YORKSHIRE WATER'S OUTCOME DELIVERY INCENTIVE RATES AT PR19

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Report for Yorkshire Water

August 2018

Economic Insight Ltd

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1. Executive summary

This report details the advice we have provided to Yorkshire Water in relation to calculating standard and enhanced incentive rates for its PR19 business plan. In addition, we present the results of assurance work we have undertaken relating to the incentive rates subsequently calculated by Yorkshire Water. We show that there are a range of feasible and pragmatic approaches that Yorkshire Water could use to calculate enhanced incentive rates, which capture 'wider benefits' of significantly improved performance. We also find that, although there is significant variation, there are good reasons why Yorkshire Water's proposed PR19 incentive rates differ compared to those set at PR14. For example, there have been methodological improvements, along with significant positive step changes in performance levels.

At PR19, companies are required to submit incentive rates alongside certain performance commitments, as part of their business plans. These incentive rates result in payments to companies if they outperform relative to their performance commitments, or penalties if they underperform. Yorkshire Water asked us to provide it with advice, both: **(i) in relation to the appropriate methods for determining incentive rates; and (ii) assurance in relation to the incentive rates it subsequently calculated**. As summarised below, this report sets out our work for Yorkshire Water on these matters.

1.1 Calculating standard incentive rates

Using a range of customer valuation evidence from a programme of research undertaken primarily around September 2017, we developed a triangulation model that calculates standard incentive rates. The Excel-based model allows the user to specify the weights to apply to the different evidence sources, which allows Yorkshire Water to flex the calculation approach, to reflect its view of the relative robustness of different evidence sources. This is in line with Ofwat's PR19 methodology, which explicitly acknowledges the usefulness of drawing on multiple pieces of evidence.

In addition to developing the triangulation model, we provided the following advice to Yorkshire Water.

- **Choice of weights**. The customer valuation research specified weights that could be applied to the different sources of benefits valuations. This includes the weight given to estimates of willingness to pay from the stated preference survey that were calculated using both linear, and non-linear, models. The customer valuation research used the linear stated preference estimates, rather than the non-linear versions (i.e. giving them a zero weight), on the grounds that the linear versions reflect the range of service levels in the research. However, we recommended to Yorkshire Water that the non-linear results could be considered, as they may better reflect incremental willingness to pay around the performance commitment level.

- **Calculation of marginal costs**. In addition to marginal benefits, to apply Ofwat's formula for calculating <u>underperformance</u> incentive rates, estimates of marginal costs are also required. For some ODIs, marginal cost data is not readily available (reflecting the fact that it can be challenging to derive marginal costs specific to an 'outcome' type, as outcomes are often a function of various combinations of activities and investments). In cases where outcome specific marginal cost data is not available therefore, we have suggested to Yorkshire Water that a reasonable assumption is that incremental cost equals incremental benefit. This is because Yorkshire Water has undertaken extensive work identifying the optimal investment programme for PR19 (using its 'Decision Making Framework' model - DMF). The approach applied by the DMF should ensure that investments / projects / schemes included in the Plan are 'optimal' (i.e. marginal benefit = marginal cost). Therefore, it seems reasonable to assume that for the 'outcomes' delivered by the Plan, it is also the case that marginal benefit = marginal cost. This seems to be an intuitively reasonable, and pragmatic, solution in cases where marginal cost cannot be robustly measured for the outcome. Accordingly, we have assumed that marginal costs equal marginal benefits in our triangulation model.

1.2   Calculating enhanced incentive rates

In addition to standard incentive rates, companies can propose enhanced incentive rates for common performance commitments that are comparable. They are designed with the aim of encouraging companies to deliver exceptional performance and shift the benchmarks against which other companies' performance is compared. It is assumed that if the benchmarks are shifted, other companies will also improve their performance over time – thus, giving rise to 'wider benefits'.

However, we note that the rationale for enhanced incentive rates is questionable. If a company's performance commitment is correctly calibrated, it should reflect the optimal level of service for its customers. Consequently, it is unclear as to why companies should benefit from (and customers should pay for) performance beyond that level, particularly at a 'higher' (i.e. enhanced) rate. As a consequence of this and other limitations, our approach has been to identify a range of practical methods that *can* be applied to calculate enhanced incentive rates – but none are entirely conceptually sound.

We first identify four approaches to calculate enhanced rates that use the customer valuation evidence from the customer valuation research. More specifically:

- assigning 100% weight to the *evidence source that gives the highest valuation* ('maximum evidence source' approach);
- *applying a percentage uplift* to the standard benefit rate;
- *using the 95% confidence interval* around willingness to pay estimates; and
- *evaluating willingness to pay at a '-2' service increment.*

These approaches are implemented within the triangulation model.[1]

One limitation of these approaches is, however, that they do not explicitly account for the 'wider benefits' that enhanced incentive rates are designed to capture. As such, and to support Yorkshire Water's stretching leakage targets, we have developed

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[1] *See accompanying Excel workbook 'ODI triangulation of customer valuations (workbook)'.*

further approaches that capture the benefit to all industry customers of Yorkshire Water shifting the leakage benchmark. The following table shows the rates implied by each of these further approaches.

Table 1: Potential enhanced rates for leakage that reflect wider benefits

Approach	Enhanced benefit rate (Ml/day)
Approach 1: incrementally driving the UQ	£2.82m
Approach 2: average effect of a step change in performance on the UQ	£0.23m
Approach 3: industry average incentive rate	£0.85m

Source: Economic Insight analysis

1.3   Review of Yorkshire Water's proposed incentive rates

Following our advice and support, Yorkshire Water has selected incentive rates for PR19. To provide assurance in relation to its calculations, we have both reviewed the approaches used by Yorkshire Water and compared the resulting incentive rates with those set at PR14.

Yorkshire Water has made extensive use of the triangulation model. For all the performance commitments for which the model provides evidence, the triangulated benefit rates (using the original weights from the customer valuation research) have been used to calculate *standard* incentive rates. For enhanced incentive rates: Yorkshire Water has used the 'maximum evidence source' approach from the triangulation model for supply interruptions, pollution incidents and internal sewer flooding; and 'Approach 1: incrementally driving the UQ' for leakage outperformance. A separate method for calculating the enhanced incentive rates for per capita consumption (PCC) has been developed; and is outlined in Yorkshire Water's 'Performance Commitments and Outcome Delivery Incentive' appendix. Based on our review, Yorkshire Water has made a series of sensible adjustments to the benefit rates to arrive at incentive rates (such as assuming marginal cost is equal to marginal benefit, where other evidence isn't readily available).

In relation to the comparisons between Yorkshire Water's proposed PR19 incentive rates and those set at PR14, we first note that there are a number of 'general' reasons why there could be substantial differences. For example, service levels and valuations can change over time; and customers of different companies may have different preferences.

The following table shows that, for the four performance commitments for which a direct comparison is possible, there is significant variation between Yorkshire Water's PR19 and PR14 rates. The variations between the valuations are likely to be a result of:

● **The improved methodological approach between the PR14 stated preference study and the PR19 programme of customer valuation research**.

The scale and scope of the research at PR19 is much greater, incorporating a variety of different elicitation techniques to allow for triangulation across multiple sources. The PR19 approach has allowed Yorkshire Water to distinguish between different aspects of service, such as 'use' and 'non-use' benefits, providing a more reliable understanding of customer valuations than previously. Additionally, the improved valuation method at PR19, which explicitly incorporated the use of comparative information, provides a richer context for customers to make informed choices about service improvements.

- **The coverage of services included in the PR19 customer valuations exercises**. For example, Yorkshire Water did not include leakage in the PR14 valuation research, and so the incentive rate did not capture the wider social and environmental benefits. As a result, the PR14 incentive rate for leakage was very low compared to the rest of the industry. By incorporating leakage into the PR19 valuation research, the incentive rate is now more reflective of the wider social and environmental value and is more aligned with the industry incentive rates.

- **Changes in Yorkshire Water's service levels over the 2015-2020 period affects the range over which the incentive rate is applied** (i.e. the 'start point' from which marginal customer value is measured has changed over time).

- **Customer preferences change over time**. It is unsurprising that customer valuations changed between 2013 and 2017, as one would naturally expect customer preferences to change over time.

Table 2: Yorkshire's PR19 standard incentive rates relative to its PR14 incentive rates

Performance commitment	Outperformance payment rate (% difference to PR14 rate)	Underperformance payment rate (% difference to PR14 rate)
Supply interruptions	+73%	+73%
Leakage	+58%	-21%
Pollution incidents	-55%	-10%
Internal sewer flooding	-37%	-84%

Source: Economic Insight analysis

There is also significant variation between Yorkshire Water's PR19 rates and other companies' PR14 incentive rates. There will inevitably be differences between companies' incentive rates, for example, because:

- Companies' current levels of outcome performance vary, and so the 'start point' from which customers are being asked to value marginal changes is different. Logically, this could explain material differences across companies in incentive rates.

- Companies may have adopted 'benefit transfer' approaches, rather than direct customer elicitations in the incentive calculations, which are likely to capture different aspects of the service improvement.

- Companies may have adopted 'cost-based' incentives, rather than using information from customer research, which could create wider variations in incentive rates.

- For companies using stated preference and revealed preference techniques, there are likely to be differences between water only and water and wastewater companies. Water only companies will naturally only be asking customers to value services relating to clean water in the package of attributes tested, whereas water and wastewater companies will be testing a wider range of service areas. Known as the 'package effect', the range of services tested in qualitative research techniques can create variations in the economic valuations.

- The application of marginal cost information in companies' incentive calculations is likely to cause significant differences in the incentive rate. Assessing marginal costs for service improvements is complex, and companies may have adopted a range of approaches.

2. Background and approach

As part of the ODI framework at PR19, companies must propose financial incentive rates that will apply if they outperform or underperform against their performance commitments. Yorkshire Water has asked us to review its draft incentive rates and provide recommendations in relation to the calculation of enhanced incentive rates.

In the sections below, we briefly outline: the regulatory framework in relation to outcome delivery incentive rates; the customer valuations research, which is a key input into our work; and the objectives of our work and the methodology we have used.

2.1   Regulatory framework for outcome delivery incentive rates

Following on from their introduction at PR14, outcome delivery incentives (ODIs) will be used at PR19 to incentivise companies to improve their performance and deliver outcomes that customers value. Companies will make a range of performance commitments and receive payments if they outperform, or penalties if they underperform, against these performance commitments.

The rationale for having financial incentive rates can be considered as the following.

- **Alignment of the incentives of companies and customers**. Economic theory tells us that, whilst monopoly providers may retain strong incentives to 'cost minimise', they are not allocatively efficient. Consequently, without incentive mechanisms being applied (or price control deliverables being stipulated) one might not expect companies to strive to deliver the 'right' outcomes for customers. Consequently, incentive rates within the ODI package can help address this, by aligning company and customer incentives.

- **The above rationale strictly only applies to underperformance incentive rates.** That is to say, if a company's 'target' level (i.e. performance commitment) is correctly specified, then is should equate to the point at which marginal cost = marginal benefit. Accordingly, if a company deviates from this, the result is an allocative inefficiency (as above), which is detrimental to customers. Specifically, underperformance means that customers receive a lower level of service than is optimal (or than they have 'paid for'). Accordingly, a penalty incentive rate is conceptually valid. However, if a company overdelivers, then this is equally allocatively inefficient and is, therefore, 'bad' for customers (i.e. the company is providing 'more' than customers are willing to pay for). Consequently, outperformance incentive rates may in theory reward companies for allocative inefficiency.

- **However, both underperformance and outperformance incentives rates may be rationalised, if one relaxes certain assumptions.** Firstly, it is extremely challenging to precisely identify the economically efficient level of service when setting a performance commitment level. Both marginal cost and marginal benefit are subject to measurement error. Consequently, by both applying under and outperformance incentives: (i) companies may be more likely to reveal the 'true' efficient costs and benefits of delivering outcomes over time;

and (ii) one mitigates the risk of unduly penalising or rewarding companies and customers for 'measurement error'. Secondly, marginal costs can change over time. For example, should marginal costs fall, then the economically efficient level of outcome performance will rise. However, without outperformance incentive rates, companies will not be encouraged to achieve this.

In addition to the above, we later discuss the rationale for 'enhanced' incentive rates. In the sub-sections below, we detail further relevant aspects of the ODI framework.

2.1.1   Types of ODIs

The approach to ODIs at PR19 has the following features.

- Ofwat has specified 14 **common performance commitments**. These have specific definitions, and all companies are required to have them.

- Four common performance commitments are supported by good quality comparative information, and Ofwat expects companies to set their performance commitment levels for these at no lower than the forecast upper quartile level. These performance commitments consist of: water supply interruptions; internal sewer flooding; pollution incidents; and leakage.[2] They can be considered '**comparative common**' performance commitments.[3]

- For common performance commitments that are comparable, companies can propose **enhanced payments**, as detailed further below.

