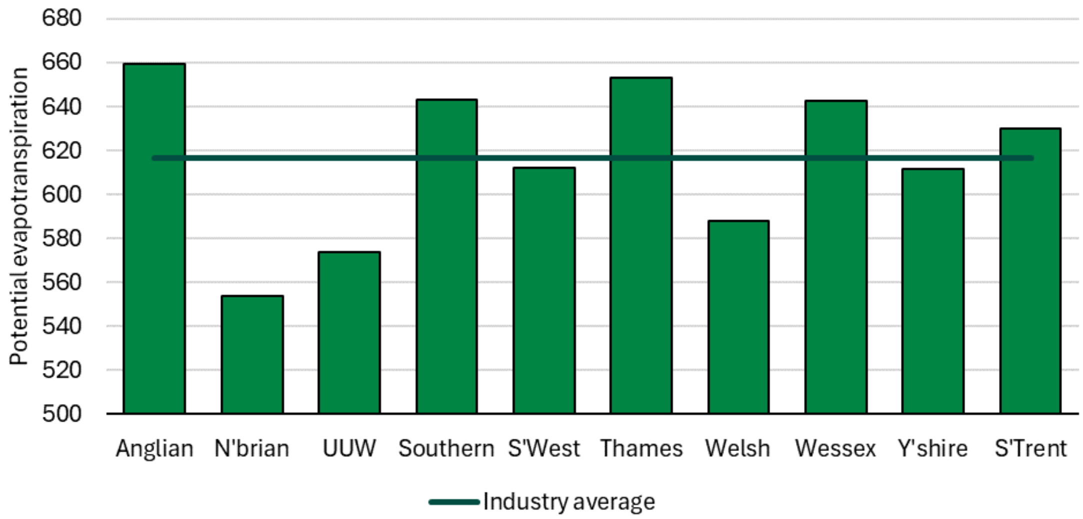


Source: UUW analysis

Groundwater

Potential evapotranspiration (PET) reflects the capacity of groundwater to evaporate into the lower atmosphere. Higher PET means that more evaporation is possible, meaning less groundwater remains. Conversely, areas characterised by low PET will suffer from high levels of groundwater. This can directly impact storm overflow costs because higher groundwater levels will need to be mitigated through dewatering or overpumping and will require more expensive construction techniques. It also requires an abstraction licence – experience in AMP7 suggests that these are taking around 13 months to agree and require extensive additional surveys and testing, which drives up complexity and cost.

Figure 10: Potential evapotranspiration is significantly below average in UUW's region

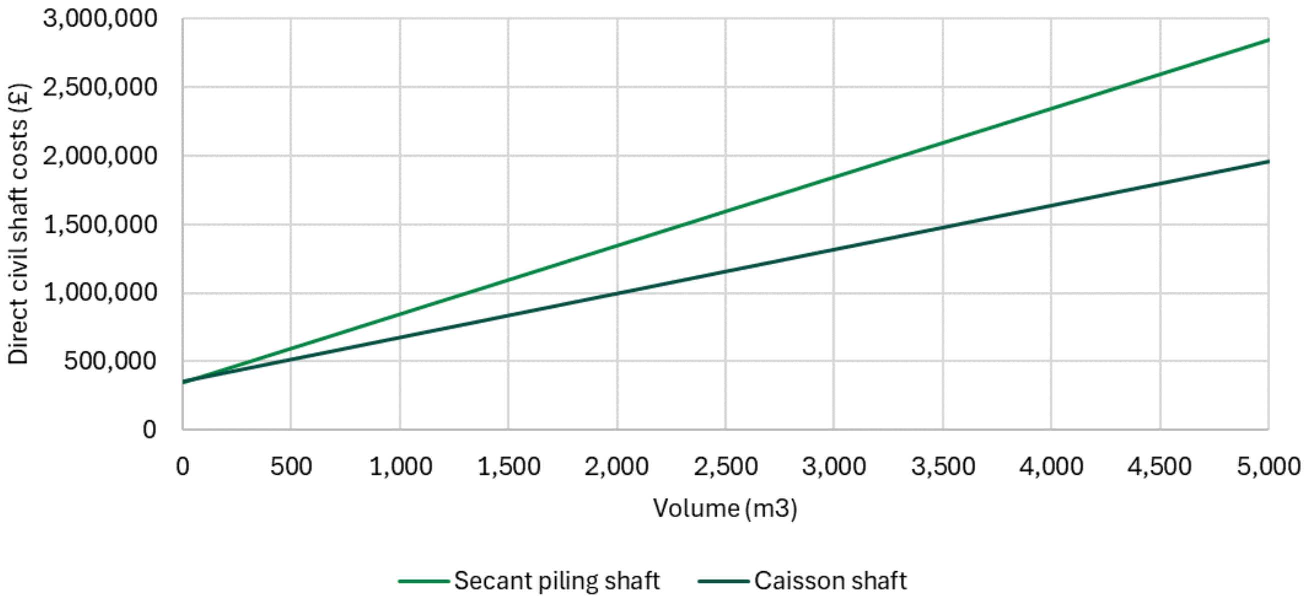


Source: UUW analysis based on publicly available data

As Figure 10 shows, PET within UUW's region is significantly below average. This suggests that UUW's storm overflow programme will be adversely affected by a more groundwater relative to other companies and it will be required to use more expensive construction techniques than other companies. We note that Northumbrian (NES) has adopted many blue-green solutions, which tend to be above ground. This means it is unlikely to encounter similar adverse groundwater conditions to UUW.

In areas of high groundwater, more expensive techniques requiring specialist contractors may be required such as secant piling or diaphragm walling. Figure 11 illustrates the step up in costs between Caissson shaft construction (typically used at less complex sites) versus secant piling shaft construction. There is a clear step up in the direct cost.

Figure 11: Comparison of caisson and secant piling shaft construction costs across excavated volumes



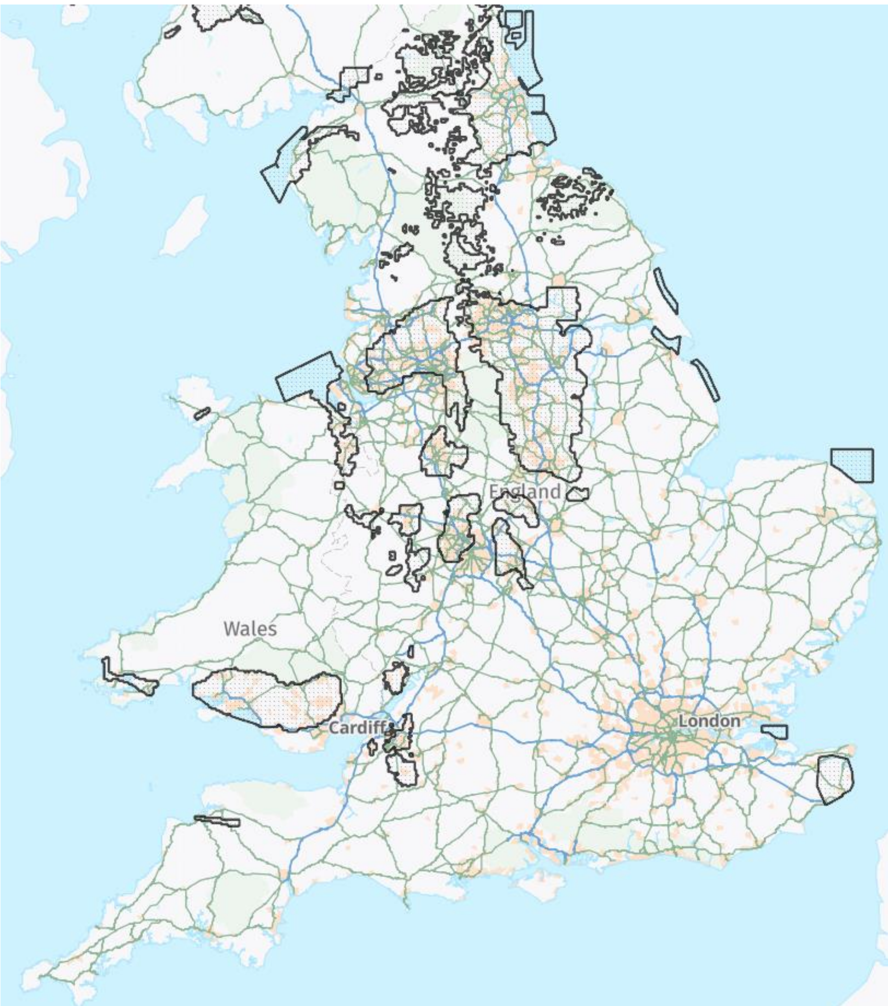
Source: UUW estimating data

Mine workings

Buried mine workings significantly complicate delivery of underground infrastructure schemes. Such structures are volatile and require additional scoping and investigation prior to scheme delivery. Additional mitigation measures are also needed to minimise the risk that there is any interference between the two assets. We note that Coal Authority permits require UUW to take liability up to £10m for any damage linked to a specific project for up to 12 years. This acts to increase risk mitigation, scheme complexity and cost.

Figure 12 shows a map of England and Wales overlaid with all coal mining reported areas as per the British Coal Authority. While UUW's region is not an outlier, there is clearly a high concentration of coal mines across significant swathes of UUW's densely populated southern region. It is also clear that almost no part of Southern England has any coal mining reported areas.

Figure 12: Coal mining reported areas in England and Wales



Source: The Coal Authority[11]

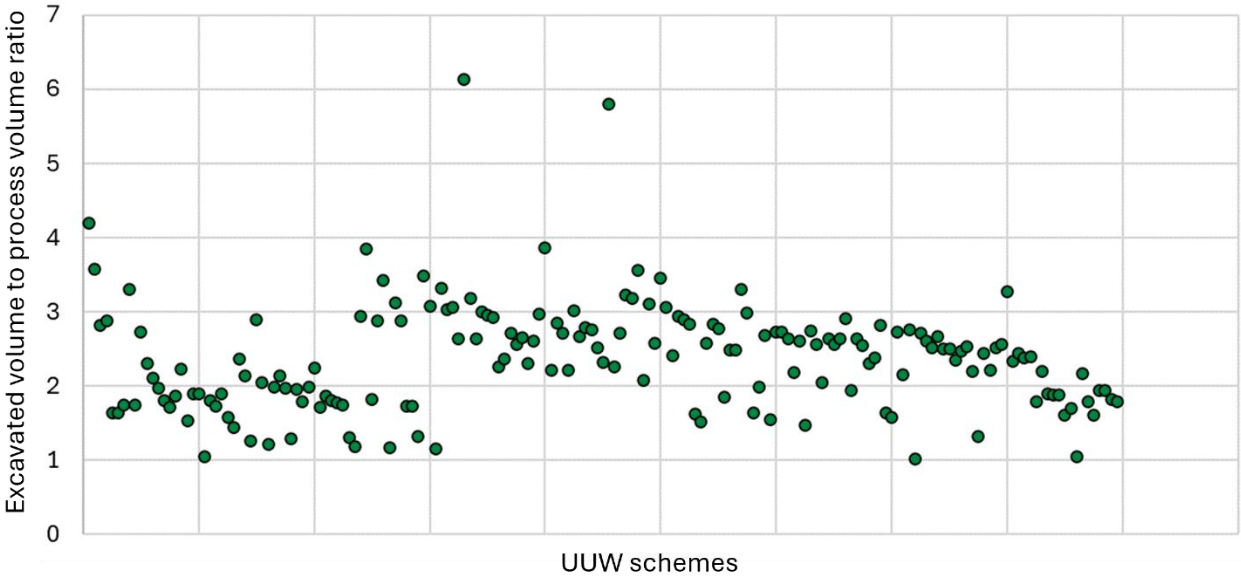
Deep excavation

The process volume (i.e. equivalent storage) is different to the volume that is excavated. This is because the tank needs to be located at a deeper depth than the local sewer system. In areas where sewers are deeper, excavated volumes will need to be larger which will drive additional costs. Ofwat should not underestimate the role that excavated volume can play in driving additional cost. This factor will cause unexplained variances in scheme-level unit costs – all else equal, schemes that require more excavation will be associated with a higher unit cost. We consider that excavated volumes should be considered by Ofwat.

[11] The Coal Authority [online] Interactive map. Available at: https://mapapps2.bgs.ac.uk/coalauthority/home.html

Figure 13 shows the excavated volume to process ratio for a sample of UUW schemes

Figure 13: Ratio of excavated volume to process volume for schemes within UUW's programme



Source: Internal UUW estimating data

Is UUW uniquely affected by these factors?

We consider that this section contains compelling evidence that UUW has above average prevalence of all factors relating to atypical geological complexity. This means that these factors will have a collective detrimental effect.

Is 'atypical geological complexity' likely to be reflected in Ofwat's model?

We do not consider that this factor is adequately reflected in Ofwat's models:

- **Ground hardness.** As Figure 7 demonstrates, soil types vary across the country. As such, Ofwat's simplistic model will be more favourable to companies with softer soil types. It will also understate the efficient cost of delivering storage schemes in areas of hard soils.
- **Geology.** As Figure 8 demonstrates, geology is different across the country. As such, we do not consider that a simplistic modelling approach appropriately reflects the associated differences in efficient delivery costs.
- **Groundwater levels.** Ofwat's simple model implicitly assumes all companies have equivalent levels of PET. However, as Figure 10 shows, this is not the case. This means that Ofwat's models are not reflecting the efficient costs of delivering storm overflow reductions in an area with low PET.
- **Mine workings.** It is unlikely that an overflow in the vicinity of mine workings would have passed the cost beneficial test prior to the Environment Act. As such, it is unlikely that companies' historic cost curves reflect the associated additional cost. Figure 12 shows that concentrations of coal mines varies across the industry.
- **Excavated volumes.** Ofwat's table guidance explicitly states volumes included should be process/effective storage volume. This assumes that all companies have an equivalent process to excavated volume ratio. However, we do not know of any data source that would allow us to test the validity of this assumption.

3.6 Solution scope

Solution scope considers a range of site-specific factors such as tank size and whether the storage is provided through a grey-only or hybrid solution. We consider that there are clear reasons to expect efficient costs to vary depending on the solution scope.

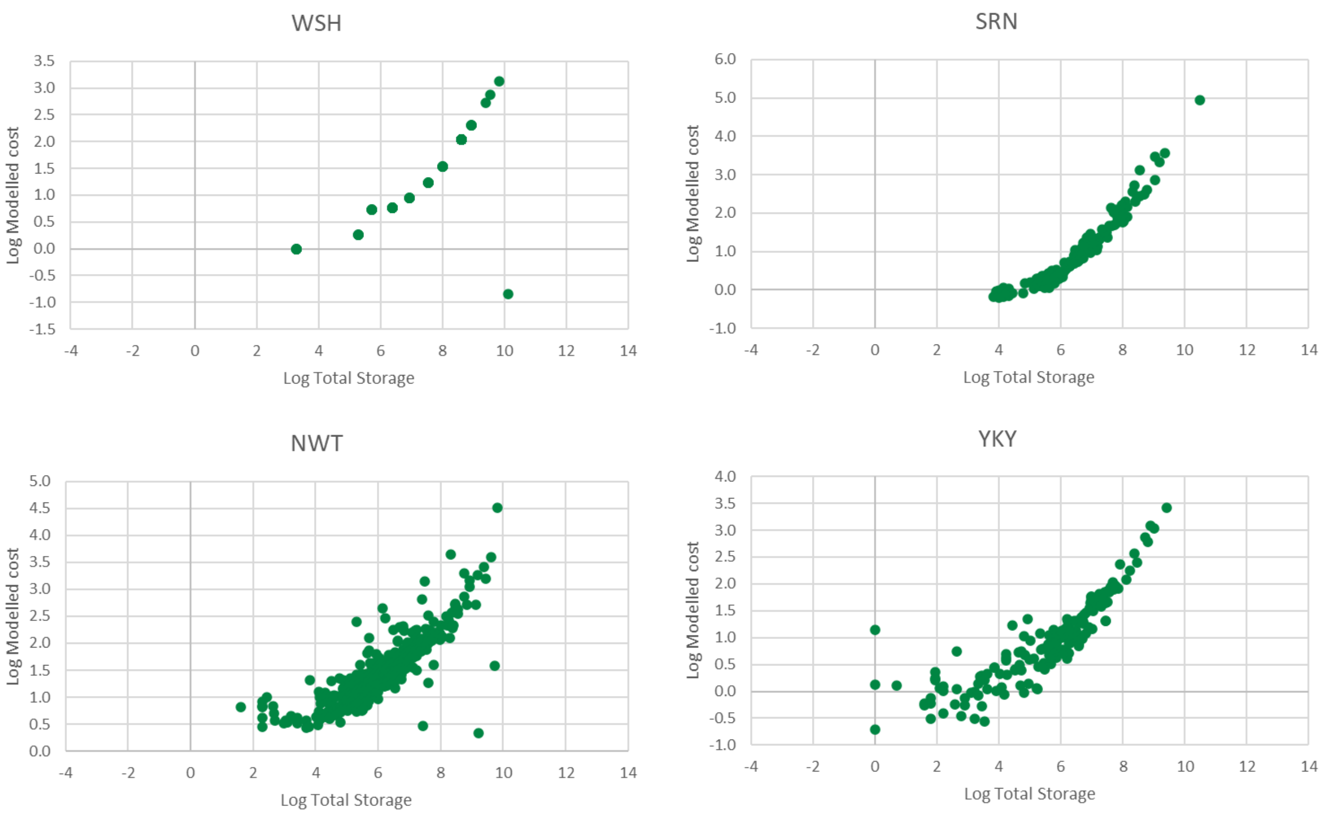
Effective storage provided

Larger tanks will be associated with higher costs. This is a basic engineering principle. Ofwat's approach assumes that effective storage provided is the only relevant cost driver. It also assumes that as tank size increases, unit costs fall. This may be a reasonable starting assumption but we note there are reasons to consider that diseconomies of scale exist in some cases. For example:

- Where a tank is located below ground, its overall size is constrained by the need to ensure it doesn't collapse in on itself. In these circumstances, a multi-tank solution is required - this is discussed below.
- Where space constraints mean scheme delivery is complicated or requires additional land purchase – this is discussed below.
- Larger tanks are associated with a bigger risk of encountering poor ground conditions – this risk would be correlated with atypical geological complexity discussed in section 3.5.

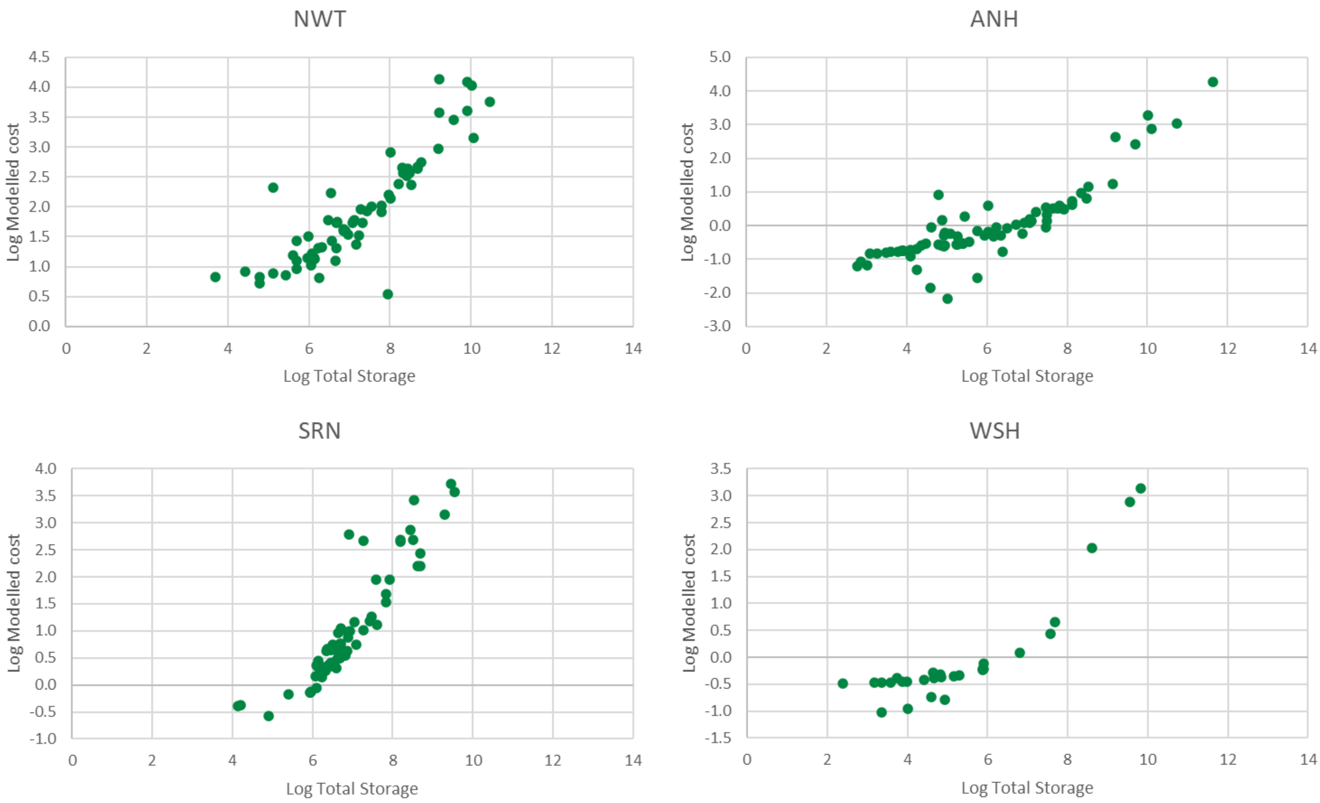
As such, we consider that Ofwat's assumption that economies of scale are always feasible as tank size increases may be simplistic. We have identified clear evidence of diseconomies of scale in Ofwat's dataset. These relationships do not appear to have been considered by Ofwat at DD when it made its economies of scale assumption. Figure 14 and Figure 15 show forecast cost and associated storage in log-log scale for network and STW sites respectively. The increase in the slope at higher volumes of storage indicates the unit cost begins to increase at higher levels of storage. This is consistent with diseconomies of scale.

