TW-OC-A1

Outcomes Supporting Evidence

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Section 1

Introduction

Purpose

1.1 The purpose of this document is to provide supplementary evidence to our main submission document[1], and to provide a substantive response to each of the Required Actions that Ofwat has raised in the 'Delivering outcomes for customers' IAP test area.

1.2 A more detailed explanation as to why we have chosen to stretch our ambition on four key performance commitments: supply interruptions, leakage, internal sewer flooding and pollution is described in Section 2 of the main submission document.

1.3 In Section 2 we explain the Performance Commitments (PCs) that we have removed in consultation with our Customer Challenge Group ('CCG'), and those that we have added following Ofwat's IAP feedback.

1.4 In Section 3, we respond to the Company-wide Actions (Table 1) that Ofwat has raised in the IAP 'delivering outcomes for customers' test area.

1.5 In Section 4, we respond to the PC Specific Actions (Table 2) that Ofwat has raised in the IAP 'delivering outcomes for customers' test area.

1.6 In Section 5, we provide line commentary for App1, App1a and App1b for our revised April Business Plan. Additional explanation is presented, which for some PCs is not an Agreed Action in Sections 3 and 4.

1.7 In Section 6, we provide additional evidence to support the challenge of stretching performance on bursts and leakage.

Mapping to IAP Agreed Actions

1.8 For ease of reference, we have structured this document in the same chronological order that the 'Delivering outcomes for customers' IAP Required Actions have been raised. These are presented in Table 1.

Table 1: Mapping to Agreed Actions

Required Action	Area	Section	Sub Section
TMS.OC.A1	ODI Type	3	ODI Type
TMS.OC.A2	ODI Rate	3	ODI Rate
TMS.OC.A3	Overall ODI Package	3	Overall ODI Package
TMS.OC.A4	Asset Health ODI Package	3	Asset Health ODI Package
TMS.OC.A5	Customer Protection	3	Customer Protection
TMS.OC.A6	Stretch	4	BW01 Mains Bursts
TMS.OC.A7	ODI Type	4	BW01 Mains Bursts
TMS.OC.A8	ODI Rate	4	BW01 Mains Bursts

[1] *TW-RS1 Building a better future: Response to Ofwat's IAP, April 2019.*

TMS.OC.A9	Definition	4	BW02 Unplanned outage
TMS.OC.A10	Stretch	4	BW02 Unplanned outage
TMS.OC.A11	ODI Type	4	BW02 Unplanned outage
TMS.OC.A12	ODI Rate	4	BW02 Unplanned outage
TMS.OC.A13	Stretch	4	BW03 Interruptions to supply
TMS.OC.A14	ODI Rate	4	BW03 Interruptions to supply
TMS.OC.A15	Stretch	4	BW04 Leakage
TMS.OC.A16	ODI Rate	4	BW04 Leakage
TMS.OC.A17	Stretch	4	BW05 Per capita consumption
TMS.OC.A18	ODI Rate	4	BW05 Per capita consumption
TMS.OC.A19	ODI Type	4	BW06 Water Quality CRI
TMS.OC.A20	ODI Rate	4	BW06 Water Quality CRI
TMS.OC.A21	Collars Caps and Deadbands	4	BW06 Water Quality CRI
TMS.OC.A22	Stretch	4	CS01 Treatment works compliance
TMS.OC.A23	ODI Rate	4	CS01 Treatment works compliance
TMS.OC.A24	ODI Rate	4	CS02 Sewer collapses
TMS.OC.A25	Stretch	4	CS03 Internal sewer flooding
TMS.OC.A26	ODI Rate	4	CS03 Internal sewer flooding
TMS.OC.A27	Definition	4	DS01 Risk of sewer flooding in a storm
TMS.OC.A28	Stretch	4	DW01 Risk of severe restrictions in a drought
TMS.OC.A29	Stretch	4	ES01 Pollution incidents
TMS.OC.A30	ODI Type	4	ES01 Pollution incidents
TMS.OC.A31	ODI Rate	4	ES01 Pollution incidents
TMS.OC.A32	Collars Caps and Deadbands	4	ES01 Pollution incidents
TMS.OC.A33	Definition	4	BW06 Water Quality CRI Other
TMS.OC.A34	Definition	4	BW06 Water Quality CRI Metaldehyde
TMS.OC.A35	Definition	4	AR02 Households on a payment plan
TMS.OC.A36	Definition	4	AR03 Household accounts on our new billing system
TMS.OC.A37	ODI Rate	4	AR03 Household accounts on our new billing system
TMS.OC.A38	Definition	4	AR05 Customers recommending priority services
TMS.OC.A39	Stretch	4	AR05 Customers recommending priority services

TMS.OC.A40	Definition	4	AWS02 Proactive customer engagement
TMS.OC.A41	Stretch	4	AWS02 Proactive customer engagement
TMS.OC.A42	Definition	4	AWS03 Business retailer measure of experience
TMS.OC.A43	Definition	4	AW01 Improving customer engagement concerning leaks on customers' pipes
TMS.OC.A44	Stretch	4	AW01 Improving customer engagement concerning leaks on customers' pipes
TMS.OC.A45	ODI Type	4	BW07 Properties at risk of receiving low pressure
TMS.OC.A46	Definition	4	BW08 Acceptability of water to customers
TMS.OC.A47	ODI Type	4	BW08 Acceptability of water to customers
TMS.OC.A48	Stretch	4	BW11 Responding to trunk mains bursts
TMS.OC.A49	Definition	4	BW12 Improving system resilience of North East London water supply
TMS.OC.A50	Definition	4	BW12 Improving system resilience of North East London water supply
TMS.OC.A51	Definition	4	BW12 Improving system resilience of North East London water supply
TMS.OC.A52	Stretch	4	BW12 Improving system resilience of North East London water supply
TMS.OC.A53	ODI Type	4	BW12 Improving system resilience of North East London water supply
TMS.OC.A54	Definition	4	CS05 Sewage pumping station availability
TMS.OC.A55	ODI Type	4	CS05 Sewage pumping station availability
TMS.OC.A56	ODI Type	4	DS02 Surface water management
TMS.OC.A57	ODI Rate	4	DW02 Security of supply index SoSI
TMS.OC.A58	Definition	4	DWS01 Power resilience
TMS.OC.A59	Timing	4	DWS01 Power resilience
TMS.OC.A60	Definition	4	DWS02 SEMD - securing our sites

TMS.OC.A61	ODI Rate	4	DWS02 SEMD - securing our sites
TMS.OC.A62	Collars Caps and Deadbands	4	DWS02 SEMD - securing our sites
TMS.OC.A63	ODI Type	4	ER01 Unregistered household properties
TMS.OC.A64	ODI Type	4	ER02 Empty household properties
TMS.OC.A65	Definition	4	ES02 Environmental measures delivered (wastewater)
TMS.OC.A66	ODI Type	4	ES02 Environmental measures delivered (wastewater)
TMS.OC.A67	ODI Rate	4	ES02 Environmental measures delivered (wastewater)
TMS.OC.A68	ODI Type	4	ES04 Compliance with bioresource environmental permits
TMS.OC.A69	Stretch	4	ET01 Readiness to receive tunnel flow at Beckton
TMS.OC.A70	ODI Rate	4	ET01 Readiness to receive tunnel flow at Beckton
TMS.OC.A71	Stretch	4	ET02 Effective stakeholder engagement
TMS.OC.A72	Definition	4	ET03 Timely return to customers from land sales
TMS.OC.A73	Definition	4	ET03 Timely return to customers from land sales
TMS.OC.A74	Definition	4	ET03 Timely return to customers from land sales
TMS.OC.A75	Definition	4	ET03 Timely return to customers from land sales
TMS.OC.A76	Definition	4	ET03 Timely return to customers from land sales
TMS.OC.A77	Stretch	4	ET03 Timely return to customers from land sales
TMS.OC.A78	Stretch	4	ET03 Timely return to customers from land sales
TMS.OC.A79	Stretch	4	ET03 Timely return to customers from land sales
TMS.OC.A80	Stretch	4	ET03 Timely return to customers from land sales
TMS.OC.A81	Definition	4	ET04 Establish and effective

			system operator for the London Tideway Tunnels
TMS.OC.A82	Definition	4	ET04 Establish and effective system operator for the London Tideway Tunnels
TMS.OC.A83	Definition	4	ET04 Establish and effective system operator for the London Tideway Tunnels
TMS.OC.A84	Definition	4	ET04 Establish and effective system operator for the London Tideway Tunnels
TMS.OC.A85	ODI Rate	4	ET04 Establish and effective system operator for the London Tideway Tunnels
TMS.OC.A86	ODI Rate	4	ET04 Establish and effective system operator for the London Tideway Tunnels
TMS.OC.A87	Definition	4	EW02 Environmental measures delivered (water)
TMS.OC.A88	ODI Type	4	EW02 Environmental measures delivered (water)
TMS.OC.A89	ODI Rate	4	EW02 Environmental measures delivered (water)
TMS.OC.A90	Stretch	4	EWS01 Enhancing biodiversity
TMS.OC.A91	ODI Type	4	EWS02 Smarter Water Catchments
TMS.OC.A92	ODI Type	4	EWS08 Empty business properties

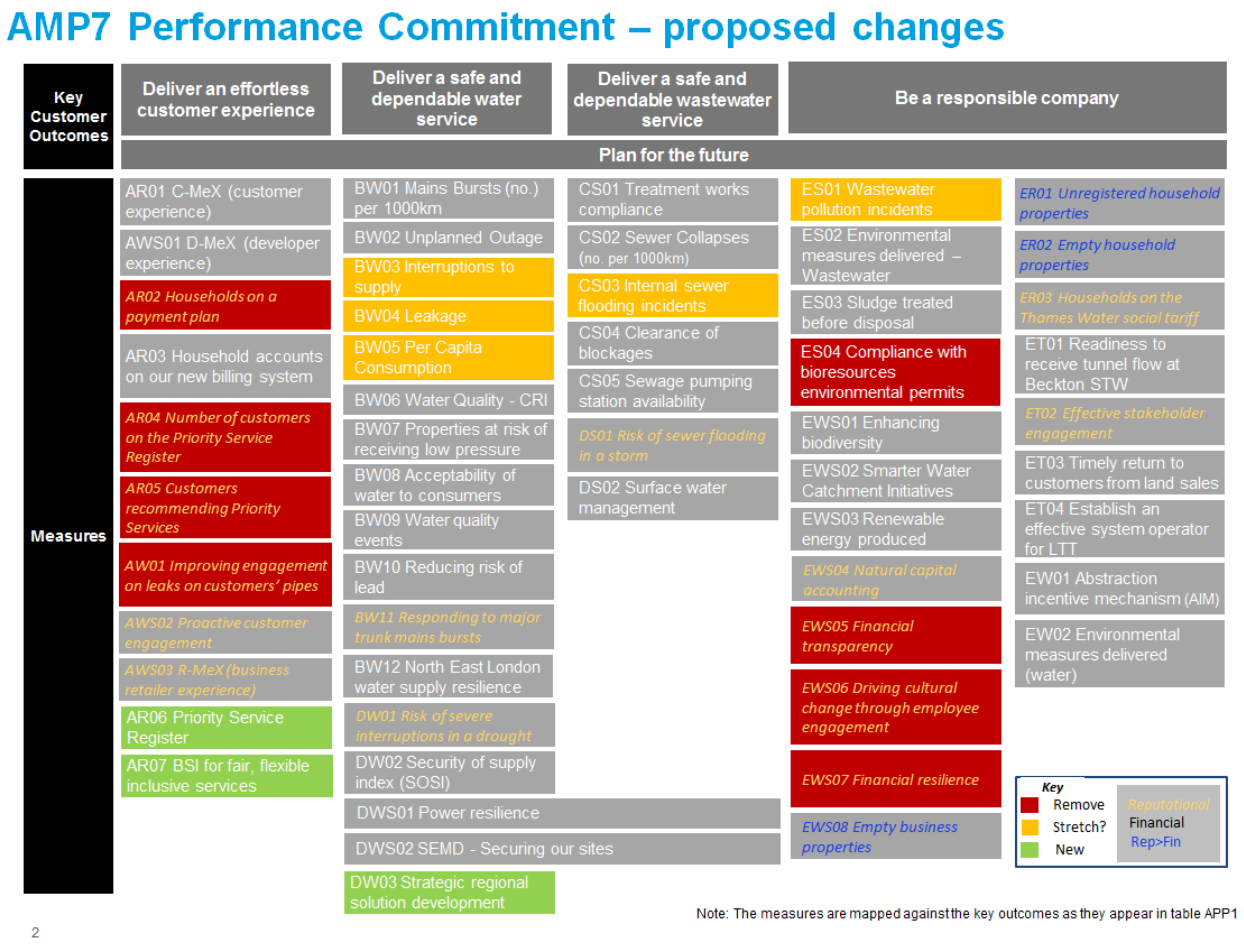
Source: Thames Water and Ofwat IAP Delivering Outcomes for Customers detailed actions

Section 2

PC Additions and Removals

In Section 2 of our main submission document[2], we explain how our plan is the product of industry-leading research and how we developed 53 Performance Commitments to reflect what customers want. Following the supplementary customer research we conducted in January 2019, discussions with our CCG, and consideration of Ofwat's IAP feedback, we have made the changes to our Performance Commitments shown in the figure below.