- In addition to common performance commitments, companies are required to propose **bespoke performance commitments**. These are expected to include the following areas: the different price controls; vulnerability; the environment; resilience; and abstraction.[4]

2.1.2   Setting performance commitment levels

In setting performance commitment levels, Ofwat expects companies to use a range of approaches, including:
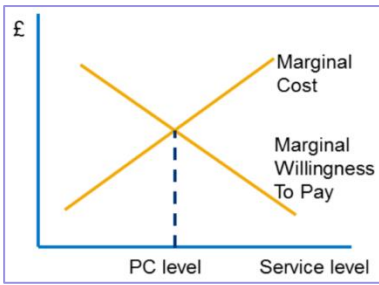
- cost benefit analysis;
- comparative information;
- historical information;
- minimum improvement;
- maximum level attainable; and
- expert knowledge.[5]

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[2] '*Delivering Water 2020: Our methodology for the 2019 price review Appendix 2: Delivering outcomes for customers.' Ofwat (December 2017). Pages 61-65.*
[3] *We recognise that a broader set of 'comparative' performance commitments could be defined if it can be shown that they have 'good quality comparative information'. For the purpose of this report, we focus on the four performance commitments that Ofwat has stated do have good quality comparative information.*
[4] *Ibid. Page 31.*
[5] *Ibid. Page 45.*

In particular, cost benefit analysis, which compares marginal cost with marginal willingness to pay, (at least in theory) identifies the efficient service level – as is illustrated opposite. The setting of performance commitment levels is therefore closely related to marginal costs and marginal benefits, which are in turn closely related to the setting of incentive rates, as is discussed in the next sub-section.

At PR14, stated preference willingness to pay results were relied on heavily to set performance commitment levels and incentives. Whereas, at PR19, Ofwat encourages companies to use a wider range of sources of evidence on customer preferences. Ofwat also notes that different sources of customer research may give conflicting results; and suggests that 'triangulation' could be one approach to deal with it.[6]

In addition to using multiple evidence sources, Ofwat states that companies should use forecast efficient cost levels in their cost benefit analysis.

2.1.3 Calculating standard incentive rates

Companies are expected to base their standard ODI outperformance and underperformance payment rates on the following formulas.[7]

$$ODI_{underperformance} = incremental\ benefit - (incemental\ cost \times p)$$

$$ODI_{outperformance} = incremental\ benefit \times (1 - p)$$

Where:

- – incremental benefit is the value foregone (gained) by customers for a given level of under- (over-) delivery;
- – values can be marginal (one-unit change) or incremental (potentially more than one-unit change);
- – incremental cost is an estimate of the expenditure that can be avoided by the company for the given level of under-delivery; and
- – p is the customer share of expenditure performance from the totex efficiency sharing incentive.

Incremental cost does not appear in the outperformance formula, because it is assumed to be equal to the incremental benefit. If performance levels are set at the economically efficient level, incremental cost would be above incremental benefit – and therefore the outperformance should not occur. It is assumed that if outperformance does occur, the incremental cost will be lower than expected at the time the price control was set (this is consistent with our previous discussion of 'when' an outperformance incentive could be rationalised). Without knowing what the incremental cost will be, Ofwat assumes it is equal to the incremental benefit (the highest cost at which it would be beneficial to outperform).

Companies can use other customer evidence to propose changes to the ODI outperformance and underperformance payment rates, calculated according to the formulas, provided the changes are well justified.

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[6] See, for example, 'Defining and applying triangulation in the water sector.' CCWater, 2017.
[7] 'Delivering Water 2020: Our methodology for the 2019 price review Appendix 2: Delivering outcomes for customers.' Ofwat (December 2017). Page 91.

Companies are also expected to ensure that proposed incentive rates and expected performance levels are consistent with Ofwat's RoRE range guidance. Our work for Yorkshire Water on this is presented in a separate document.

2.1.4   Enhanced ODIs

Further to standard incentive rates, companies can propose enhanced incentive rates for common performance commitments that are comparable. Enhanced incentive rates are of greater marginal value to the company, and take effect after performance is significantly different to the performance commitment level – as is illustrated opposite.

Of relevance to this report, Ofwat states that:[8]

- An enhanced outperformance payment rate must be accompanied by an enhanced underperformance penalty rate for below-standard, poor and unacceptable performance.

- The threshold for the enhanced outperformance payments should be set at the performance level of the current leading company, or higher (for example, including a forecast improvement).

- Enhanced underperformance penalties will apply at least at the current lower quartile company performance.

The regulator has set out its perspective on the underlying rationale for enhanced rates, as follows:

"We want to encourage companies to improve performance beyond the best level currently achieved by any company to deliver benefits for all customers over the long term. This is likely to involve innovation and risk-taking by companies as they seek to significantly improve their performance.

Calculating outperformance and underperformance payments based purely on customer valuations does not take into account the wider benefits that customers would obtain from the kind of significant shifts in performance that would set a new benchmark for industry performance. We are therefore encouraging companies to propose higher outperformance payments for very high levels of performance against the common performance commitments – high enough, that is, to shift the industry frontier."[9]

Ofwat has therefore designed enhanced incentive rates with the aim of encouraging companies to deliver exceptional performance and shift the benchmarks against which other companies' performance is compared. It is assumed that if the benchmarks are shifted, other companies will also improve their performance over time.

Ofwat's given logic for enhanced underperformance penalties is to provide 'balance' and protect customers in case companies take unreasonable risks to achieve high performance and end up with very poor performance. The same logic that improvements in the outperformance benchmark could increase the performance of others could also be applied to underperformance: a company that lowers the LQ

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[8] *Ibid. Page 85.*
[9] *Ibid.*
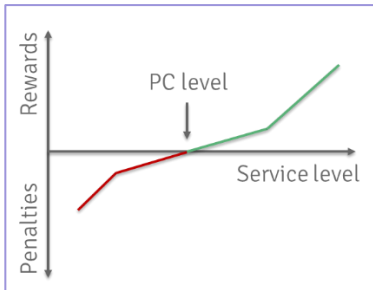
could lessen the performance of other low performance companies because the 'bar' has been lowered.

The following box discusses the implications of Ofwat's rationale for calculating enhanced incentive rates.

Box 1: Implications of the rationale for enhanced incentive rates

> Ofwat's rationale for enhanced payments means that there is no theoretically 'correct' approach for calculating the incentive rates. If a company's performance commitment is correctly calibrated, it should reflect the optimal level of service for its customers.
>
> In relation to enhanced outperformance incentives, it is unclear as to why companies should benefit from (and customers should pay for) performance beyond such an optimal level, particularly at a 'higher' (i.e. enhanced) rate. Further, even if that company were the leading performer in the industry (so that, as per Ofwat's reasoning, its increased performance drove the frontier), this underlying problem still holds.
>
> Namely, it implies that the frontier is, itself, 'artificial'. For example, in a competitive market, if a firm provided a level of service 'beyond' what its customers were willing to pay for, that firm would not have 'raised the benchmark' for its rivals within the market it operates in. Rather, that firm would ultimately not be economically profitable and would be forced to exit the market.
>
> A related issue is that marginal benefits typically decline as service levels rise, rather than increase.
>
> In relation to enhanced underperformance penalties, if a company's performance commitment and standard incentive rate are correctly calibrated, it is also unclear as to why companies should face additional penalties. An outcome that is not economically efficient could arise, companies may be incentivised to misallocate resources, and customers may be over compensated.
>
> As a consequence of the above, our approach has been to identify a range of practical methods that can be applied to calculate enhanced incentive rates – but none are entirely conceptually sound.

2.2   Customer valuation research

A key input into our work was customer valuation research conducted by six separate organisations and academic institutions, which was led by AECOM (hereon 'the customer valuation research').[10] The study undertook primary research to estimate the values that Yorkshire Water customers place on changes in service outcomes.

14 'performance areas' were tested in the customer valuation research. These broadly align with Yorkshire Water's final performance commitments, but vary in some cases (e.g. planned and unplanned interruptions are separate performance areas).

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[10] *'PR19 Understanding Customer Values: Data Triangulation.'* AECOM (2017).

Furthermore, for some performance areas, different sub-measures were tested – for example, different lengths of supply interruptions.

The performance areas included in the customer valuation research were:

- – unplanned interruptions;
- – planned interruptions;
- – low pressure;
- – drinking water quality (bio/chem);
- – drinking water quality (aesthetic);
- – leakage;
- – water restrictions;
- – internal sewer flooding;
- – external sewer flooding;
- – bathing water quality;
- – river water quality;
- – pollution incidents;
- – odour; and
- – land improved.

A list of sub-measures included is also provided in the annex to this report.

To estimate the value customers place on these performance areas, the customer valuation research consisted of a variety of work packages, as is illustrated in the following figure.

Figure 1: Sources of evidence for triangulation
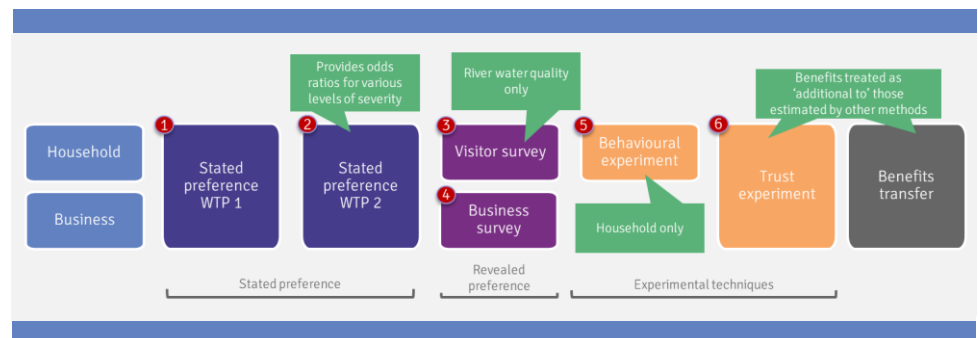
Source: Adapted from AECOM, 'PR19 Understanding Customer Values: Data Triangulation.'

As can be seen, the customer valuation research produced seven sources of valuation evidence, consisting of:

- – first round stated preference survey ('WTP1');
- – second round stated preference survey ('WTP2');
- – revealed preference visitor survey;
- – revealed preference business survey;
- – behavioural experiment;
- – trust experiment; and
- – benefits transfer.

The sources of evidence vary in their 'scope' – both with respect to the outcomes they relate to and their focus. In this regard, we draw attention to the following:

- The first stated preference survey covered 'use' and 'non-use' values for the services tested.

- The second round stated preference estimates do not constitute separate estimates to the first round per se – instead, they provide odds ratios that enable willingness to pay estimates to be decomposed into different levels of severity.

- The visitor survey provides benefits estimates for households with respect to river water quality only. These results were combined with previous stated preference survey results and travel cost methods to provide both a single valuation for river water quality, and a dynamic model illustrating how valuations change depending on where service improvements are made geographically.

- The behavioural experiment covered households only, and included three separate 'treatments' where respondents where shown different contextual information to understand the effect of valuations.

- The trust experiment and benefits transfer evidence have been treated as though they measure 'additional' benefits, not captured in the other sources of evidence.

Furthermore, and of particular note, the first round stated preference results have been calculated using both:

- a linear model, where (effectively) a straight line is drawn through the willingness to pay results for different service levels; and
- a non-linear model, where marginal benefits are calculated from the incremental improvements and deteriorations around the baseline, and are not necessarily equal.

In addition to calculating valuations from each individual source of evidence, the customer valuation research calculated the weighted averages of the sources to give point estimates for performance areas and sub-measures. Of particular note:

- The customer valuation research used the linear stated preference estimates rather than the non-linear versions, on the grounds that the linear versions reflect the range of service levels in the research. That is, the non-linear stated preference estimates received a zero weight.

- In most cases, linear stated preferences received a 50% weighting, with either the business survey or the behavioural experiment also receiving a 50% weighting. The exception is the leakage estimate for business customers, for which no business survey evidence is available.

- Second round stated preference evidence did not receive a weighting – instead, the associated odds ratios were used to calculate benefits estimates for different levels of severity.

- Trust experiment and benefits transfer data were treated as 'additional' benefits, so are simply added to the weighted average of the other evidence.

Notably, the weighted results provide 'benefit rates' (i.e. incremental benefits), which are just one component of Ofwat's suggested ODI formulas.

2.3   Objectives and approach

In the above context, Yorkshire Water asked Economic Insight to:

- – firstly, provide advice in relation to potential approaches to calculating both standard and enhanced incentive rates; and
- – secondly, provide high-level assurance in relation to the incentive rates that it has calculated.

In order to meet the above objectives, we have undertaken a range of work within the following categories.

- **Calculating standard incentive rates**. We have developed a triangulation approach, along with an Excel model, to calculate the value of benefits associated with a selection of ODIs. The model allows Yorkshire Water to flex the weightings given to different estimates of benefits from different research.