Figure 14: Evidence of diseconomies of scale at network sites



Source: UUW analysis based on publicly available data

Figure 15: Evidence of diseconomies of scale at STW sites



Source: UUW analysis based on publicly available data

Storage type

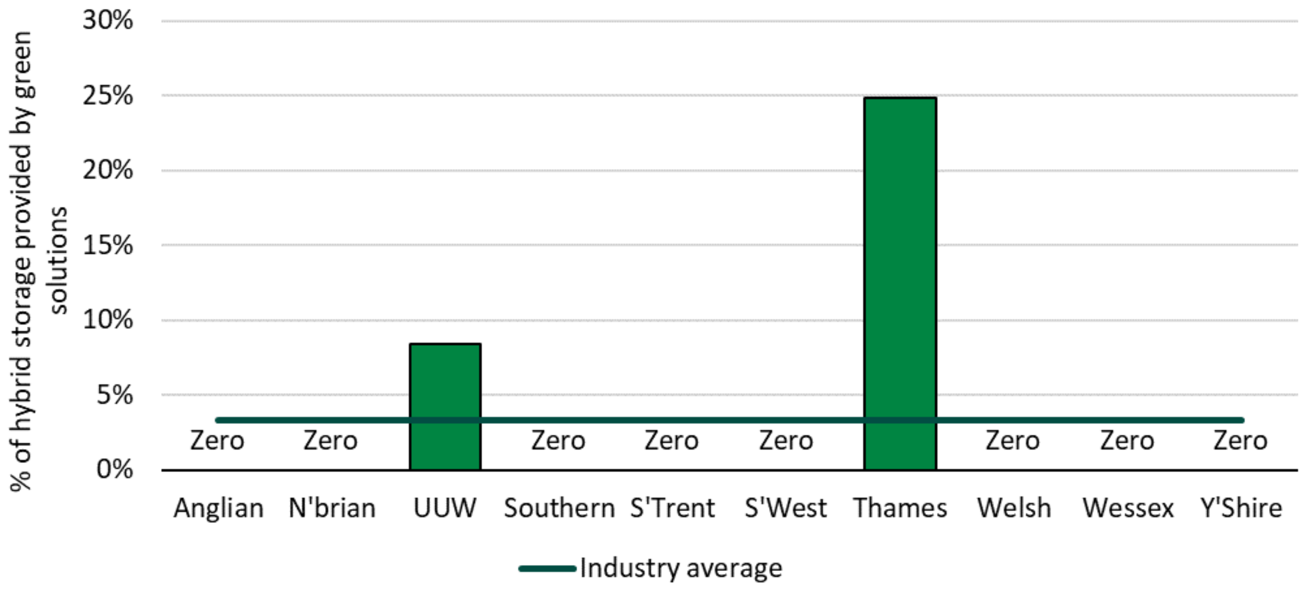
Storage can be provided by:

- **Grey solutions**. These solutions provide storage through grey storage only. They tend to be cheapest to deliver.
- **Green solutions**. These solution use blue-green infrastructure to attenuate/store excess wastewater. They tend to be more expensive to deliver. This is recognised by Ofwat in its storm overflow methodology: *"Some SuDS features could potentially have higher costs"*[12].
- **Hybrid solutions.** These solutions use a mix of grey and blue-green storage. They tend to be more expensive than grey solutions but less expensive than fully green solutions. These solutions can offer a suitable compromise between grey and green solutions, where a fully green solution isn't feasible.

Figure 16 shows that UUW is delivering an above average proportion of green storage at the solutions assessed by Ofwat as part of its simple modelling approach i.e. its hybrid solutions feature a much higher percentage of green solutions than almost every other company.

[12] Ofwat (2024) *Draft Determinations - Expenditure allowances: enhancement cost modelling appendix.*

Figure 16: UUW is delivering an above average level of storage delivered by green solutions at its hybrid schemes (network and STW)



Source: UUW analysis based on Ofwat's storm overflows dataset

Below versus above ground storage

Constructing a below ground tank is associated with additional construction costs. This is due to increased complexity and risk that is associated with underground structures. Ofwat assumes that STW storm tanks are located above ground. However, it is not always feasible to construct an above ground storm tank, due to local planning restrictions and/or space availability. This is more likely to be an issue in heavily built-up areas (e.g. near to residential properties) or in areas with sensitive environmental designations (e.g. within a National Park).

Screens

Screens prevent rags entering watercourses during a storm overflow spill. Installing a screen is associated with additional costs. For example, it is usually necessary to install screen chamber infrastructure to support the screen. This results in a clear upwards pressure on prices.

Multi tank or site solution

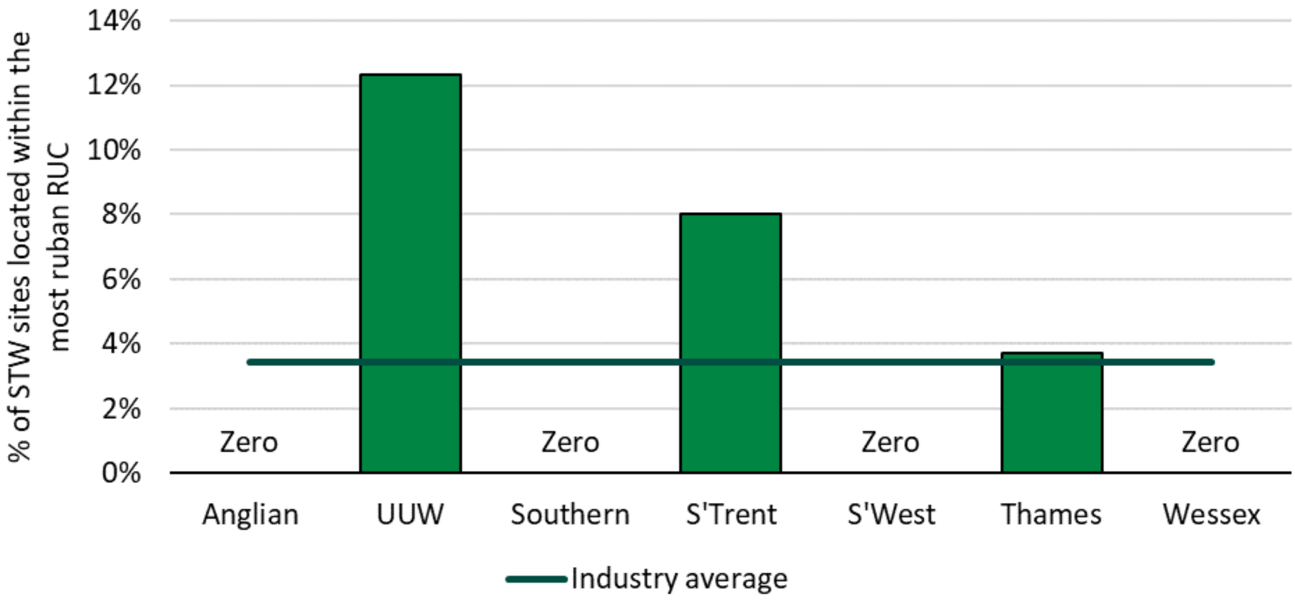
Space constraints or wider site configuration can lead to the need to install a number of smaller tanks, rather than one big tank. For example, this might be the case if it isn't feasible to build the size of tank required. This means that the solution is not able to benefit from any economies of scale that might be associated with a single large tank.

On-site space constraints at wastewater treatment works

Some WwTWs have limited site footprints. This, combined with the scale of storage volume required by a 10 spill driver, can lead to diseconomies of scale when delivering storage tanks. This is because on-site delivery is complicated by restricted working environments. It may lead to the need for additional land purchase. If a site is located in proximity to nearby houses, then underground storage may be required.

We consider that on-site space constraints are heavily correlated with heavily urbanised environments. As Figure 17 illustrates, UUW is targeting the most overflows in the most urban RUC category. This suggests that on-site space constraints are likely to increase the complexity of UUW's AMP8 STW schemes. Our deep dive evidence sets out cases where on-site space constraints are forcing us to adopt a sub-optimal solution e.g. Chorley WwTW.

Figure 17: UUW is working on the highest percentage of STW sites located in the most urban RUC category



Source: UUW analysis based on publicly available data

Flow to full treatment

A flow to full treatment (FTFT) solution increases the capacity of the network or treatment works downstream of the storm overflow. This enables wastewater to flow more quickly through the overflow chamber, which reduce reduces the spill volume, duration and frequency and subsequently reduces the volume of additional storage required. We refer to the storage volume avoided through a FTFT solution and the actual storage volume installed (if applicable) as the 'equivalent storage volume' of the solution i.e. the total storage volume that would have been required in the absence of a FTFT solution.

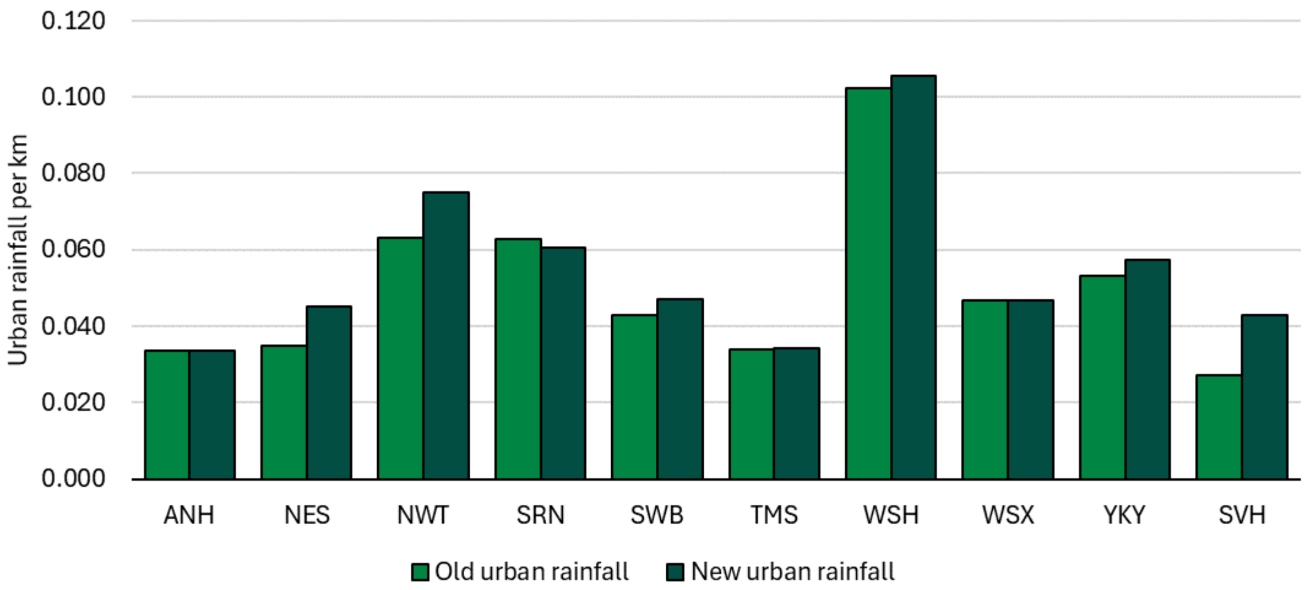
FTFT solutions can be implemented both on the network and at treatment works. FTFT solutions on the network tend to involve upsizing the receiving 'downstream' network. FTFT solutions at treatment works involve additional interventions to upsize treatment processes or require additional treatment streams. FTFT solutions can be implemented independently or alongside of storage solutions.

FTFT solutions are used for several different reasons:

- There is not enough space to install a tank of sufficient size to meet the statutory driver as a conventional storage solution;
- There is not enough space to install a tank of sufficient size to meet the statutory driver as part of a hybrid solution i.e. the blue/green opportunity does not significantly reduce the storage requirement;
- Local conditions mean that a storage tank would not be able to sufficiently drain between periods of heavy rainfall e.g. in areas characterised by persistent rainfall, the network runs fuller more of the time, thus reducing the ability of storage tanks to drain effectively;
- There is a risk to the receiving treatment works' operational processes if the stored wastewater becomes septic due to long retention times;
- As part of an opportunity on an integrated water quality solution at a treatment works i.e. requiring a tighter final effluent permit in additional to large storage; and
- As part of an optimised solution e.g. where a very large storm storage tank is viable but the volume reduction due to PFF provides a better value totex solution.

For the reasons set out above, FTFT tends to be required in areas of high rainwater run-off. UUW has an above average rate of urban rainfall, as Figure 18 illustrates[13]. Therefore, all else equal UUW will need to adopt a higher proportion of FTFT solutions.

Figure 18: Urban rainfall by company, using Ofwat's 'old' and 'new' methodology



Source: UUW analysis based on publicly available data

Is UUW uniquely affected by these factors?

We consider that multi-tank or site solutions are more likely to be required in areas where below ground storage is required e.g. heavily urbanised environments or rural areas where planning restrictions require a sensitive solution. As Figure 3 shows, UUW is working on an above average number of overflows in the most urban and the most rural environments.

Is solution scope likely to be reflected in Ofwat's model?

We consider that Ofwat's models do not appropriately account for solution scope:

- Ofwat recognises that blue-green solutions are likely to be associated with higher costs and as such assesses the cost of green schemes separately. However, Ofwat's model also assumes the cost of a grey and hybrid scheme are equivalent. As we discuss in section 4.3.2, this appears inconsistent. We do not consider that the cost of hybrid solutions are appropriately reflected in Ofwat's simple model.
- We do not consider that above/below ground tanks are appropriately reflected in Ofwat's model. In the case where local conditions dictate a below ground tank is required, then Ofwat's model would understate the efficient cost of delivery.
- Screens are not reflected in Ofwat's simple model. This means that Ofwat will understate the efficient cost of scheme delivery in the case where a screen is required.
- Multi tank solutions are not reflected in Ofwat's model. Ofwat implicitly assumes that a company is delivering a single tank.
- Ofwat does assess FTFT costs separately. However, it applies a relatively high-level assumption to assess efficient costs. We consider that this results in an understatement of the efficient costs of FTFT delivery, as we discuss in section 4.

[13] As we set out in our business plan, we are sceptical that Welsh urban data is consistent with England's. Therefore, we consider Welsh Water's urban rainfall is likely to be overstated. See Appendix F in UUW44 for more details.

3.7 Historic costs are unlikely to be reflective of AMP8 costs

Prior to the Environment Act 2021, investment in storm overflows was subject to a number of different considerations. The details of this are complex. However, in summary, improvements at storm overflows were usually subject to a cost benefit test which assessed the cost of the intervention against the environmental benefits it would bring. In order to demonstrate that an improvement to a storm overflow should be included under the WINEP, companies had to demonstrate that the benefits generated from harm reduction would be greater than the cost of intervention. This resulted from the aim of targeting investment at those interventions where it would serve to reduce most harm.

As a result of the Environment Act 2021, the sector has transitioned to a ‘spill-based’ regime. Under this regime, companies are required to meet the targeted 10 spills per overflow. There is no longer a "cost/benefit" test and the focus of investment is substantially more trained on reducing the number of spills, rather than being heavily focussed on reducing environmental harm.

The consequences of this are intuitively clear. Overflows that were previously considered as non-cost beneficial are now featuring in companies’ AMP8 programmes. As a result, the AMP8 programme is much more likely to feature interventions at overflows in complex areas with associated increases in cost. Such programmes would previously have been rejected on the basis that they did not pass the required cost-benefit threshold.

It is worth highlighting that companies with a higher share of exogenous regional factors are likely to be particularly affected by this issue. We consider that this is one of the reasons why UUW’s AMP8 costs appear to have increased by more than others’, relative to historic costs. As such, we caution that Ofwat must ensure it is making any comparisons on an equivalent basis i.e. controlling for site-specific exogenous factors. A simplistic unit cost comparison between forecast and historic costs will not provide a robust evidential basis on which to draw conclusions as to the efficiency of UUW’s AMP8 programme.

4. Ofwat's approach to modelling does not reflect exogenous drivers of scheme-level cost

The previous section evidenced that UUW is uniquely adversely affected by a range of exogenous cost drivers, which engineering rationale suggests will tend to increase efficient costs. We consider that a legitimate benchmark must seek to reflect the effect of these factors, either through developing additional variables and/or models or, where data isn't available, through post-model adjustments and/or deep dive assessments.

However, we are not confident that Ofwat's proposed approach will appropriately recognise the influence of these exogenous factors on efficient cost. We consider that there would have been considerable scope to improve the model development process. There was a distinct lack of engagement following business plan submission. What little engagement did happen was carried out through the query framework, with stringent turnaround times. Without visibility of other companies' query responses we cannot assess whether we are right to be concerned about data inconsistency.

We are also concerned that a lack of engagement may have led Ofwat to draw an inappropriate conclusion from its model results. Other companies appear to have taken surprisingly simplistic approaches to costing their storm overflow programmes, with their submission reflecting a simple cost curve. As a result, it may be tempting to conclude that the only material driver of cost is volume. However, this represents circular logic. We consider that there is a substantial risk that Ofwat has erroneously concluded that a simple unit cost is sufficient to explain costs across the industry's storm overflow programme. We are clear that this is not the case.

This section sets out more details of our observations on Ofwat's approach in its draft determination.

4.1 There are process issues with Ofwat's approach

Ofwat has modelled £10.6bn of storm overflow enhancement expenditure using very simplistic models. These have been first revealed as part of the draft determination with the only interaction with companies conducted via written queries, responses to which tended to be constrained by a two working day turnaround. This contrasts with the approach taken to base cost assessment, which was informed by engagement with industry cost assessment working groups and consultations in the lead up to both PR19 and PR24.

As a consequence of its approach, Ofwat has not collected appropriately detailed and granular high-quality data on the scheme costs and on potential explanatory variables that could explain the key underlying exogenous cost drivers. Instead, Ofwat's draft determination is reliant upon a severely limited dataset. In our view, it does not enable Ofwat's benchmarking to reasonably reflect fundamental cost drivers including urban/rural location, contaminated land, different solution types and so on. Additional engagement with the industry could have resulted in a more robust, high-quality dataset and constructive input on the underlying engineering rationale, which could have better informed Ofwat's approach[14].

For an issue of this importance and scale, it is reasonable for us to have expected that Ofwat to engage with companies during its model development process. The simplistic nature of the models indicates a lack of engagement with engineering rationale set out in section 3. It also appears to have led to issues with data quality as we discuss in the next section.

4.2 There are clear issues with data quality

We have identified clear data quality issues within the dataset Ofwat uses to set storm overflow allowances.

[14] We also note that Ofwat did not initially publish its storm overflow model calculations at DD. Instead, it published its calculations two weeks after the Draft Determinations were published in response to an inbound query. This left us with only five weeks to robustly examine Ofwat's proposals and prepare our response. Despite this, we have done what we can to present as robust an approach as possible.

4.2.1 Data appears inconsistent across the industry

Companies appear to have interpreted Ofwat's guidance in different ways. This means that Ofwat's benchmark will not be consistent across companies. For example, we have not included the equivalent storage of Pass Forward Flow solutions in our business plan submission while other companies have[15]. We note that some of the companies that have included the storage avoided by FTFT schemes within their equivalent storage data are those that are not included within Ofwat's FTFT assessment. This suggests that there is a risk that Ofwat is assessing FTFT costs inconsistently across the industry. The implication of this is that relative unit costs may appear misaligned, which risks leading Ofwat to an inappropriate conclusion on relative efficiency.

Figure 19: Companies appear to have taken different approaches to reflecting FTFT volumes in data tables

Company	Avoided FTFT storage included?	Included in Ofwat's FTFT assessment?
Anglian	Yes	No
Severn Trent	Yes	No
Welsh Water	Yes	No
Southern	Yes	Yes
South West	Unclear	Yes
Yorkshire	Unclear	Yes
Wessex	Unclear	No
Hafren	Unclear	No
UUW	No	Yes

Source: UUW analysis of other company business plans

4.2.2 The use of forecast data means there is a risk Ofwat is not assessing efficiency but cost forecasting methodology differences

Ofwat's approach to benchmarking storm overflow expenditure is based on scheme level forecast data. This means Ofwat uses the forecast cost and equivalent volumes for each scheme within its benchmark. Ofwat does not include any historical data in its regressions. The only type of historical data Ofwat considers is historical forecast data from PR19 to compare unit costs. However, it isn't clear whether the PR19 schemes have a similar range of exogenous site-specific characteristics to those within AMP8.

We do acknowledge that using forecast AMP8 costs should be legitimate. This is because the Environment Act 2021 has changed the regulatory framework surrounding storm overflows and is leading companies to intervene at overflows that were previously considered as non-cost beneficial. As such, forecast costs will better reflect cost pressures within AMP8. However, this does mean that Ofwat must account for the other issues that using forecast costs creates.