Figure 1: AMP7 Performance Commitment- proposed changes



Source: Thames Water

2.1 For five key Common Performance Commitments, we looked closely at more stretching performance. We revised our targets for three of them: interruptions to supply, internal sewer flooding and pollution. We discuss the rationale for this in Section 2 of our main submission document[3].

2.2 We have removed a total of eight PCs in consultation with our CCG.

[2] *TW-RS1 Building a better future: Response to Ofwat's IAP,April 2019, Section 2B.*
[3] *TW-RS1 Building a better future: Response to Ofwat's IAP,April 2019, Section 2D.*

2.3 Three PCs have been added following the IAP feedback.

2.4 Three PCs have been changed from reputational to financial.

New PCs

DWS03 Strategic Regional Solution development

2.5 We are developing a new performance commitment as part of the six company group that received funding for strategic solutions in the South East to secure drought resilience. These companies are Affinity Water, Anglian Water, Severn Trent Water, Southern Water, United Utilities and us. We have also been supported by Water Resources South East (WRSE). We have also worked separately with United Utilities Water and Severn Trent Water on the Severn Thames Transfer options.

2.6 For more information, please refer to:

- Annex 1 of TW-RS1 Building a Better Future: Building a Better Future: Response to Ofwat's IAP;
- TW-OC-A7 Strategic Water Resource Option Appendix (the six company joint response); and
- TW-OC-A8 Severn-Thames Transfer Resource Option Appendix (the three company joint response).

2.7 We can confirm that the joint documents align with our position, although it is worth noting that changes will occur as new information is learned from further studies or we develop an improved understanding. This has been taken account of to the best of our knowledge in this joint document.

2.8 We reiterate that further work is required, especially in the following areas:

- Use improved detail per stage to provide an initial bottom-up costing;
- Provide an improved cost per gate and per scheme;
- Confirm the ODI mechanism and application per scheme; and
- Confirm the operating model per scheme and per gate.

AR06 Priority Service Register

2.9 This is a new Common PC for all companies to adopt. We have developed a new performance commitment - AR06 Households on the Priority Services Register - which we believe will fulfil the requirements of the new common performance commitment.

AR07 BSI for fair, flexible inclusive services

2.10 We have always maintained that it is important to measure both growth in the number of customers on our Priority Services Register, and the quality of the support we provide to these customers. Our original business plan included achieving BSI certification as an ambition for AMP7. Ofwat has suggested that we include achievement of this certification as a formal performance commitment going forward.

2.11 We previously proposed performance commitment AR05 Customers recommending Priority Services[4]. The aim of both this measure and the new BSI certification commitment is to ensure we provide meaningful support to customers in vulnerable circumstances and measure the quality of our service provision. Only a single performance commitment is required to fulfil this purpose. In addition, including three performance commitments on this topic would weight our plan disproportionately in one area. We are therefore removing AR05 Customers recommending Priority Services from our plans. This has been discussed with our Customer Challenge Group (CCG).

2.12 It remains our ambition to provide industry-leading levels of support to our customers in vulnerable circumstances. Customer feedback and research is a key component of achieving BSI certification for continuous improvement – we will continue with our plans to measure the Net Promoter Score ('NPS') of customers on our Priority Service Register to ensure we are gaining insights of how meaningful our service provision is, and this will remain an important internal KPI that we intend to monitor going forwards.

Removed PCs

2.13 We have also reflected on customer feedback and our CCG's suggestion to reduce the number of PCs, and have decided to discontinue eight of them. Two have been directly replaced by the new measures outlined above. Discontinuing the others does not mean the activities they were measuring will not take place, just that the actions will not be reported externally as a PC.

2.14 These measures are:

- **AR04: Number of customers on the priority service register** – This measure has been replaced by the AR06 Priority Services Register Common PC, as detailed above.
- **AR05: Customers recommending priority services** – This performance commitment has now been removed and replaced with performance commitment AR07 – BSI for fair, flexible, inclusive services (detailed above) since they were both incentivising the same customer outcome. That is to ensure we have an appropriately robust support framework in place to meet the needs of our customers who may be in vulnerable circumstances and are registered with us as requiring priority support. Please refer to the Performance Commitment Summary document TW-OC-A3 for additional detail.
- **AR02: Households on a Payment plan** – This performance commitment has now been removed from our business plan as we focus our streamlining our customer outcome measure set. Some customers were concerned that the inclusion of this performance commitment in our plans could drive a reduction in customer choice of payment options. However, our intention here was to focus on offering customers the most effective method of payment to ensure our revenue collection activity was efficient as possible therefore making bills more affordable for all. On this basis we recognise that this is an important measure for our customers and it will continue to be measured as a key performance indicator.
- **AW01: Improving engagement on leaks to customers' pipes** – This performance commitment has now been removed from our business plan as we focus our streamlining our customer outcome measure set. Customers saw this as a relatively small project; however this activity is important in light of the relatively high percentage of leakage that occurs on customers' supply pipes. We will therefore continue with this work to seek to innovatively engage customers regarding leakage on their supply pipes. Our success in doing this will be managed and monitored as a key performance indicator.

[4] *CSD005-AR05 Customers recommending Priority Services, September 2018.*

- **ES04: Compliance with Bioresources environmental permits** – We have removed this PC because the Environment Agency has now provided certainty that the Industrial Emissions Directive does apply to sludge treatment centres, and therefore we no longer need a mechanism to protect customers should a site not require permits[5].
- **EWS05: Financial transparency** – this measure was not fully understood by customers and our CCG, so has been removed.
- **EWS06: Driving cultural change through employee engagement** – this is an important internal metric to us but there were mixed views from customers as to whether it should be included as a PC. Our CCG felt that it should be removed and so we have removed this PC.
- **Financial resilience** – there were mixed views from customers about this PC, and our CCG felt that it should be removed and so we have removed this PC.

[5] *Environment Agency / water industry Sludge Strategy Shaping Group, 21 February 2019.*

Section 3

PC Company-wide Actions

In this section we respond to the specific company-wide agreed actions that Ofwat has raised in Table 1 of its IAP 'Delivering outcomes for customers – detailed actions'.

ODI Types

TMS.OC.A1 says: "The company should provide sufficient justification for proposing outperformance payments for PCs, when customers expressed a preference for underperformance only payments. This should include a clear rationale and evidence of how this decision will benefit customers."

3.1 In our September 2018 submission we produced a summary report for each of our Performance Commitments[6] that explained how we translated our detailed customer research into stretching targets and an appropriate ODI type. In these documents we provided a detailed justification for proposing outperformance payments in each case.

3.2 We absolutely accept the importance of customer preferences in determining our ODI package. However, customer feedback on bottom-up, individual PCs sometimes does not produce a binary answer on preferences of ODI type. In some cases, customers had mixed views. A good example of this is water mains bursts, where not all customers were convinced that a stable target, against a backdrop of mains deterioration, was stretching.

3.3 In January 2019 we carried out supplementary customer research, which included customer views on the headline ODI RORE range. Fifty-three per cent of respondents thought the ODI bill impact range we proposed should stay broadly the same, seeing it as a fair balance between outperformance incentives and the potential increase on bills. Forty-four per cent of respondents indicated that the range should be amended. When comparing the ranges of all WASCs, our approach was the most popular[7].

3.4 The ODI range that we submitted in September 2018 was weighted towards underperformance because we followed Ofwat's ODI formulae in almost all cases; and our P10/P90 ranges have long tails towards underperformance in many cases.

3.5 In the 'Delivering outcomes for customers' detailed actions document, numerous challenges are raised on stretching targets and the use of outperformance payments. However, in the Risk and Return IAP test area, Ofwat states:

> "…while there is high quality and convincing evidence in the company's assessment of risk for the notional company in its RoRE analysis in the round, we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[8].

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[6] *CSD005 Performance Commitments Summary Reports, September 2018.*
[7] *TW-CSE-A1 What customers want v13 final, March 2019.*

[8] *Ofwat. Thames Water test area assessment, January 2019, Page 4 Aligning Risk and Return.*

3.6 From a top-down perspective, we surmise that our selection of outperformance ODIs is consistent with customer preferences[9] or customer benefits in the long-term.

3.7 Given the full package of risk and return contained within Ofwat's PR19 methodology, it would seem appropriate to us for the ODI RORE range to be largely symmetrical - particularly given the totex that we have removed from our resubmitted plan as described in Section 3 of our main submission document[10], but also due to the position that Ofwat is currently taking on WACC and a Gearing Sharing Mechanism.

ODI Rates

TMS.OC.A2 says: "In cases of rejection or revisions to enhancement expenditure or a cost adjustment claim, the company should consider the implications, if any, for the associated level of the PC and ODI incentive rates proposed, and provide evidence to justify any changes to its business plan submission.

"In cases where a scheme will no longer be undertaken, the company should consider the removal of the associated scheme-specific PC. The company should provide further evidence to detail the estimation of forecast efficient marginal costs within its ODI rate calculations, in line with our Final Methodology. In particular, the company should provide evidence to demonstrate how these marginal cost estimates relate to the cost adjustment claims or enhancement expenditure proposed by the company. Where the company has not followed the Ofwat formula, it should provide further evidence to justify how the methodology it used to calculate ODI rates is appropriate and how this reflects of customer valuations."

3.8 We can confirm that we have taken account of Ofwat's rejection or revision to enhancement expenditure in our resubmission. Our ODI calculations are based on our assessment of the whole life costs to achieve and sustain a unit change in performance benefit. Our ODI rates reflect our resubmitted plan, where incentive rates have been recalculated the revised calculations are presented.

3.9 These amendments are explained for each action and detailed in Section 5 (Annex 1), where we provide line commentary forApp1a and App1b. We have provided the additional evidence on ODI rates in data tables, with any removed PCs highlighted. We have predominantly used Ofwat's standard ODI formula to set our ODI rates, with any exceptions referenced. Exceptions are generally specific scheme ODIs, or measures where customer benefit is intangible.

3.10 We have compared our revised ODI rates with the range of 10 Common PCs that Ofwat has calculated for the IAP. We have used the same data as Ofwat to normalise our company ODI rates. The results are presented in Table 2.