- **Calculating enhanced incentive rates**. We have developed a range of approaches that could be used to calculate enhanced incentive rates for any of the comparative ODIs. Furthermore, we have developed additional approaches for leakage, specifically to take account of 'wider benefits' of shifting the industry benchmark.

- **Review of Yorkshire Water's proposed incentive rates**. We have reviewed the incentive rates that Yorkshire Water has calculated following our advice. In particular, we have: undertaken a review of the approaches taken by Yorkshire Water; and where feasible, compared Yorkshire Water's proposed PR19 incentive rates with those that it and other companies set at PR14. The following chapters of this report set out the results of the above work.

3. Calculating standard incentive rates

Using evidence from the customer valuation research, we developed a triangulation model that calculates standard incentive rates. As set out in this chapter, the Excel-based model allows the user to specify the weights to apply – which allows Yorkshire Water to flex the calculation approach to reflect its view of the relative robustness of different evidence sources. This is consistent with Ofwat's PR19 methodology.

The following sections in this chapter detail: our approach to triangulation; and our results and recommendations.

3.1 Triangulation approach

The Excel-based triangulation model that we developed 'triangulates' the valuation evidence from the customer valuation research (i.e. calculates weighted averages) and subsequently computes incentive rates. It builds on the customer valuation research in three main ways:

- Firstly, the model gives the user the flexibility to choose what weights to apply to the different valuation evidence sources. That is, whilst the customer valuation research computed benefits values based on 'default' weights, our model allows Yorkshire Water to choose what weights it wishes to use – based on its judgement of the robustness of different evidence sources.

- Secondly, in addition to triangulated benefit rates, our model calculates <u>incentive</u> rates by adjusting the <u>benefit</u> rates to take account of marginal costs and the totex efficiency sharing incentive. We discuss our calculation approach further below.

- Thirdly, our triangulation approach not only produces standard incentive rates, but also produces enhanced incentive rates. We detail our work on enhanced incentive rates in the next chapter of this report.

In the following two sub-sections, we further detail our approach to calculating standard incentive rates and how our Excel-based model works.

3.1.1 Calculation of standard incentive rates

As per the formulas given in sub-section 2.1.3, an <u>outperformance</u> incentive rate should be calculated by multiplying the benefit rate by one minus the totex efficiency sharing incentive rate ('*p*'). Given *p=0.5*, the outperformance incentive rate is therefore equal to half the triangulated benefit rate. More specifically, our calculation approach to standard outperformance incentive rates is:

$$ODI_{outperformance} = triangulated\ benefit\ rate \times 0.5$$

In relation to the <u>underperformance</u> incentive rates, Ofwat's formula stipulates that the incremental cost multiplied by the totex efficiency sharing incentive rate should be subtracted from the benefit rate. Within our model, we assume that incremental cost is equal to incremental benefit. The practical implication of assuming this is that the

underperformance incentive rate will also be equal to half the benefit rate. Specifically:

$$ODI_{underperformance}$$
$$= triangulated\ benefit\ rate\ - (triangulated\ benefit\ rate\ \times 0.5)$$
$$= triangulated\ benefit\ rate\ \times (1 - 0.5)$$
$$= triangulated\ benefit\ rate\ \times 0.5$$

Our rationale for equating marginal cost and marginal benefit is as follows.

- Yorkshire Water has undertaken extensive work to optimise its Plan outputs at the scheme level. The optimal 'solution' that it provides can be considered as being economically efficient, and therefore by implication it must be that marginal cost equals marginal benefit for those schemes. Accordingly, it is intuitively sensible to assume that for the outcomes delivered by those schemes, so too marginal cost = marginal benefit.

- Calculating a marginal cost for each individual performance commitment using a 'bottom-up' approach presents numerous challenges. These include: allocating costs to individual performance commitments; annualising costs that occur over multiple periods; determining the relevant planning horizon; determining the efficient costs level; and accounting for the relationship between costs associated with different performance commitments. Given these challenges, assuming that marginal cost equals marginal benefit is a practical and pragmatic approach.

- Furthermore, owing to the challenges and complexity of calculating marginal costs, it is likely that a large variety of approaches will be used across the industry – producing significantly different results. Assuming marginal cost equals marginal benefit is transparent and avoids the potential for gaming.

However, we recommend that, where Yorkshire Water does have robust evidence as to the marginal cost of its performance commitments, these should be used instead of the above assumption.

3.1.3   Excel-based triangulation model

The Excel model that we developed is illustrated in the following figure - and is described in more detail subsequently.

Figure 2: Model schematic
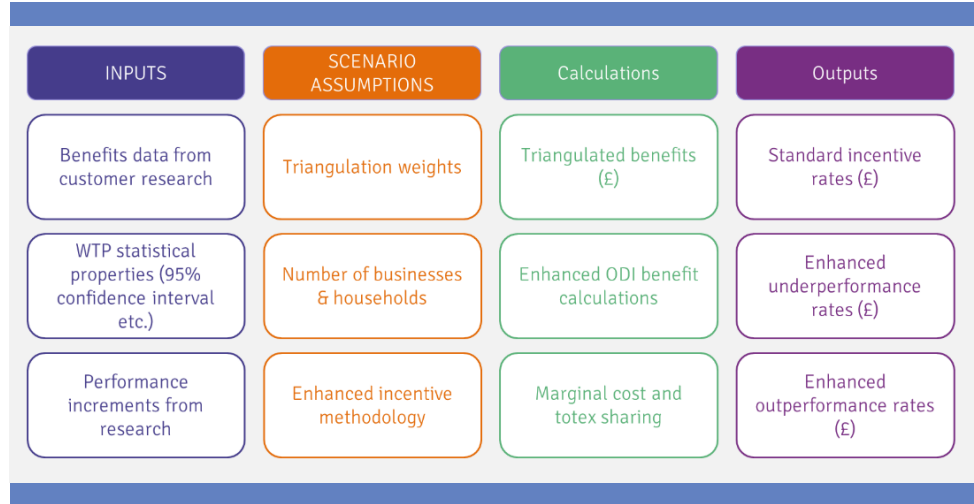
Source: Economic Insight

The main **inputs** into the model are parameters from the customer valuation research. This includes: willingness to pay results from customer research and benefits transfer analysis; statistical properties of the research results (such as 95% confidence intervals); and the specific performance increments that were tested in the research.

In calculating the incentive rates, various **scenario assumptions** need to be made. Most importantly, these include the triangulation weights to use. As is discussed later, our model is pre-populated with the weights used by the customer valuation research. In addition, assumptions are required in relation to the number of customers and the methodology for calculating enhanced incentive rates (as is discussed in the next chapter of this report).

The model subsequently **calculates** and produces **outputs** consisting of standard incentive benefit rates and, where applicable, enhanced incentive benefit rates.

3.3   Results and recommendations

Using our triangulation model and the customer valuation research weights, we calculated standard incentive rates for the 14 performance areas.

The customer valuation research weights (which are pre-populated in our Excel model) are illustrated in the following table for the performance areas that align best with the four comparative common performance commitments.

Table 3: 'Default' triangulation weights for selected performance areas

| | Customer type | Stated preference | | Visitor survey | Business survey | Behavioural experiment | Trust experiment | Benefits transfer |
		Linear	Non-linear					
Supply interruptions	Household	50%	0%			50%	100%	
	Business	50%	0%		50%			
Leakage	Household	50%	0%			50%		100%
	Business	100%	0%					
Internal sewer flooding	Household	50%	0%			50%	100%	
	Business	50%	0%		50%			
Wastewater pollution incidents	Household	50%	0%			50%	100%	
	Business	50%	0%		50%			

Source: Economic Insight

The following table (see overleaf) shows the triangulated standard benefit and incentive rates. Underperformance and outperformance rates are equal to each other, because the same benefit value evidence is used and our assumption that marginal cost equals marginal benefit means that the incentive rate formulas are mathematically equivalent. We note that there are some minor differences between the benefit rates from our triangulation model and those calculated as part of the customer valuation research. This is because we took a slightly different approach in some cases to ensure internal consistency.

Table 4: Triangulated standard benefit and incentive rates

Performance area	Benefit rate (per relevant unit per year)	Incentive rate (per relevant unit per year)
Unplanned Interruptions	£5,250	£2,625
Planned interruptions	£3,210	£1,605
Low Pressure	£278,428	£139,214
Drinking Water Quality (Bio/Chem)	£1,863,048	£931,524
Drinking Water Quality (Aesthetic)	£10,804	£5,402
Leakage	£158,960	£79,480
Water Restrictions	£37	£18
Internal Sewer Flooding	£72,010	£13,208
External Sewer Flooding	£46,951	£23,475
Bathing Water Quality	£1,271,436	£635,718
River Water Quality	£4,465,325	£2,232,663
Pollution Incidents	£115,713	£57,856
Odour	£1,301	£650
Land Improved	£3,111	£1,555

Source: Economic Insight

In addition to recommending that Yorkshire Water assume marginal cost is equal to marginal benefit (where there is no robust evidence otherwise), we also recommended that it should consider using the non-linear results from the customer valuation research, instead of the linear results. As is shown in Table 3, the customer valuation research assigned a zero weight to the non-linear stated preference results, and (in most cases) a 50% weight to the linear stated preference results. We think

that the non-linear results may better reflect incremental willingness to pay around the performance commitment level – and therefore warrant consideration.

In chapter 5, we review how Yorkshire Water has, in practice, used the triangulation model to calculate its standard incentive rates.

4. Calculating enhanced incentive rates

In this section of our report, we detail practical approaches that Yorkshire Water could use to calculate enhanced incentive rates. As is discussed previously, the economic rationale for enhanced incentive rates is questionable; and therefore we have focused on developing approaches that provide reasonable results – rather than being entirely conceptually consistent. We present a number of approaches, including ones specifically to capture the wider benefits of Yorkshire Water's leakage performance.

The approaches we have developed fall into two groups:

- **Approaches using results from the customer valuation research**. These approaches use the same evidence source as the calculation of standard incentive rates discussed in the previous chapter. They are therefore relatively simple to implement, and the relevant functionality is built into our triangulation model. We have calculated incentive rates based on these approaches for the four 'comparative common' ODIs.

- **Approaches to reflect the 'wider benefits' of leakage performance**. Given the significance of leakage performance at PR19 in particular, Yorkshire Water asked us to develop further approaches that reflect the wider benefits of performance.

The approaches that we have developed are detailed in the sections below.

4.1 Approaches using Yorkshire Water's customer research

We have developed four approaches that use valuation evidence from the customer valuation research:

- **Maximum evidence source**. Whereas the standard benefit rate is based on a triangulation of evidence sources, this approach simply takes the evidence source that gives the *highest result.* Or, put another way, assigns a 100% weight to the evidence source giving the highest value.

- **Percentage uplift**. This approach applies a percentage uplift to the standard benefit rate that results from the triangulation. In Box 2 overleaf, we present one method to calculate a percentage uplift, but ultimately the percentage chosen will be a largely arbitrary choice. The benefit of this method though is that it is simple to implement, with no additional data requirements. For the purpose of illustration in this report, we use 20%.

- **Confidence interval**. This approach uses the 95% confidence intervals around WTP estimates in the stated preference research. In effect, this would use the same weights as the standard incentive triangulation; but would use higher stated preference WTP values. This approach is unlikely to give materially larger benefit rates than the triangulation approach for standard incentive rates.

- **Service increment**. This approach is to use WTP for particular service increments in the WTP research. As WTP decreases at the margin, this would have to focus on the service deterioration estimates, i.e. using incremental improvements is likely to give a smaller enhanced benefit rate – although, as is shown below, service deteriorations can also give smaller rates. As a default, we have selected '-2' service decrements. Again, this approach preserves the weights but alters the WTP values.

Box 2: Calculating a percentage uplift

An appropriate percentage uplift to the standard benefit rate could be calculated by considering the enhanced penalty as a form of regulatory fine – punishing a company when customers have been harmed by the firm's performance. Common levels of fines for material regulatory breaches are 5% of a firm's revenue, though it would clearly be excessive to use this figure for each PC. Instead, we can use each PC's benefit value (for a given service increment) relative to the total benefit values of all PCs for the same service increment as an estimate of the proportion of overall service benefits attributable to each PC. This could then be multiplied by an 'overall' fine amount, e.g. 5% of total revenue.

In mathematical terms, the percentage would be calculated as:

$$\frac{Benefit\ of\ change\ in\ PC\ service\ \times\ Fine\ Percentage\ \times\ Wholesale\ revenue}{Benefit\ of\ change\ in\ all\ PC\ service}$$

In practice, to calculate these percentages, further information would be needed in relation to the service increments tested in the customer valuation research WP2.

The following figures (starting overleaf) show the resulting benefit rates of the above approaches, for each of the four performance areas that best align with the comparative common ODIs. As can be seen, the benefit rate for a '-2' service decrement is not always greater than the standard benefit rate. This is because very large service deteriorations are used, which leads to a small unit WTP.