The implication of using forecast costs is that the benchmarking model is not based on observable differences in outturn efficiency between companies. Instead, the model reveals the different forecasting approaches that companies have used. Ofwat has applied a similar approach to the cost assessment of other enhancement areas but the risks inherent in this approach are greater when:

(i) the benchmark is set by a company that has adopted a simplistic approach to cost forecasting;

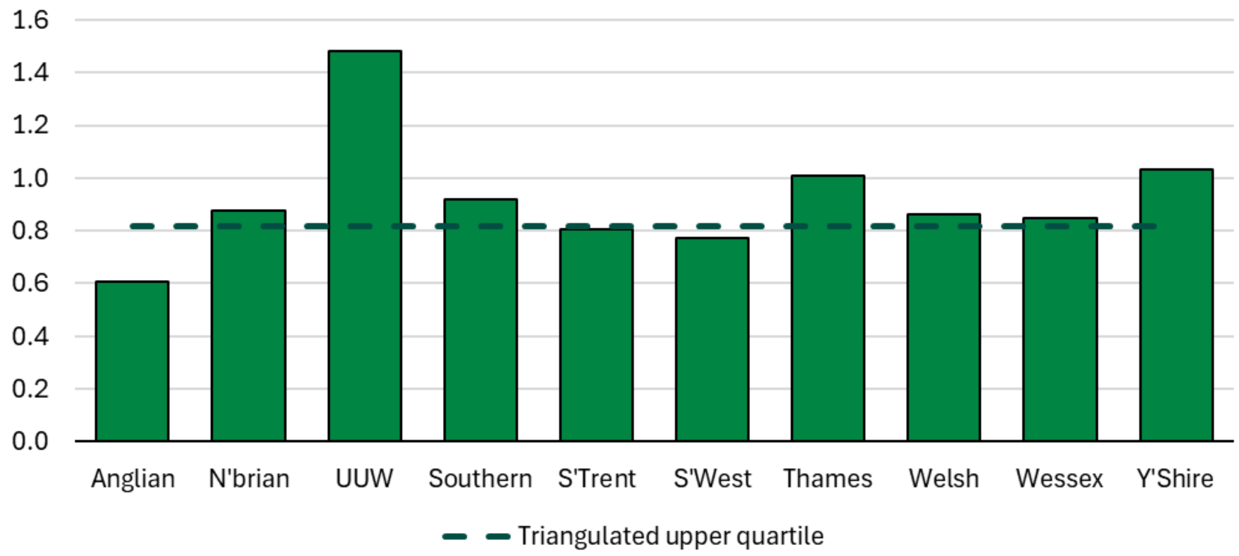
(ii) the investment programmes are inherently complex; and

(iii) companies do not have sufficient experience of a programme of this type and scale.

[15] In our further submission to OFW-OBQ-UUW-178, we provided Ofwat with our equivalent storage volumes for FTFT solutions and suggested that Ofwat could use these to ensure that it assesses FTFT and storage costs consistently across the industry. We note that Ofwat is proposing to assess FTFT separately and, as such, have not reflected the equivalent storage related to FTFT schemes in our DD submission.

All factors are relevant in the case of storm overflows. For example, Figure 20 shows the range of efficiency scores across the industry, overlaid with Ofwat's triangulated upper quartile challenge. It is clear that, under Ofwat's methodology, Severn Trent is setting the efficiency benchmark.

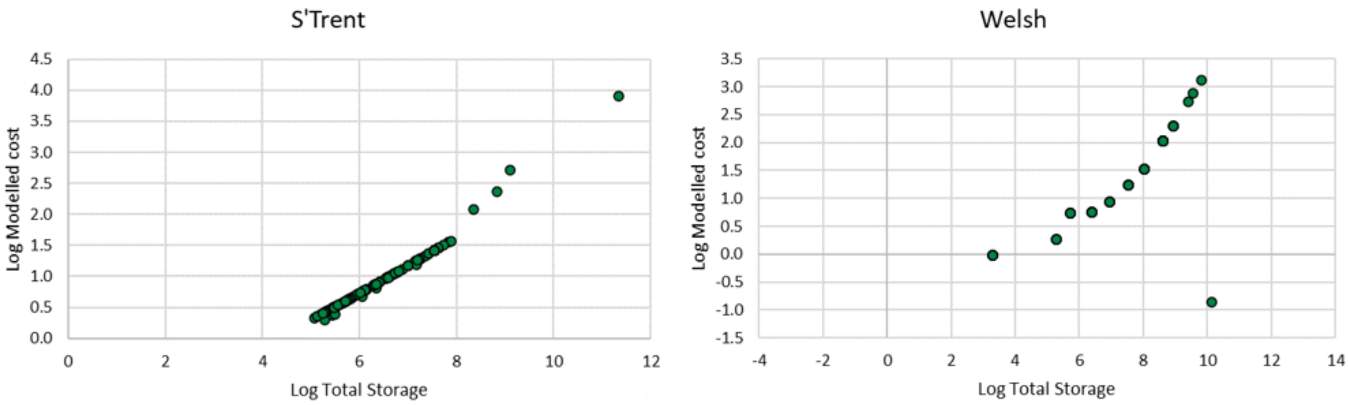
Figure 20: Severn Trent sets the upper quartile in network models



Source: UUW analysis of "PR24-DD-WW-Storm-overflows-econometric-model.xlsx"

The problems with this become apparent when considering the scheme level data submitted by different companies. Figure 21 below illustrates the cost forecasts for network schemes submitted by Severn Trent Water and Welsh Water on a log-log scale. The scatterplots show that there is almost no variation in costs other than that driven by cubic metres of storage.

Figure 21: Some companies' network storage cost estimates are clearly oversimplistic



The most likely explanation of the pattern shown in these charts is that these companies have used highly simplistic top-down methods to forecast costs by scheme with volume as the primary cost driver. While there is some limited non-scale-related variation, it would be clearly non credible to suggest that:

(i) These companies' cost estimates are materially driven by a range of exogenous cost drivers. It is clear that volume is the primary cost driver; and

(ii) the patterns set out in Figure 21 are realistic forecasts of the costs likely to be incurred at each of the sites.

In turn, these simplistic cost forecasts appear to lead Ofwat to conclude that volume is the only cost driver of relevance. For example, in its response to OFW-IBQ-UUW-008, Ofwat states:

"Some companies have no outliers and therefore we infer that the model includes all costs relating to storage solutions, including a range of ground conditions and site constraints."

We are concerned that Ofwat may not appreciate that its inference in this statement is informed by the cost forecasting methodology employed by individual companies and, crucially, not the underlying engineering rationale. Ofwat appears to suggest that the fact no companies have outliers is evidence that its model is capturing all relevant cost drivers. However, Ofwat may wish to reconsider the direction of causality inherent within its statement. We would consider a more appropriate statement to be that: its model appears to capture all relevant cost drivers because some companies have costed their schemes using a simple unit cost model – as such, mechanistically, these companies will not have any outliers **if Ofwat also aligns its cost model to a simple unit cost model**. As a result, we consider that Ofwat's approach risks being characterised as 'data fitting'.

We are clear that the relationships set out in Figure 21 do not imply that the actual costs for each scheme and site will only be driven by cubic metres of storage. Instead, it means that site-specific characteristics were not considered by these companies when developing their cost forecasts. This does not mean that site-specific factors will not drive differences in efficient costs. Equally, we must stress that this does not mean that Ofwat's model is already reflecting these site-specific factors. To suggest otherwise would appear misguided.

We accept that the simplicity of the benchmark company's approach to cost forecasting may limit the ability of forward-looking benchmarking models to reflect variation in site-specific costs. This is because the benchmark can only capture those factors that companies reflect in their costings. If, for example, some companies only use cubic metres of storage to inform their cost forecasts, any other site-specific explanatory variables are likely to be unsupported by the models. We are clear that this is not because these site-specific factors are not important cost drivers. Instead, it is because the benchmarking model is being influenced by differences in company costing methodology. As we illustrated in Figure 20, the network storage benchmark is demonstrably being set by a company that has taken a very simple approach to site-specific costing.

In any case, we would strongly reject the conclusion – which Ofwat appears to have drawn – that a simple unit cost model is already reflecting differences in site-specific costs in the presence of regional variation in exogenous factors, particularly where the benchmark company has very different concentrations of exogenous regional factors. Ofwat has not presented any evidence that suggests it has appropriately accounted for these factors when considering the reasonableness of its modelling approach.

4.2.3 Ofwat should not assume that inaccuracies will even out 'in-the-round'

Ofwat could take the view that it does not matter if companies have submitted costs based on simple equations because the inherent inaccuracy of this approach will broadly 'even out'. We do not agree with this approach for the following reasons:

- Ofwat has not presented any evidence to support its belief that top-down approaches for costing storage solutions are robust and will result in allowances sufficient to ensure programme delivery. For example, we have not seen evidence of any cross check to historical costs at schemes with similar exogenous site-specific characteristics.
- There is a strong risk that Ofwat is observing differences in forecasting approaches instead of differences in efficiency. We do not consider that this point is adequately recognised by Ofwat, especially given its view that the models capture site-specific cost drivers. Indeed, Ofwat has explicitly stated its view that the gap between UUW's business plan and the benchmark is indicative of 'inefficiency'.
- If most companies rely on a top-down method for developing costs but we use a bottom-up method that is site specific, the industry approach will not be appropriate for our costs in the case where we have a higher share of exogenous regional characteristics that drive higher costs. Section 3 presented clear evidence this is the case.

One of the remedies Ofwat could consider is how to include outturn historical data and we welcome Ofwat's indication that it will consider this for the Final Determination. However, we caution that in doing this it is important that Ofwat recognises that distribution of historical costs is likely to be skewed towards lower cost sites as – consistent with the requirements of the SOAF process used at the time - the early sites tackled were usually those that revealed a high benefit-cost ratio. This will tend to bias historical investment towards relatively lower cost sites. It will also be important to control for site-specific exogenous factors when carrying out comparisons between historical and forecast costs.

4.3 We do not consider Ofwat's modelling approach to be robust

For the network schemes, Ofwat uses a log and a linear model with storage volumes as a single explanatory variable. It reasons that the log model captures economies of scale better while the linear model captures high fixed costs for smaller schemes. Ofwat averages the results from both models. For STW[16], Ofwat uses a linear model with cubic meters of storage as the single explanatory variable. This section sets out our views on Ofwat's proposed approach.

4.3.1 Ofwat's models do not adequately explain the variation in costs

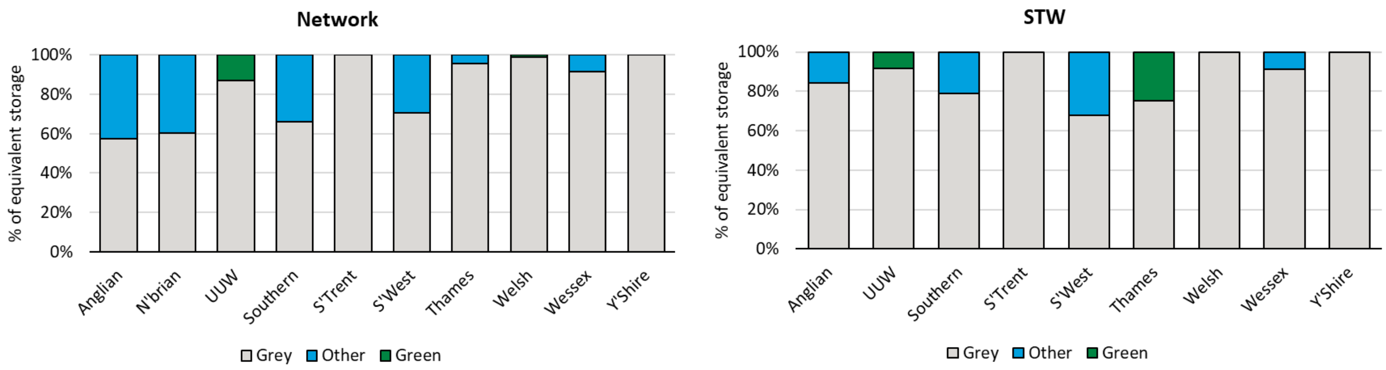
Ofwat's models have a relatively low R-squared of around 60 percent. This is particularly low for a 'total cost' model specification, which strongly suggests that there are explanatory variables missing. However, rather than working with the industry to try and understand this unexplained variation, Ofwat has made the very strong assumption that these differences can only be attributed to differences in efficiency.

In particular, Ofwat has given insufficient weight to other credible cost drivers that could explain site-specific costs. For example, it excludes all exogenous variables set out within section 3. It would be inappropriate to assume that the influence of these factors evens out 'in-the-round'. Without careful consideration and analysis, Ofwat cannot be confident that its modelling is identifying differences in efficiency between companies as opposed to differences in the distribution of these cost drivers. We presented clear evidence of variation in exogenous cost drivers in section 3. Therefore, we consider there is a risk that a simple model is leading Ofwat to incorrectly assume that UUW's exogenous variation in cost is inefficiency.

Additionally, as we discussed in section 4.2.2, we can only observe the variation in costs that companies have reflected in their simplistic forecasts. In this context, the low R-squared is particularly surprising but also likely to be understated - the dispersion in costs is likely to be much higher than that implied by top-down cost curves. Using cubic metres of storage only is therefore likely to have even less explanatory power than suggested by the models.

4.3.2 Ofwat's failure to distinguish between grey and hybrid storage will drive worse environmental outcomes

Figure 22: The industry is demonstrably delivering storage through different mixes of grey, green and other storage at hybrid schemes



Source: UUW analysis of Ofwat's dataset

[16] Sewage treatment works (STW), also known as wastewater treatment works (WwTW).

A hybrid solution uses a mix of grey storage and blue-green infrastructure to deliver spill reductions. There are clear environmental and societal benefits from implementing blue-green solutions where possible. However, Ofwat's DD approach uses a single volumetric cost driver, which reflects storage delivered through both grey and hybrid solutions. This implicitly assumes that all companies are delivering the industry average mix of grey and hybrid solutions. As discussed in section 3.6, business plan data suggests that this is not the case, as illustrated in Figure 22.

It is worth reflecting on the incentive implications of this methodological decision:

- A company that wishes to implement above average levels of hybrid solutions will be underfunded by the simplistic unit cost. This creates a clear disincentive to identify and implement additional blue-green schemes, even where it is feasible and would drive additional environmental and societal benefits.
- Conversely a company is incentivised to outperform against Ofwat's simplistic unit cost by reducing the number of hybrid schemes.

We consider that this could be characterised as a perverse incentive, which will drive poorer environmental outcomes. We also consider that this incentive is inconsistent with Defra's statement that: *"…The Environment Agency and Ofwat will work to ensure assessment processes promote and incentivise the use of nature-based solution in favour of more carbon intensive alternatives."*[17]

Companies have proposed a wide range of solution types. The optimal mix for each company will be different and will depend on a range of factors, including whether blue-green infrastructure is feasible at a specific site. As such, it appears inappropriate to assume that all companies have equivalent opportunities to deliver blue-green solutions. However, this is the effect of Ofwat's simplistic modelling approach.

Ofwat appeared to justify its approach to assessing hybrid schemes in response to OFW-IBQ-UUW-08. It said:

"As can be seen in table 1 below, prior to removing outliers, the majority of company costs where [sic] reasonably comparable between grey only and hybrid schemes, whereas green only schemes were significantly higher. This led to the decision to combine grey only and hybrid solutions into one model."

We are concerned Ofwat's conclusion that grey only and hybrid schemes are comparable in cost is inappropriate. Ofwat has accepted that green infrastructure is associated with additional costs. Therefore, simple intuition would suggest that a hybrid scheme – which includes both grey and green elements – is more expensive than a grey only scheme.

Additionally, we are concerned that data consistency issues have led Ofwat to an inappropriate conclusion. We have replicated Ofwat's table 1[18] in Table 5 below. This shows that three companies consider that hybrid schemes are cheaper to deliver than grey only schemes. We have highlighted these instances in red. It appears counter intuitive and contrary to engineering rationale for hybrid schemes to cost less than grey schemes. This appears to contradict Ofwat's approach to green-only schemes, which it accepts costs more than grey-only schemes.

We have edited Ofwat's analysis to provide a view on what the median hybrid unit cost would be if companies with counter-intuitive unit costs were removed. This demonstrates a clear increase in the cost of delivering hybrid schemes relative to grey only. If Ofwat considers it is inappropriate for us to remove ANH, NES and SVE from the sample, then it should also explain why it is consistent to expect green schemes to cost more than grey schemes, but hybrid schemes to cost less as these companies suggest.

[17] Defra (2021) *Storm Overflows Discharge Reduction Plan*. Available here: https://assets.publishing.service.gov.uk/media/631063778fa8f5448a3836e4/Storm_Overflows_Discharge_Reduction_Plan.pdf

[18] OFW-IBQ-UUW-08

Table 5: Replication of table 1 in Ofwat's response to OFW-IBQ-UUW-008

Company	Total	Only grey	Only green	Hybrid	% difference
ANH	1,758	1,796		1,480	82%
NES	5,201	4,490		2,463	55%
SWW					
SRN	3,749	2,571	22,996	3,316	129%
SVE	2,343	1,956	8,169	1,671	85%
TMS	2,892	2,980			
UUW	4,876	4,300	4,185	7,526	175%
WSH	1,394	1,376	9,108	1,511	110%
WSX	3,080	3,551	1,538		
YKY	4,887	4,607		5,476	119%
Total	3,353	3,070	9,199	3,349	109%
Median	3,080	2,980	8,169	2,463	83%
UUW edit – median excluding companies with counterintuitive hybrid unit costs					
Median excl. ANH, NES, SVE	3,415	3,266	6,647	4,396	**135%**

Source: OFW-IBQ-UUW-008

As such, we do not consider Ofwat's decision to ignore the higher efficient costs associated with hybrid schemes to be legitimate. We would support the reflection of higher costs of a hybrid scheme in its FD approach.

4.3.3 Ofwat's approach to outliers is not robust

Given the limited dispersion of data observed in the sample driven by top-down cost equations, excluding outliers means that Ofwat is removing specific schemes that may contain important information about what drives costs. While these schemes may appear as outliers when only using cubic meters as the single explanatory variable, **they may be explained by other explanatory variables**. For example, companies may have used top-down cost equations for most schemes but for schemes with specific characteristics a more detailed approach may have been used. By removing such outliers Ofwat misses the opportunity to understand what drives costs. It also reduces the information available to the model that could inform a robust benchmark. As we set out in section 5.3, this appears to be supported by empirical evidence – supplementing Ofwat's simple model with exogenous variables reduces the number of outliers.

In its response to OFW-IBQ-UUW-008, Ofwat says:

"…The storm overflow model includes a large number of schemes, so the model reflects the characteristics of an average scheme. Some schemes may be more complex and others less complex than the average scheme."

We note that Ofwat's approach to outliers means this not strictly true. The model does not reflect the costs of an average scheme. Instead, it reflects the costs of an average scheme **once outliers have been removed**. Crucially, these schemes are considered outliers by a simple model with one variable – they may not be outliers but instead might be legitimate high-cost schemes and would be recognised as such by a more robust, better specified model. As such, it is not clear to us that Ofwat's model is an appropriate benchmark for high-cost (or low-cost) schemes.

Once the outliers are removed, Ofwat's response to evidence of site-specific variation in efficient cost (e.g. contaminated land, rail infrastructure, etc) is to state that these factors are already captured by the models. However, this appears to be a value judgement rather than one based on objective evidence. We consider that the evidence of regional variation of exogenous factors presented in section 3 and evidence of data issues presented in section 4.2 demonstrates that these factors are not appropriately reflected in the benchmark.

We are clear that Ofwat has not presented the data that would enable it to be confident that its simple model is appropriately reflecting these exogenous factors and therefore, differences in the cost of efficient delivery.

Therefore, in its assessment of outliers, we consider it is important for Ofwat to be clear about the limitation of using simplistic models and reflect this as a mitigating factor in its assessment. Ofwat should recognise and address the obvious point that, by definition, for outliers that have been removed from the modelling the model predictions are irrelevant.

Finally, Ofwat's approach is to remove the same set of outliers from both the log and linear model. While we understand why Ofwat has chosen to do this, as it simplifies the approach for setting the costs for the outliers, the problem is that it undermines the modelling for the rest of the scheme. From a modelling perspective removing outliers identified from the log model from the linear model and vice versa is not appropriate, for the simple reason that an outlier in the log model outlier will not necessarily be, and often will not be, an outlier in the linear model.

4.3.4 The choice of efficiency benchmark is not justified

Ofwat uses the upper-quartile as the industry benchmark for network schemes and the median for Sewage Treatment Works (STW) schemes. The reasons for this choice are not transparent. Ofwat states that the upper quartile is chosen in line with the mid-range of the unit cost benchmarks considered but does not provide a list of these benchmarks. We suspect that Ofwat is referring to PR19 forecast data but it is not clear whether Ofwat has also considered any outturn cost data. It also isn't clear whether Ofwat controlled for the exogenous characteristics of schemes when it made this assessment. If it didn't, then we would question the validity of any subsequent conclusions.

We also consider that the explanatory power of the model is too low to support an upper quartile benchmark. For STW, Ofwat states that the median is appropriate as it is in line with engineering judgement that costs should be lower than network schemes. However, details on the engineering judgement are missing. Ofwat appears to have selected the upper quartile benchmark for network purely because the median would have been higher than the median for STW without any regard for the explanatory power of the model, the relevance of historical outturn costs or the presence of exogenous factors that might lead efficient costs to vary across the industry. As such, we do not consider that the efficiency benchmarks are justified.

4.3.5 Ofwat's approach to FTFT schemes is simplistic

As set out in section 3.6, flow to full treatment (also known as Pass Forward Flow) schemes will be increasingly required in AMP8. This is because the volume of storage required to deliver ten spills is substantial and as such, is not always feasible to build and/or operate. However, we consider Ofwat's approach to FTFT schemes to be simplistic, as set out in section 2.

We have strong concerns that the exogenous factors set out in section 3 will also lead to higher FTFT costs. As such, the efficiency challenge that Ofwat is currently applying against our FTFT costs is inappropriately high. We do not consider that Ofwat's resulting benchmark represents a realistic cost forecast.