[9] *TW-CSE-A1 What customers want v13 final, March 2019, Further PCs and ODI research, page 177.*
[10] *TW-RS1 Building a better future: Response to Ofwat's IAP, April 2019.*

Table 2: ODI rates and comparison with Ofwat's IAP range

PC	Normalised Unit	Thames April Submission			Ofwat's range		Thames April Submission	Ofwat's range	
		(Not normalised)		£ / Normalised Unit	£ / Normalised Unit		£ / Normalised Unit	£/ Normalised Unit	
		Under £m/unit	Out £m/unit	Under	Lower	Upper	Out	Lower	Upper
Leakage	(£/HH/% Distribution Input)	0.236	0.29	-1.618	-0.993	-2.369	1.989	0.849	2.113
PCC	(£/HH/l/person/d)	0.696	0.76	-0.189	-0.103	-0.294	0.206	0.091	0.282
CRI	(£/HH/index point)	2.163	N/A	-0.587	-0.373	-0.791	N/A	N/A	N/A
Supply interruptions	(£/HH/minute per property)	1.697	1.415	-0.461	-0.236	-0.778	0.384	0.184	0.536
Pollutions	(£/HH/incident per 10,000km sewer)	0.865	0.892	-0.153	-0.159	-0.309	0.157	0.131	0.253
Internal sewer flooding	(£/HH/incident per 10,000 connections)	21.635	16.762	-3.814	-2.745	-7.445	2.955	2.133	4.865
Mains bursts	(£/HH/repair per 1000km of mains)	0.177	0.224	-0.048	-0.095	N/A	0.061	0.075	N/A
Sewer collapses	(£/HH/incident per 1000km of sewer)	0.967	0.755	-0.171	-0.272	N/A	0.133	0.052	N/A
Unplanned outage	(£/HH/% of max prod capacity)	0.858	0.788	-0.233	-0.897	N/A	0.214	N/A	N/A
STW compliance	(£/HH/%)	3.063	N/A	-0.54	-0.505	N/A	N/A	N/A	N/A

Source: TW-OC-A12-ODI Business Plan ODI Model

3.11 We note that for Leakage, PCC, Water Quality CRI, Supply interruptions internal sewer flooding and treatment works compliance, our revised underperformance and outperformance rates are within the range that Ofwat has identified for the IAP. Pollutions incidents is on the boundary of Ofwat's range. We have not increased the ODI rate for mains bursts, unplanned outage and sewer collapses to the rates that Ofwat has identified. The reasons for this are explained in Section 4 of this document and also in the line commentary for App1 which is in Section 5 (Annex 1) of this document.

Overall ODI Package

TMS.OC.A3 says: "The company should provide further explanation of how its ODI package incentivises it, through better aligning the interests of management and shareholders with customers, to deliver on its PCs to customers. The company should provide further explanation why some bespoke PCs that are not of high importance to customers have relatively large ODI rates and why others PCs that are of high importance have lower ODI rates."

3.12 To ensure we provide services which align to our customers' requirements, we created a process to actively engage with them to understand their preferences. This concluded with analysis of data (insights) from more than more than 984,000 customers. These insights resulted in 42 customer wants and needs, which were further grouped into five principal outcomes.

3.13 We used these insights and outcomes when structuring our ODIs for both common and bespoke performance commitments. This has ensured that our plan is balanced, and that we are prioritising cost beneficial improvements in areas that customers value. Overall, we have engaged our customers throughout the development of our PCs, PC targets, and development and revision of our ODIs.

3.14 The process we have followed to ensure that our PCs and ODIs are credible and customer led are set out very clearly in a suite of documents that we included in the September submission:

- **ODI Approach and Principles Report**[11]. This document provides clarity on the process we have followed: calculation of marginal costs and benefits, designing financial incentives, understanding uncertainty, and balancing risk and reward for our customers.
- **What customers want**[12]. This document consolidates all of our customer findings into a single report. We continue to update this report as the Periodic Review progresses and further customer insight is acquired.
- **Customer research, consultation and operational data**[13]. Including numerous customer research reports.
- **Triangulation Report**[14]**.** This summarises our customer and societal values evidence base, customer and societal valuations workbook, aggregated customer values, and general approach to specifying the customer and societal values.

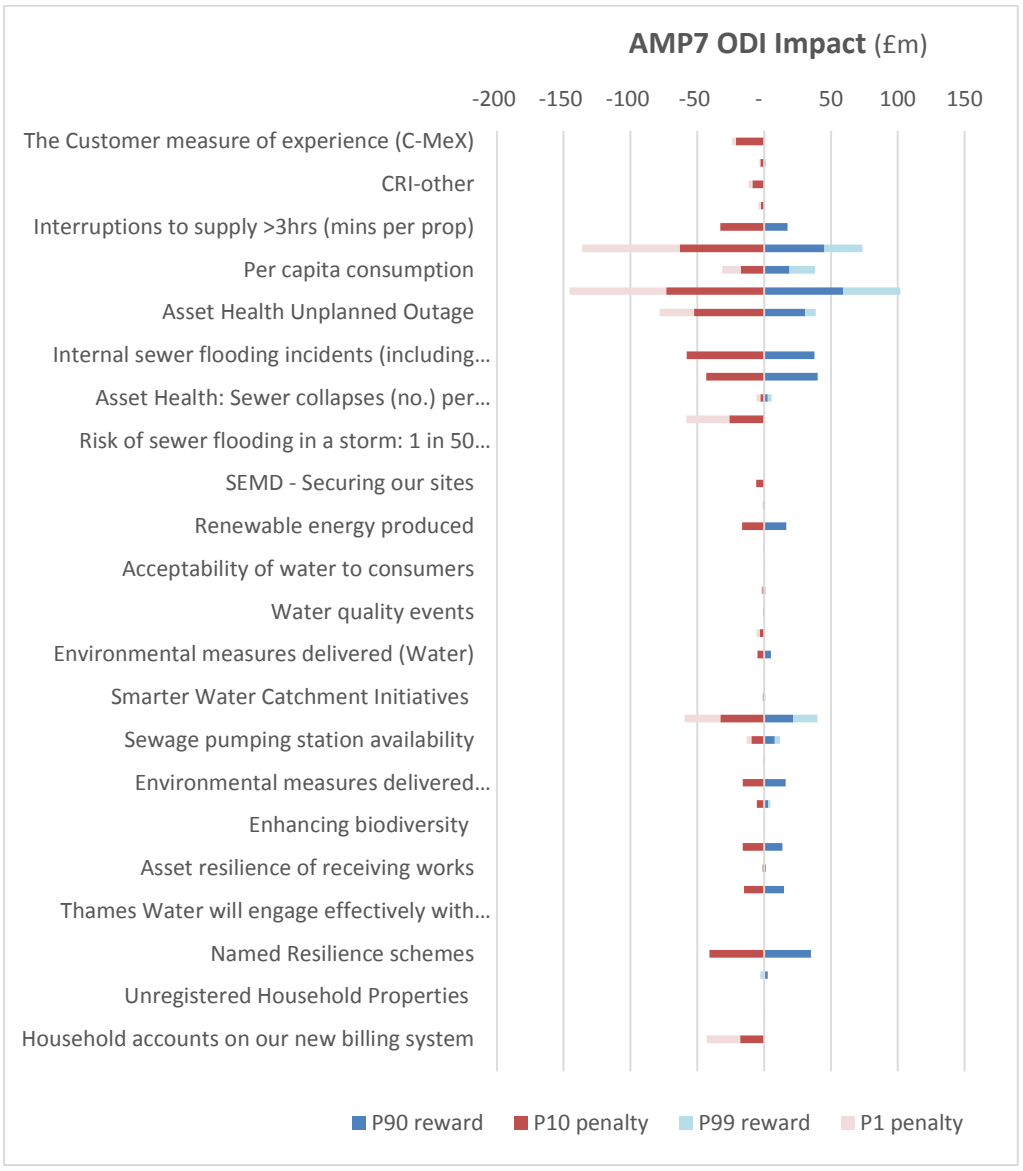
[11] *CSD025 ODI Approach and Principles Report, September 2018.*
[12] *TW-CSE-A1 What customers want v13 final, March 2019.*
[13] *TSD019-PR19-Customer research, consultation and operational data analysis reports, September 2018.*
[14] *Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018.*

- **Performance Commitment Summaries[15].** These 53 detailed documents, produced for each PC summarise: customers' views and requirements; definitions, AMP7 and long term targets, why it's cost beneficial for customers, marginal costs and benefits, scaling with other measures, how the ODI is calculated, incentive rates, and performance risk and reward.
- **Performance Values Report[16]**. This details the process of how we have applied triangulated customer values to the PCs in our framework and scaled benefits to avoid double counting.

We have ensured that our plan is balanced and that we are prioritising improvements in areas that our customers value. We disagree with Ofwat's assertion that some bespoke PCs that are not of high importance to customers have relatively large ODI rates, and other PCs that are of high importance have lower ODI rates. Evidence is provided for PC specific actions in Section 4 of this document. This is demonstrated below in Figure 2 where the P10/P90 exposure from our ODIs are clearly focused on the issues that customers most value i.e. supply interruptions, pollutions, leakage and sewer flooding. It also shows that our exposure to bespoke PCs is small.

Figure 2: PC ODI Range over AMP7

[15] *CSD005- 53 Performance Commitment Summary documents (S0005), September 2018.*
[16] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.*



Source: Internal Thames Water Analysis

3.15 Our plan is based on the detailed process we have been through, the thoroughness of our customer research and engagement, and the robust challenge of our CCG. We have ensured that our plan is balanced and that we are prioritising improvements in areas that customers value. We believe, therefore, that our proposed ODI package delivers the right balance of risk and reward for our customers.

3.16 We have consulted customers about the measures and type of incentive mechanism we have included in our plan and how we should calculate the incentives. We have also gone back to customers to ask whether the balance of weighting of performance measures is appropriate[17].

[17] *Appendix 2-PR19-Engaging and delivering for our customers, Thames Water, September 2018.*

3.17 To deliver this work with confidence we have worked with Eftec and ICS Consulting as they have wide ranging customer and stakeholder engagement experience in regulated sectors, working across investment planning and regulatory functions to help companies understand and incorporate stakeholders' and customers' views into decision making, investment planning, and delivery. This is complemented by technical expertise in the application non-market valuation methods that are used to estimate customer willingness to pay (WTP) values.

3.18 The credentials of the team are substantial. Allan Provins, who was the lead for WTP work, was a key contributor to reports for Ofwat 'Expert Advice on Assessing Customer Valuations' (2018) and CCWater 'Improving Willingness-to-Pay Research in the Water Sector' (2017). These reports reviewed the role, use, and good practice for customer WTP research for PR19 business planning. Professor Ken Willis, who peer reviewed and assured the work, is a world renowned expert in WTP estimation techniques, travel-cost models, hedonic price models, contingent valuation methods, stated preference or choice experiment methods, and contingent ranking techniques.

3.19 More broadly, the team's work in relation to the use of non-market valuation for cost-benefit analysis and investment planning forms part of the supplementary guidance that supports the recently refreshed HM Treasury 'The Green Book: Central Government Guidance on Appraisal and Evaluation' (2018), which sets out best practice for appraising policies, programmes and projects. Members of the team are also part of the technical working group developing the ISO standard on monetary valuation (ISO 14008), which is due to be published in 2019.

3.20 Findings from the customer WTP research that the project team have conducted with us have been published in established peer-reviewed academic journals, contributing to the overall literature on the use of these methods to inform decision-making. This includes analysis of potential bias in customers' responses in stated preference surveys (Journal of Regulatory Economics; Environmental and Resource Economics) and the novel uses of revealed preference methods in the UK water sector (Resource Energy Economics; Water Resources Research).

3.21 Beyond their work for Thames Water, the project team's PR19 willingness to pay research for Anglian Water was commended as 'innovative' and contributed to their overall A grade for the Engaging Customers test area assessment in Ofwat IAP. Our research has followed a similar 'multi-stage' process, has had the same peer review and external assessment format, and has followed a similar valuation triangulation process.

3.22 In addition to the research conducted to support our September 2018 business plan, over the period January 2019 to February 2019 we undertook a series of customer workshops and focus groups to further test our performance commitment targets and ODIs. This involved five half-day customer workshops and five focus groups across our region. In this latest research customers reiterated that they thought it was not beneficial for a single measure to dominate the incentive framework. Customers felt that this practice would place too much focus on one area of service, potentially to the detriment of others. The approach that we have taken in September and in this resubmitted plan is consistent with this customer feedback.

3.23 In summary we believe our ODIs are:

- in line with customers' views and Ofwat guidance. The majority of our incentives are financial, meaning our ODIs provide a clear link between performance, bills and delivery for our customers. For example, our greatest ODI risk exposure is on supply interruptions, pollution, internal sewer flooding, leakage, per capita consumption and mains bursts;
- based on triangulated customer values drawn from a range of sources over an extended period of time. This ensures that the incentives are stronger where customers prioritise service and provides them with appropriate protection where they need it the most;

- reputational where this is in the best interests of customers and in line with their views; and
- designed to protect customers' interests in the event that circumstances changes and expenditure is no longer required. This is done, for example, through limited and targeted use of caps and collars for specific ODIs.

Asset Health ODI Package

TMS.OC.A4 says: 'The company should propose an appropriate service level and ODI for wastewater treatment works compliance PC as set out in table 2. The company should provide sufficient evidence that its customers support its proposed Asset Health outperformance payments. If it cannot do this, the company should remove the outperformance payments. The company should provide a clear list of what it considers to be its Asset Health PCs, and state its P10 underperformance payments and P90 outperformance payments for each of its Asset Health ODIs in £m and as a percentage of RoRE.'