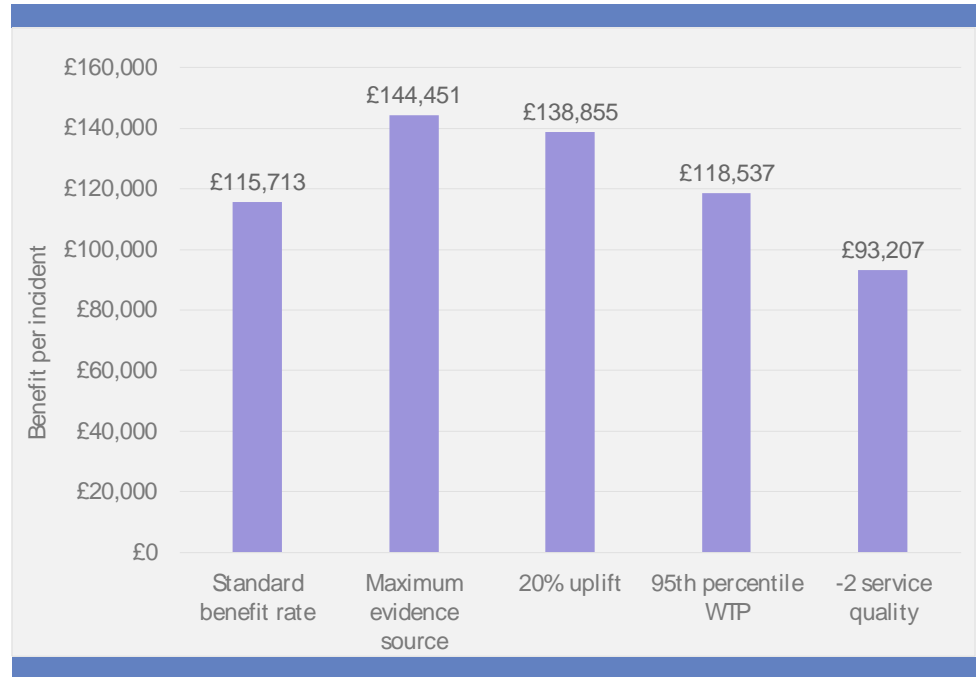Figure 3: Potential enhanced benefit rates for leakage

Source: Economic Insight analysis

Figure 4: Potential enhanced benefit rates for internal sewer flooding

Source: Economic Insight analysis

Figure 5: Potential enhanced benefit rates for pollution incidents

Source: Economic Insight analysis

Figure 6: Potential enhanced benefit rates for unplanned supply interruptions

Source: Economic Insight analysis

A table in the annex provides all the above figures in a table.

4.2 Approaches to reflect the 'wider benefits' of leakage performance

One potential limitation of the approaches presented above is that they do not explicitly reflect the 'wider benefits' that Ofwat wishes the enhanced incentive rates to capture. As such, and because of the importance of leakage, we have developed further approaches that could be used to calculate enhanced incentive rates for this ODI in particular.

In the following sections we discuss the aims and challenges of calculating enhanced incentive rates to explicitly reflect wider benefits, along with three approaches we have developed and the rates that they imply.

4.2.1 Aims and challenges

Consistent with Ofwat's concept of wider benefits, the aim of these approaches is to quantify the effect of Yorkshire Water's performance on wider industry performance – and therefore the benefits/costs to all customers. However, a number of conceptual and practical issues limit the extent to which this can be done. In particular:

- Once a company is at the frontier (and therefore eligible for enhanced outperformance payments), marginal increases in its performance **do not affect the upper quartile** – and therefore, it doesn't change the 'standard' benchmark against which other companies are judged.

- We only know the incentive rates for other companies from PR14. This means that the valuations may be out-of-date, or applicable to service levels already surpassed.

- If enhanced outperformance rates reflect benefits to customers of other companies, customers as a whole may end up paying twice e.g. Yorkshire Water customers would pay once through the enhanced incentive rate, and customers of other companies would pay through standard incentive rates once their companies improved their performance. A similar situation could occur through underperformance rates: customers of one company would be compensated through the enhanced incentive rate and then all other customers would also be compensated through their own companies' incentive rates.

Notwithstanding these limitations, we have developed the following three practical approaches to calculate enhanced incentive rates. We illustrate the approaches based on enhanced **outperformance,** but the same steps can be taken to calculate enhanced **underperformance** rates. Furthermore, (i) we do not necessarily think that the same approach needs to be used to set enhanced out and underperformance rates (i.e. one could 'mix and match' for any given ODI); and relatedly (ii) we do not necessarily consider that enhanced out and underperformance rates should be 'symmetrical'. This is because the 'point' at which enhanced outperformance rates apply (the frontier) differs from that for enhanced underperformance rates (lower quartile), meaning that the enhanced underperformance rates will typically apply to a "wider" range of performance. In addition, because the 'rationale' for enhanced rates in the first instance is questionable, one may adopt differing perspectives as to what purpose an enhanced outperformance rate is serving, compared to an enhanced underperformance rate, for any given ODI (e.g. one could drive wider benefits to customers; one might be capturing negative externalities).

4.2.2 Approach 1: incrementally driving the UQ

The first approach calculates Yorkshire Water's marginal effect on the UQ and assumes that by shifting the UQ, every other company will subsequently increase its performance by that amount. The incentive rate is calculated as the sum of the value of the change in UQ performance for each company – thus, the wider benefits of Yorkshire Water's performance.

More specifically, the calculation steps are as follows:

- It is assumed that Yorkshire Water's marginal performance directly affects the UQ. For this to be true, it must be that Yorkshire Water is one of the two companies that sits either side of the mathematical upper quartile.[11] It is further assumed that Yorkshire Water is the worst performing of these two companies.

- The effect of a marginal change in Yorkshire Water's performance on the UQ is calculated.

- It is assumed that this change in UQ will improve every other company's performance by the same amount. For example, if Yorkshire Water's marginal improvement increases the UQ by 1 unit, it is assumed that this will result in all other companies subsequently increasing their performance by 1 unit.

- For each company, the change in UQ (and therefore its performance) is multiplied by its PR14 incentive rate.

- The above results for all companies are summed to give the enhanced incentive rate for Yorkshire Water.

The benefits of this approach are that it quantifies the benefit to all customers of Yorkshire Water's incremental performance – and thus reflects 'wider benefits' of shifting the benchmark. However, it assumes that Yorkshire Water is one of the companies that directly determines the UQ; and is therefore not a frontier company and would not be eligible for enhanced outperformance payments (as noted above, this is an inherent tension between Ofwat's stated rationale for enhanced incentives, and the 'mathematical method' used in PR19 to set benchmarks).

This approach could also be applied to calculate enhanced *underperformance* incentive rates e.g. to estimate the wider effect of poor performance on the LQ and, subsequently, other companies' performance.[12] Instead of using PR14 outperformance incentive rates, PR14 underperformance incentive rates could be used. However, using this approach for both enhanced outperformance and underperformance rates introduces an internal inconsistency in that the effect of both improving the UQ and lowering the LQ is assumed to have a 'one-for-one' effect on all other companies' performance – which cannot simultaneously be true. Although this inconsistency could be ignored, it is perhaps one reason why it could be appropriate

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[11] *For example, if there are 18 companies, the upper quartile is calculated as part way between the performance of the 4th and 5th best performing companies.*
[12] *We recognise that Ofwat does not 'benchmark' to LQ; rather our reference to this here is simply intended to reflect that one company 'pulling down' a measure of cross industry performance, which could be the LQ, but equally, could be an average etc (to which comparisons could be made) could disincentivise other companies from improving.*

to use different methodologies to calculate outperformance and underperformance rates.

4.2.3   Approach 2: average effect of a step change in performance on the UQ

The second approach is similar to the above, but based on Yorkshire Water making a step change from its forecast 2020-21 performance level to being at the frontier in 2020-21. More specifically:

- Two scenarios are assumed:

    - Scenario 1: all companies perform as per our forecasts in 2020-21.[13]
    - Scenario 2: all companies perform as per our forecasts in 2020-21, with the exception of Yorkshire Water, which is set at (marginally) the frontier company.

- The UQ is calculated in both scenarios.

- The difference between the UQs is calculated.

- It is assumed that each company will subsequently increase its performance by this change in the UQ.

- For each company, the change in UQ is multiplied by its PR14 outperformance incentive rate. These values are then summed.

- The sum is divided by the change in Yorkshire Water's performance between scenarios to give a Ml/day enhanced incentive rate.

The benefit of this approach is that it more accurately reflects the performance that Ofwat wishes to encourage with enhanced incentive rates – a step change in performance to the frontier. However, it does not reflect the marginal benefit to all customers, once the company is at the frontier.

A similar enhanced *underperformance* rate could be calculated by setting Yorkshire Water's performance in 'scenario 2' to an LQ level and using PR14 penalty rates.

4.2.4   Approach 3: industry average incentive rate

The third approach calculates the average equivalent incentive rate across the industry. Specifically:

- The PR14 incentive rate for each company is divided by its number of customers to give a rate per customer per Ml/day.

- The average of these per customer per Ml/day rates is multiplied by Yorkshire Water's number of customers to give an average equivalent incentive rate for Yorkshire Water.

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[13] *In a separate piece of work for Yorkshire Water, we forecasted each companies' performance up to the end of AMP7 based on an autoregressive process.*

Either PR14 outperformance or underperformance rates could be used, depending on the enhanced rate one wishes to calculate.

This approach reflects the value that all industry customers place on leakage, but is arguably less well aligned with 'wider benefits' compared to the above two approaches.

4.2.5   Calculated enhanced outperformance rates for leakage

The calculated enhanced outperformance rates from each of the above approaches, along with the standard benefit rate for comparison, are shown in the following figure (relating to leakage). We note that:

- **Approach 1 gives a rate that is significantly larger than the standard benefit rate.** Intuitively, this is because it captures the benefit to all industry customers – some of which have higher valuations for leakage.

- **Approach 2 gives the lowest of the three approaches** because the increase in performance level from Yorkshire Water's forecast position to the frontier is 'large', and therefore the per unit industry benefit is relatively small.

- The rate for **Approach 3 suggests that the industry average incentive rate for leakage at PR14 was much higher than Yorkshire Water's.**

Figure 7: Potential enhanced outperformance rates for leakage that reflect wider benefits
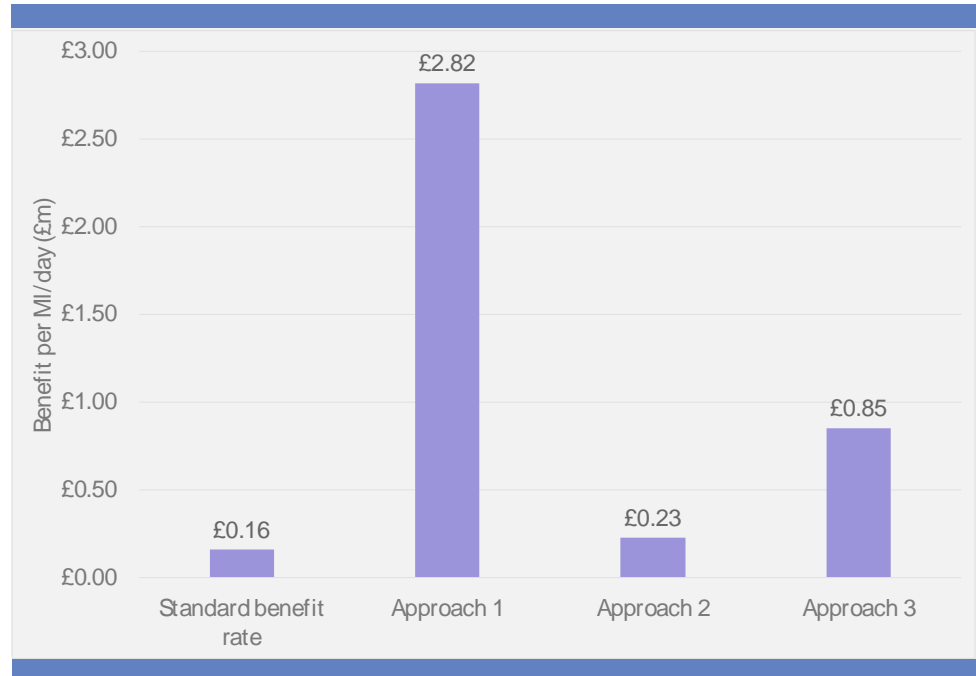
Source: Economic Insight analysis

5. Review of Yorkshire Water's proposed incentive rates

This chapter reviews Yorkshire Water's proposed incentive rates by comparing them to PR14 rates. The purpose of this chapter is to provide assurance to Yorkshire Water in relation to its calculated incentive rates. We find that there are significant differences between Yorkshire Water's PR19 incentive rates and those it, and other companies, set at PR14. There are a number of good reasons why these differences occur, including methodological improvements and step changes in performance levels.