We note that Ofwat is collecting additional data through the DD submissions to support a more robust approach to FTFT cost assessment. Ofwat should bear in mind the exogenous factors we have set out in section 3 when considering company submissions.

As we set out in section 4.2.1, we continue to consider that companies have included equivalent volumes relating to FTFT schemes in their cost driver data. We believe it is important for Ofwat to appropriately investigate whether this is a risk because this will likely lead to inconsistent cost assessment and an unrealistic benchmark.

5. UUW has identified model improvements that better reflect exogenous drivers of storm overflow cost

This section considers how the limitations of Ofwat's approach highlighted in Section 4 could be addressed by better reflecting the exogenous cost drivers identified in Section 3.

Some of the data necessary for model improvements is already available to Ofwat. However, in some cases this data is not available within Ofwat's dataset. Therefore, we have sourced and developed variables that capture the scheme-level variation in exogenous regional factors we identified in section 3. We have then tested these variables within an expanded version of Ofwat's model.

As discussed in section 4.2.2, the simplistic approach taken to scheme-level cost forecasting by some companies will limit the effectiveness of attempting to include additional variables within a benchmarking model. This fact will need to frame how Ofwat perceives the results presented in this section. However, our analysis suggests that there is enough site-specific variation to support an approach that considers a wider range of cost drivers. As such, we have been able to develop a series of models that support our hypothesis that the regional factors identified in section 3 influence variation in scheme-level costs.

The output of these models is set out in Table 6. This shows that recognition of exogenous factors results in a higher allowance for UUW, while keeping Ofwat's efficiency challenge assumptions constant for transparency (we set out our reservations about Ofwat's chosen efficiency benchmarks in section 4.3.4). We consider that the lack of data for some exogenous factors will mean that the modelled estimates set out in Table 6 are actually understating the efficient costs of delivering a storm overflow programme in an area with UUW's characteristics.

Table 6: Summary of UUW's modelling adjustments (maintaining Ofwat's catch-up efficiency challenges)

			Network		STW		
	Total	**Total net of outliers**	**Modelled**	**Outliers**	**Modelled**	**Outliers**	**FTFT**
Ofwat	**1,523**	1,272	904	145	223	106	146
Range of allowances from updated models							
Lower bound*	**1,554**	1,434	923	68	262	52	147
Mean	**1,748**	1,507	1,011	130	330	110	166
Upper bound*	**2,003**	1,584	1,209	246	399	174	190

**The 'total' lower bound is the minimum allowance implied by one of the model specifications when used for both network and STW modelled costs, outliers, and FFT. Hence, it is higher than the sum of the lower bounds of the individual components. Similarly, for the 'total' upper bound, which is lower than the sum of the individual components.*

We have re-calculated the allowances following Ofwat's approach. We used Ofwat's upper quartile efficiency benchmark for network and median efficiency benchmark for STW. Our outlier allowance is a conservative estimate based on Ofwat's assessment of outliers deemed to be with 'significant concern'. For the avoidance of doubt, we have adopted Ofwat's methodology for transparency. This should not be interpreted as our acceptance of its legitimacy.

Source: UUW analysis

We recognise that Ofwat may be unwilling to adapt its models in response to our representations. However, we are clear that the results presented in this section represent strong evidence its simple unit cost models are understating the efficient costs of delivering UUW's storm overflow programme. As such, we consider that the model evidence presented in this section should support Ofwat's recognition that its view of efficient cost provided at DD is unrealistically low.

5.1 Exogenous cost drivers considered by UUW

Section 3 set out a range of exogenous cost drivers that influence the efficient costs of delivering the storm overflow programme. We consider that all these factors will affect efficient scheme-level costs. However, it is not practical to reflect all these variables within a benchmarking model due to data availability.

Table 7: Exogenous factors considered for use in modelling by UUW

Exogenous factor	Considered for modelling?	Reason
Urban/post-industrial sites	Yes	Scheme-level data publicly available.
Rurality	Yes	Scheme-level data publicly available.
Environmental complexity	No	Scheme-level data unavailable. Suitable for deep dive.
Planning complexity	No	Scheme-level data unavailable. Suitable for deep dive.
Diseconomies of scale	Yes	Scheme-level data available within Ofwat's dataset.
Local complicating factors	No	Scheme-level data unavailable. Suitable for deep dive.
Ground hardness	Yes	Scheme-level data publicly available.
Geology	No	Scheme-level data available but we could not verify its robustness in the time available. Suitable for deep dive.
Mine workings	No	Scheme-level data unavailable. Suitable for deep dive.
Excavated volume	No	Scheme-level data unavailable. Suitable for deep dive.
Contaminated ground	No	Scheme-level data unavailable. Suitable for deep dive.
Storage type	Yes	Scheme-level data available within Ofwat's dataset.
Screens	Yes	Scheme-level data available within Ofwat's dataset.
Potential evapotranspiration	No	Scheme-level data unavailable. Suitable for deep dive.

Source: UUW analysis

5.2 How UUW sourced additional data to support modelling

Ofwat's storm overflow dataset is relatively limited in scope. As a general point, we believe that information could be gathered to allow Ofwat to take advantage of the much larger sample size created by scheme-level modelling. It is may have not been possible to do this in the context of the time pressures Ofwat is under during the price review process.

As such, UUW has been able to source data that reflects a subset of the scheme-level variation in exogenous cost drivers set out in section 3. We have then supplemented Ofwat's dataset with our additional data. This section sets out the process we followed to identify, gather and incorporate this additional data into our revised models.

The dataset used by Ofwat does not contain the site location. However, the site geographical coordinates can be found in the National Storm Overflows plan for England dataset[19] for English schemes. This meant we were able to match the two datasets by scheme name. We were not able to identify the location of the Welsh schemes in the time available to us in preparing this representation.

In some instances, we found that the scheme names did not match exactly. In those cases, we applied some simple and pragmatic rules to match the names of the schemes (e.g. removing special characters). By doing this we managed to match most of the schemes in England. The overall match rate by company is set out in Table 8. We note that we were unable to match any Welsh Water datapoints in the time we have available. However,

[19] WaterUK (online) National Storm Overflows Plan. Available here: https://www.water.org.uk/sites/default/files/2024-07/National%20Plan%20Data%20-%20updated.xlsx

given that all other companies have substantial representation within the dataset we consider that the supplemented dataset will still reflect a broad range of regional characteristics.

Table 8: Matching success rate between Ofwat's DD dataset and WaterUK's National Storm Overflows Plan dataset

	Network schemes			*STW schemes*		
	Full sample	**Density**	**Soil hardness**	**Full sample**	**Density**	**Soil hardness**
ANH	101	95	85	79	76	71
NES	128	128	128			
NWT	352	346	338	65	65	62
SRN	141	140	115	64	44	34
SVE	146	139	139	75	75	75
SWB	204	186	131	38	38	34
TMS	46	36	36	27	27	27
WSH	109	0	0	28	0	0
WSX	69	69	60	23	23	17
YKY	174	153	150	10	0	0
Total	**1,470**	**1,292**	**1,182**	**409**	**348**	**320**
% of sample matched	**100%**	**88%**	**80%**	**100%**	**85%**	**78%**

Source: UUW analysis

This has allowed us to supplement Ofwat's dataset with geographical-based data, which means we are able to test a subset of the exogenous drivers of scheme-level cost within a benchmarking model. We set out what data we used and where we sourced it from in the following sections.

Urbanicity and rurality data

The engineering rationale discussed in section 3 expected a u-shaped relationship between urbanicity and rurality i.e. the most urban areas and the most rural areas would be associated with higher costs on average. We considered what data would best support this rationale within a benchmarking model.

The Office for National Statistics publishes the Rural Urban Classification (RUC). This sets out a classification of a local area depending upon whether the land cover of the area, including how urban or rural it is. More information on the RUC can be found here[20]. UUW provided an explanation of the RUC in its business plan[21]. We used the longitude and latitude information to capture the RUC for each overflow.

As section 3.2 indicated, UUW is a significant outlier in the most rural category. This creates a risk that using the RUC data creates a dummy variable effect that risks introducing company-specific bias into the model. For example, a categorical RUC variable may pick up inefficiency rather than the underlying exogenous cost driver. To mitigate this risk, we used population density with a squared term to reflect the u-shaped relationship between density and cost expected by engineering rationale. Population density at a Lower-layer Super Output (LSOA) layer was sourced from the ONS to enact this methodology.

[20] ONS (online) 2011 rural/urban classification. Available here: https://www.ons.gov.uk/methodology/geography/geographicalproducts/ruralurbanclassifications/2011ruralurbanclassification

[21] UUW44 (2023) *Drainage cost adjustment claim, Appendix F.* Available here: https://www.unitedutilities.com/globalassets/z_corporate-site/pr24/supplementary-documents/uuw44r.pdf

Diseconomies of scale

This data exists in Ofwat's dataset. We test whether costs increase exponentially as tank size increases using a squared volume term. This type of relationship is evident in companies' submissions and aligns with the engineering rationale that bigger tanks can be associated with diseconomies of scale.

Soil hardness

We sourced information on soil hardness from the British Geological Survey (BGS)[22]. This data has geographical identifiers which allowed us to map it into the storm overflow dataset. The dataset includes four different categories of soil hardness: soft, medium-soft, medium-hard and hard. As shown in Table 9, there are a relatively small number of observations in the 'hard' category. As such, we combined the medium-hard and hard categories when modelling.

Table 9: Soil hardness across the industry

	Soft	Medium soft	Medium hard	Hard
ANH	92	51	4	9
NES	0	94	30	4
NWT	0	231	158	11
SRN	77	39	0	33
SVE	0	162	37	15
SWB	2	107	53	3
TMS	43	16	2	2
WSX	19	45	12	1
YKY	2	117	20	8
Total	**235**	**862**	**316**	**86**
Variable name	*None (constant)*	*Dummy soft medium soil*	*Dummy medium-hard soil*	

Source: British Geological Survey

Storage type

This data is captured in Ofwat's dataset, which splits out equivalent storage into 'grey', 'green' and 'other'. This allows the creation of a model specification which reflects the storage type.

Screens

This data is collected in the dataset Ofwat published two weeks after the DD publication. However, it performs poorly suggesting underlying issues with Ofwat's dataset. We do not consider screens further as part of this section, although we are clear that it drives additional efficient costs and should be reflected in some form in Ofwat's FD.

5.3 UUW modelling results

We estimate a range of alternative models for grey network and STW schemes by including the additional explanatory variables mentioned above. We compared:

- The goodness of fit of the models. We used three commonly used measures of goodness of fit: Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), and adjusted R-squared. The use of a wide range of goodness of fit metrics provides additional confidence that our models do improve model robustness.

[22] British Geological Survey (online) BGS Geology 250k. Available here: https://www.bgs.ac.uk/datasets/bgs-geology-250k/

- Whether the estimated coefficients have the expected sign and magnitude and are statistically significant.

We estimated these models on the largest sample possible, without removing any potential outliers. This is because the inclusion of additional explanatory variables is likely to be able to explain some of the variation in costs that Ofwat's models are not able to. As mentioned in section 5.3, we were only able to match a subset of all network and scheme type with soil hardness and density. Therefore, when comparing the performance of these models with Ofwat's model specification, we have re-estimated Ofwat's model on the same subset.

We find that most of our alternative models perform better than Ofwat's models and the estimated coefficients have the expected sign and magnitude and tend to be statistically significant. Again, we recognise the data limitations that we are working with. If more companies had used a bottom-up approach to forecasting scheme costs, we would expect to be able to produce a more robust model.

Our key findings are the following:

- **Mix of solutions.** Models that reflect a mixture of different storage types fit the data better than Ofwat's model across all measures of goodness of fit which we have considered. The coefficients have the expected sign and magnitude, with green storage found to be generally more expensive than grey storage, which aligns with engineering rationale.
- **Urban/rural location.** As engineering rationale suggests, we find a U-shaped relationship between costs and urbanity and rurality. Models with density included perform better than Ofwat's models on at least two of the three measures of goodness of fit, except the linear model for network which perform worse across the three measures.
- **Soil hardness.** Models with soil hardness perform better than Ofwat's models across all three measures of goodness of fit, except the network linear model where two of the three measures are better. The coefficients have the right sign and tend to be statistically significant.
- **Storage squared in log models**. Log models with storage squared perform better than Ofwat's models and the estimated coefficients have the expected sign and magnitude.

We also find that it is possible to combine a number of these factors in the same model.

Table 10 summarises how our models compare to Ofwat's model specification. It is clear that our updated models are associated with better goodness of fit, align to engineering rationale and tend to be statistically significant.

Table 10: Comparison of UUW's models with Ofwat's model specification

		Network		STW	
		Linear	Log	Linear	Log
Number of goodness of fit measures for which alternative model is better (AIC, BIC, adjusted R2)	Storage squared	Not estimated	3	Not estimated	3
	Mix of solutions	3	3	3	3
	Density	0	2	3	2
	Soil hardness	2	3	2	2
Are estimated coefficients of expected sign and magnitude?	Storage squared	Not estimated	Yes	Not estimated	Yes
	Mix of solutions	Yes	Yes	Yes	Yes
	Density	Not significant	Yes	No	Yes
	Soil hardness	Yes	Yes	Partially (not all dummies statistically significant)	Yes

Best combination identified	Mix of solutions, soil hardness	Mix of solutions, storage squared	Mix of solutions, soil hardness	Mix of solutions, storage squared, density

Source: UUW analysis

We now present model results from different model specifications and provide a comparison with Ofwat's model. As discussed in section 5.2 due to issues with data matching, we modelled using a subset of observations. Therefore, when comparing the performance of these models with Ofwat's model specification, we have re-estimated Ofwat's model on the same subset to ensure the fit improves by including these variables.

We have estimated models across separate samples for density ('density subsample') and soil hardness ('soil hardness subsample'). This is because the sample size when soil hardness is included is smaller than the sample size with population included as the 'soil hardness' dataset had some missing information. Models that use information already contained with Ofwat's dataset are estimated on the 'full sample' i.e. Ofwat's data. As previously stated, the results from Ofwat's simple model are re-estimated using the data sample in question to enable consistent comparison.

We estimated these models on the largest sample possible, without removing any potential outliers. This is because the inclusion of additional explanatory variables is likely to be able to explain some of the variation in costs that Ofwat's models are not able to. However, when calculating subsequent modelled allowances, we did adopt Ofwat's approach to excluding outliers to ensure consistency. For the avoidance of doubt, this does not mean we support this element of the methodology.

We present the following results:

- Table 11 contains model results from linear network specifications;
- Table 12 contains model results from log network specifications;
- Table 13 contains model results from linear STW specifications[23]; and
- Table 14 contains model results from log STW specifications.

[23] Ofwat does not include a network linear model at DD, though we consider the evidence of diseconomies of scale may justify a linear specification. As such, we present results for a network linear specification here.

Table 11: UUW model specifications (network linear models)

	Full sample		Density subsample		Soil hardness subsample		
	Ofwat	**Mix of solutions**	**Ofwat**	**Density**	**Ofwat**	**Soil hardness**	**Combination**
Total storage	0.001***		0.001***	0.001***	0.001***	0.001***	
Grey storage		0.001***					0.001***
Green storage		0.008***					0.008***
Other storage		0.003***					0.001***
Population density				-0.000			
Population density^2				0.000			
Dummy soft medium soil						0.683**	0.517
Dummy medium-hard soil						0.958***	0.704**
Constant	2.416***	2.301***	2.435***	2.495***	2.747***	2.081***	2.126***
Number of observations	1,470	1,470	1,292	1,292	1,182	1,182	1,182
AIC	8,591	8,148	7,618	7,621	6,483	6,480	6,425
BIC	8,601	8,169	7,628	7,642	6,494	6,500	6,455
Adjusted R2	0.433	0.581	0.446	0.446	0.381	0.384	0.413

Source: UUW analysis based on Ofwat's dataset and publicly available data.

Table 12: UUW's model specifications (network log models)

	Full sample				Density subsample		Soil hardness subsample	
	Ofwat	**Storage squared**	**Mix of solutions**	**Combination**	**Ofwat**	**Density**	**Ofwat**	**Soil hardness**
ln(Total storage)	0.386***	0.169***	0.386***	0.137***	0.387***	0.388***	0.376***	0.383***
ln(Total storage)^2		0.020***		0.023***				
Proportion grey storage			0.267***	0.287***				
Proportion green storage			1.062***	1.163***				
ln(Population density)						-0.182**		
ln(Population density)^2						0.015**		
Dummy soft medium soil								0.401***
Dummy medium-hard soil								0.491***
Constant	-1.338***	-0.820***	-1.592***	-1.020***	-1.335***	-0.808***	- 1.261***	-1.669***
Number of observations	1,470	1,470	1,470	1,470	1,292	1,292	1,182	1,182
AIC	2,922	2,886	2,863	2,814	2,656	2,655	2,394	2,332
BIC	2,932	2,902	2,885	2,841	2,667	2,676	2,404	2,352
Adjusted R2	0.523	0.535	0.542	0.557	0.493	0.494	0.483	0.51

Source: UUW analysis based on Ofwat's dataset and publicly available data.

Table 13: UUW's model specifications (STW linear models)

	Full sample		Density subsample		Soil hardness subsample		
	Ofwat	**Mix of solutions**	**Ofwat**	**Density**	**Ofwat**	**Soil hardness**	**Combination**
Total storage	0.001***		0.001***	0.001***	0.001***	0.001***	
Grey storage		0.001***					0.001***
Green storage		0.009**					0.010**
Other storage		0.001***					0.001***
Population density				0.002*			
Population density^2				-0.000			
Dummy soft medium soil						0.192	0.122
Dummy medium-hard soil						2.149**	2.261**
Constant	3.182***	2.908***	3.452***	2.648***	3.134***	2.523***	2.353***
Number of observations	409	409	348	348	320	320	320
AIC	2,617	2605	2,269	2255	1,993	1989	1987
BIC	2,625	2622	2,276	2271	2,000	2004	2010
Adjusted R2	0.618	0.63	0.617	0.633	0.624	0.631	0.635

Source: UUW analysis based on Ofwat's dataset and publicly available data.

Table 14: UUW's model specifications (STW log models)

	Full sample			Density subsample			Soil hardness subsample	
	Ofwat	**Storage squared**	**Mix of solutions**	**Ofwat**	**Density**	**Combination**	**Ofwat**	**Soil hardness Log**
ln(Total storage)	0.545***	0.131	0.574***	0.540***	0.530***	0.239*	0.516***	0.506***
ln(Total storage)^2		0.031***				0.024***		
Proportion grey storage			-0.095			-0.005		
Proportion green storage			2.330***			2.364***		
ln(Population density)					-0.567***	-0.395**		
ln(Population density)^2					0.056***	0.042**		
Dummy soft medium soil								0.225**
Dummy medium-hard soil								0.288**
Constant	-2.658***	-1.363***	-2.840***	-2.596***	-1.204**	-0.947	- 2.451***	-2.577***
Number of observations	409	409	409	348	348	348	320	320
AIC	861	850	790	749	743	673	678	675
BIC	869	862	806	756	758	700	685	690
Adjusted R2	0.626	0.636	0.687	0.600	0.609	0.683	0.579	0.585

Source: UUW analysis based on Ofwat's dataset and publicly available data.

We are clear that this modelling evidence supports the engineering rationale set out in section 3. The added variables are generally of an intuitive sign and statistically significant. This is despite the data issues highlighted in section 4.

As expected, we also find that the number of outliers identified by Cook's statistic reduces on average across UUW's model specifications, relative to Ofwat's DD model suite. This is shown in Table 15. This is demonstrable evidence that Ofwat's simple model is not recognising underlying engineering rationale that would support a different efficient benchmark.

Table 15: UUW's models result in less outliers relative to Ofwat's DD approach

	Network (linear)	Network (log)	STW (log)
Ofwat	42	102	33
Storage squared	n/a	84	23
Mix of solutions	54	105	24
Density	40	86	21
Soil hardness	33	86	22
Combination	42	98	22
UUW average	**42**	**92**	**22**

Source: UUW analysis based on Ofwat and publicly available data

As such, we do not consider that it is legitimate for Ofwat to claim that its simple model already reflects the exogenous factors that lead efficient costs to vary across sites and companies. The weight of evidence presented in section 3, section 4 and section 5 would suggest that Ofwat's approach is excluding the impact of exogenous factors. This means that the efficient cost of delivering spill reductions at storm overflows in UUW's region is understated by Ofwat's simplistic approach.

The reduction of outliers within a more comprehensive model suite also demonstrates that Ofwat's removal of outliers prior to estimating the model used to calculate allowances for outliers will tend to systematically understate the efficient costs of delivering complex schemes. This is because these schemes are not spurious outliers but are genuinely complex due to their set of exogenous circumstances. As such, their removal from the dataset isn't removing a spurious datapoint - it is removing relevant information that should rightly be reflected in the benchmark.

5.4 UUW's model specifications show that efficient costs are substantially higher than Ofwat's simple model suggests

We have applied Ofwat's approach to re-calculate the allowances for all the companies for both network schemes, STW schemes, and FFT. We have done so by re-estimating the models presented in the previous section after removing the outliers. We used Ofwat's approach to identify the outliers and applied the same benchmark challenge based on the upper quartile and median for network and STW schemes, respectively, for consistency. For the avoidance of doubt, this is for consistency only at this stage and should not be interpreted as our acceptance of this element of Ofwat's methodology.

We have estimated a conservative allowance for outliers by setting it equal to the predicted costs from the model in line with Ofwat's treatment of outliers where it found 'severe concerns'. For clarity, this is for transparency and does not represent our acceptance of the legitimacy of this approach. We set out our representations on Ofwat's approach to outliers in section 4.3.3.