3.24 Our Treatment Compliance performance commitment is to achieve 100% compliance, as this is a statutory requirement. This was set out clearly in data table App1.[18]

3.25 We respond to specific items on the wastewater treatment works compliance PC in response to TMS.OC.A22 in Section 4 of this document. The remainder of this section focuses on general comments on our Asset Health package.

3.26 We have a strong framework for Asset Health in AMP 6 and we are maintaining a strong framework for the measurement and incentivisation of Asset Health in AMP7.

3.27 Our customers consistently tell us that Asset Health is important to them and we believe we have captured their views[19]. They want robust levels of service today and in the future. It is therefore important that we measure and target Asset Health – and we have responded to this customer feedback by introducing Asset Health measures into our PC framework, covering all water and wastewater assets.

3.28 Our customers want Asset Health to be financially incentivised to ensure we deliver against targets. Throughout our engagement with customers, they indicate that Asset Health PCs are equal in importance to performance-based PCs – and incentives need to reflect this.

3.29 We have tested our approach to developing incentives for Asset Health with customers. In research in January 2019 we explained our approach to estimating Asset Health incentive rates, which involves linking Asset Health performance (e.g. bursts) to customer impacts (e.g. supply interruptions) and scaling the overall impact to avoid double counting. Three-quarters of customers agreed with this approach. Those against our approach to setting Asset Health incentives – or against Asset Health incentives in general – are typically concerned about having too many overlapping or financial incentives, rather than considering Asset Health to be less of a priority.

3.30 Therefore, it is essential that Asset Health incentives are grounded in our customers' views – i.e. the marginal benefits used in setting incentives need to be based on our customer WTP values, especially given that our customer WTP values have been built up from multiple studies using a range of traditional and innovative techniques over several years.

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[18] *TWDOT01, App1, line 24, September 2018.*

[19] *TW-CSE-A1 What customers want v13 final, March 2019, p112, PCs & ODI Research from June 2018.*

3.31 However, we have reviewed and challenged our incentive rates based on the IAP feedback of our incentive rate benchmark position provided by Ofwat. This highlighted that some individual measures have incentive rates that are not fully aligned with other companies.

3.32 Following this review, we have considered whether to align our Asset Health incentives to Ofwat's benchmarked view for industry levels. We note that our customers have told us in recent research that they are generally in favour of PC targets and incentive rates across the industry – so we recognise some changes to our incentive rates to improve alignment would be in line with customers' views. However, they also support the way we valued Asset Health in terms of the value of associated service disruption. Therefore, in undertaking this review we think it is important that all marginal benefits estimates remain within the range estimated from our customer WTP. We consider this to be essential to ensure the incentives deliver against customer priorities.

3.33 For treatment works compliance and sewer collapses we have moved the estimate of marginal benefit to the upper level of our estimated WTP range. This increases the impact of these measures on our RORE range and brings the incentive into alignment with other companies. Given how important these measures are to our customers, we consider these revised incentives to still be in line with their views.

3.34 For mains bursts we have increased the marginal benefit estimate by ten percent, which is still inside the confidence intervals from customers. We have not opted for the value from the upper range, as this would mean this measure would have a disproportionate weight within our framework exceeding leakage and supply interruptions. This would also exceed the RORE cap that customers want for this measure and would therefore be disproportionate for customers.

3.35 For unplanned outage, we have not made any changes on the basis that this measure already accounts for a sizeable percentage of our RORE range and there is little evidence that increasing this further is in line with customers' views. Moreover, this is a measure where the industry is maturing in its measurement – and confidence in industry data and accuracy of the incentive rates is low.

3.36 We have not made any changes to sewage pumping station availability, acceptability of water to customers and properties at risk of receiving low pressure. We have updated our view of P10 and P90 for blockages.

3.37 Our list of Asset Health PCs is provided in the table below with our April P10 and P90 positions for our April resubmission expressed in terms of payments and percentage of RORE as requested:

Table 3: Asset health measures – underperformance and outperformance ODIs

Asset Health PC	Units	Underperformance		Outperformance	
		P10 £m	P10 %RORE	P90 £m	P90 %RORE
Mains Bursts	Nr/1000km	73	-0.232%	59	0.188%
Unplanned Outage	%	52	-0.166%	31	0.097%
Sewer collapses	Nr/100000km	2.9	-0.009%	2.6	0.008%
Treatment works compliance	%	26	-0.083%	N/A	0.000%
Properties at risk of receiving low pressure	Nr/1000 props	0.34	-0.001%	0.12	0.000%
Acceptability of water to customers	Contacts/1,000	0.08	0.000%	0.08	0.000%
Blockages	Nr	33	-0.104%	22	0.069%

Sewage pumping station availability	%	9.6	-0.030%	7.8	0.025%

Source: Thames Water App1 and App1a, April 2019

3.38 In summary, we believe that our weighting of Asset Health measures and incentivisation is appropriate. It reflects an increase in incentivisation of Asset Health measures from our current AMP6 framework, which had a combined P10 and maximum underperformance payments of -£55.3m and -£184.2m respectively over the five-year period[20]. Our P10 position in AMP7 is greater than our maximum penalty exposure position in AMP6 for combined Asset Health measures.

Customer Protection

TMC.OC.A5 The company should apply additional protections through an appropriate outperformance payment sharing mechanism and by implementing caps on individual PCs which could result in material outperformance payments. The payment sharing mechanism and caps to material ODIs should be applied in accordance with guidance provided in the 'Technical appendix 1: Delivering outcomes for customers'.

3.39 We agree that customers should be protected from excessive outperformance payments. We proposed to do this by:

- introducing an overall sharing mechanism to protect customers, with customers sharing (50:50) in any RORE returns >3% over AMP7; and
- applying individual reward caps to PCs, such that no single measure exceeds 0.25% RORE (approximately £15m) in any one year.

3.40 This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important. We have only applied this as a reward cap, at present, although based on our customer engagement we consider this should be applied symmetrically as a penalty collar as well.

[20] *Ofwat, Final Price control determination notice: company specific appendix – Thames Water, December 2014, Pg. 187.*

Section 4

PC Specific Actions

4.1 In this section we respond to the Required Actions that Ofwat raised in Table 2 of the Delivering outcomes for customers detailed actions.

4.2 We also comment on any key changes that we have made to our PCs and ODIs between September 2018 and April 2019.

BW01 Mains Bursts

TMS.OC.A06 Asset Health Mains Bursts (no.) per 1000km PC says:' The company should reconsider its proposed service levels and ensure that these are stretching. If the company continues to propose performance that is worse than its historical levels, it should provide compelling evidence that increased active leakage control (ALC) activity impacts the total number of mains repairs using its own data, including the relationship between proactive and reactive mains repairs. As a minimum the evidence should show the historical correlation between active leakage control, proactive and reactive mains repairs. It should also show the impact of this relationship on forecast repair rates from the output of asset performance modelling. The company should also demonstrate that reduced (worse) performance levels are in the interests of customers and the assets'

4.3 We have not changed our proposed service level for bursts in our April Business Plan, as we continue to believe that it is stretching. We respond to Ofwat's Required Action above by demonstrating that:

- our forecast ALC levels in AMP7 are on average higher than in recent years;
- an increase in ALC levels does not necessarily result in a reduction in visible bursts;
- that we are able to forecast repair rates with reasonable accuracy; and
- we have re-tested our mains bursts target with customers to confirm whether it is stretching.

4.4 Further detailed evidence demonstrating the challenges of maintaining stable bursts whilst reducing leakage is presented in Section 6 (Annex 2) of this document.

ALC Levels in AMP7 are on average higher than in recent years

4.5 If the level of effort in ALC that we are forecasting for AMP7 is higher than recent years to reduce leakage levels, all other things being equal, it therefore must therefore follow that bursts rates would increase.

4.6 Table 4 below sets out our recent historical data on bursts, plus the year to date position for 2018/19.

Table 4: Relationship between mains bursts and Active leakage control

Mains repair activity	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19(*	Average	AMP7	AMP7
Visible bursts (nr)	5,131	5,495	4,281	5,908	5,635	6,751	5,376	4,990	-7%
Active leakage control and network maintenance (nr)	4,116	3,327	2,645	2,418	2,895	3,850	3,169	3,850	+21%
Total bursts (nr)	9,247	8,822	6,926	8,326	8,530	9,620	8,370	8,840	0%**

** based on year end forecast with 11 months of actual data and current proportion of visible leaks*
*** from 19/20 forecast, not the 6-year average*
Source: Thames Water

4.7 Table 4 above shows that visible mains bursts can fluctuate significantly year on year and we know from our own observations that the total annual number is influenced by seasonal environmental conditions such as water temperature and soil movement.

4.8 However, in order to hit our proposed 20% reduction in leakage over the AMP7 period, we want to maintain the level of active leakage control at 2018/19 levels. This is a 21% increase in ALC activity over the average of the last 6 years and maintains the momentum and capability that has been established as part of our leakage recovery plan.

4.9 To ensure that mains bursts remain stable overall, we will need to reduce visible bursts by 7% a year on average compared with the last six years. In the short-term we will offset deterioration by investing in CALM networks as described in Section 2 of our main submission document[21]. However, in the long-term a significant mains replacement programme is almost inevitably required to restore Asset Health.

An increase in ALC levels does not necessarily result in a reduction in visible bursts

4.10 The purpose of this section is to show that our forecast increase in ALC activity does not lead to a sudden reduction in visible bursts. This bolsters the evidence that our stable burst target is stretching.

4.11 The modelling and prediction of visible mains bursts is a highly complex area of analysis. Our modelling work has confirmed that the ultimate driver for visible mains bursts is the condition of the mains themselves, which deteriorate over time making them more prone to leak or burst. This may be worsened by local environmental factors (water temperature and soil movement) and also potentially offset by the intensity of leakage repair activity, but largely only in the short-term. We do apply local operational practices (such as pressure management) to offset the long-term deterioration of mains, but this only results in short-term deferment of the problem and in the long-term our only recourse to improve visible bursts is to reduce the length of the affected vulnerable mains through mains rehabilitation.

[21] TW-RS1 Building a better future: Response to Ofwat's IAP, Section 2D Outcome and Executive summary, April 2019.

4.12 We have developed a multi-step regression model to assist with our operational decision making[22]. This model uses a combination of long-term asset replacement benefits, for example, from our historical Victorian Mains Replacement (VMR) programme and shorter term weekly environmental variables that can affect mains integrity (water temperature, temperature drops, soil moisture deficit) and an independent variable to take account of Active Leakage work undertaken. This model is used in operational planning and forecasting on a weekly basis, to provide an accurate near-term prediction of visible mains bursts.

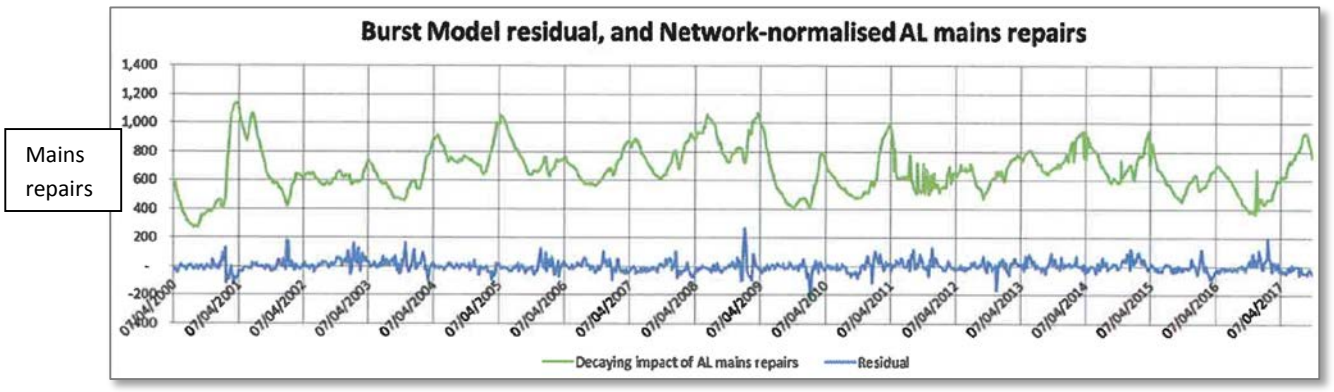
4.13 This is the model that we use to understand the relationship between historical levels of (ALC) activity and the number of visible bursts we have to manage.