Before looking at how Yorkshire Water's incentive rates compare, it is worth noting that there are a number of 'in-principle' reasons why Yorkshire Water's incentive rates may be different between AMPs and may be different to other companies. More specifically:

- Yorkshire Water's level of service has changed over time, and therefore its customers' marginal willingness to pay (relative to its performance commitment levels) may reasonably have changed. Furthermore, it is plausible that willingness to pay for a service feature changes over time.

- Yorkshire Water's customers may value service elements differently to customers of other companies. Firstly, customers across companies may have heterogeneous preferences. Indeed, one benefit of Ofwat's approach to ODIs is that the preferences of each company's customers can be reflected in outcomes and incentives. Secondly, and related to the above point, different companies have different levels of performance and therefore it can be expected that marginal willingness to pay will differ (i.e. in each case, the 'start point' from which customers' marginal valuation of improvements is measures, can be very different across companies).

- From a more practical perspective, the framework and research approaches differ between PR14 and PR19. Ofwat's methodology suggests that a broader range of evidence sources should be used to calculate incentive rates. Furthermore, the results of willingness to pay research is sensitive to the specific approach taken, and therefore – as PR14 approaches have been built on for PR19 – it is reasonable to expect results to be different. Indeed, companies are expected to have improved their approach to customer research for this price control.

In the following sections we first provide an overview of Yorkshire Water's proposed performance commitments (including how they were calculated), and then present comparisons of the incentive rates.

5.1 Overview of Yorkshire Water's performance commitments

The following bullet points set out key characteristics of Yorkshire Water's draft performance commitments.

- Yorkshire Water has **41 performance commitments** (including C-Mex and D-Mex).

- **14 performance commitments have no financial incentives**. This means that 25 performance commitments (excluding C-Mex and D-Mex) have financial incentives attached to them.

- **All financial incentives are to be taken in the form of revenue**, rather than, for example, additions to the RCV.

- **4 performance commitments with financial incentives will be evaluated at the end of the AMP**, whereas the rest are 'in-period'.

- Of the performance commitments with financial incentives (excluding C-Mex and D-Mex): **4 are a continuation from PR14**; **12 are a revision from PR14**; and **9 are new for PR19**. We note that some performance commitments labelled as a continuation from PR14 were sub-measures at PR14, and therefore did not have a specific incentive rate. Furthermore, some continued performance commitments have switched from not having a financial incentive to having one. The comparability between PR14 and PR19 performance commitments, in terms of their incentive rates is, therefore, limited.

We have reviewed the extent to which Yorkshire Water has used the results and approaches outlined previously in this report to calculate its incentive rates. The table below shows that, for all the performance commitments for which customer benefits evidence is available, the triangulated results – based on weightings from the customer valuation research – have been used to calculate standard incentive rates. Furthermore, adjustments have been made where it is necessary. For example: converting the 'per person' benefits value into the relevant basis for a performance commitment; or taking a weighted average of sub-measures.

Table 5: Yorkshire Water's approach to calculating standard incentive rate for performance commitments for which triangulated benefits evidence is available

Performance commitment	Triangulated benefit rates used?	Adjustments to triangulated benefits value
Land Conserved and Enhanced	✓	Weighted average of sub-measures based on the types of land in Yorkshire Water's area
Length of River Improved	✓	None
Drinking Water Quality	✓	Weighted average of sub-measures based on historical occurrence of drinking water sample failures
Water Supply Interruptions (Customer Minutes Lost)	✓	Weighted average of sub-measures based on historical occurrences
Leakage	✓	None
Drinking water contacts	✓	Weighted average of sub-measures based on historical contacts
Water Supply Interruptions (12 hours or longer)	✓	Adjusted to reflect events rather than properties affected
Low Pressure	✓	None
Wastewater Pollution Incidents (Category 3)	✓	None
Internal Sewer Flooding	✓	Weighted average of sub-measures based on historical incidents
External Sewer Flooding	✓	Weighted average of sub-measures based on historical incidents
Bathing Water Quality	✓	None

Source: Economic Insight analysis

We have also reviewed Yorkshire Water's approach to calculating enhanced incentive rates. Here, our findings are as follows:

- **The 'maximum evidence source' approach from the triangulation model was used for supply interruptions, pollution incidents and internal sewer flooding**. This approach was chosen because of the clear link to actual elicited values, and because it provides relatively strong enhanced incentives. The limitations to the other approaches that use Yorkshire Water's customer research were also recognised. For example: the percentage uplift approach would be relatively arbitrary; the confidence interval approach would likely not give materially different rates to the standard rates; and the service increment approach would give inconsistent results.

- **'Approach 1: incrementally driving the UQ' was used for leakage outperformance**. This was selected because it recognises the benefits to all customers nationally, and – given the relative importance of leakage to customers – the need for particularly strong incentives. Yorkshire Water's approach to calculating the enhanced underperformance incentive rate is detailed in Yorkshire Water's 'Performance Commitments and Outcome Delivery Incentive' appendix.

- **A separate method for per capita consumption**. This is also outlined in Yorkshire Water's 'Performance Commitments and Outcome Delivery Incentive' appendix.

The methods used are summarised in the table below.

Table 6: Yorkshire Water's evidence source / approach for calculating enhanced incentive rates

Performance commitment	Evidence source / methodology
Supply interruptions	Maximum evidence source
Pollution incidents	Maximum evidence source
Internal sewer flooding	Maximum evidence source
Leakage (outperformance)	Approach 1: incrementally driving the UQ
Per capita consumption	Separate method

Source: Economic Insight analysis

5.3   Comparison with Yorkshire Water's PR14 incentive rates

Yorkshire Water's PR19 incentive rates vary considerably to its PR14 rates. Where possible, the table below shows Yorkshire Water's PR19 incentive rates relative to its PR14 incentive rates.[14] For example, the proposed PR19 payment rate for leakage is 58% <u>higher</u> than the PR14 one, and the underperformance penalty rate is 21% <u>lower</u>.

Table 7: Yorkshire Water's PR19 standard incentive rates relative to its PR14 incentive rates

Performance commitment	Outperformance payment rate (% of P14 rate)	Underperformance payment rate (% of P14 rate)
Supply interruptions	+73%	+73%
Leakage	+58%	-21%
Pollution incidents	-55%	-10%
Internal sewer flooding	-37%	-84%

Source: Economic Insight analysis

We note that the PR19 incentive rates are not all higher than the PR14 incentive rates, and nor are they all lower. Furthermore, through discussions with Yorkshire Water we recognise that:

- **There have been methodological improvements between the PR14 stated preference study and the PR19 programme of customer valuation research**. The scale and scope of the research at PR19 is much greater, incorporating a variety of different elicitation techniques to allow for triangulation across multiple sources. The PR19 approach has allowed Yorkshire Water to distinguish between different aspects of service, such as 'use' and 'non-use' benefits, providing a more reliable understanding of customer valuations than previously. Additionally, the improved valuation method at PR19, which explicitly incorporated the use of comparative information, provides a richer context for customers to make informed choices about service improvements.

- **The coverage of services included in the PR19 customer valuations exercises**. Yorkshire Water did not include leakage in the PR14 valuation research (the incentive rate was based on a marginal cost approach), and so the incentive rate did not capture the wider social and environmental benefits.

- **Yorkshire Water's outcomes performance has changed significantly since PR14.** This means that the 'starting point' from which further marginal

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[14] Of the 11 performance commitments labelled as continuations from RP14, only four have comparable incentive rates. Reasons why some performance commitments are not comparable include: the outperformance rate for working with others at PR14 was a percentage of the relevant totex; external sewer flooding was a non-financial incentive; and sewer collapses was a performance commitment sub-measure. The four performance commitments that are comparable across PR14 and PR19 happen to be the four comparative common performance commitments at PR19.

improvements are valued is materially different at PR19. Logically, this would result in incentive rates varying materially.
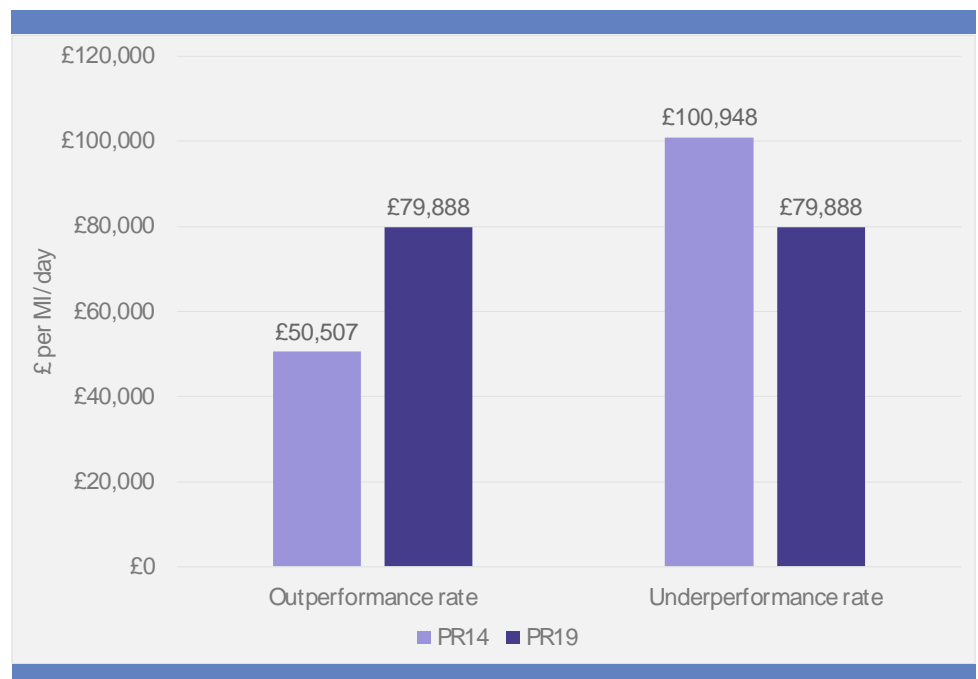
The following figures show the comparison between PR14 and PR19 incentive rates in levels.

Figure 8: Yorkshire Water's PR14 and PR19 incentive rates for supply interruptions
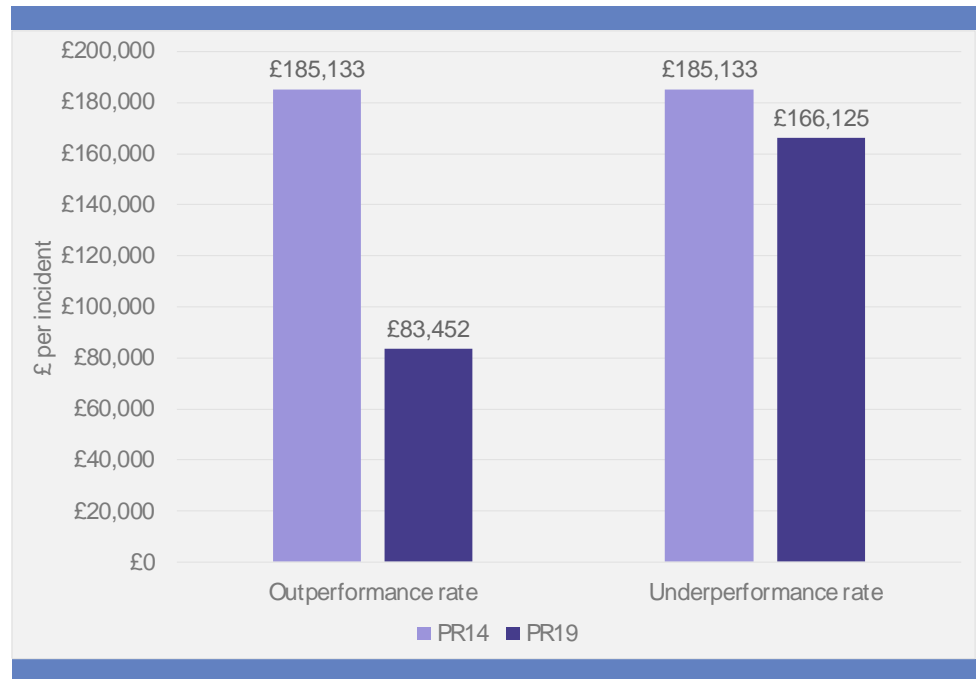