The tables and figures below summarise the allowances for UUW across grey network, STW, and FFT schemes across the range of models we have estimated. Overall, we find that Ofwat's models imply a materially lower cost allowance than the allowance calculate from the range of UUW's improved models. In particular, our allowances with the revised models are c. £162m-£312m[24] higher than the allowance estimated by Ofwat of £1,523m[25], maintaining Ofwat's assumptions on catch-up efficiency for transparency.

Table 16: Summary of UUW's modelling adjustments (with Ofwat's catch-up efficiency assumptions)

			Network		STW		
	Total	**Total net of outliers**	**Modelled**	**Outliers**	**Modelled**	**Outliers**	**FTFT**
Ofwat	1,523	**1,272**	904	145	223	106	146
Range of allowances from updated models							
Lower bound*	1,554	**1,434**	923	68	262	52	147
Mean	1,748	**1,507**	1,011	130	330	110	166
Upper bound*	2,003	**1,584**	1,209	246	399	174	190

**The 'total' lower bound is the minimum allowance implied by one of the model specifications when used for both network and STW modelled costs, outliers, and FFT. Hence, it is higher than the sum of the lower bounds of the individual components. Similarly, for the 'total' upper bound, which is lower than the sum of the individual components.*

We have re-calculated the allowances following Ofwat's approach. We used Ofwat's upper quartile efficiency benchmark for network and median efficiency benchmark for STW. Our outlier allowance is a conservative estimate based on Ofwat's assessment of outliers deemed to be with 'significant concern'. For the avoidance of doubt, we have adopted Ofwat's methodology for transparency. This should not be interpreted as our acceptance of its legitimacy.

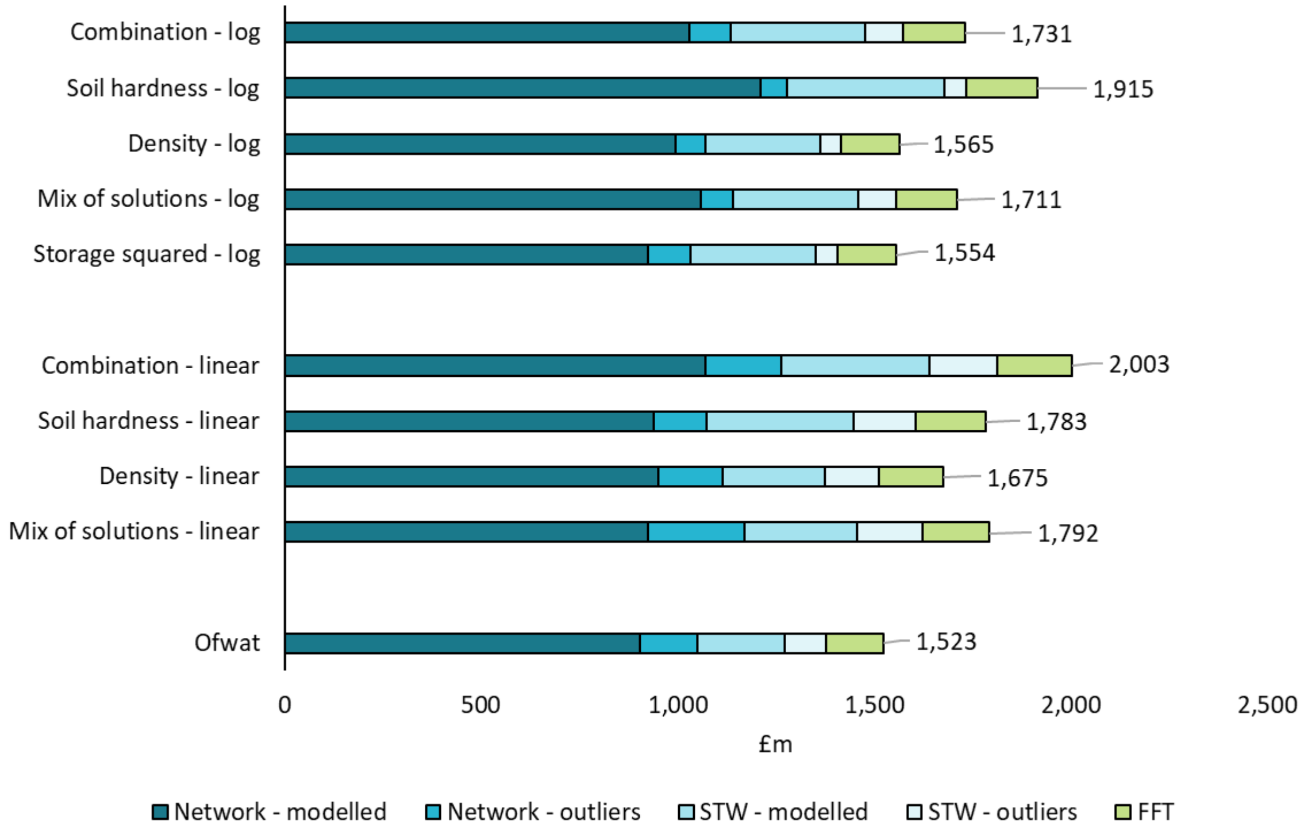
Source: UUW analysis using Ofwat and publicly available data

Figure 23: shows the allowances from the different model specifications used in UUW's model suite. Again, note these figures maintain Ofwat's catch-up efficiency challenges of upper quartile for network schemes and median for STW schemes.

[24]Calculated as the difference between Ofwat's allowance and the allowance implied from the density linear model and the linear model which includes a combination of variables.

[25]We also note that Ofwat's allowance for UU across the grey network, STW, and FFT scheme of c. £1,523m (excluding green schemes and Advanced WINEP and Eccles scheme) compares to the total costs assessed by Ofwat in this way of c. £3,030m.

Figure 23: Comparison of allowances for grey network, STW and FTFT schemes across UUW's different model specifications (maintaining Ofwat's catch-up efficiency challenges for transparency)



Source: UUW analysis

5.5 Ofwat should make a UUW-specific uplift to modelled allowances

Our assessment of Ofwat's approach to setting cost allowances for storm overflow enhancement has identified both data and methodological limitations. These problems mean that Ofwat's allowance does not reflect efficiency differences between companies but instead highlights different concentrations of exogenous factors and cost forecasting approaches across the industry.

However, data and time constraints mean that we are not in a position to implement a complete remedy. Again, we note that had it been possible for Ofwat to follow an approach to storm overflow cost assessment similar to that adopted for base cost model development, we (and other companies) may have had more opportunity to work constructively to develop a robust and more widely understood modelling approach. As it is, we have been obliged to work with the data that is available and the time that we have and within that constraint we have identified a number of modelling improvements that mitigate some of the issues identified.

We consider that the evidence set out in section 3 demonstrates that UUW's region is characterised by a series of exogenous factors that make delivering storage solutions generally more expensive. We consider this is the case whether a scheme is identified by Ofwat as an outlier or not i.e. UUW's costs will generally be higher relative to other companies operating in more benign areas. Indeed, this is supported by the modelling evidence presented in section 5.

As such, we consider that Ofwat's simplistic model will understate the efficient costs of delivering storage solutions for all UUW schemes, including those not identified as an outlier by Ofwat. We recognise that Ofwat may not find it agreeable to make a model change that affects benchmarks across the entire sector. However, that does not mean it is legitimate for Ofwat to continue to claim that its presented model is capable of reasonably reflecting scheme-level cost variations or provides an average allowance that balances out these site-specific variances 'in-the-round' across the industry.

Ofwat's assertion that its model is sufficient to explain storage costs for all companies rests on the assumption that exogenous factors that affect scheme-level costs are evenly distributed across the industry. The weight of evidence presented in section 3, section 4 and section 5 demonstrates that this is not the case.

As such, we consider that Ofwat should make a UUW-specific upwards adjustment to modelled allowances. This upwards adjustment will reflect the exogenous regional characteristics highlighted by UUW within its representation. The models developed by UUW provide a transparent way to inform this adjustment. A UUW-specific uplift also addresses Ofwat's concerns over an approach that provides a generalised uplift for storm overflow allowances across the industry. This uplift should form two parts:

(1) Accept the model improvements identified by UUW by reflecting the mean of the model improvements identified in Table 16 (£1,964m).

(2) Relax the catch-up efficiency challenge for network schemes, in recognition that the model is still not reflecting a significant number of the exogenous factors identified within section 3.

The net result of these two adjustments is set out in Figure 24: . We are also proposing a further adjustment for our deep dive schemes, which we set out in section 6 - this adjustment will represent an incremental addition to the increase set out in Figure 24: .

Figure 24: The impact of UUW's proposed UUW-specific uplift to modelled allowances

£m, 2022-23 CPIH	Total	Network		STW		FFT
		Modelled	Outliers	Modelled	Outliers	
Ofwat	1,523	904	145	223	106	146
Revised allowance						
Lower bound*	1,622	996	82	262	52	153
Mean	**1,964**	1,191	154	330	110	180
Upper bound*	2,398	1,548	282	399	174	215

**The 'total' lower bound is the minimum allowance implied by one of the model specifications when used for both network and STW modelled costs, outliers, and FFT. Hence, it is higher than the sum of the lower bounds of the individual components. Similarly, for the 'total' upper bound, which is lower than the sum of the individual components.*

We have re-calculated the allowances following Ofwat's approach. We relaxed Ofwat's upper quartile efficiency benchmark to median for network and median efficiency benchmark for STW. Our outlier allowance is a conservative estimate based on Ofwat's assessment of outliers deemed to be with 'significant concern'.

Source: UUW analysis

We also consider a further adjustment relating to the effect of groundwater, mine workings and geology is appropriate. These factors are not reflected in our updated model, but our experience suggest that these factors drive significant additional cost. We have estimated the additional cost relating to these factors net of the implicit allowance provided in Ofwat's benchmark as £152m. We add this value to our modelled network allowance for simplicity and because this is where such costs are most likely to be incurred. We note the resulting value is well within the upper bound of £2,398m established by our modelling and is likely to be higher due to the factors we have not been able to quantify. There is no overlap with the deep dive schemes.

The resulting changes to allowances relative to Ofwat's DD is set out in Table 17. This shows the uplift across network, STW and FTFT schemes. Note this includes the uplift to modelled allowances for schemes assessed using Ofwat's model and through Ofwat's deep dive. We include deep dive schemes because the modelled allowance acts as the default allowance under Ofwat's methodology. Therefore, any subsequent increase to allowances reflected as part of Ofwat's deep dive would be made via an additional uplift to this modelled allowance, as we discuss in section 6. The FTFT allowance increases because the efficiency gap Ofwat uses to inform FTFT cost assessment reduces as a result of the model improvements identified by UUW.

Table 17: How Ofwat should uplift UUW's modelled allowance

Value (£m, 2022-23 CPIH)	Network	STW	FTFT	Total
Ofwat DD	1,049	328	146	1,523
UUW DD adjustment	1,496	440	180	2,116
Increase	**447**	**112**	**34**	**593**

Source: UUW analysis

Section 6 sets out additional evidence on the schemes Ofwat assesses as part of its deep dive process. This section argues that the costs for these schemes should be recognised as efficient by Ofwat and as such, UUW's business plan costs should be accepted in full. This would represent a further increase relative to the increase set out in Table 17, as per Ofwat's methodological approach to deep dive assessment.

Additional evidence of cost efficiency for schemes assessed by Ofwat's simple model

In recognition that Ofwat may require additional evidence, beyond UUW's model improvements, to provide evidence for an uplift of the cost allowance, we have sought to provide Ofwat with additional assurance that the exogenous factors reflected within UUW's updated models are having an appreciable scheme-level impact on costs. In particular, we provide compelling evidence on how the factors included within our models manifest in site-specific cost pressures that align with engineering rationale.

As part of this, UUW has provided additional deep dive evidence on 90 schemes that are assessed using Ofwat's simple model approach. The additional evidence of cost efficiency at these schemes is set out within '*UUWR_10.01*' to '*UUWR_10.90*' inclusive. More information on how UUW has structured this evidence is set out in section 6. This additional deep dive evidence supplements further evidence we are providing on the 30 schemes assessed as part of Ofwat's deep dive process. We provide further information on this evidence in section 6.

We believe that this provides Ofwat with sufficient evidence that the updated allowances reflected in UUW's updated model suite reflect the underlying engineering rationale highlighted in section 3 and are not reflective of company-specific effects.

6. Additional evidence of scheme-level cost efficiency

Section 3 identified exogenous drivers of scheme-level costs, while section 5 set out how a sub-set of these factors could be incorporated into a model specification. These models suggest that these exogenous drivers do impact efficient scheme-level costs.

We acknowledge that it has not been possible to reflect all these exogenous drivers within a model specification due to data availability. We also acknowledge that these model specifications were estimated on a subset of Ofwat's data, again due to data availability (however, we do note that the sample coverage was high – over 80 percent). As such, we accept that Ofwat may not consider it feasible to update its modelling approach for FD.

However, this doesn't mean that it would be reasonable for Ofwat to assume site-specific factors don't drive differences in efficient cost across schemes and companies or that Ofwat's models already reflect variation in efficient costs. Indeed, as the previous sections have shown, we have been able to identify relatively straightforward changes in a short period of time that objectively improve the performance of the models.

As such, we consider that Ofwat should evolve its overall approach for FD. We have presented clear evidence of exogenous regional factors that will increase the efficient cost of delivering spill reductions within UUW's region. However, in recognition that it may be unlikely Ofwat will develop and consult upon a more robust model in time for FD, we have provided additional bottom-up information that sets out efficient costs above and beyond the level implied by Ofwat's simple unit cost model.

This section sets out additional evidence that will allow Ofwat to feel more confidence in making an out-of-model adjustment to UUW's storm overflow cost allowance, either through its deep dive process or through a wider general uplift. We frame this evidence using the exogenous cost drivers we have identified in the preceding sections.

6.1 Ofwat's deep dive

Ofwat identifies outlier schemes using Cook's Distance. This statistic revealed that 30 of UUW's schemes were considered as outliers. Ofwat sought additional information on the cost efficiency of these schemes within OFW-OBQ-UUW-178. UUW provided as complete a response as feasible within the tight turnaround time imposed by the query. This response was used by Ofwat to inform its deep dive assessments. None of our evidence was considered acceptable by Ofwat.

We now understand that through this query, Ofwat was looking for evidence that the site-specific factors at each site were not captured by its benchmarking model. We would question whether it was reasonable to expect companies to be able to answer this question without having visibility of Ofwat's model. Regardless, Ofwat does not appear to have considered this issue as a mitigating factor in its assessment.

We have sought to expand the evidence we provided in response to OFW-OBQ-UUW-178. The remainder of section 6 sets out the framework we used to codify this additional evidence, with particular emphasis on the exogenous factors highlighted in section 3. We also provide evidence that suggests the implicit allowance provided by Ofwat's model is not sufficient to reflect the site-specific variation in efficient costs caused by regional exogenous factors.

As discussed in our further response to OFW-OBQ-UUW-178, we have reduced costs at three schemes. These are:

- 08UU101285-Carleton Hall Templebank CSO EDE0116SO
- 08UU101184-Adj to No. 6 Talke Road CON0020SO
- 08UU101237-WADDINGTON WwTW 017160048ST

As such, these are not included within our deep dive evidence. We refer to 27 schemes in the remainder of our deep dive evidence.

6.2 Our deep dive framework

We have related the challenges faced at each of the 30 sites back to the exogenous factors we highlighted in section 3. For each of the 27 sites, we indicate whether that site is affected by one of the exogenous factors. Where feasible, we have also reflected how much additional cost this has driven at a site level. Table 18 sets out the different exogenous factors considered as part of our additional deep dive evidence. We have also considered a series of indicators that are linked to each exogenous factor. For example, environmental designations such as SSSI indicate atypical environmental complexity.

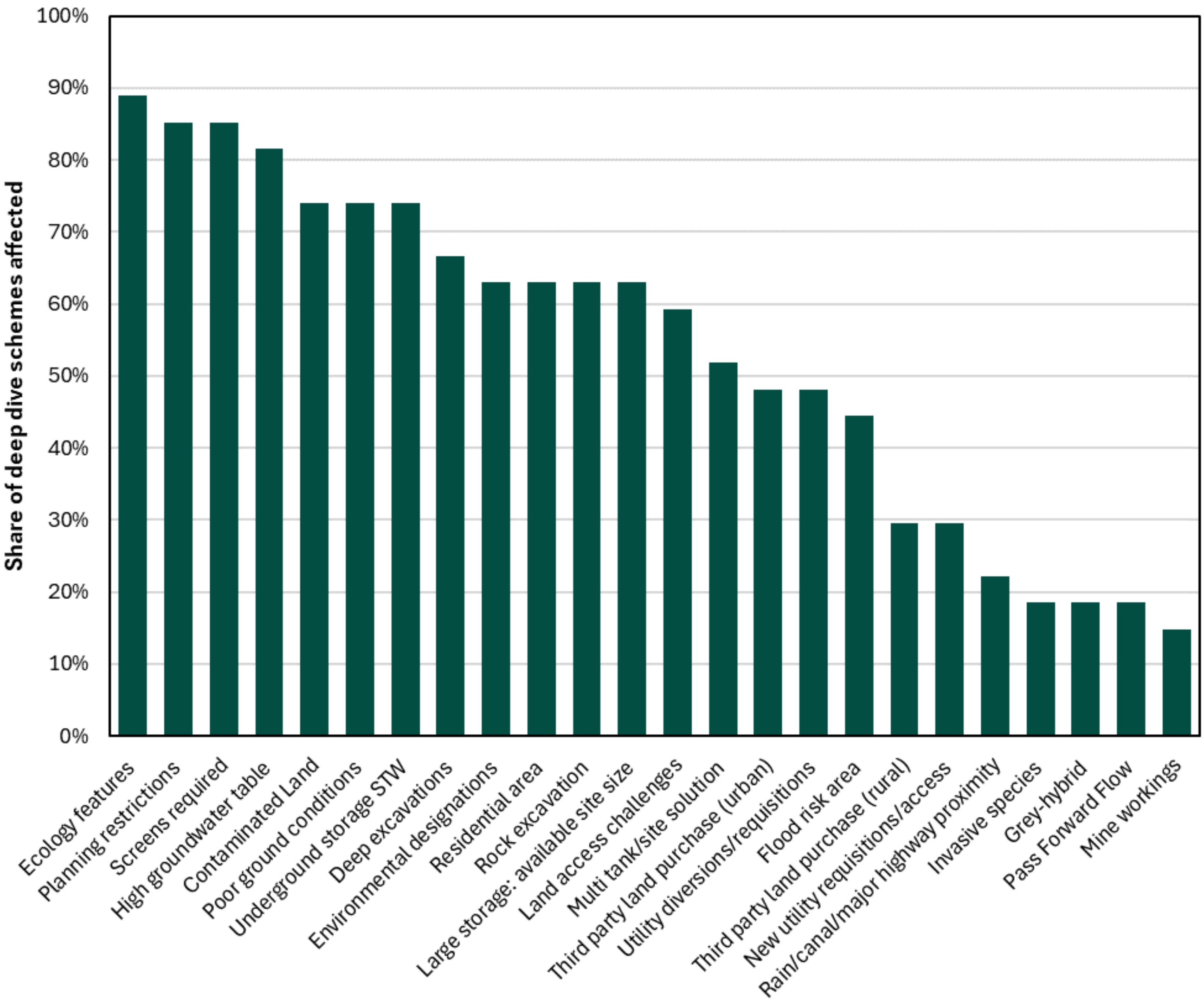
Table 18: Exogenous factors considered by UUW as part of our updated deep dive evidence

Exogenous factor	Indicator
Urban/former industrial site (Section 3.1)	Contaminated land
	Third party land purchase
	Land access challenges
	Network Rail/canal proximity
	Utility Diversions/requisitions
Atypical environmental complexity (Section 3.3)	Environmental designations
	Ecology features
	Invasive species
	National Park
Atypical planning complexity (Section 3.4)	Heritage designation
	Planning restrictions
	Residential area
	Flood risk area
Atypical geological complexity (Section 3.5)	Deep excavation
	Rock excavation
	High groundwater table
	Poor ground conditions
	Mine workings
Remote location (Section 3.2)	3rd Party Land purchase
	New utility requisitions/access
Solution scope (Section 3.6)	Underground storage STW
	Large storage: available site size
	Multi tank/site solution
	Grey-hybrid
	Pass forward flow

Source: UUW analysis

Figure 25 shows the share of deep dive schemes affected by the exogenous factors listed in the table above. Full scheme-level exogenous factor information is presented in Table 19.

Figure 25: Prevalence of exogenous factors within UUW's deep dive schemes



Source: UUW analysis

Ofwat can find all deep dive assessments in documents '*UUWR_10.01*' to '*UUWR_10.90*' inclusive.

6.3 Summary of UUW's deep dive evidence

Table 19 summarises the range of site-specific exogenous factors that characterise the schemes that Ofwat is assessing through its deep dive process. It is clear that these schemes are characterised by a range of factors associated with exogenous characteristics which are atypically concentrated in UUW's region, as evidenced in section 3.