4.14 The relationship between these two metrics is a complex one. More ALC may increase visible bursts in the short-term (as more are found) but then reduce in the longer-term and both may decline as average network condition improves (through replacement). Equally, the same resources may be used for both types of work. Hence, an increase in visible mains bursts (due to, for example, a period of variable temperature) may be associated with a reduction in ALC as resources are diverted to help manage the peak in bursts.

4.15 To explore this further, we have used our operational model, based upon data from 2000 to 2018 and have analysed the relationship between the residual of the visible mains bursts predictive model based upon environmental factors only and a lagged variable for ALC mains repairs[23].

4.16 The two charts in the figure below show this relationship, firstly as a weekly time series of data over the 18-year period and then as a plot of the sum of the weekly values aggregated for each Annual Return period.

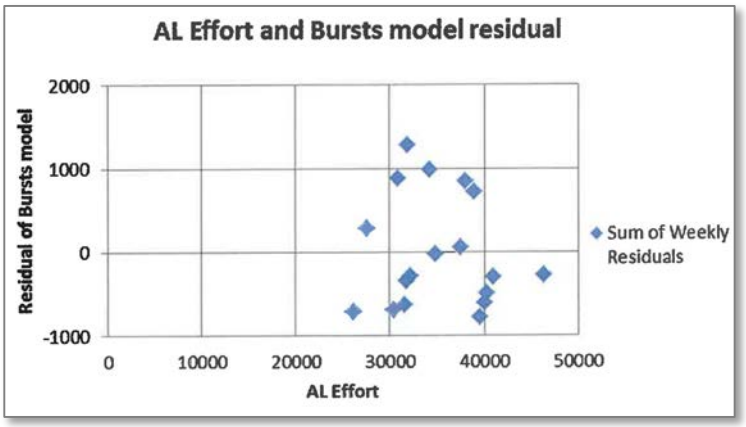
Figure 3: Burst model and Activty leakage mains repairs time series



Source: Thames Water 8 February 2019 "Relationship between AL effort and Visible Bursts", v2

Figure 4: Relationship between Active Leakage effort and visible bursts

[22] Thames Water, 19/12/18 update "Looking for Trends in Burst Rates", Thames water internal analysis.
[23] The decaying impact of Active Leakage mains repairs: The potential benefit of the repairs in a particular week decay by 11% each week, so the effect in, for example, 4 weeks' time is only 63% of the value in the original week of the repair. The use of this decay rate, rather than the simple activity rate, provides a much better model of the benefits of the ALC.



Source: Thames Water, 8 February 2019 "Relationship between AL effort and Visible Bursts", v2

4.17 As can be seen from Figure 3, ALC activity (and benefit) generally rises up to March 2009, as a relatively constant effort is applied to the diminishing population of old, leaky pipes (i.e. as the VMR programme is progressing and gradually replacing the old network). Following this was a reduction in ALC between 2008/9 and 2009/10, whereas the actual mains bursts model residual falls by 400 over this same period.

4.18 The periods with highest recent ALC activity (such as 2008/9) do not show a reduced level of visible bursts and, where there have been low levels of ALC activity (such as 20012/13 and 2015/16), we have not seen any coincidental increase in bursts. There are occasional short periods of high correlation, such as in January 2002, when ALC activity was reduced as resources were re-deployed to cope with large numbers of visible bursts.

4.19 Figure 4 above shows that ALC is almost independent of the Bursts model residual. If ALC activity reduced the number of mains bursts, we would expect a slope from upper left to lower right but there is no indication of a statistically significant relationship, confirmed by regression which gives a t-value of only 0.6 to a slight negative slope.

We are able to forecast repair rates

4.20 To guide our longer-term strategic planning, we have developed a deterioration model within the Asset Investment Manager) modelling software. This is a complex, linear mathematical model composed in an "Asset – Cause – Probability – Impact – Probability – Severity" structure, which takes into account as much as possible about what we know with regard to the condition, nature and recent history of our pipes. This allows us to consider the volume of mains replacement and pressure management that we need to undertake to achieve a particular level of bursts. The model for PR19 is based upon our burst data from 2012 to 2016. The purpose of the software is to provide an understanding of the expected long-term performance of the distribution network to enable the development of cost-benefit balanced solutions to various performance commitment scenarios. The model for bursts predicts deterioration (and hence investment need) based upon the age, location, material and function of each main.

4.21 To estimate the deterioration rate in pipe bursts, we carry out a separate analysis which looks at the relationship between age and bursts. For mains bursts, annual deterioration was estimated at several levels: company level, regional, material-linked and function (i.e. distribution/trunk). Global deterioration is estimated to be 1.8% per annum, with estimates for various regions, materials, and function ranging from 1.0% to 2.25%.

Re-testing customer view on whether our mains burst target is stretching

4.22 We have recently further engaged with customers on Asset Health mains bursts[24]. Based on this engagement and previous engagement we are confident our mains burst target is in line with their views and represents a stretching value for money target.

4.23 In addition to the research conducted to support our September Business Plan, over the period January 2019 to February 2019 we undertook additional customer workshops and focus groups to further test our performance commitment targets and ODIs. This involved five half-day customer workshops and five focus groups across our region. One area covered was the target for Asset Health mains bursts.

4.24 Customers have indicated that Asset Health and performance are important and both need to be managed and incentivised. When asked whether Asset Health or performance related measures are more important, customers indicated it is hard to prioritise service over Asset Health – demonstrating the importance of Asset Health.

4.25 With respect to mains bursts, customers were asked if the overall target to keep bursts stable is acceptable. In customer voting exercises 67% of respondents accepted a stable target in the short term – with a longer-term trend downwards. There was no support for mains bursts getting any worse over the period 2020-25. Customers recognised that over the period 2020-25 there are higher priorities for us to focus on – most notably leakage is a higher priority than bursts, and a stable target for mains bursts reflects that. Customers do not want us to be penalised for being proactive towards leakage as illustrated by the two quotes below:

"I don't think Thames Water should be penalised for being proactive (towards leakage)" – Reading, C2DE Household 1.

"It's fine because it's still stable, and where people are saying I've got a leak they react to it. But they should eventually bring it down over time" – London, C2DE Household.

Conclusion

4.26 We have reconsidered our service level for bursts, but have not changed it from our September Business Plan because we can show that stable performance it is already stretching alongside a 20% reduction in leakage in AMP7:

- ALC activity throughout AMP7 will need to be sustained at 2018/19 levels, 21% higher than the average of the last 6 years;
- statistical analysis shows that an increase in ALC activity does not necessarily result in a reduction in visible leakage;
- we are able to forecast burst rates and pipe deterioration rates; and
- we have re-tested with customers our proposal for stable burst rates alongside our leakage reduction target and they agree that achieving stable bursts is stretching.

TMS.OC.A07 Asset Health Mains Bursts (no.) per 1000km PC: The company should provide further evidence to justify the use of an outperformance payment on this PC, including evidence of customer support. If it cannot do this, the company should remove the outperformance incentive.

[24] TW-CSE-A1 What customers want v13 final, March 2019, Further PCs & ODI Research (January – February 2019).

4.27 This performance commitment has a financial incentive which has been calculated in line with Ofwat guidance[25]. It is appropriate that we are incentivised to deliver our performance commitment in this area and that customers are compensated for benefits foregone for performance that is not delivered.

4.28 This is an underperformance and outperformance incentive, because this is an area where customers value service and we believe that outperformance will deliver sustainable benefits for customers in the long-term.

4.29 We have tested our approach to developing incentives for Asset Health with customers. In recent research we explained our approach to estimating incentive rates, which involves linking performance (e.g. bursts) to customer impacts (e.g. supply interruptions) and scaling the overall impact to avoid double counting. Three quarters of customers who took part agreed with this approach[26].

4.30 We have scaled our benefits between leakage reduction and supply interruptions, including the assumption that programmes that reduce bursts will have a measurable benefit. (Our customers understand outperformance in this measure given the leakage target is difficult, but they wish us to improve over the long term.)

4.31 "The target is fine because it's still stable, and where people are saying I've got a leak they react to it. But they should eventually bring it down over time" – London, C2DE Household.

4.32 Customers have also said that they want a strong incentive for us to outperform our target as they value a proactive, rather than reactive, approach to network maintenance[27].

4.33 We note that in the risk and return IAP feedback section, Ofwat states "…we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[28].

4.34 We conclude that not only do we have support for outperformance on this PC, removing it would place our overall RORE range more at odds with the feedback that Ofwat has provided in the risk and return feedback section of the IAP, where an unsymmetrical range has been challenged. We have a clear customer benefit associated with under and outperformance. Incentivising outperformance aligns with our long-term aspirations to improve Asset Health, reduce risk and reflects our ambition to improve resilience. The outperformance payment helps to recover some of the costs required to reduce bursts and improve the network. The benefits of these programmes may not occur in the year that the work is done. We receive a payment only where measurable enhancements in reduced bursts are realised which we believe is fair.

4.35 We provided the evidence for this Required Action in the Performance Commitment Summary included with our September submission[29].

TMS.OC.A08 Asset Health Mains Bursts (no.) per 1000km PC says: "The company should explain and evidence how its proposed ODI rates for mains bursts are coherent with the rates proposed for PCs relating to the associated customer facing-impacts of the asset failure (including leakage, supply interruptions and low pressure) and demonstrate how the package of ODIs across the relevant group of PCs appropriately incentivises performance in the long and short-term.

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[25] *Ofwat: Delivering Water 2020: Our final methodology for the 2019 price review, December 2017.*

[26] *TW-CSE-A1 What Customers Want v13 (final), January – February 2019 PC & ODI research, March 2019.*

[27] *Britain Thinks PC and ODI research summary report, p65,*

[28] *Ofwat, Thames Water test area assessment, page 4, Aligning risk and return, January 2019.*

[29] *Thames Water, CSD0005 TMS-BW01 Asset Health Mains, September 2018.*

The company should also provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for mains bursts and assess the appropriateness of the company's customer valuation evidence supporting its ODI."

4.36 We have used the standard Ofwat formula for calculation of our incentive rates for bursts. Our costs are whole life costs and our benefit values are based upon whole life sustained benefits. Therefore, our assessments address whether these levels of performance are appropriate for the short and long term.

4.37 The benefit value applied for mains bursts is based on the customer and societal valuations for the service impacts that are experienced by customers when a burst occurs. For example, the resulting interruption to supply, rather than the burst itself. The value for the mains bursts is based on the likelihood that a burst will cause interruptions, leakage and pressure impacts.

4.38 The value is based upon the performance commitment values for supply interruptions and leakage and the OPM values for low pressure due to operational impacts, as opposed to the value for chronic low pressure, which is not generally due to a burst, but sustained low pressure due to network constraints.

4.39 The leakage performance commitment value is derived from both the values for reducing the risk of water restrictions during drought and the additional value, over and above this, for reducing leakage in itself. Full details of the source OPM values are available in our Triangulation Report[30].

4.40 The customer preferences research from 2011 to 2017 provides stated valuations that measure the disruption and inconvenience to customers from low pressure, planned and unplanned supply interruptions (ranging from less than 3 hours through to 7 days or more), the impact of reducing the likelihood of water restrictions and the value in addition of this for reducing leakage on customers.

4.41 In addition, the relative values for persistent and one-off low pressure and interruptions to tap water supply were tested in the 'customer valuation testing' focus groups. Customer views were consistent with the central estimates and how these compared to the disruption and inconvenience from other water service disruptions (discolouration, tap water use notices).

4.42 All values have been assessed against valuations from other companies as part of our triangulation process.

4.43 The interruption to tap water supply and water restriction values have been assessed against valuations from other industries, alongside estimates of disruption to non-households (productivity impacts) as part of the triangulation process for customer values. The set of triangulated OPM and PC values which are central to this measure are shown in Table 5.