Source: Economic Insight analysis

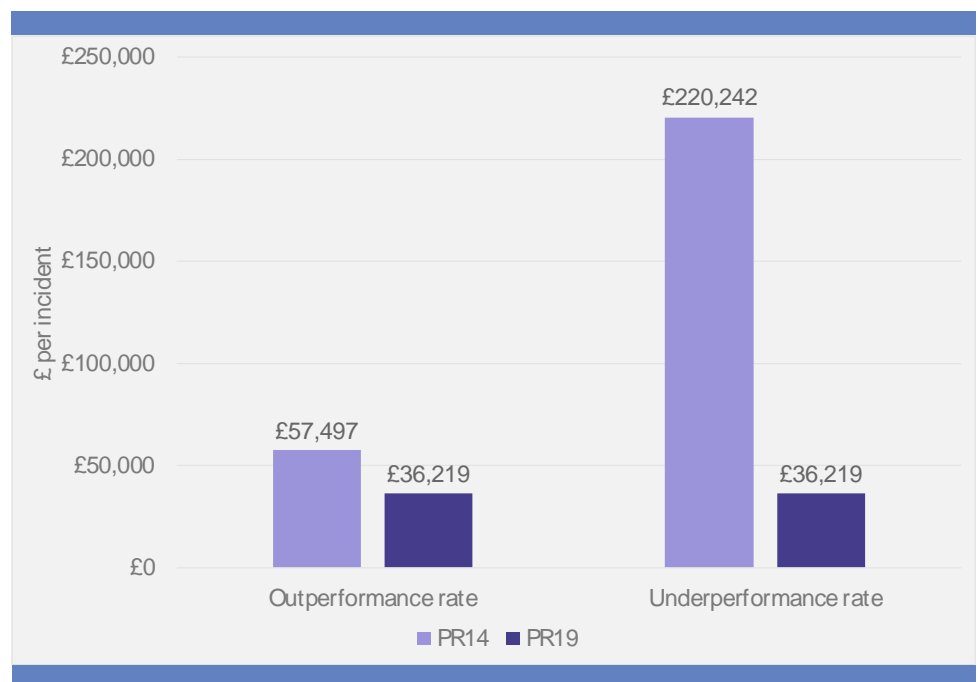Figure 9: Yorkshire Water's PR14 and PR19 incentive rates for leakage

Source: Economic Insight analysis

Figure 10: Yorkshire Water's PR14 and PR19 incentive rates for pollution incidents

Source: Economic Insight analysis

Figure 11: Yorkshire Water's PR14 and PR19 incentive rates for internal sewer flooding

Source: Economic Insight analysis

5.4   Comparison with other companies' PR14 incentive rates

We have also compared Yorkshire Water's proposed PR19 standard incentive rates with those of the whole industry set at PR14. We have selected six performance commitments for which comparisons can be made. Specifically: the four PR19 comparative common performance commitments; in addition to external sewer flooding and per capita consumption. We have taken a pragmatic approach to selecting which performance commitments to include; and have focused on those for which we know there are a reasonable number of data points.

It should be noted that the comparability between Yorkshire Water's proposed PR19 rates and other companies' at PR14 is often limited by performance commitments being specified differently, and incentive rates taking different 'forms' e.g. an addition to RCV rather than revenue.[15] Where feasible, we have made adjustments to PR14 rates to maximise comparability – and note these subsequently.

Below, Table 8 shows how Yorkshire Water's proposed PR19 incentive rates compare to the industry average PR14 rates. Although some of the differences appear 'large', there is significant variation between PR14 rates and therefore Yorkshire Water's PR19 rates are not necessarily so dissimilar when compared to the spread of PR14 rates. Indeed, the second table that follows shows that only some of Yorkshire Water's PR19 rates are greater (less) than the maximum (minimum) rates set at PR14.

Table 8: Yorkshire Water's PR19 standard incentive rates relative to PR14 industry averages

	Outperformance payment rate	Underperformance payment rate
Supply interruptions	+533%	+348%
Pollution incidents	+23%	-55%
Internal sewer flooding	-33%	-62%
External sewer flooding	+158%	+77%
Leakage	-90%	-96%
Per capital consumption	N/A	-97%

Source: Economic Insight analysis. Note, insufficient comparators for PCC outperformance rate.

[15] *Whilst 'in theory' revenue and RCV incentives are equivalent in NPV terms, in practice this is unlikely to be the case. In particular, the implicit discount rate for revenue incentives is likely to be higher than for RCV incentives. This is because companies with revenue incentives face increased risk (in the form of various pressures to mitigate short-term bill impacts) which mean they are less likely to be able to realise outperformance payments in practice.*

Table 9: Whether Yorkshire Water's PR19 standard incentive rates exceed the max/min industry rates set at PR14

	Outperformance payment rate	Underperformance payment rate
Supply interruptions	> max PR14	-
Pollution incidents	-	-
Internal sewer flooding	-	-
External sewer flooding	> max PR14	-
Leakage	-	< min PR14
Per capital consumption	N/A	< min PR14

Source: Economic Insight analysis. Note, insufficient comparators for PCC outperformance rate.

In relation to the above, we note that:

- For supply interruptions, Yorkshire Water is currently performing above the industry UQ level; and is forecasting to be close to the industry frontier during PR19. The incentive rate for PR19 reflects the range over which outperformance can be earned. For example, a company operating at 2 minutes will only be able to earn outperformance payments over 2 units. However, a company operating at a worse performance level of 5 minutes (but still better than the forecast UQ level) will be able to earn outperformance payments over 5 units, over double that of the better performing company.

- For external sewer flooding, Yorkshire Water is currently performing in the lower quartile performance range. The larger incentive value reflects both the importance that customers place on the service failure, and a realistic incentive to improve performance. In order to protect customers from the company receiving outperformance payments for performance lower than the industry average, a reward deadband has been applied to the industry average level.

- The leakage incentive rate at PR14 did not account for social or environmental benefits, and was not based on customer valuations. In the absence of this information, a conservative estimate of leakage benefits was used in the incentive calculation. As customer valuations have been developed for PR19, this partly explains the change in Yorkshire Water's low PR14 rate and increased PR19 rate.

- Yorkshire Water's PR19 per capita consumption standard incentive rate has been based on the 'price' to customers for a litre of water saved, and is therefore a proxy market valuation. The enhanced incentive rate captures wider benefits from reducing water consumption, such as the avoided carbon impact.

In each of the following sections, for each of the six performance commitments we have selected, we show the distribution of PR14 incentive rates – for both outperformance and underperformance – and how they compare to Yorkshire Water's proposed PR19 rates.
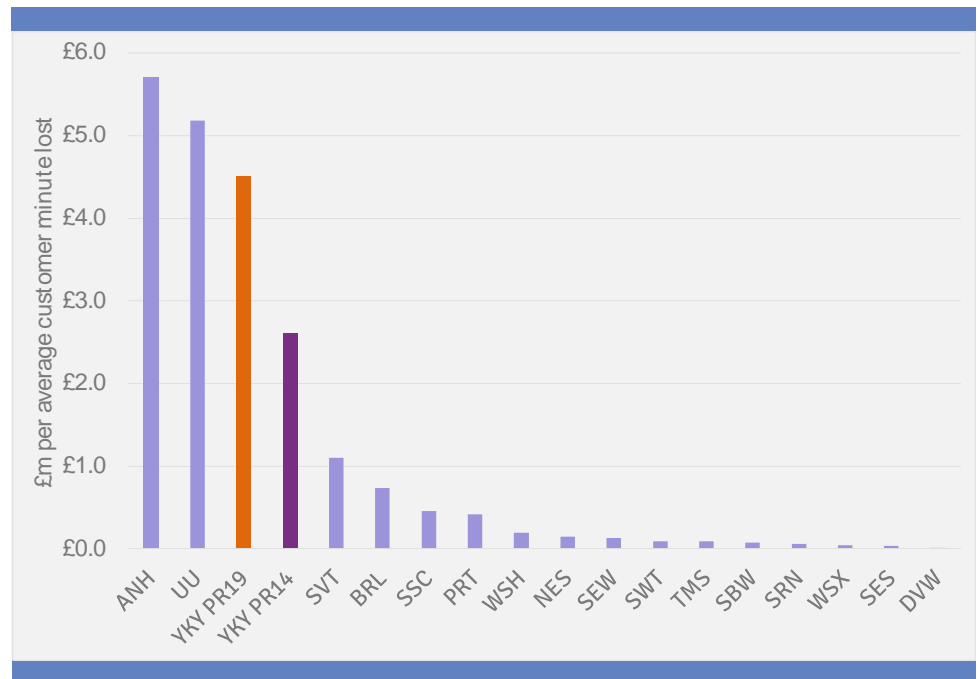
5.4.1   Supply interruptions

Figure 12: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – <u>supply interruptions outperformance payment rate</u>
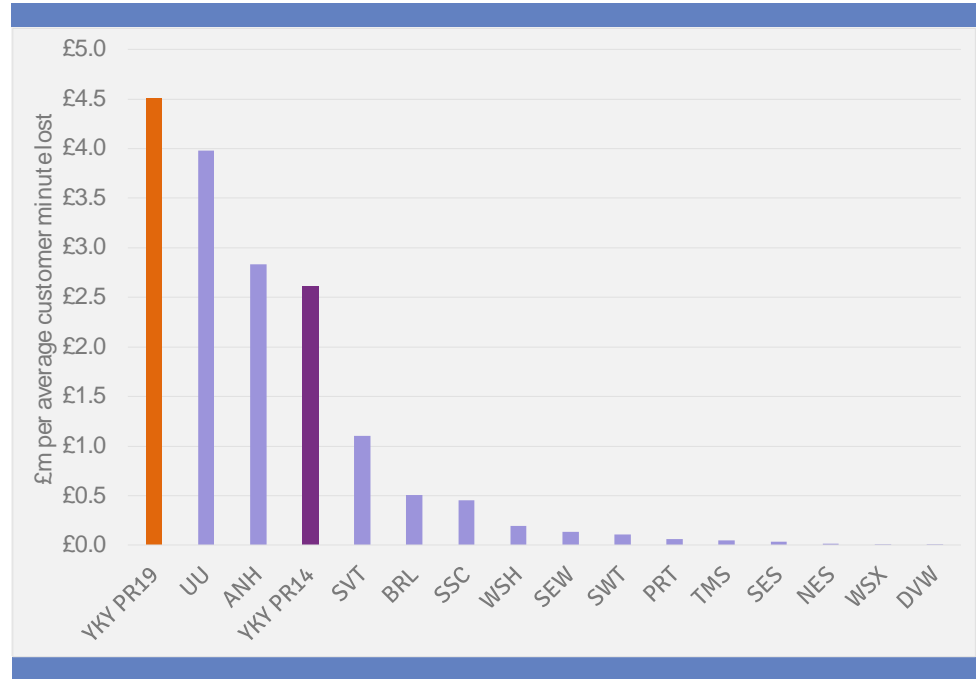
Source: Economic Insight analysis

Figure 13: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – <u>supply interruptions underperformance penalty rate</u>
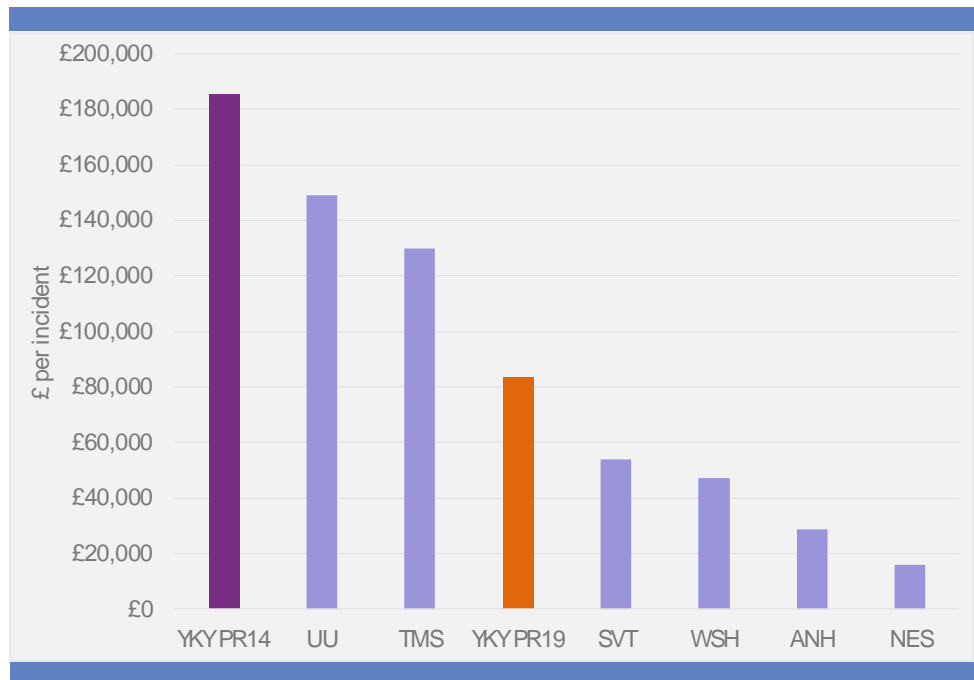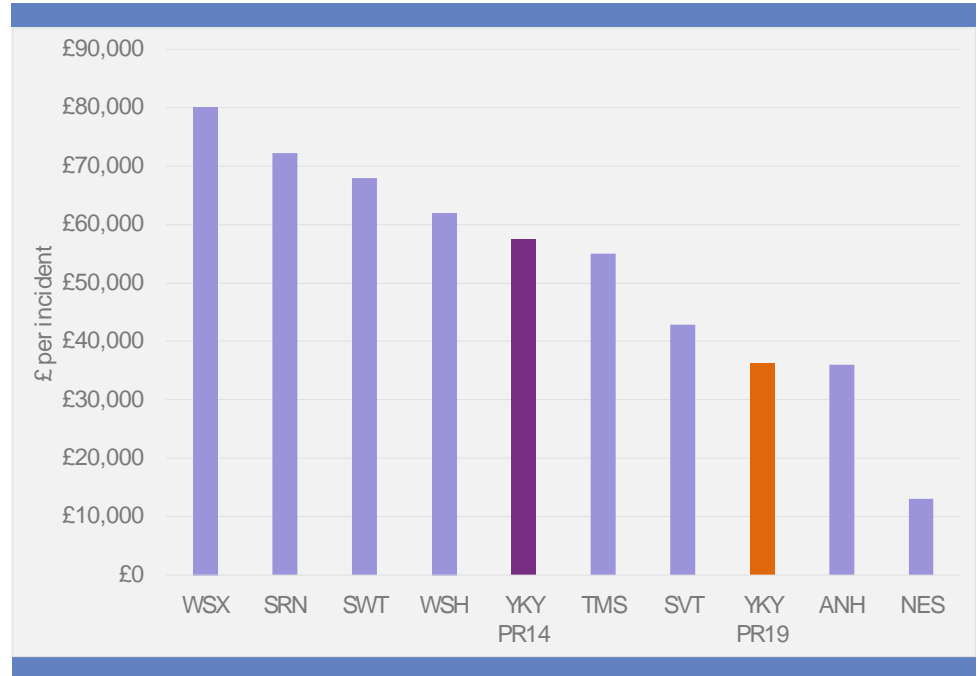