Table 19: Summary of UUW's additional evidence to support Ofwat's deep dive assessment

■ = Scheme contains exogenous factor

Exogenous factor	Indicator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Urban/former industrial site	Contaminated Land		■	■		■			■	■	■	■	■	■	■		■	■	■	■	■	■		■	■	■	■	
	Third party land purchase (urban)		■			■	■	■		■		■		■		■		■	■	■							■	■
	Land access challenges	■	■	■	■	■	■	■		■		■		■	■	■				■		■					■	■
	Rain/canal/major highway proximity		■									■		■			■		■						■			
	Utility diversions/requisitions	■	■	■		■	■	■				■						■	■	■					■		■	■
Atypical environmental complexity	Environmental designations		■	■	■	■			■		■	■	■	■		■	■	■		■		■			■		■	■
	Ecology features		■	■	■	■	■	■	■	■	■	■		■	■	■	■	■		■	■	■	■	■	■	■	■	■
	Invasive species									■					■					■		■			■			
	National Park																											
Atypical planning complexity	Heritage designation																											
	Planning restrictions	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■		■		■	■		■	■	■	■
	Residential area	■	■	■	■		■	■	■	■		■		■		■		■	■	■			■			■	■	
	Flood risk area		■	■		■					■	■			■			■		■		■	■		■		■	
Atypical geological complexity	Deep excavations		■	■	■	■	■		■				■	■	■	■	■	■			■	■	■	■	■	■		
	Rock excavation		■	■		■			■	■			■	■	■		■		■	■	■	■		■	■	■		■
	High groundwater table		■	■	■	■				■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■
	Poor ground conditions		■	■		■			■	■	■		■	■	■		■	■	■	■	■	■		■	■	■	■	■
	Mine workings								■	■				■					■									
Remote location	Third party land purchase (rural)								■		■		■	■			■	■					■			■		
	New utility requisitions/access								■		■		■	■			■				■		■			■		
Solution scope	Underground storage	■	■	■	■	■	■	■	■	■		■	■	■	■						■		■	■	■	■	■	■
	Large storage: available site size		■		■	■		■		■	■	■	■	■		■	■	■	■	■						■	■	■
	Multi tank/site solution											■		■	■	■	■		■	■	■	■		■	■	■	■	■
	Screens required	■	■	■	■	■	■	■	■	■	■	■	■	■			■	■	■	■	■		■	■	■		■	■
	Grey-hybrid		■						■	■			■											■				

Source: UUW analysis

Table 20: Site key to support Table 19

Label	Site name	Label	Site name	Label	Site name
1	08UU101073-Percy Street CSO PRE0003SO	11	08UU102441-Frederick Street Pumping Station BRW0044SO	21	08UU101158-Dukinfield WwTW 016940087ST
2	08UU102443-Oxford Street/Ainsley Street CSO BRW0091SO	12	08UU101231-SHAP WwTW 017670025SO	22	08UU101271-Threapland WwTW 017570074ST
3	08UU101295-ASPIN LANE CSO MAN0031SO	13	08UU101002-Hindley PS SO WIG0255SO	23	08UU101379-MACCLESFIELD WwTW 016910009ST
4	08UU101028-Upton Storm Tanks WIR0071SO	14	08UU101382-Sale WwTW 016940149SO	24	08UU101381-STOCKPORT WwTW 016940151ST
5	08UU101007-Long Hey Road CSO WIR0094SO	15	08UU102422-LAMALEACH CSO FYL0002SO	25	08UU102417-GARSTANG WwTW 017260046ST
6	08UU101093-Bear Street CSO BUR0037SO	16	08UU102415-PALACE NOOK PS BRW0097SO	26	08UU102419-SOUTHPORT (BANK END) WwTW 017030100ST
7	08UU101099-Manchester Road/Park Lane CSO WIG0199SO	17	08UU100997-Graving Dock PS	27	08UU102420-LANCASTER WwTW 017270050ST
8	08UU101316-GREAT ASBY WwTW 017680364SO	18	08UU101368-Philips Road CSO BBN0167SO		
9	08UU101332-Maple Avenue CSO BRY0086SO	19	08UU102423-LYTHAM PS FYL0003SO		
10	08UU101005-King Street PS COP0049SO	20	08UU100995-GLAZEBURY WwTW 016920350ST		

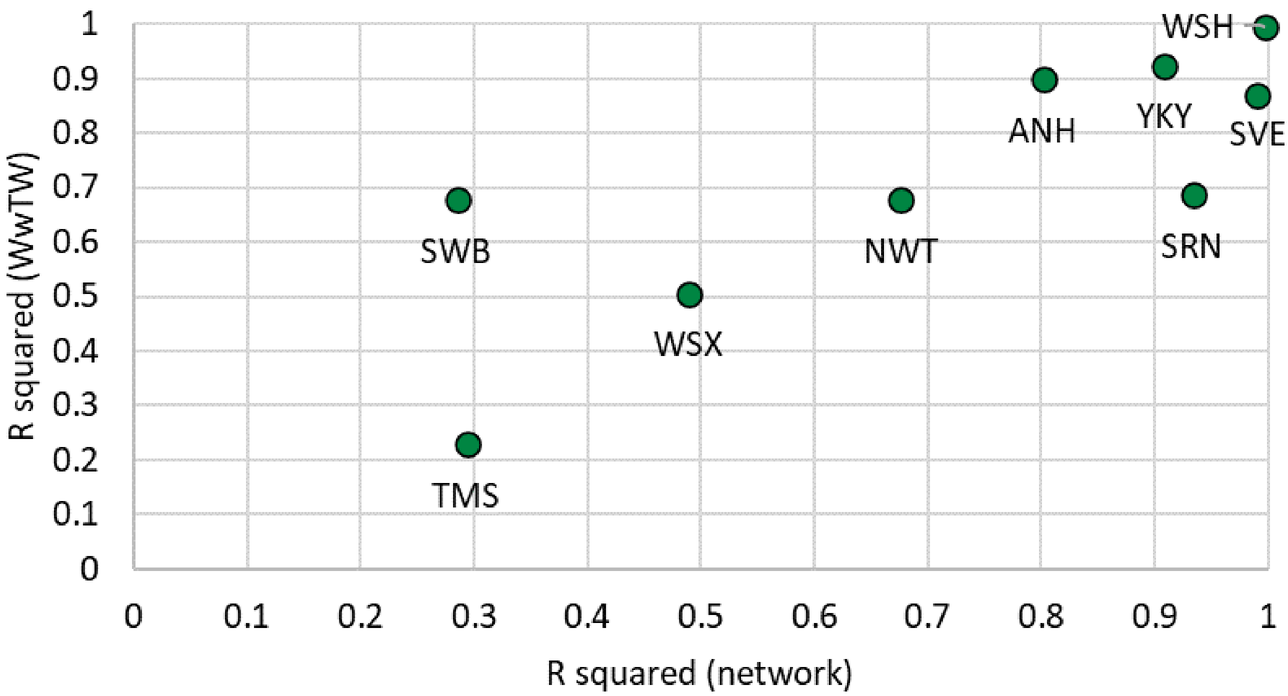
Source: UUW analysis

6.4 Ofwat's model does not provide an implicit allowance for these sites

Ofwat considers that its models provide an implicit allowance for all site-specific factors. However, as discussed in section 4.2, we disagree with this position. We do not restate those arguments here, but we do present additional evidence that suggests other companies have taken overly simplistic approaches to forecasting their costs, such that the models cannot reasonably be thought to provide an allowance sufficient for particularly complex sites.

Figure 26 shows the respective R-squared for each companies' submitted costs and equivalent volumes, across network and WwTW schemes. The grouping of companies in the upper-right corner indicates those that have a high R-squared across both network and WwTW schemes. This implies that volume explains almost all of these companies' costs. We acknowledge that volume is a major cost driver, but as discussed above, we are clear that other site-specific factors also have a material impact on cost. As such, the very high R-squared values illustrated in Figure 26 (especially for the benchmark companies – SVE and WSH) mean that we do not consider there is evidence to suggest that these companies' estimates appropriately reflect these site-specific factors.

Figure 26: A substantial proportion of companies have implemented a simplistic approach to cost forecasting

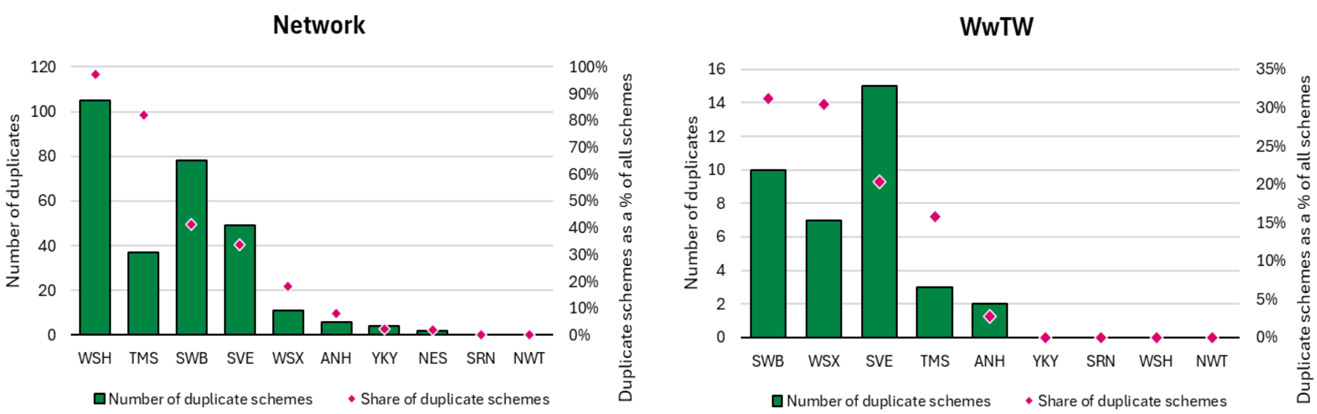


Source: UUW analysis of "PR24-DD-WW-Storm-Overflows.xlsx"

We also note that other companies appear to have used duplicated schemes (where cost and storage values are identical) a number of times within their programme. This may be because, for example, using duplicate schemes is a quicker way to cost an entire storm overflow programme. However, it does mean that the amount of site-specific information contained within the dataset is also reduced. This is because historic information regarding costs at the same site will inform each duplicate cost estimate. As such, it is not credible to assume that the data reflects a wide range of site-specific information.

Figure 27 shows the number of duplicate schemes by company, in absolute terms and as a percentage of the overall programme, split by network and WwTW schemes. It is clear that a substantial number of companies have relied extensively on the use of duplicated schemes.

Figure 27: Number and share of duplicated schemes in the storm overflows dataset



Source: UUW analysis of "PR24-DD-WW-Storm-Overflows.xlsx"

We consider that this provides a strong indication that other companies' cost data does not reflect a wide range of site-specific information. However, we recognise that Ofwat may still consider that it is appropriate to assume its models reflect sufficient site-specific variation such that an uplift via its deep dive assessment is not needed. We are clear that this would constitute an incoherent approach. This is because Ofwat excludes outliers when it calculates its modelled allowances. Schemes with exogenous cost pressures are more likely to be identified as outliers, meaning that this effectively removes site-specific information from the benchmark. Therefore, the model cannot reasonably be considered to provide an allowance for schemes that are atypically complex.

This is supported by empirical evidence. Table 21 tabulates the percentage of schemes that are considered outliers, by company. It then compares these to those companies that appear to have focused on volume as the main storage driver and have a high number of duplicate schemes in their programmes. It shows a clear relationship: those companies that have taken a simplistic approach to their cost forecasts typically have a small proportion of outliers. Crucially, this means that the model is removing a significant proportion of exogenous site-specific information prior to estimating a modelled benchmark.

Table 21: Percentage of schemes considered outliers tabulated by cost forecast approach

Company	**% of schemes identified as outliers**		**Simplistic cost estimates?**	
	Network	*WwTW*	*Network*	*WwTW*
NES	47.22%		No	
YKY	38.89%	62.50%	No	No
TMS	2.22%	47.37%	Yes	No
SWB	8.51%	21.88%	Yes	Yes
ANH	38.36%	8.22%	No	Yes
WSX	23.33%	0.00%	No	Yes
SRN	3.68%	4.92%	Yes	No
SVE	0.69%	1.35%	Yes	Yes
WSH	0.93%	3.70%	Yes	Yes
NWT	7.32%	18.18%	No	No

Source: UUW analysis of "PR24-DD-WW-Storm-Overflows.xlsx"

This means that the site-specific relationship between cost and cost drivers that characterise these sites is not reflected in Ofwat's benchmark. As such, we consider it is reasonable to assume Ofwat's allowance contains no implicit allowance for the site-specific factors set out within our deep dive evidence, beyond that already included in Ofwat's modelled benchmark that acts as the 'default' allowance in cases where Ofwat does not find the deep dive evidence acceptable.

6.5 Ofwat should allow the costs of UUW's outliers in full

We consider that the further evidence presented in this section and documents '*UUWR_10.01*' to '*UUWR_10.90*' inclusive represents compelling evidence of cost efficiency across the schemes that Ofwat has considered as part of its deep dive. We have identified key drivers of exogenous costs and demonstrated these particularly impact UUW. We have also connected these exogenous cost drivers to the specific schemes covered by Ofwat's deep dive.

As such, we consider that Ofwat should allow the costs for these schemes in full. This is set out in Table 22.

Table 22: Proposed uplift for deep dive schemes

Value (£m, 2022-23 CPIH)	Outliers
Ofwat DD – memo	251
UUW outlier modelled allowance	264
UUW representation	673
Increase	**409**

Source: UUW analysis based on Ofwat's dataset and publicly available data

The full list of schemes conspired as part of UUW's deep dive is set out in Table 23 below.

Table 23: Storm Overflow site specific evidence

Document Reference
UUWR_10.01_Overflow evidence_08UU101381-Stockport WwTW 016940151ST
UUWR_10.02_Overflow evidence_08UU102420-Lancaster WwTW 017270050ST
UUWR_10.03_Overflow evidence_Pennington Flash-(Multiple)
UUWR_10.04_Overflow evidence_08UU102417-Garstang WwTW 017260046ST
UUWR_10.05_Overflow evidence_08UU101285-Carleton Hall Templebank CSO EDE0116SO
UUWR_10.06_Overflow evidence_08UU101379-Macclesfield WwTW 016910009ST
UUWR_10.07_Overflow evidence_08UU102423-Lytham PS FYL0003SO
UUWR_10.08_Overflow evidence_08UU101158-Dukinfield WwTW 016940087ST
UUWR_10.09_Overflow evidence_08UU101005-King Street PS COP0049SO
UUWR_10.10_Overflow evidence_08UU102441-Frederick Street Pumping Station BRW0044SO
UUWR_10.11_Overflow evidence_08UU100997-Graving Dock PS
UUWR_10.12_Overflow evidence_08UU100995-GlazeburyWwTW 016920350ST
UUWR_10.13_Overflow evidence_08UU102415-Palace Nook PS BRW0097SO
UUWR_10.14_Overflow evidence_08UU100983-Chorley WwTW 017060016ST
UUWR_10.15_Overflow evidence_08UU101368-Philips Road CSO BBN0167SO
UUWR_10.16_Overflow evidence_08UU102422-Lamaleach CSO FYL0002SO
UUWR_10.17_Overflow evidence_08UU101231-Shap WwTW 017670025SO
UUWR_10.18_Overflow evidence_08UU101157-Dearham WwTW 017570068SO
UUWR_10.19_Overflow evidence_08UU101007- Long Hey Road CSO WIR0094SO
UUWR_10.20_Overflow evidence_08UU102452-No 76 Middle Brook CSO BOL0039
UUWR_10.21_Overflow evidence_08UU101382-Sale WwTW 016940149SO
UUWR_10.22_Overflow evidence_08UU100977-Kirkway CSO ROC0136SO
UUWR_10.23_Overflow evidence_08UU101173-Plumbland WwTW 017570072ST
UUWR_10.24_Overflow evidence_08UU101103-Milnrow Road CSO ROC0103SO

Document Reference
UUWR_10.25_Overflow evidence_08UU101380-Biddulph WwTW 016810052ST
UUWR_10.26_Overflow evidence_08UU101020-Skippool PS WYR0076SO
UUWR_10.27_Overflow evidence_08UU101146-Brookside CSO COP0091SO
UUWR_10.28_Overflow evidence_08UU101026-Town Beck CSO LAK0059SO
UUWR_10.29_Overflow evidence_08UU101217-Little Clifton WwTW 017570045ST
UUWR_10.30_Overflow evidence_08UU101371-St Bees PS COP0097SO
UUWR_10.31_Overflow evidence_08UU101197-Elterwater PS LAK0025SO
UUWR_10.32_Overflow evidence_08UU101325-Irlam WwTW 016940133ST
UUWR_10.33_Overflow evidence_08UU102418-Station Road CSO FYL0014SO
UUWR_10.34_Overflow evidence_08UU101136-Ambleside WwTW 017370024ST
UUWR_10.35_Overflow evidence_08UU101085-Central PS WIG0100SO
UUWR_10.36_Overflow evidence_08UU101018-Rookery CSO NEW0038SO
UUWR_10.37_Overflow evidence_08UU101120-Tebay Sewage PS EDE0079SO
UUWR_10.38_Overflow evidence_08UU101030-Penn Lane (Weston Point, Point R) CSO HAL0060SO
UUWR_10.39_Overflow evidence_08UU101041-Corporation Street CSO TAM0099SO
UUWR_10.40_Overflow evidence_08UU101093–Bear Street CSO – BUR0037SO
UUWR_10.41_Overflow evidence_08UU101364-Heywood (Botany) STW CSO ROC0139SO
UUWR_10.42_Overflow evidence_08UU101378-Westminster Road CSO MAC0062SO
UUWR_10.43_Overflow evidence_08UU101029-Weston Street/Viking Street CSO BOL0115SO
UUWR_10.44_Overflow evidence_08UU101110-Raglan Street CSO TAM0020SO
UUWR_10.45_Overflow evidence_08UU101243-Hall Nook CSO WAR0007SO
UUWR_10.46_Overflow evidence_08UU101367-Parr Brook CSO BRY0133SO
UUWR_10.47_Overflow evidence_08UU101094-Inskip Street CSO BUR0022SO
UUWR_10.48_Overflow evidence_08UU101077-Rishton Lane CSO BOL0127SO
UUWR_10.49_Overflow evidence_08UU100979-Adjacent Duxbury Mill PS CSO CHR0024SO
UUWR_10.50_Overflow evidence_08UU101058-Turner Bridge CSO BOL0092SO
UUWR_10.51_Overflow evidence_08UU101012-Orrell House Farm CSO WIG0173SO
UUWR_10.52_Overflow evidence_08UU101369-Oxford Street West/ Pottinger Street CSO TAM0045SO
UUWR_10.53_Overflow evidence_08UU101348-Zulu Street CSO BOL0109SO
UUWR_10.54_Overflow evidence_08UU100989-East Lancs Road PS WIG0179SO
UUWR_10.55_Overflow evidence_08UU101036-Sherborne Street CSO MAN0052SO
UUWR_10.56_Overflow evidence_08UU101154-Coppull New Road/Butterworth Brow CSO CHR0050SO
UUWR_10.57_Overflow evidence_08UU101151-Church Lane CSO (CREWE) CRE0043SO
UUWR_10.58_Overflow evidence_08UU101156-Dean Wood CSO WLN0020SO
UUWR_10.59_Overflow evidence_08UU101096-Kirkhall Lane Sewer WIG0107SO
UUWR_10.60_Overflow evidence_08UU100998-Grove Road CSO TAM0096SO
UUWR_10.61_Overflow evidence_08UU101046-Chapel-en-le-Frith WwTW 016940168ST
UUWR_10.62_Overflow evidence_08UU101032-Lytham Road CSO TRA0038SO
UUWR_10.63_Overflow evidence_08UU101059-Albert Road CSO BOL0095SO
UUWR_10.64_Overflow evidence_08UU101119-Tan House Lane/Moss Bank Road SO HAL0052SO
UUWR_10.65_Overflow evidence_08UU101247-Boothroyden Road CSO ROC0018SO
UUWR_10.66_Overflow evidence_08UU101240-Frankby Close CSO WIR0087SO
UUWR_10.67_Overflow evidence_08UU101126-Water Street CSO ROC0097SO
UUWR_10.68_Overflow evidence_08UU101025-Thermal Road Port, Causeway WIR0132SO

Document Reference
UUWR_10.69_Overflow evidence_08UU101271-Threapland WwTW 017570074ST
UUWR_10.70_Overflow evidence_08UU101047-Worsley WwTW 016940139ST
UUWR_10.71_Overflow evidence_08UU101109-Radford Street CSO SAL0079SO
UUWR_10.72_Overflow evidence_08UU101345-Sheridan Way CSO TAM0015SO
UUWR_10.73_Overflow evidence_08UU101066-Agecroft PS SAL0097SO
UUWR_10.74_Overflow evidence_08UU101116-Sheepfoot Lane CSO OLD0032SO
UUWR_10.75_Overflow evidence_08UU101065-Bury New Road CSO BRY0130SO
UUWR_10.76_Overflow evidence_08UU101193-Chorley New Road/Beaumont Road CSO BOL0096SO
UUWR_10.77_Overflow evidence_08UU101274-Bank Lane CSO PEA0043SO
UUWR_10.78_Overflow evidence_08UU101332-Maple Avenue CSO BRY0086SO
UUWR_10.79_Overflow evidence_08UU101078-Carr Mill Road CSO STH0059SO
UUWR_10.80_Overflow evidence_08UU101356-Briarlands Close CSO STK0123SO
UUWR_10.81_Overflow evidence_08UU101073-Percy Street CSO PRE0003SO
UUWR_10.82_Overflow evidence_08UU100984-Crown Street (Town Dyke Orchard) CSO CAR0042SO
UUWR_10.83_Overflow evidence_08UU101217-Oxford Street/Ainsley Street BRW0091SO
UUWR_10.84_Overflow evidence_08UU102419-Southport (Bank End) WwTW 017030100ST
UUWR_10.85_Overflow evidence_08UU102416-Croston WwTW 017060017ST
UUWR_10.86_Overflow evidence_08UU100988 – Dunham Massey WwTW 016940003ST
UUWR_10.87_Overflow evidence_08UU101295a–Aspin Lane MAN0031
UUWR_10.88_Overflow evidence_08UU101028-Upton Storm Tanks WIR0071SO
UUWR_10.89_Overflow evidence_08UU101316-Great Asby WwTW 017680364SO
UUWR_10.90_Overflow evidence_08UU101099-Manchester Road/Park Lane CSO WIG0199SO
Total 90

7. Approach to Price Control Deliverables

In conjunction with the concerns already articulated on Ofwat's approach to storm overflow cost assessment, UUW also have strong concerns on Ofwat's proposed PCDs for storm overflows. Ofwat has proposed two new price control deliverables (PCDs) at draft determination[26]:

- PCDWW5 Equivalent storage, measured through two separate metrics
  - Green
  - Grey/ grey-hybrid
- PCDWW5c Flow to full treatment increase

UUW does not agree that these are the most appropriate mechanisms for protecting customer interests. Our business plan (UUW64, section 10 Customer protection) proposed a simple and effective PCD mechanism that measured customer outcomes and reflected the expenditure profile and corresponding spill reduction. This section sets out why we have strong concerns about Ofwat's proposals and details why we consider our recommended approach will result in a better outcome for customers and the environment by allowing more efficient and effective delivery of the very large AMP8 overflows investment programme.