Table 5: Mains burst customer valuations pre-calibration

Value type	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Supply interruptions	Per property minute lost	4,945,275	11,507,227	18,705,743

[30] *Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018*

Leakage	Per Ml/d	412,474	587,649	761,797
Pressure	Per property per day	2	5	7

Source: Thames Water data and CSD020 PR19 Performance Commitment Values Report

4.44 To calculate the pre-calibrated benefit values, the value of one burst is calculated using the relationship between a burst and impacts on these measures. For supply interruptions data is used from our infrastructure decision making software to estimate the total property minutes lost per burst. For leakage we calculate and use the average volume of water lost per burst. The unit impacts of an average burst are then multiplied by the customer values in the table above and summed to estimate the total value of a burst. To convert this to a value for one burst per 1,000km then the value per burst is multiplied by the number of 1,000km of mains (31.43).

Table 6: Mains burst customer valuations post-calibration

Value type	Units per burst	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Supply interruption	0.0014 property minutes	6,792	15,806	25,693
Leakage	0.0067 MLD	2,745	3,910	5,069
Pressure	92 properties	202	428	681
Total per burst	-	**9,739**	**20,144**	**31,443**
Total per burst per 1,000 km	-	**306,391**	**633,760**	**989,214**

Source: CSD020 PR19 Performance Commitment Values Report

4.45 The values are then calibrated, adjusted via scaling to account for the crossover with the service PCs (interruptions to supply and leakage), to ensure that the benefit is not double counted. This analysis is detailed in our Performance Commitment Values Report[31]. Our scaling analysis shows that the scaling factor is 0.57 for interruptions and 0.89 for leakage. The values above are multiplied by this scaling factor to produce the final values for this PC:

Table 7: Benefit values used for mains burst pre-calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Total mains burst - per burst	**6,517**	**12,932**	**19,866**
Total mains burst – per 1,000 km	**205,033**	**406,853**	**625,013**

Source: CSD020 PR19 Performance Commitment Values Report

[31] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.*

4.46 We calculate the costs of providing an incremental change in the performance commitment. These are depreciated over the long-term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life Totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement.

4.47 The incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels through AMP7. In this instance, the incremental costs are associated with the costs required to prevent deterioration in reported performance.

4.48 These values are then used to calculate the outperformance and underperformance rates using the standard Ofwat formula.

4.49 We have, however, been mindful of the industry's position on incentivisation of Asset Health and our customers' acknowledgement that Asset Health improvements sustain service improvements in the long term. We acknowledge Ofwat's benchmark rate view for Asset Health in its IAP, but we disagree that an upper quartile approach should be taken where this breaks the link with customer preferences.

4.50 Therefore, in our April submission, we have our revised our ODI incentive rate calculations on Asset Health common measures, but have done so whilst retaining a line of sight to our customer research.

4.51 In undertaking this exercise we have taken into account our customer views and we are ensuring that customers are protected from a single measure dominating the incentive framework. We have applied a 0.25% RORE cap to all measures as a cap on outperformance payments in a single year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important. This also protects customers from excessive outperformance payments.

4.52 In the recalculation of our incentive rates, we have not taken the central triangulated customer value, as used in the September 2018 submission, but a ten percent uplift of the central customer valuation. We note that in doing so, the p10 or p90 performance still does not exceed the 0.25% RORE cap.

4.53 There have been no changes to targets, risk or marginal costs.

4.54 In Table 2 in Section 3 above, we show our revised ODI rates for mains bursts which have been normalised using the same approach as Ofwat in the IAP. We have not move to Ofwat's benchmarked rate as we consider that this would lead to a disproportionate weighting of this measure within our PC portfolio and would not align with our customer research.

4.55 In summary, this PC and its ODI form part of an overall package that appropriately incentivises our performance in the long and short-term because:

- The marginal benefits that we had calculated and triangulated from a customer research dating from 2011 to 2017 – this is now a business as usual exercise and we now have substantial dataset to draw from.
- We calculate the costs of providing an incremental change in the performance commitment. These are depreciated over the long-term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life Totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement.
- The incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels through AMP7.

- We use scaling to ensure that we do not double count benefits delivered by associated performance commitments.

BW02 Unplanned outage

TMS.OC.A09 Asset Health Unplanned Outage PC says: "The company should provide details on the actions needed to comply with the standard definition of this common performance metric and its timetable for completing them (where there is a sub-component rated Amber or Red in table 3S of the 2018 APR submission)."

TMS.OC.A10 Asset Health Unplanned Outage PC says: "The company is required to provide fully audited 2018-19 performance data by 15 May 2019. This should take the form of an early APR submission, but only for Unplanned Outages. Board assured data can be provided with the main APR in July 2019, any changes will be taken into account for the Final Determination. Based on the latest performance and updated methodologies, the company should resubmit 2019-20 to 202425 forecast data in the 15 May 2019 submission. The company should also report its current and forecast company level peak week production capacity (PWPC) (Ml/d), the unplanned outage (Ml/d) and planned outage (Ml/d) in its commentary for the May submission."

4.56 Following the publication of PR19 business plans, we are aware that companies are applying different assumptions and therefore we do not yet have a common metric across the industry against which all companies can report Unplanned Outage consistently. We remain committed to working with Ofwat and other companies to ensure that we have a metric that is easily understandable by customers and is governable so that it is applied consistently.

4.57 We took part in a Water UK workshop on the 8 February 2019 with other companies to discuss this common performance measure. The group made consensus recommendations for submission to Ofwat that were included in response to Ofwat's APR reporting requirements consultation, which closed on the 22 February.

4.58 We are developing an action plan to comply with the standard definition of the measure for Unplanned Outage, which we can share as part of the update requested for 15 May 2019. However, it is necessary to see the final methodology approved by Ofwat in order to confirm our timetable for completing our returns.

4.59 The Water UK working group has also raised a proposal for an UKWIR project to provide more detailed guidance to sit under the Ofwat methodology definition, to promote further alignment and ensure that a benchmark of good practice could be established.

4.60 Whilst the vast majority of the industry supports the measure, there is a consensus that we do not currently collect the data required to calculate it, and therefore it would not be possible to immediately use it as a common measure. Although we continue to report unplanned outage as a financial PC in App1[32], we would not expect to be financially penalised until an established reporting process is in place. Until then, we recommend that this measure is treated as reputational.

TMS.OC.A11 Asset Health Unplanned Outage PC says: "The company should provide further evidence to justify the use of an outperformance payment on this PC, including evidence of customer support for this approach. Alternatively, the company should remove the outperformance payment."

[32] *Thames Water, TW-DT01, PR19 data tables (with TTT updates), April 2019.*

4.61 As noted in our response to TMS.OC.A10, we have concerns about the maturity of this measure and, although we continue to report it as financial, we recommend that it is treated as reputational for the time being.

4.62 Once the definition and reporting improves, we consider that an outperformance payment for this measure is justified and it currently forms a significant part of our overall RORE balance of risk and reward.

4.63 Throughout the development of PR19, the industry has been working with Ofwat to agree a common reporting methodology for this performance measure. Whilst we were engaging with customers, we were therefore unable to provide comparable or historic data. We believe the ambition we have set reflects a stretching target to meet and maintain performance.

4.64 In the research that we conducted in June 2018[33], some customers felt that the incentive for this measure should be for underperformance only – exceeding the target was considered by some customers to have little benefit to them. However, in initial voting, incentives for both underperformance and outperformance was also popular. More broadly, discussions around Asset Health versus service delivery measures indicated the importance of Asset Health measures to customers.

4.65 In our September 2018 submission, we set out the rationale for an outperformance payment in the Unplanned Outage performance commitment summary[34]:as follows:

- customers see this as a priority area;
- there is evidence that a payment incentive could drive innovation that benefits customers over the long-term;
- an outperformance payment is feasible;
- we can demonstrate customer benefits and willingness to pay for improved performance beyond the AMP7 performance commitment target;
- the outperformance payment covers a stretching level of performance; and
- an outperformance payment could drive innovation that benefits customers over the long-term.

4.66 In January and February 2019 we carried out supplementary research to test customer views on the overall ODI RORE range[35]. Our customers are in favour of us having a more symmetrical balance incentive. Removal of this outperformance payment creates a more negative bias. Fundamentally we think it is important for customers that outperformance in this measure is incentivised for the long-term.

4.67 We also note that in the risk and return IAP feedback section, Ofwat states "…we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[36].

4.68 We conclude that we have a clear customer benefit associated with under and outperformance for this PC. Incentivising outperformance aligns with our long term aspirations to improve Asset Health, reduce risk and reflects our ambition to improve resilience. The outperformance payment helps to recover costs, the company only receives a payment only where measureable enhancements in unplanned outage are realised which we believe is fair. Removing an outperformance payment will put us at odds with IAP feedback that Ofwat has provided in the risk and return IAP test area.

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[33] TW-CSE-A1 What Customers Want v13 (final), March 2019.

[34] Thames Water, CSD005, BW02 Unplanned Outage Performance Commitment Summary, Section 6, Design of the ODI, September 2018.

[35] TW-CSE-A1, What Customers Want v13 (final), January – February 2019 PC & ODI Research.

[36] Ofwat,Thames Water test area assessment, aligning risk and return, page 4.

TMS.OC.A12 Asset Health Unplanned Outage PC says: "The company should explain and evidence how its proposed ODI rates for unplanned outages are coherent with the rates proposed for PCs relating to the associated customer facing- impacts of the asset failure and demonstrate how the package of ODIs across the relevant group of PCs appropriately incentivises performance in the long and short-term.

The company should also provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for unplanned outages and assess the appropriateness of the company's customer valuation evidence supporting its ODI."

4.69 We have linked our customer preference values to customer and societal valuations for reducing the risk of water restrictions[37]. This is a direct measure of benefit. The level of unplanned outage will impact the potential for the early onset of water use restrictions. During normal operation with variable demand, water treatment plants may not be required to run or run at their full capacity and when outage occurs demand may be met by other sites. Therefore, there may not be a direct impact on customers from an unplanned outage. However, we have modelled the impact of various levels of outage on timing of triggers for different levels of water use restrictions and these have been used as a clear relationship with customer preferences and valuations.

4.70 In Table 2 in Section 3 above, we show our revised ODI rates for unplanned outage that have been normalised using the same approach as Ofwat in the IAP. We have not move to Ofwat's benchmarked rate as we are unclear of the approach that other companies have taken to calculate incentives for this measure and expect, that given the maturity of the measure within the industry there will be a lot of variability in the approach taken. Therefore, we do not believe that it is appropriate to benchmark incentives given disparities in approach to incentivisation and measurement for this measure. This is not a reflection on the measure itself, but the maturity within the industry in its approach to the measure.

4.71 Our customer preferences research from 2011 to 2017 includes stated preference values measuring the impact of water restrictions on customers. These have been assessed against valuations from other industries and estimates of disruption to the productivity of non-household customers as part of the triangulation process for customer values. We understand that we have the most comprehensive and long-standing customer set of customer valuations in the industry in this area.

4.72 The values applied for this PC are taken from the Security of Supply Index (SOSI) PC valuations from our Triangulation report which converts the water restriction triangulated OPM values into values per volume of water.[38] The values for a one mega litre per day (Ml/d) change are calculated and these are applied to the number of Ml/d in 1% of outage. Therefore, we have a clear customer benefit associated with under and outperformance.

Table 8: Benefit values used for unplanned outage – pre-calibration

Value type	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Security of supply	Per Ml/d	104,476	152,058	199,591

Source: CSD020 PR19 Performance Commitment Values Report

[37] *Eftec and ICS, CSD019 Triangulation Report – Customer and Societal Valuations, Junes 2018.*
[38] *Eftec and ICS, CSD019-PR19 Triangulation Report - Customer & Societal Valuations, June 2018.*

4.73 The values are applied to the number of Ml/d associated with 1% of outage. This is 23 Ml/d if 1% is based on the deployable output of 2305 Ml/d[39].

Table 9: Full benefit value pre-calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Unplanned outage - %	**2,408,173**	**3,504,945**	**4,600,561**

Source: CSD020 PR19 Performance Commitment Values Report

4.74 These values have been adjusted to account for the overlap with SOSI by ensuring the remainder not captured by SOSI are captured under the unplanned outage PC.

4.75 The analysis in our valuation report[40] shows that the scaling factor for SOSI is 0.55.

4.76 As unplanned outage is excluded from the scaling calculation, we have applied a scaling factor of 0.45 to account for the value not captured by security of supply. The values above are multiplied by this scaling factor to produce the final values for this PC.