Source: Economic Insight analysis

Notably:

- The extent to which the incentive rates for supply interruptions are comparable is further limited by the fact that companies' incentive rates may been calculated to reflect both 'duration' and 'occurrence' of supply interruptions. That is, the marginal benefit to customers of decreasing the average duration of a supply interruption will depend on how many customers experience it.

- Adjustments have been made to Dee Valley, Sutton and East Surrey, South West, and Thames to reflect the fact their performance commitment is set in terms of hours, rather than minutes.

- Incentives for Northumbrian and South West are in the form of additions to the RCV.

- Sembcorp Bournemouth and Southern only had underperformance penalties, and not outperformance payments, for supply interruptions.

5.4.2   Pollution incidents

Figure 14: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – pollution incidents outperformance payment rate

Source: Economic Insight analysis

Figure 15: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – pollution incidents underperformance penalty rate
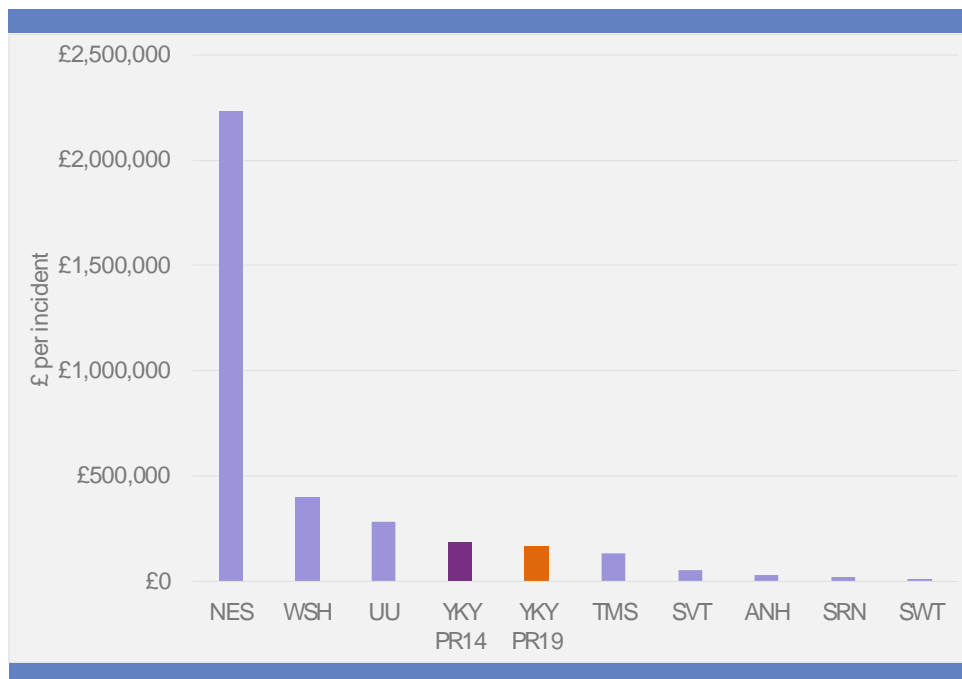
Source: Economic Insight analysis

Notably:

- Northumbrian's and Southern's incentives are RCV.

- Thames' performance commitment is in terms of category 1, 2 and 3 pollution incidents; South West's is in terms of category 3 and 4; and all other PR14 performance commitments are in terms of category 3.
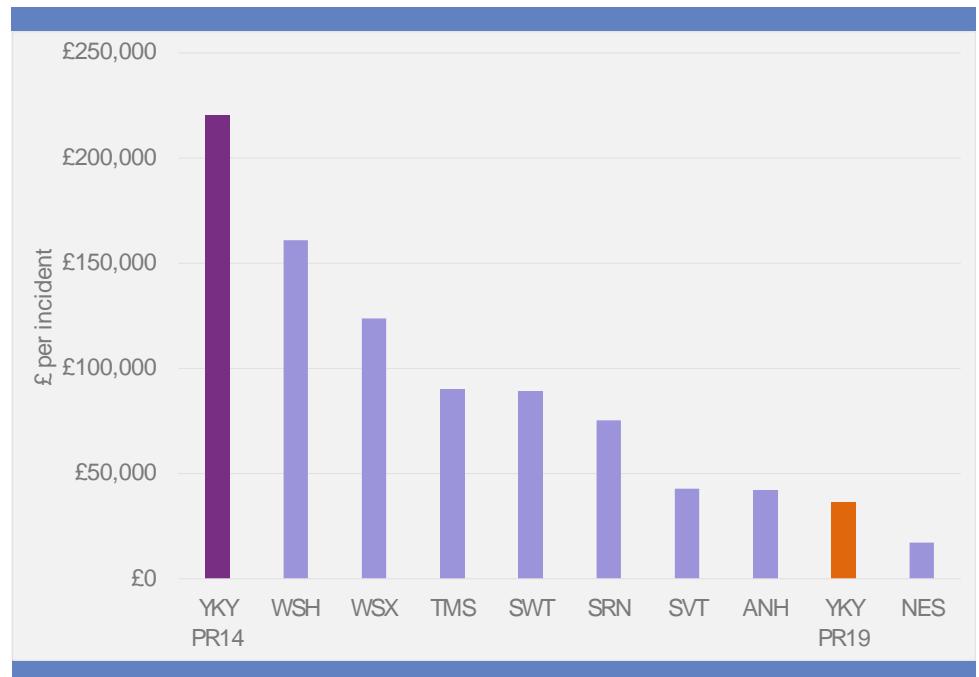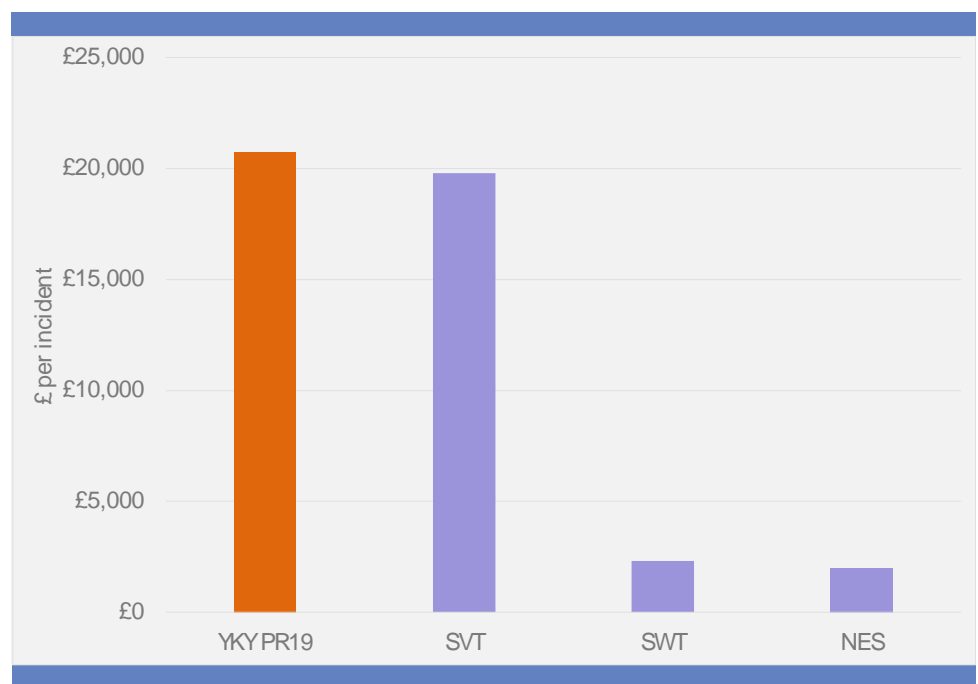
- Southern's and South West's incentives are penalty only.
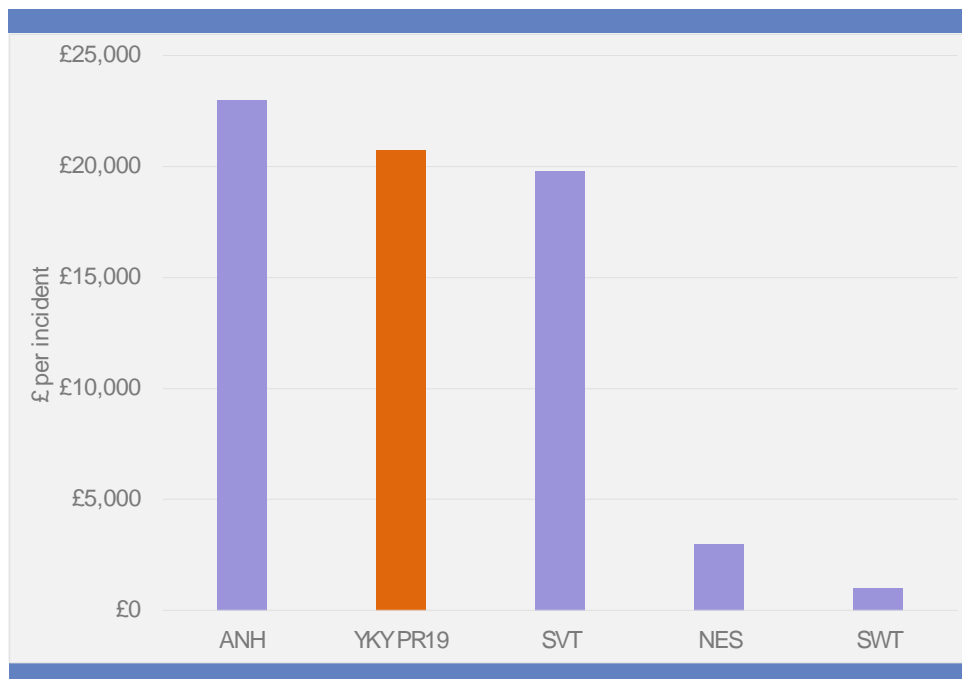
5.4.3 Internal sewer flooding

Figure 16: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – <u>internal sewer flooding outperformance payment rate</u>

Source: Economic Insight analysis

Figure 17: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – <u>internal sewer flooding underperformance penalty rate</u>
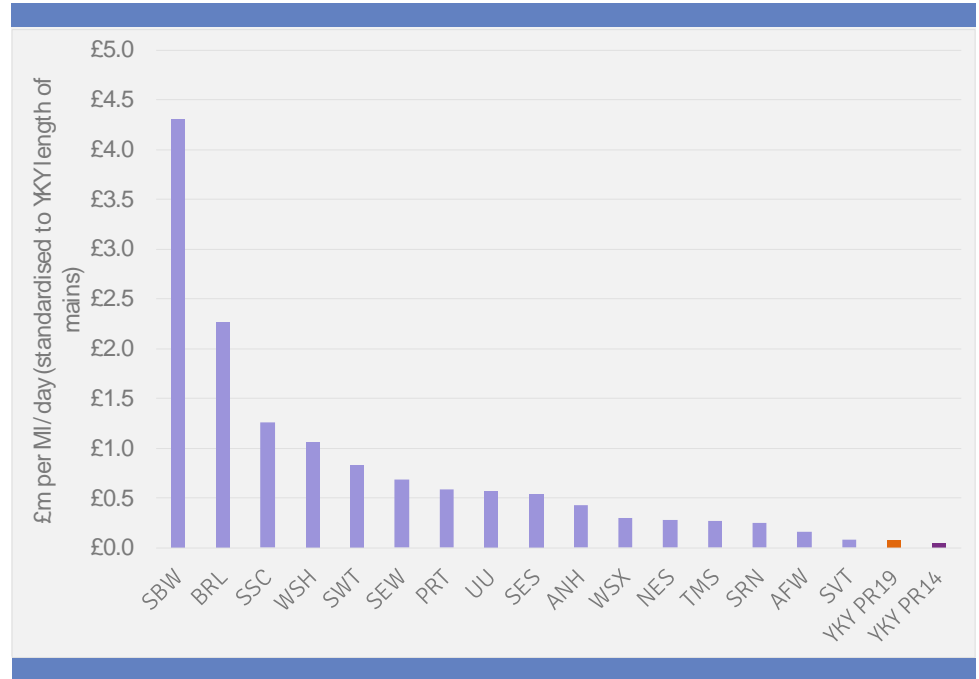

Source: Economic Insight analysis

Notably:

- Adjustments have been made to Wessex's rates to give a per incident figure.