7.1 Our PCD proposal at October submission

In our October submission we proposed a PCD that measured spill reduction to reflect the large water industry national environment plan (WINEP) enhancement programme and requirements of the Government's storm overflow discharge reduction plan. Measuring delivery based on our proposed approach will ensure that companies have the flexibility to deliver their programme in an efficient manner, targeting best value, and ensuring that the programme delivers the outputs required by the WINEP and expenditure funded by customers.

Within our proposal we identified that the spill reduction benefit would be based on modelled outputs and fixed at FD, making it easy to identify the benefit delivered by each scheme and map schemes back to the WINEP, our PCD and PCL. UUW consider that this outcome-based PCD is more appropriate and easier to understand. It also benefits because reporting could be linked back to current regulatory processes, avoiding duplicative and burdensome activity that, in any case, tends to reduce the clarity of performance outcomes by increasing the number of alternative outcome measures for the same activity. We consider that information collected within the new PR24 data table ADD20 (cost driver 42 to cost driver 46) would enable Ofwat to report spill reduction performance at a scheme level and that a consistent approach could be adopted for all companies.

The existing regulatory regime would also help to support that projects are delivered on time and to the requirements set out within the WINEP. Late delivery of WINEP projects will be captured through the environmental performance assessment (EPA) and will impact upon AMP8 performance commitments and result in potential permit non-compliance. For the storm overflow programme, all permits will be updated to reflect the new spill frequency requirements upon completion of a scheme. A scheme would only be considered as complete if signed-off by our environmental regulator, the Environment Agency, which ensures that our statutory obligations have been met and that sufficient evidence has been provided to enable sign-off. All projects delivering statutory requirements also go through significant internal scrutiny, every project produces evidence packs to demonstrate compliance with the new regulatory requirements, this includes photographic evidence or external reports (e.g. MCERTS certificates) where appropriate. All evidence packs are reviewed and signed-off by key internal stakeholders before being uploaded to the Environment Agency SharePoint for external review. Our internal process is also subject to independent audit to ensure that our processes are accurate and robust.

[26] Ofwat set out detailed PCD proposals in [PR24 draft determinations: Price control deliverables appendix]

7.2 The Ofwat PCD proposal and its implications

Ofwat has proposed two new price control deliverables (PCDs) at draft determination, measuring equivalent storage delivered and flow to full treatment increase.

Upon review of these PCDs, we believe that they are overly prescriptive and difficult to understand. The reporting requirements appear overly burdensome and not focussed on the statutory requirements or outcome. Crucially, they also limit the intervention type and flexibility on delivery options which both are critical when seeking to efficiently deliver a large and complex programme such as this.

We note that Ofwat's derivation of the PCD appears to be highly academic i.e. focused upon mathematical equations. We also note that Ofwat hasn't provided an associated Excel model that would have enabled us to "road test" these theoretical equations or allow us to stress test different delivery scenarios to understand the implications. This has made it difficult for us to properly assess the implications of Ofwat's proposals.

Furthermore, Ofwat has not provided models that would help companies to understand the impact of changes in the programme, as such we are unable to adequately assess the risk associated with these PCD within the limited timeframe of draft determination. Ofwat has also offered no commentary or feedback on the proposal we submitted in October 2023.

We fundamentally disagree with Ofwat's proposed time incentives and a common delivery target

PCDs were intended to protect customers in the event of none or late delivery. We consider that Ofwat's approach to time incentives is fundamentally inappropriate and represents a significant departure away from what UUW understood to be the purpose of PCDs, without any engagement or signalling from Ofwat.

Within PR24 draft determination[27], Ofwat propose a common delivery profile for PCDWW5, measuring the 'cumulative percentage of equivalent storage delivered' with the intention of applying a time incentive to this profile. It is unclear how Ofwat has derived the proposed delivery profile and the logic of applying a consistent profile to all companies is also unclear. This creates different levels of customer protection as expenditure profiles will differ on a company by company basis.

We strongly disagree with Ofwat's proposal for a common delivery target. Ofwat's proposed PCD profile is entirely dislocated from our delivery profile and appears to fundamentally misunderstand the nature of capital programme delivery. Schemes begin to incur expenditure in the early periods of the AMP and ramp up towards the end of the AMP. It is not realistic to assume full delivery of schemes in line with Ofwat's PCD profile. As such, Ofwat will effectively return money to customers that companies are in the process of using to deliver projects in line with their WINEP obligations. This appears to us to be fundamentally inappropriate and overly punitive. It is also inconsistent with the purpose of PCDs (i.e. to pass money back to customers in the event of non-delivery or late delivery of funded investments) – if PCDs are measuring delivery earlier than the actual funded delivery profile, then this is clearly an inappropriate application of the PCD methodology. We also note that the PCL already incentivises faster delivery so the merits of Ofwat's approach in this area is unclear.

Ultimately, the PCD should be aligned with expected project delivery put forward by companies. We consider that Ofwat's proposals fail this test. Our October 2023 proposed PCD profile reflected early delivery of schemes where this is possible. We are concerned that Ofwat's PCD is reflecting an impossible delivery timetable.

We also note that timing of delivery is already effectively incentivised by the PCL and related ODI, and therefore we question why there is need for the additional complexity and duplication of regulatory mechanisms. As such, we do not endorse the need for a timing incentive within the PCD.

A greater focus on outcomes rather than outputs would unlock efficiency and flexibility

We do not agree with Ofwat's proposal to use equivalent storage delivered as the basis for the PCD (PCDWW5). This results in a lack of flexibility by measuring this output (equivalent storage) rather than the outcome (expected reduction in spill frequency), and hence compromises efficient delivery of the programme.

[27] Price control delivery appendix, table 2 (p. 32)

UUW has put forward a programme of work to deliver the customer outcome of spill frequency reduction. Any changes within the requirements should be managed through the storm overflow uncertainty assessment and other existing mechanisms such as the storm overflows performance commitment and Environment Agency's environmental performance assessment (EPA).

The equivalent storage required to deliver the AMP8 spill reduction programme has been derived from a modelling assessment. Hydraulic network models are used to identify the storage required to achieve a modelled target spill frequency. Over time we are able to gather more and more information to help us validate our model outputs, full coverage of EDM on our storm overflows allows us to record and report data to a high level of detail.

In AMP7, we have been using the EDM data as a check against our model performance to provide confidence to the Environment Agency on an overflow's impact and proposed solution. This process, which we term 'Fit for Use' (FFU) is now standard practice at UUW on all projects using network models.

The FFU process is about running the baseline models with the latest rainfall and comparing the EDM spill and duration against the model. In most situations this is the end of the task, and we continue to use the model to develop the detailed solution. In some circumstances there is a discrepancy between the performance figures and the predicted model performance and further investigation is required. This may simply be a level discrepancy requiring an asset survey to rectify, or an issue with the EDM data, but in some cases, we may be required to undertake a short term flow survey to check a model's verification which can take longer to get to the FFU (typically 9 to 12 months). An example of this may be where the model was previously verified for a different purpose i.e. summer season for bathing water, but winter flows are critical for a 10 spills solution to match the EDM, so we need a winter survey.

This process is part of the overall capital delivery process, but at the time of PR24 we could only use the models that were available. Therefore, following the FFU process, some site solution requirements may increase i.e. increase storage to meet the spill target, but similarly some may decrease. Therefor it is reasonable to expect changes in storage volumes required to deliver the spill reduction in AMP8.

Ofwat's current PCD proposal limits flexibility within the programme, which is not supportive of innovation and efficient delivery for a programme of the size and scale of the storm overflow investment in AMP8 and beyond. The proposed PCDs are prescriptive in nature which leaves limited opportunity for exploring alternative solutions to deliver best value options for spill reduction or updating solution requirements to mirror the FFY model. Under Ofwat's proposed PCDs the best value assessment would need to be updated to consider the impact of the PCD and financial implications of delivering an alternative solution. In addition, reporting of the PCD would be overly burdensome, to reflect changes in the solution and the financial impact of the changes every 6 months would be a significant undertaking.

Furthermore, it is not clear within the PCD mechanisms whether an alternative solution, that results in a scheme being assessed under a different PCD than what is proposed at FD, is possible. For example, in the PR24 draft determinations[28], Ofwat have stated that 'we do not allow companies to substitute 'green only' solutions for grey or grey-hybrid solutions'. Yet at the Ofwat Webinar: Wastewater Price control Deliverables (PCDs) held 25th July 2024, Ofwat indicated that a site initially identified as a pass forward flow (PFF) solution could be changed to a grey or hybrid solution and the equivalent storage could be recorded against the relevant PCD. We are concerned that such inconsistencies further adds to the complexity of these measures, making them difficult to understand, and limiting flexibility. This not only increases the regulatory risks that companies are having to manage, but it also tends to reduce scope for companies to deliver optimally for customers and the environment. For example, there does not appear to be any justification to disallow a grey or hybrid solution that has been delivered in place of a 'green only' solution (which may be necessary for many reasons) – especially if the environmental requirement has been met (i.e. required spill reduction) and hence the primary purpose of the funded investment had been successfully achieved.

We assume that equivalent storage PCD does not include storage associated with PFF, however this is not clear from the methodology.

[28] Price control deliverables appendix (p.30)

We are concerned about Ofwat's approach to assessing outliers/deep dive schemes within the PCD

We have strong concerns in relation to Ofwat's approach to assessing inefficient outlier scheme PCD penalties. Ofwat has stated that "[w]here companies replace an existing deep dived scheme with a substitute scheme and / or change a deep dived scheme, we will provide an updated allowance as calculated by the cost models and would not undertake a deep dive assessment in-period."[29] Inefficient outlier allowances are based on cost model predictions plus a discretionary uplift based on deep dive evidence.

Our understanding is that Ofwat's PCD outlier methodology implies a 'cliff-edge' situation: if an outlier scheme output target is missed by one unit, the re-calculated allowance will only be based on the cost model prediction. In other words, minimal deviations from delivery targets will result in significant PCD non-delivery penalties. For instance, at DD our Hindley overflow scheme was set an allowance of around £28m – this is made up of a model allowance of £16m plus a discretionary uplift of £12m. Based on Ofwat's methodology, a 1m^3 under-delivery at this scheme would result in a PCD non-delivery penalty of £12m. We consider that it is inappropriate to claw-back such a large portion of the allowance if the company has delivered most of the expected outputs. A more pragmatic approach would be to first calculate how the cost model allowance changes after plugging in the new cost drivers; the change in model allowance should then be subtracted from the deep dive total allowance to arrive at an ex-post estimate of efficient costs. We consider that this approach would provide more balanced incentives, without increasing regulatory complexity.

Lack of visibility of the regulatory contract prior to FD

Ofwat have not provided clear reporting guidance for the PCDs but have indicated within their webinar sessions that further information would be available post final determination. We do not believe that this is an acceptable approach. Companies need to be able to understand the regulatory contract at final determination so that they can make appropriate decisions on how to proceed with implementing it.

7.3 UUW's proposed PCD addressed all these shortcomings

This sub-section considers how the limitations of Ofwat's PCD approach highlighted in Section 7.2 should be addressed. Within our October 2023 submission, (UUW64, section 6) we identified our ambition to deliver our storm overflow spill reduction profile as soon as possible to ensure that the maximum benefit can be realised. In addition we proposed a programme of short-term solutions to deliver further spill reduction in AMP8 during the construction of the permanent spill reduction solution. Our proposed accelerated delivery profile will deliver 406 schemes, equivalent to 90% of storm overflow solutions, ahead of the regulatory dates therefore demonstrating our ambition and commitment for accelerated spill reduction. Our PCD already reflects an ambitious delivery profile and associated expenditure profile that we have proposed – delivering ahead of regulatory dates – and set out within PR24 data table ADD20.

Design of the PCD should also consider other punitive measures, such as the PCL and ODI mechanisms associated with it. Our accelerated delivery profile is already built into our PCL and therefore late delivery may also result in underperformance ODIs from this measure. In addition, all of the storm overflow spill reduction schemes within the PCD are also subject to regulatory scrutiny via the WINEP sign-off process as such companies are already incentivised to deliver schemes on time and to the standard expected by our regulators. The PCD proposed in our PR24 submission, and summarised in table 22 and 23 below is a better reflection of our customer commitment and provides a clear link between delivery of the WINEP enhancement programme, delivery of expenditure, and reduction of storm overflow spills without the introduction of yet more parameters through measuring pass forward flow increased and equivalent storage (green, grey and hybrid). As such, we do not consider that the PCDs proposed by Ofwat at draft determination are appropriate, nor effective and ask Ofwat to consider our alternative, simplified PCD ahead of final determination.

[29] Ofwat (2024), *Price control deliverables appendix*, p. 28.

Table 24: PCD Summary

Scheme delivery expectations	
Description of deliverable	Delivery of storm overflows spill reduction programme (for both network and STW) in line with our AMP8 WINEP or accelerated delivery programme, which entails delivering projects that contribute to a modelled expectation value of spill reduction of 30,124 per annum by the end of AMP8. Excludes schemes delivered through Advanced WINEP and 3 Windermere schemes forecast to deliver in AMP9.
Output measurement and reporting	This metric reflects the modelled overflow spill reduction from each scheme delivered within the financial year. The modelled spill reduction is identified within PR24 data table ADD20 cost driver 5 – BP spill reduction (annual spills). The PCD target is in line with the profile of delivery in the company's PR24 business plan, to deliver AMP8 WINEP requirements. These are set out in the table below. WINEP will be subject to a change control process through application to the Environment Agency - any variation in scheme will have its own modelled/expected spill reduction, which will count against delivery of this PCD.
Assurance	Successful completion of WINEP Enhancement schemes is assured internally through review of evidence compiled by delivery partner / Engineering and External assurance is by the Environment Agency confirming completion and updating the WINEP Tracker to reflect the date the output was claimed. Generation of an associated output in use (OIU) certificate and evidence pack will include the modelled spill prior to the scheme and post scheme completion. The evidence pack is provided to the Environment Agency for their sign off that the scheme has been completed
Conditions on scheme	None
Impact on PCs	In the event on project non-delivery, the expected spill frequency will be higher than target, and hence we will also be penalised via the associated PCL and ODI - this PCD therefore relates directly to the storm overflows performance commitment (expected performance, before the impact of any weather-related variability). To avoid double counting, the associated ODI impact should be deducted from the PCD rate. ODI impact = ODI rate £1,779,103 / 2267 = £785

Table 25: UUW proposed PCD delivery profile

	Unit	AMP8	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	Ultimate delivery
Cumulative delivery target for PCD	modelled reduction in total spills		161	819	3,336	7,345	18,830	30,124	30,124
AMP8 Capex (22/23 pb)	£	2,973	191	450	684	841	635	173	
AMP8 Opex (22/23 pb)	£	45	0	0	1	6	14	24	
ODI impact per unit of PCD volume	£/modelled reduction in total spills	785							

Source: UUW analysis of hydraulic network model data and financial information

All finances will be allocated to the WwN+ price control.

Table 26: UUW proposed PCD Incentive rates

	Unit	WR	WN+	WwN+	BR
Overall delivery	£/modelled reduction in total spills	0	0	39,295	0
Time value rate	£/modelled reduction in total spills	0	0	1,438	0
Late delivery	£/modelled reduction in total spills	0	0	2,321	0

Source: UUW analysis

8. Performance commitment level (PCL) and Outcome Delivery Incentive (ODI)

8.1 Company specific PCL

In our PR24 business plan submission document UUW64 Wastewater (Quality – Overflows) Enhancement Case, we provided compelling evidence as to why a company specific target for United Utilities was essential. We demonstrated that the performance commitment should reflect the impact of past and current regulatory frameworks on our current spill frequency, and account for scale of investment required to reduce spill frequency as a result of unique operating circumstances in the North West. We also demonstrated our commitment to the North West and reducing storm overflow discharges as soon as possible.

The application of a common performance target would therefore not be achievable for UUW. We support Ofwat's decision to apply a company specific target.

Delivery of long-term improvements in storm discharges is reliant upon delivery of our storm overflow enhancement programme. We have chosen to accelerate this programme as far as possible to ensure that we are delivering spill reduction improvements as early as possible in AMP8. In addition, we proposed an ambitious target, that went above and beyond our enhancement programme, to deliver spill reduction early in AMP8 whilst long-term solutions would still be under construction. Whilst we believe that our PCL proposal a 27% reduction over AMP8 (FY25-FY30) was already very stretching, we accept the additional stretch reflected in Ofwat's PCL proposed at draft determination. This will require us to find additional performance improvements to reduce spills.

We accept the spill performance identified by Ofwat within PR24 Performance Commitment Model: PR24-DD-PCM-Storm-overflows-1, which is used within the PCL calculation but we have updated the number of storm overflows (used within the PCL normalisation) to reflect our best understanding of our network, the PCL shown in the table below accounts for an arithmetic update to take into account of the change in number of storm overflows from 2280 to 2267, this is also reflected within PR24 data tables OUT5 and OUT1.

Table 27: AMP8 Storm Overflow PCL including adjustment for change in number of storm overflows

Line description	Units	DPs	2025-26	2026-27	2027-28	2028-29	2029-30	PR24 BP reference
Average number of spills per overflow – monitored	Number	2	26.35	25.50	24.09	22.28	18.71	OUT5.74

Source: Table OUT 5.74

Performance commitment definition

During the draft determination and consultation and query process we have been unable to clarify the storm overflows performance commitment and ODI calculations that can be used within our representation[30].

Within query reference OFW-IBQ-UUW-037 we identified inconsistencies within Ofwat's storm overflows performance commitment definition and the worked example shared by Ofwat on slide 12 from the performance commitments webinar 'PR24 draft determinations webinar slides: Performance commitments (PCs) Ofwat' [31]. We appreciate Ofwat's intention to share the examples within the webinar, however we do not believe that this happened due to timings in the webinar session itself and therefore companies were not given the opportunity to review the examples and ask relevant questions to Ofwat during the webinar. As such companies have had to use the query process and responses have yielded insufficient details regarding the performance commitment and

[30] The response to the most recent query on this point - Query OFW-IBQ-UUW-037 – was issued on 23 August 2024. This meant we were unable to incorporate this into our representation.

[31] https://www.ofwat.gov.uk/wp-content/uploads/2024/07/Webinar-slides-Performance-commitments-PCs.pdf

associated calculations for use within our DD representation. We have therefore set out our assumptions regarding the proposal in order to complete the PR24 data tables and will consider the impact of any guidance subsequently given. UUW has assumed two credible options for the setting of performance commitments and the calculation of ODI payments.

(1) The performance commitment is a measure of monitored storm overflow spills only. Performance is reported as the average monitored spill frequency (total number of monitored spills / total number of storm overflows). Any ODI payments are calculated as a variance of average monitored spills from the PCL. Ofwat has introduced a gateway mechanism to only allow outperformance payments if the 'uptime' target is met however performance reporting against the PCL does not include 'uptime'.

(2) The performance commitment is a measure of monitored storm overflow spills and uptime. Therefore for UUW the PCL would be set as:

Table 28 : UUW PCL performance commitment from Key Dataset 1: Outcomes data

	2025-26	2026-27	2027-28	2028-29	2029-30
Average monitored spills per overflow	26.20	25.35	23.95	22.15	18.60
Uptime, %	97.00%	97.25%	97.50%	97.75%	98.00%
UUW storm overflow PCL (inclusive of uptime adjustment)	29.20	28.10	26.45	24.40	20.60

Source: UUW analysis

Performance is reported as the average monitored spill frequency (total number of monitored spills / total number of storm overflows) plus an 'uptime' adjustment. Any ODI payments are calculated as a variance of average monitored spills plus uptime from the target. Ofwat has also introduced a gateway mechanism to only allow outperformance payments if the 'uptime' target is met in addition to the PCL spill target which also includes uptime.