Table 10: Unplanned outage value post calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Unplanned outage - %	**1,083,409**	**1,576,834**	**2,069,739**

Source: CSD020 PR19 Performance Commitment Values Report

4.77 These values are therefore the basis of the marginal benefit applied to the performance commitment.

4.78 This approach is robust and has been externally audited.

4.79 In summary, this PC and its ODI form part of an overall package that appropriately incentivises our performance in the long and short-term because:

- the marginal benefits that we had calculated and triangulated from a customer research dating from 2011 to 2017 – this is now a business as usual exercise and we now have substantial dataset to draw from;
- we calculate the costs of providing an incremental change in the performance commitment. These are depreciated over the long-term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life Totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement;

[39] Outage is measured relative to maximum production capacity however, the impact on customers is linked to the reduction in the deployable output. The calculation shown is simplified. An alternative approach would be to scale the DO up to maximum production capacity and then scale the resulting value down by the same factor to assess the impact on customers. These two effects cancel out.

[40] Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018.

- the incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels to ensure through AMP7; and
- we use scaling that we do not double count benefits delivered by associated performance commitments.

BW03 Interruptions to supply

TMS.OC.A13 Interruptions to supply PC says ": 'For this common PC we expect all companies' service levels to reflect the values we have calculated for each year of the 2020 to 2025 period."'

4.80 In Section 2 of our main submission document[41], we have commented on the reasons for improving our stretch on interruptions to supply. Our September plan proposed a 5.6% improvement from 10 minutes, 35 seconds per property in 2019/20, to 9 minutes, 59 second per property by 2024/25. We propose to improve our performance to 8 minutes, 30 seconds per property by 2024/25. This represents a significant 20% reduction over AMP7.

4.81 Our enhancement case for supply interruptions also provides additional information about our strategy and activities and costs to achieve our revised stretching target[42].

4.82 We have chosen this stretching level of service, but not to adopt Ofwat's IAP upper quartile profile of 3 minutes per property by 2024/25, because:

- the upper quartile targets are based on other company forecasts that lack credibility and do not reflect their current performance;
- We have concerns about consistency of reporting across the industry;
- The target does not allow for traffic congestion in London;
- We have an older network in corrosive soils that is prone to bursting;
- The operational improvements that we have identified are not readily scalable; and
- Customers do not support the IAP upper quartile target, as it would place too much focus on this area of service to the detriment of others.

4.83 Ofwat's assumption that base expenditure should be sufficient to achieve upper quartile performance fails to recognise the specific regional circumstances listed above that are contributing factors to our current level of performance. We have successfully presented our mitigating regional circumstances before. Following ours and other companies' representations on the PR14 draft determination, Ofwat revised its comparative assessment proposals for supply interruptions for the final determinations. We see parallels between the limitations in Ofwat's approach at the PR14 draft determinations and its approach for the IAP.

4.84 We elaborate and provide additional evidence for each of the points above for the remainder of this section.

The upper quartile targets are based on other company forecasts that lack credibility and do not reflect their current performance

[41] *TW-RS1 Building a better future: Response to Ofwat's IAP, April 2019.*
[42] *TW-CE-A10 Supply interruptions improvement, Enhancement Case, April 2019.*

4.85 We believe that historical analysis plays an important role in setting realistic baselines upon which we can plan to deliver different levels of performance and service in the future, based upon customer priorities.

4.86 Using information from the App1 tables, we have reviewed the other companies' current supply interruptions performance and the targets that they have set out in their plans. The results are shown in the table below and the upper quartile forecasts are underlined.

Table 11: Industry supply interruptions current performance and AMP7 forecasts

Interruptions to supply per connected property (mins:secs)	Best recent level (APP1)	Worst recent level (APP1)	Plan 2019/20	Plan 2020/21	Plan 2024/25	2024/25 To meet Plan compared to best	2024/25 To reach UQ compared to best
Affinity Water	18:00	32:54	06:00	05:00	03:00	-83%	-83%
Anglian Water	07:24	24:16	11:00	07:27	05:34	-25%	-59%
Bristol Water	12:34	>60:00	12:12	04:12	01:48	-86%	-76%
Hafren Dyfrdwy	11:30	30:24	19:47	15:00	13:00	13%	-74%
Northumbrian Water	02:10	05:19	05:00	04:20	04:20	100%	38%
Portsmouth Water	03:30	04:17	04:00	03:00	03:00	-14%	-14%
SES Water	03:14	28:34	02:48	02:40	02:06	-35%	-7%
South East Water	08:42	44:36	10:00	06:29	03:58	-54%	-66%
Southern Water	06:18	14:46	06:11	06:11	05:30	-13%	-52%
South Staffs Water	04:14	11:59	07:00	05:30	04:50	14%	-29%
Severn Trent Water	10:35	35:50	08:50	08:49	08:41	-18%	-72%
South West Water	09:02	17:26	07:43	07:14	04:41	-48%	-67%
United Utilities Water	10:04	25:47	11:50	06:00	06:00	-40%	-70%
Dwr Cymru	12:12	50:24	12:00	11:12	08:00	-34%	-75%
Wessex Water	12:34	49:18	12:20	04:17	03:07	-75%	-76%
Yorkshire Water	06:12	08:14	04:00	03:36	02:00	-68%	-52%

Source: Company business plans, APP1. Figures underlined indicate Upper Quartile

4.87 We note that four of the six companies forecasting to be upper quartile or better believe they can reduce interruptions by between 68% and 83% in their plans. We don't believe that their plans are credible. For our part, we cannot offer a credible, affordable plan that delivers this scale of improvement in one AMP period and our customers are in agreement[43].

[43] *TW-CSE-A1 What customers want v13 (final), January-February 2019 PCs and ODIs, March 2019.*

4.88 Many companies are proposing a step change in performance between 2019/20 and 2020/21. Given the value that customers of most companies place on having a reliable supply of water, we cannot understand why these companies are not already delivering the forecast levels of performance, rather than waiting until 2020/21.

We have concerns about consistency of reporting across the industry

4.89 Following the industrywide targeted review of Common performance commitments conducted earlier in 2018, we believe that inter-company comparisons must be treated with caution.

4.90 We have invested in extensive pressure monitoring in our network. In accordance with best practice, our approach assumes customers to have been impacted by a supply interruption when our modelled view of pressure outside their property falls below the requisite level. In other words, we do not specifically rely on a customer having to contact us to inform us that their supply has been interrupted. We believe other companies rely solely on customer contacts, which in our view will substantially under-report the number of customers affected by an incident.

The target does now allow for traffic congestion in London

4.91 Analysis of the time spent on travel by our field resources indicates that a significant proportion of their time is spent travelling to site to attend events and waiting on repair and maintenance gangs to deliver appropriate fittings to site for repairs to be undertaken. London accounts for a substantial portion of the Thames Water area and experiences the lowest average speed in the country. The figures below provide evidence of the congestion issues in London.

Figure 5: Average delay on A roads in England

Department for Transport statistics

Road Congestion Statistics

Table CGN0502b

Average delay on locally managed 'A' roads[2]: by local authority in England: annual from 2015

		Average delay (spvpm)[1,2,3,4]				Change in last year
Country/region/local authority	*ONS area code*	2015	2016	2017	2018	%
ENGLAND	*E92000001 (921)*	44.6	45.9	46.9	47.3	*0.9%*
NORTH EAST	*E12000001 (A)*	30.1	31.4	32.8	33.0	*0.6%*
NORTH WEST	*E12000002 (B)*	49.5	50.9	53.9	53.8	*-0.2%*
YORKSHIRE AND THE HUMBER	*E12000003 (D)*	39.5	40.1	41.1	42.1	*2.4%*
EAST MIDLANDS	*E12000004 (E)*	31.4	32.1	33.7	34.6	*2.7%*
WEST MIDLANDS	*E12000005 (F)*	41.0	41.4	43.4	44.6	*2.8%*
EAST OF ENGLAND	*E12000006 (G)*	30.3	31.8	32.7	32.9	*0.6%*
LONDON	*E12000007 (H)*	98.9	100.8	101.9	116.7	*14.5%*
SOUTH EAST	*E12000008 (J)*	35.4	36.6	37.5	37.6	*0.3%*
SOUTH WEST	*E12000009 (K)*	32.0	33.2	33.7	34.3	*1.8%*

Source: DfT Travel Time Data

Notes

1. Delay is calculated by subtracting derived 'free flow' travel times from observed travel times for individual road sections. Free flow travel times are calculated using the 85th percentile speed observation for each individual road sections. These are 'capped' at national speed limits.
2. Average delay is calculated by aggregating delay estimates from individual road sections and weighting observations by associated traffic flows so that it is representative of traffic volumes.
3. Travel time observations used to calculate this measure are derived from cars and light vans data only.
4. All day average delay calculated across the complete 24 hourly period and includes all days (weekdays, weekends, bank holidays etc.)

'..'. No data for road segment available.

Last updated: 28 February 2019

Source: Department for Transport statistics

Figure 6: Average speed on A roads in England

Department for Transport statistics

Road Congestion Statistics

Table CGN0501b

Average speed on local 'A' roads[2]:
by local authority in England: annual from 2015

		Average speed (mph)[1,2,3]				Change in last year
Country/region/local authority	*ONS area code*	2015	2016	2017	2018	
ENGLAND	*E92000001 (921)*	25.5	25.2	25.2	24.9	*-1.3%*
NORTH EAST	*E12000001 (A)*	30.0	29.6	29.1	28.9	*-0.6%*
NORTH WEST	*E12000002 (B)*	23.4	23.1	22.8	22.7	*-0.3%*
YORKSHIRE AND THE HUMBER	*E12000003 (D)*	26.2	26.0	26.0	25.6	*-1.8%*
EAST MIDLANDS	*E12000004 (E)*	29.8	29.5	29.3	28.9	*-1.3%*
WEST MIDLANDS	*E12000005 (F)*	26.3	26.1	25.9	25.5	*-1.4%*
EAST OF ENGLAND	*E12000006 (G)*	31.3	30.8	30.7	30.5	*-0.9%*
LONDON	*E12000007 (H)*	16.6	16.3	16.4	14.5	*-11.3%*
SOUTH EAST	*E12000008 (J)*	28.5	28.1	28.2	28.0	*-0.5%*
SOUTH WEST	*E12000009 (K)*	29.0	28.6	28.6	28.3	*-1.0%*

Source: DfT Travel Time Data

Notes

1. The measure weights speed observations from a sample of vehicles by associated traffic flows so that it is representative of traffic volumes on the roads in different locations and at different times of day.
2. Travel time observations used to calculate this measure are derived from cars and light vans travel time data only.
3. All day average speed calculated across the complete 24 hourly period and includes all days (weekdays, weekends, bank holidays etc.)

'..'. No data for road segment available.

Last updated: 28 February 2019

Source: Department for Transport statistics

4.92 From these figures, London clearly has the worst traffic congestion issues in England. In the additional regional information that can be accessed from the DfT tables, it can be seen that Reading and Slough suffer similar performance to London in terms of both average delays and average speeds on local 'A' roads.

We have an older network in corrosive soils that is prone to bursting

4.93 The age of the mains in the Thames Water network are a unique factor as they are of a greater age than other water companies, as shown in the figure below.

Figure 7: Average age of water mains – industry comparison

Company	Proportion of mains pre 1920	Average age of mains (years)
Thames	38%	79
Southern	29%	69
Bristol	22%	64
Bournemouth	16%	62
Sutton and East Surrey	17%	61
Anglian	25%	59
South East	6%	59
Yorkshire	10%	58
Affinity	5%	52
Dee Valley	10%	51
Wessex	7%	50
Portsmouth	10%	50
Welsh	13%	50
South Staffs	7%	47
United Utilities	10%	46
Severn Trent	9%	46
South West	1%	45
Northumbrian	2%	40

Source of data: PR19 cost assessment tables 2017

Water Resource Zone	Proportion of mains pre 1920	Average age of mains (years)
London	50%	88
Guildford	37%	80
SWA	26%	74
Kennet Valley	22%	71
Henley	18%	68
SWOX	19%	64

Source: Thames Watet analysis

4.94 The age of our network and the prevalence of corrosive soils in our region is inevitably a factor in our burst rate, which is the highest in the industry. In our document Supply Interruptions improvement Enhancement Case[44], we have demonstrated that burst mains are related to 84% of our interruptions to supply.

4.95 We also experience a high level of pipe condition deterioration due to the material of our mains (many of which are old cast iron mains), the corrosive soil conditions in our region and high levels of demand. Therefore we have to work harder than other companies to offset the effects of this deterioration in order to maintain current performance levels.