- Incentives for Northumbrian and South West are RCV.

- No adjustments have been made to account for the fact that some performance commitments are based on the number of sewer flooding incidents, whereas others are based on the number of properties flooded.
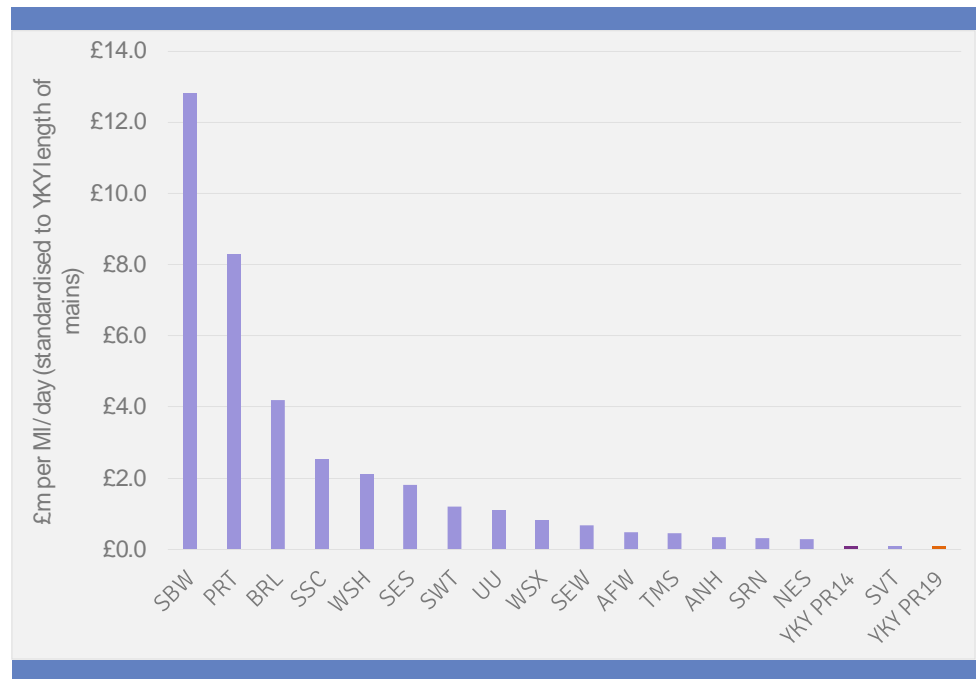
5.4.4   External sewer flooding

Figure 18: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – <u>external sewer flooding outperformance payment rate</u>

Source: Economic Insight analysis

Figure 19: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – external sewer flooding underperformance penalty rate

Source: Economic Insight analysis

Notably:

- Incentives for Northumbrian and South West are RCV.

- No adjustments have been made to account for the fact that some performance commitments are based on the number of sewer flooding incidents, whereas others are based on the number of properties flooded.

5.4.5   Leakage

Figure 20: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – <u>leakage outperformance payment rate</u>

Source: Economic Insight analysis

Figure 21: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – <u>leakage underperformance penalty rate</u>
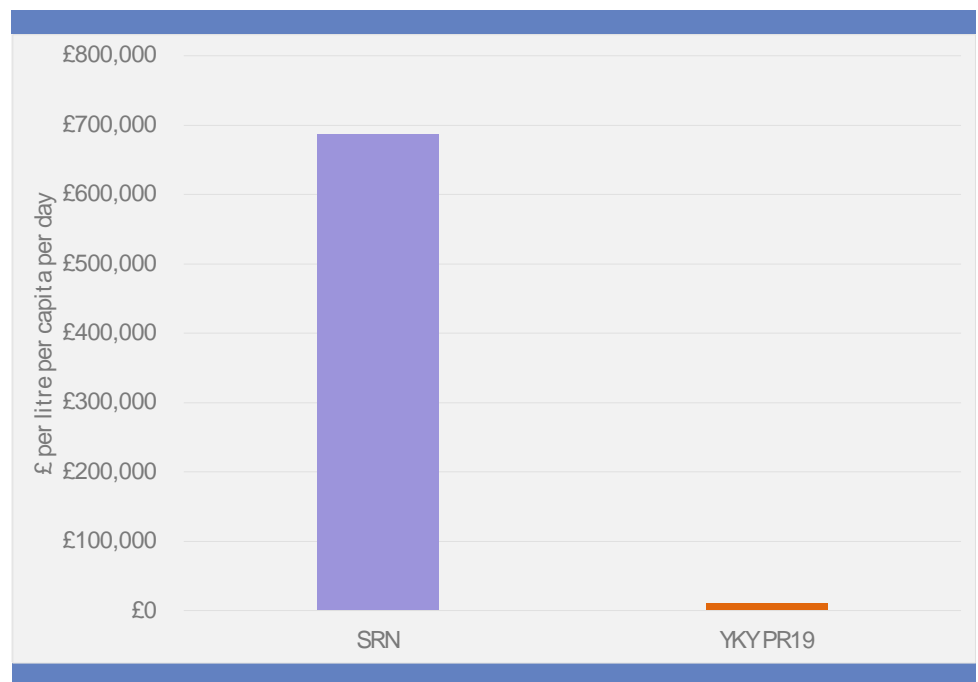

Source: Economic Insight analysis

Notably:

● Leakage incentive rates have been standardised to Yorkshire Water's length of mains.

● Northumbrian and South Staffordshire set leakage performance commitments for separate supply areas, and these have been aggregated.

● Northumbrian's incentive is RCV.

5.4.6   Per capital consumption

Figure 22: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – <u>per capita consumption outperformance payment rate</u>

Source: Economic Insight analysis

Figure 23: Comparison of PR14 incentive rates with Yorkshire Water's PR19 rate – per capita consumption underperformance penalty rate
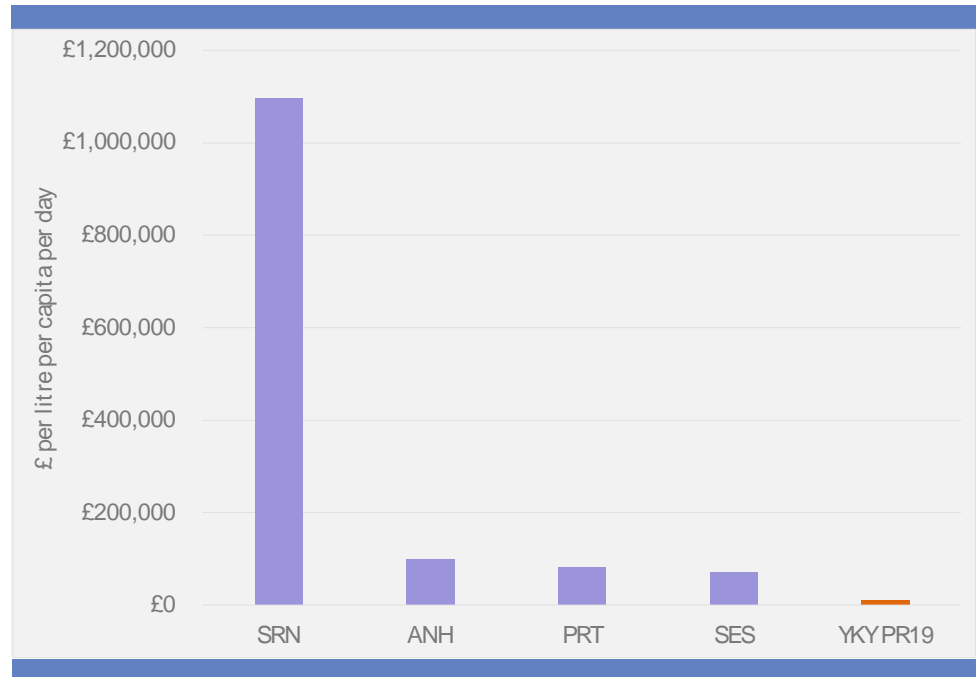
Source: Economic Insight analysis

Notably:

- The comparability of per capita consumption rates is limited by the fact that there is also a 'scale' effect. That is, reducing per capita consumption in a larger supply area will deliver higher benefits (all else equal) than in a smaller supply area. However, given Yorkshire Water has a relatively large customer base, making an adjustment will further decrease the relative magnitude of Yorkshire Water's incentive rate.

- An adjustment has been made to Anglian's incentive rate as it is based on consumption per household.

6.   Annex

This annex contains:

– the list of performance areas and sub-measures included within the customer valuation research; and
– a table of results for the potential enhanced benefit rates from customer research.

6.1   Performance commitments and sub-measures

The following table lists all the performance commitments and sub-measures from the customer valuation research.

Table 10: Performance commitments and sub-measures

Performance commitment	Sub measure
Unplanned Interruptions	Supply interruption of less than 3 hours
Unplanned Interruptions	Supply interruption of 3-6 hours
Unplanned Interruptions	Supply interruption of 6–12 hours
Unplanned Interruptions	Supply interruption of 12–24 hours
Unplanned Interruptions	Supply interruption of over 24 hours and up to 48 hours
Planned Interruptions	Supply interruption for < 3 hours which is announced in advance
Planned Interruptions	Supply interruption for 3-6 hours which is announced in advance
Low Pressure	Properties experiencing low pressure
Drinking Water Quality (Bio/Chem)	Drinking water sample failure (no health impact)
Drinking Water Quality (Bio/Chem)	Drinking water sample failure (public health impact)
Drinking Water Quality (Bio/Chem)	Drinking water sample failure (boil order notice)
Drinking Water Quality (Aesthetic)	Drinking water the colour of weak tea

Drinking Water Quality (Aesthetic)	Water with a taste or smell of disinfectant
Drinking Water Quality (Aesthetic)	Cloudy water
Leakage	Ml lost per day
Water Restrictions	Reduction in supply with no impact on customers
Water Restrictions	Voluntary restriction
Water Restrictions	Compulsory restriction (hose pipe ban)
Water Restrictions	Emergency restriction
Internal Sewer Flooding	Flooding of cellar
Internal Sewer Flooding	Flooding of habitable area
External Sewer Flooding	Flooding of minor roads
External Sewer Flooding	Flooding of major roads
External Sewer Flooding	Flooding within property boundary not inhibiting access
External Sewer Flooding	Flooding within property boundary inhibiting access
External Sewer Flooding	Flooding causing societal disruption
Bathing Water Quality	Water quality sample failure at a bathing water
Bathing Water Quality	Deterioration in classification
Bathing Water Quality	Loss of Blue Flag status
River Water Quality	Length of river water improved
Pollution Incidents	Category 1 pollution incidents
Pollution Incidents	Category 2 pollution incidents
Pollution Incidents	Category 3 pollution incidents
Pollution Incidents	Category 4 pollution incidents
Odour	Complaints about chronic intolerable odour
Odour	Complaints about transient odour
Land Improved	Area of land conserved or improved (general)

Land Improved	Area of land conserved or improved (coniferous woodland)
Land Improved	Area of land conserved or improved (broadleaf woodland)
Land Improved	Area of land conserved or improved (semi-natural grassland)
Land Improved	Area of land conserved or improved (farmland)
Land Improved	Area of land conserved or improved (wetlands & floodplains)
Land Improved	Area of land conserved or improved (mountains, moorlands & heaths)
Land Improved	Area of land conserved or improved (coastal margins)
Land Improved	Area of land conserved or improved (green space)

Source: customer valuation research

6.2   Potential enhanced benefit rates from customer research

The table below details the potential enhanced benefit rates illustrated in Figure 3 to Figure 6.

Table 11: Enhanced benefit rates

	Leakage	Internal Sewer Flooding	Pollution Incidents	Unplanned supply interruptions
Standard benefit rate	£158,960	£72,010	£115,713	£5,250
Maximum evidence source	£169,839	£127,725	£144,451	£10,144
20% uplift	£190,752	£86,411	£138,855	£6,300
95th percentile WTP	£172,587	£72,753	£118,537	£5,268
-2 service quality	£312,823	£69,212	£93,207	£5,690

Source: Economic Insight

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