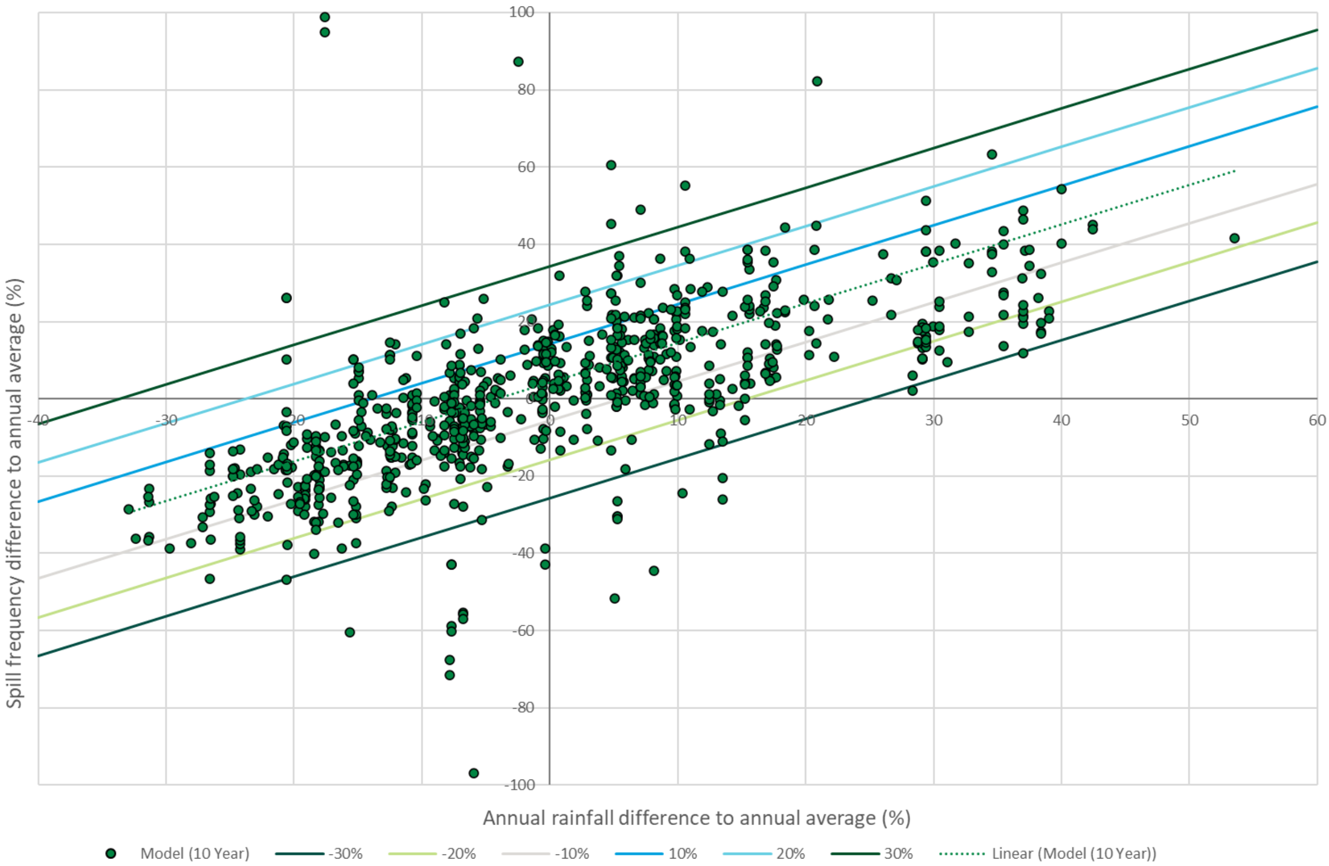
Within our representation we have assumed that the storm overflows performance commitment definition is in line with option 1 identified above. Within the PR24 data tables, OUT1.17 sources the values from OUT5.77. Therefore in order to represent our understanding of the PCL within the data tables UUW has reflected 100% uptimes for AMP8 within OUT5.75 to ensure that the PCL in OUT 1.17 is representative of the Average number of monitored spills per overflow only.

Caps and collars

We support the inclusion of a cap and collar for this measure. However, we do not consider Ofwat's proposal of +/- 0.5% RORE to be an appropriate measure. In our PR24 business plan submission document UUW64 Wastewater (Quality – Overflows) Enhancement Case, we proposed a performance cap and collar of +/-30% of the performance commitment level. This proposal was based on analysis of UUW modelled data. We ran 10 years' of time series rainfall through our hydraulic network models for 82 sites to identify the modelled annual spill frequency which was then compared to the ten-year average for each site. The annual variance was measured as a percentage of the ten-year average spill frequency; by using the percentage variance we were able to compare results from overflows that had varying annual spill frequencies.

Using 10 years of rainfall data, rather than a single year, ensured that we modelled the potential variation in spill frequency that would be predicted to arise as a result of variations in annual rainfall. The annual spill frequency variation (given as a percentage from the average) was plotted for each of the sites. We observed that most (but not all) points fell within a +/- 30% range from the average. This can be seen in the overlay of the +/-10% (green line) to 30% (purple line) tramlines on Figure 40 from our PR24 business plan submission document UUW64 Wastewater (Quality – Overflows) Enhancement Case:

Figure 28: 10 year spill analysis representing the spill frequency vs annual rain fall



Notes: 10 Year Model Spill Analysis, Spill Frequency % difference to average v Annual Rainfall % difference to average, 85 sites (with EDM) spills >40 per annum
Source: UUW analysis of modelled data

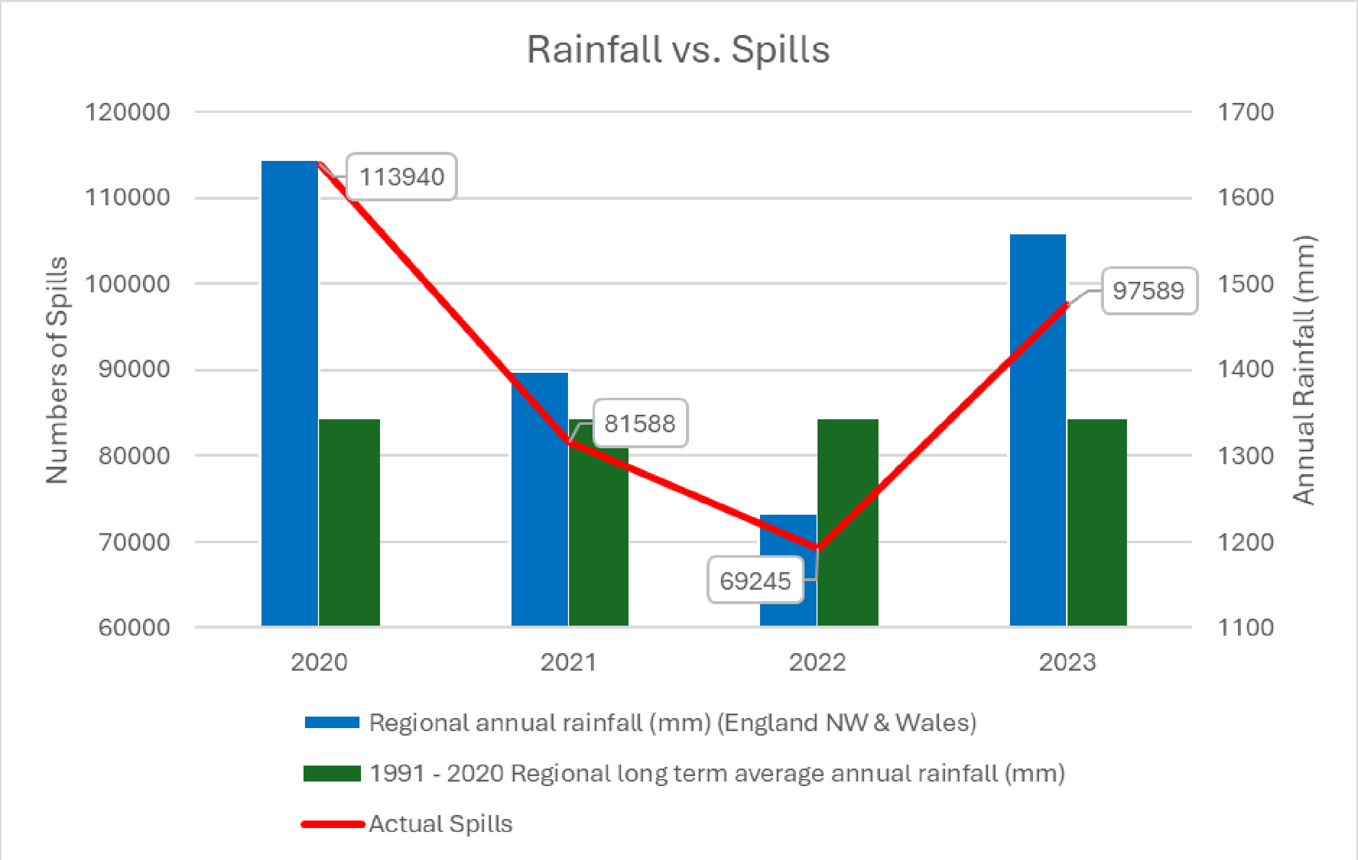
Further details on site specific maximum and minimum spill frequency variations, used to produce the graph above, can be found in our response to query reference OFW-OBQ-UUW-147.

Modelled data has been used to set the range for the cap and collar as there is limited historic data available from storm overflow event duration monitors (EDM). All storm overflows had monitors installed by 31/12/2023 with the majority of EDMs being installed in AMP6. EDM data, where available, is used within the calibration of hydraulic network models however, modelled data, unlike EDMs, are not subject to external influence and therefore the results are a good indication of a single exogenous factor such as climate change or rainfall. This makes the modelled data a good indicator of performance as a result of changes in rainfall.

Data recorded through EDMs will capture the impacts of rainfall in additional to operational and external influences, including, but not limited to: operational maintenance, vandalism, sensor failure, sewer blockages, wildlife, impacts of wind on storm tank top levels, and power outages. As a result, a single year of data is not sufficient to identify a trend however as we gain a better understanding of the operation of our assets and the data, we will be able to use this information to better forecast performance and impact of rainfall on annual spill frequency.

We are already starting to see how we can use this data over a relatively short period to demonstrate how changes in rainfall impact annual spill frequency. Figure 26 (below) shows annual rainfall alongside annual spill frequency and long-term average rainfall (1991-2020). We can observe from this data that there is a direct link between rainfall and spill frequency, as a result we would expect the cap and collar for this measure to protect against extreme weather events, that are outside of company control, which may cause large swings in annual spill frequency and as a result large swings in outperformance and underperformance payments.

Figure 29 Impacts of rainfall and climate change on annual spill frequency



Source: Analysis of UUW spill data and regional rainfall data, published on our website[32]:

Whilst EDM data can augment our models, we observe that our modelling has proven to hold up well against subsequent empirical observations. For example, the 2023/24 EDM return reports EDM data from calendar year 2023. Rainfall in 2023 was significantly higher than the prior year, particularly in the second half of the year. Rainfall was noted as “exceptionally high” by the Environment Agency, with annual rainfall 30% higher than the long-term average across the North West, with some parts of the region as much as 50% higher than 2022. 2023 was the wettest year in 69 years and second wettest in 133 years since 1880. The average spill frequency reported in the EDM return for 2023 is 45, compared to the modelled average spill frequency of 33, gives an annual variation of 37% from the modelled average.

As noted above, in our modelling we observed that most (but not all) points fell within a +/-30% range from the average. The 37% 2023 new data point provides a helpful validation for the performance range that we have assessed using our model results, where most (but not all) data points fell within the +/-30% range. The graph below shows where the 2023 EDM return sits opposite the +/- 30% range:

[32] https://www.unitedutilities.com/better-rivers/our-challenges/edm-return-data/

Figure 30 Average spill frequency recorded within 2023 vs the +/-30% range from the modelled average spill frequency

Source: *UUW analysis*

Given that 2023 was one of the wettest years on record in the North West it is not unexpected that this 2023 data point would fall outside of our proposed range. The performance range we included in our PR24 submission is not intended to cover the extremes of such historic rainfall excesses, but rather a more plausible P10. Our recent experience here shows that we have taken a reasonable and measured approach to proposing performance ranges in our PR24 submission.

Following our PR24 submission, UUW have continued to model storm overflows to further enhance our understanding of operation of storm overflows under different rainfall years. We have now modelled over half of our storm overflows to identify the range in spill frequencies as a result of rainfall. Following the same methodology as carried out previously, we ran hydraulic network models using 10 years' of time series rainfall to identify the annual spill frequency from 1179 storm overflows within the North West. The annual spill frequency was compared to the average spill frequency and presented as a percentage change from the average.

The maximum and minimum variance represent the worst/best case performance over a ten-year period for individual storm overflows. In reality, there will be a range in performance over the region based on rainfall with some areas experiencing greater than average and some less than average rainfall, as a result the average maximum and minimum spill frequencies represent a regional performance that is beyond that of the p10/p90 forecast performance. Within the analysis, we grouped sites by average spill frequency to review the impact of spill frequency on the variance, Table 29 shows the average maximum and minimum for each group. From these data we can observe that the small spill frequencies have a much larger range than the groups with higher spill frequencies. This is expected as a site that spills 1 in 10 years will have a range of -100 to +900%, whereas higher spill frequencies tend to have a much smaller range. We have weighted the average maximum and minimum based on percentage of modelled average spills.

Table 29: The modelled spill frequency variance (measured as a percentage) from the average spill frequency

Average spill range	% Min (average for range)	% Max (average for range)	Number of sites in each range	Count of modelled spills within each range	% of modelled average spills	Weighted min %	Weighted max %
0-3	-97	385	355	324	0.8%	-0.7	3.0
>3 to 10	-66	96	175	1035	2%	-1.6	2.4
>10-20	-51	65	154	2226	5%	-2.7	3.4
>20-30	-47	54	77	1948	5%	-2.2	2.5
>30-40	-45	45	59	2069	5%	-2.2	2.2
>40	-36	29	359	34618	82%	-29.8	23.8
Total			1179	42219	100%	-39	37

Source: UUW analysis of hydraulic network modelling data for 1179 storm overflows

The table shows reasonable correlation between the variation in spill frequency from our initial sample of 82 sites and the much larger sample of over 1179. For sites discharging an average 10 times or more, 80% of data points fell within the +/-30% variance, and 89% fell within a +/-40% variance. This indicates that, based on the evidence, it is reasonable to limit any under-performance and out-performance payments at +/-30% of the target.

In summary:

- Ofwat proposed a cap and collar set at a financial range of +/-0.5% RORE. We do not agree that this adequately takes into account the variation in performance that is outside of management control. Our analysis of modelled data suggests that to meet performance range equivalent to +/-0.5% of RORE would be as a result of severe weather and therefore we do not consider this financial range to be an appropriate mechanism for setting the cap and collar for storm overflows.
- In our October 2023 submission we provided evidence that supported a +/-30% cap and collar for this measure.
- Further justification was provided in our response to query OFW-OBQ-UUW-147.
- In this document we have provided additional modelling analysis, reviewing modelled performance of over half of our storm overflows, to support a tighter cap and collar for this measure.
- We believe that Ofwat should adopt our proposal for a cap and collar set at +/-30% of the target spill frequency.

9. Storm overflow uncertainty mechanism

Ofwat has introduced a storm overflows uncertainty assessment at draft determination (expenditure allowances p.187). UUW support the inclusion of the storm overflow uncertainty mechanism and agree that this is required for changes in understanding as a result of investigations, new bathing water designations and revisions to SODRP. In our representation below we propose some amendments or clarification to the inclusion criteria beyond that specified by Ofwat. We also note that Ofwat should recognise the time value of money adjustment within the PR29 reconciliation.

Additional investigation requirements should be funded through the uncertainty mechanism
The Environment Agency have informed water companies that the current storm overflow assessment framework (SOAF) has been updated and that this will go to consultation later this year, post draft determination representations. In AMP7 SOAF investigations have been undertaken as an enhancement activity either through delivery of WINEP requirements or through our agreed Green recovery programme. The enhancement funding is necessary to undertake these investigations due to the prescriptive nature of what is required under each stage, including invertebrate sampling, water quality modelling, high level solution development and benefits assessment. Under the current guidance, SOAF investigations will take a minimum of two years to deliver.

If the SOAF guidance is updated and additional investigations are required, UUW believe that the investigations, and any subsequent enhancement activity required following the investigation, should be included within the storm overflow uncertainty mechanism.

Additional requirements following AMP7 SOAF investigations
Ofwat have specified that investigations completed in 2025-2020 period may lead to new storm overflow requirements or removed storm overflow requirements. UUW believe that improvements as a result of investigations completed in the final year of AMP7 (FY25) are therefore included within the storm overflow uncertainty mechanism e.g. SOAF investigations completed under WINEP or Green recovery in FY25.

Changes in requirements as a result of investigations should be included within the uncertainty mechanism
Ofwat has specified that the uncertainty mechanism can provide funding for delivery of additional storm overflow schemes and storage. It is important that any changes in requirements as a result of investigations are also captured within the uncertainty mechanism. For example, UUW are undertaking over 700 investigations in AMP8 under the WINEP driver EnvAct_INV4. In some cases an investigation may identify the need to go beyond the current WINEP requirement of 10 spills on average over ten years but will not result in a change to the WINEP driver. Similarly, UUW are undertaking investigations at 5 newly designated bathing waters, if these investigations identify additional storm overflow activity, then we would anticipate that this is included within the uncertainty mechanism, regardless of the driver (e.g. Bathing waters or Urban waste regulation). We believe that changes in storm overflow requirements as a result of investigations, regardless of the driver, should be accounted for within the uncertainty mechanism.

New Bathing Waters
The potential for newly arising designated bathing waters is noted in Ofwat's PR24 Draft Determination expenditure allowances section 4.7.5. We agree that this is a risk and that an approach to deal with this for storm overflows is set out however this does not appear to apply to disinfection of final effluents. As most wastewater treatment works discharge 24 hours a day, 7 days a week the final effluents are more likely to require improvement than the storm overflows, so the approach set out in the Draft Determination, whilst welcome, appears to have an important gap that needs to be addressed. It is therefore proposed that a mirror scheme should exist for disinfection of wastewater effluents to enable companies to respond to emerging needs.

10. Changes to the programme

The table below identifies a list of schemes or drivers that have been added to the WINEP following re-submission of our data tables in January 2024. The sites below have been included within our data tables, included ADD20 and are also represented within our proposed PCD table above where the delivery date is within AMP8.

WINEP ID	Site name	Storm overflow driver(s)
08UU102490a	08UU101164-Hawkshead PS LAK0107SO*	EnvAct_IMP4
08UU102459a	Winton Outfall CSO SAL0018SO	EnvAct_IMP2, EnvAct_IMP4
08UU102457a	Eccles WwTW 016940144SO	EnvAct_IMP2, EnvAct_IMP4
08UU102458a	Eccles WwTW 016940144ST	EnvAct_IMP2, EnvAct_IMP4
08UU102454a	STAVELEY WwTW 017370061ST	EnvAct_IMP2, EnvAct_IMP4
08UU102453a	Princes Street CSO STK0108SO	U_IMP4, EnvAct_IMP4, EnvAct_IMP5
08UU102491a	Glebe Road Pumping Station LAK0045SO	EnvAct_IMP3, EnvAct_IMP4, EnvAct_IMP5
09UU102492a	Grasmere WwTW SO 017370027SO	EnvAct_IMP4, EnvAct_IMP5

Source: AMP8 WINEP (5th July 2024)

*Note Hawkshead was in our PR24 submission under WINEP references 08UU101164a and driver codes EnvAct_IMP2 and EnvAct_IMP5. A new requirement was added following submission under WINEP reference 08UU102414a and driver code EnvAct_IMP4. This new driver meant that a change in solution was required to meet the tighter spill frequency threshold.

Appendix A Post-modelled uplift methodology

As set out in section 5, we implement a post-modelled uplift to reflect a subset of the more material factors that haven't been accounted for within our proposed modelled improvements. These are groundwater, mine workings and geology. This appendix sets out our methodology for calculating these uplifts.

Groundwater-related costs

As discussed in section 3.5, UUW's region is characterised by especially low potential evapotranspiration (PET). This leads to higher levels of groundwater being retained, which can require the use of more complicated, specialist construction techniques such as secant piling.

We calculated the additional cost by multiplying the total volume of storage provided within our programme by: i) the average slope of the caisson shaft line; and ii) the average slope of the secant piling line set out in Figure 11. This calculated the maximum difference in direct construction costs between 'standard' and more specialist techniques. In recognition that not all projects would be affected by adverse groundwater conditions, we halved this total difference. We then applied Ofwat's upper quartile challenge for network schemes to act as a further challenge. Note that this is in recognition that these calculations are slightly subjective by nature and therefore we consider it reasonable to 'aim-down' in the calculation. It should not be taken as our acceptance that it is reasonable to apply these against the overall programme.

This results in an uplift of £53m.

Mine working-related cost

As illustrated in Figure 12, UUW's densely populated south overlaps with areas with reported coal mines. As such, a material number of our storm overflows are likely to be affected by historic coal mines. This is borne out in the deep dive evidence presented as part of our DD representation.

Figure 12 suggests that half of companies in the industry also have significant mine-workings. As such, we divide the total cost of mitigating mine workings within our programme by half to estimate the modelled implicit allowance for the cost of dealing with mine workings. Similar to groundwater-related costs, we apply Ofwat's upper quartile challenge for network schemes to the remaining cost to 'aim down'.

This results in an uplift of £28m.

Geology-related cost

As evidenced in section 3.5, UUW's region is comprised of areas with harder rock, lying at shallower depths. This means more expensive excavation techniques are required.

Figure 9 illustrated the difference in costs between different excavation techniques. We used these different unit costs to estimate the difference in cost between a digging in UUW's region compared to digging in across the whole of England and Wales. We based the different characteristics of rock underlying UUW's region and England and Wales based on visual analysis of Figure 8. This calculated an estimated difference in excavation costs between UUW's region and the entirety of England and Wales, on average. We multiplied this difference by Ofwat's upper quartile challenge for network schemes to the remaining cost to 'aim down'.

This results in an uplift of £71m.

The total uplift is £151m. This is well within the upper bound implied by UUW's modelled improvements as set out in Figure 24.