4.96 While we have undertaken high levels of mains replacement in AMP3 and AMP4 to reduce leakage and improve our network condition, there remains a large proportion of our network which consists of older mains. Since 2010, investment in infrastructure has been more focused on maintaining asset health, interruptions and bursts at relatively constant levels, with more modest programmes of replacement for leakage reduction.

4.97 We have explored the option of undertaking increased levels of mains replacement in AMP7 to secure a high confidence solution to reducing our current levels of bursts, interruptions to supply and improving network resilience.

4.98 Our asset investment planning tool, has been used to forecast the impact of future mains replacement and pressure management schemes on asset health and customer service.

4.99 The scenario that we have included in our business plan includes the mains replacement and pressure management activities that are required to achieve stable performance in terms of bursts and interruptions, by offsetting deterioration.

[44] *TW-CE-A10 Supply interruption improvement, Enhancement Case, April 2019.*

4.100 Our plan includes 650 km of mains replacement to offset a deterioration rate of 820 bursts in AMP7. If we did not offset these bursts, then we predict that our interruptions to supply performance would also deteriorate by about 30 seconds per connected property.

4.101 The 650 km of mains replacement also contributes a 6 Ml/d sustainable reduction to our leakage performance.

4.102 An additional scenario was run to achieve the above reduction plus a 20% improvement in unplanned interruptions to supply caused by distribution mains failures. This scenario required 1,326 km of mains replacement, which would have added approximately £680m to our plan.

4.103 Further enhancements to the upper quartile levels that Ofwat has identified in the IAP would require the asset health of our water network to improve significantly. In other words, upper quartile performance is only realistic from a notional company that has had the benefit of a much newer network with very low burst rates.

The operational improvements that we have identified are not readily scalable

4.104 Since September, we have identified some operational improvements that could be made, to improve performance. These include: enhanced maintenance of trunk mains valves so that areas of the network can be isolated more expediently following a burst; more flexible approach to field staff shift patterns to ensure better staff coverage at times in the day when major supply interruptions are more likely (in London – typically early in the morning); better equipping of field teams with pump spares to put customers back in supply quicker; and more forensic root cause analysis to ensure better operational learning; and

4.105 While these operational improvements offer a forecast step-change in performance, they cannot be scaled up to achieve the upper quartile levels of service that Ofwat has identified in the IAP.

4.106 To achieve our proposed service enhancement, we also plan to roll-out CALM network technology. The approach is to place less stress and strain on our fragile network, when we have to move water around quickly to meet customers' demand. We will do this through improved pressure management and by starting and stopping pumps in a much 'softer' way using variable speed drives so as not to create pressure transients in the network (also known as 'water hammer').

Customers do not support the IAP upper quartile target, as it would place too much focus on this area of service to the detriment of others

4.107 In addition to the research conducted to support our September 2018 Business Plan, over the period January 2019 to February 2019 we undertook a series of customer workshops and focus groups to further test our performance commitment targets and ODIs. This involved five half-day customer workshops and five focus groups across our region. One area covered was supply interruptions.

4.108 This latest research indicated that customers thought we could be more ambitious in our targets around supply interruptions. However, in customer voting exercises within the sessions, 71% of respondents did not believe we should amend the business plan target for supply interruptions as far as the target proposed in the IAP feedback. Customers indicated they were concerned about the proposed target, arguing this would place too much focus on this area of service to the detriment of others, especially given the current industry performance differs significantly to this level[45].

- "This is an unrealistic target and efforts to meet it may impact other services" – Reading ABC1
- "To me these targets look unrealistic. It's a huge drop in time." – Croydon C2DE

[45] *TW-CSE-A1, CR70a-PCs and ODIs, September 2018*

Conclusion

4.109 We have revised our ambitions for supply interruptions and also our target and glide paths:

Table 12: Supply interruptions – revised targets

	AMP6 forecast	2020 –25 Performance commitment targets				
Year	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
PC target Min:sec	10:35	10:10	09:45	09:20	08:55	08:30

Source: Thames Water App1

4.110 We are proposing a stretching target for supply interruptions in AMP7 that will be achieved through a number of operational improvements together with investment in CALM networks. Our revised proposal for supply interruptions represents a significant risk to our operations, as the initiatives that we are proposing have yet to be proven on our network. We are unable to stretch our performance further than this due to our specific regional circumstances that Ofwat has already recognised in previous price reviews.

TMS.OC.A14 Interruptions to supply PC: 'The company should explain why its proposed rates differ from our assessment of the reasonable range around the industry average (as set out in 'Technical appendix 1: Delivering outcomes for customers') and demonstrate that this variation is consistent with customers' underlying preferences and priorities for service improvements in supply interruptions.'

'The company should also provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for supply interruptions and assess the appropriateness of the company's customer valuation evidence supporting its ODI.'

4.111 We are unable to provide a critique as to why our ODI rate may be different from other companies, as we do not have access to their detailed calculations. Our response to this Required Action therefore focuses on explaining how our ODI rate aligns with our customer preferences.

4.112 Our incentives for supply interruptions have been calculated bottom-up from our triangulated customer willingness to pay and the incremental costs associated with delivering the performance enhancements detailed in the plan.

4.113 The benefit value applied to supply interruptions is based on the customer and societal valuations for reducing interruptions to customers' water supply[46].

4.114 Our customer preferences research from 2011 to 2017 provides stated preference valuations that measure the disruption and inconvenience to customers from planned and unplanned supply interruptions, ranging from less than 3 hours through to 7 days or more. These have been assessed against valuations from other companies and industries, alongside estimates of disruption to non-households (productivity impacts) as part of the triangulation process for customer values.

[46] Eftec and ICS, *CSD019 Triangulation Report – Customer and Societal Valuations, June 2018.*

4.115 Testing of supply interruptions values in the plan balancing process indicated that the scope of the investment programme was sensitive to the value range. As part of the triangulation process, these findings were tested with customers. A series of 'customer valuation testing' focus groups were undertaken and customers were shown what the relative valuations could mean in practice for business planning, e.g. how a given water budget and wastewater budget would be prioritised on the basis of the valuations; this was used to assess the validity of the valuations. Customers provided a quantitative view and ranked aspects of service disruption. Customer views were consistent with the central estimates and how these compared to the disruption and inconvenience from other water service disruptions (no water, low pressure, discolouration, tap water use notices). This has provided assurance that the range of the value is appropriate and how they influence the balance of the plan is consistent with customers' priorities. We have the longest standing and most comprehensive set of valuations in the industry in this regard.

4.116 The set of triangulated OPMs values for this PC are outlined in the table below:

Table 13: OPM benefit values for supply interruptions

OPM	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
3 to 4 hours	Per property	300	800	1,300
4 to 8 hours	Per property	500	1,100	1,800
8 to 12 hours	Per property	900	1,900	3,100
12 to 24 hours	Per property	1,100	2,600	4,200
24 to 48 hours	Per property	2,200	5,100	8,000
48 hours to 7 days	Per property	5,000	11,600	18,400
Greater than 7 days	Per property	6,500	14,900	23,700

Source: CSD020 PR19 Performance Commitment Values Report

4.117 The water supply interruptions PC unit is per property minute. The unit value is computed from the weighted average of a minute in each of the duration bands (3-4hr, 4-8 hr, etc) using data from the business plan.

4.118 The average of one minute of interruptions in any one band is computed as WTP divided by the mid-point of the band expressed in minutes. The average of all the bands is the overall weighted average. The weights are based on what is being delivered by the plan. The unit of measure for the PC is the number of minutes per total property served.

4.119 To produce an initial estimate of the unit PC value we have used programme data to provide the expected numbers of properties in each band. The total number of hours of interruptions is computed using the mid-point of each band. This data is used to calculate a weighted average value per property minute. The first step is to calculate the total duration lost. The midpoint for each band and the number of properties affected are shown below. They are multiplied together to calculate the total duration lost.

Table 14: Number of properties and total hours lost in each band

OPM	No. Properties	Mid point	Total hours lost

3 to 4 hours	80585	1.5	282,048
4 to 8 hours	77424	3.5	464,544
8 to 12 hours	18992	6.0	189,920
12 to 24 hours	11166	10.0	200,988
24 to 48 hours	2053	18.0	73,908
48 hours to 7 days	409	36.0	44,172
Greater than 7 days	42	108.0	10,080
		Total Hours	**1,265,660**
		Total Minutes	**75,939,570**

Source: CSD020 PR19 Performance Commitment Values Report

4.120 Given there are 3,789,622 properties, this is 20.04 minutes per property per year.

4.121 The second step is to estimate the total value of the interruptions. The total hours lost are multiplied by the OPM values and summed.

Table 15: Total value of all interruptions

OPM	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
3 to 4 hours	24,175,500	64,468,000	104,760,500
4 to 8 hours	38,712,000	85,166,400	139,363,200
8 to 12 hours	17,092,800	36,084,800	58,875,200
12 to 24 hours	12,282,600	29,031,600	46,897,200
24 to 48 hours	4,516,600	10,470,300	16,424,000
48 hours to 7 days	2,045,000	4,744,400	7,525,600
Greater than 7 days	273,000	625,800	995,400
Total value of all interruptions	**99,097,500**	**230,591,300**	**374,841,100**

Source: CSD020 PR19 Performance Commitment Values Report

4.122 The total value and total duration are used to produce a weighted average value per minute at one property:

4.123 Weighted average value per minute = total value / total number of minutes

4.124 This value is multiplied by the total number of properties to produce the value of an interruption lasting one minute at all properties.

Table 16: Full benefit value pre-calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Interruptions to supply - Weighted value per minute	1.30	3.04	4.94
Interruptions to supply - Weighted value per minute for all properties	**4,945,275**	**11,507,227**	**18,705,743**

Source: CSD020 PR19 Performance Commitment Values Report

4.125 These values have been adjusted via scaling to account for the crossover with other PCs, e.g. mains bursts and water quality events. The analysis resulted in a scaling factor of 0.57[47]. The values above are multiplied by this scaling factor to produce the final values for this PC.

Table 17: Interruptions to supply value post calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Interruptions to supply - Weighted value per minute for all properties	**2,829,155**	**6,583,198**	**10,701,415**

Source: CSD020 PR19 Performance Commitment Values Report

4.126 In January 2019 in our supplementary research, we also engaged with customers on our ODI for supply interruptions. Customers were clear that they would rather we maintain the proposed approach to the incentive rate associated with the target put forward in our draft plans, as this is based upon customer values, instead of adjusting it to be more in line with Ofwat's views. However, they added that changes to the target for supply interruptions would need to be matched by changes to the incentive rate – so that the overall impact of supply interruptions on the RORE range remains similar. In customer research before submission of our September 2018 plan and recent research, it is clear that customers are not supportive of a single measure dominating the RORE range.

4.127 We have revised our performance target and assessed what the cost to the business of achieving this target may entail and have recalculated our ODI incentive rate using our current view of revised incremental costs and updated incremental benefits.

4.128 The bottom-up calculation for revised incentive rates results in an increase in outperformance payment and penalty rate and resulted in this measure dominating the RORE range. We feel that this change would have increased the dominance of supply interruptions further in our overall package of performance commitments, which was contrary to customers' views.

[47] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.*

4.129 We have, therefore, taken the lower benchmark value for supply interruptions for the revision of the incentive rates. In Table 2 in Section 3 above, we show our revised ODI rates for supply interruptions, which have been normalised using the same approach as Ofwat in the IAP. Our revised ODI rates for out and underperformance now site within the range that Ofwat has identified for the IAP, whilst retaining line of sight to our customer research.

Table 18: Revised incentive rates for supply interruptions

Performance commitment	Marginal cost (£m)	Marginal benefit (£m)	Penalty rate (£m/min)	Reward rate (£m/min)
Supply interruptions (April 2019)	2.26	2.83	1.70	1.41
Supply interruptions (September 2018)	6.08	6.58	3.54	3.29

Source: TW-OC-A12-ODI Business Plan ODI Model and Thames Water App1, April 2019

BW04 Leakage

TMS.OC.A15 Leakage PC: 'The company should reconsider its proposed service levels and ensure that they are stretching and meeting the upper quartile values or provide compelling evidence to demonstrate why this level cannot be achieved. Based on the forecast data provided by companies in the September 2018 business plan submission the upper quartile values are 75 litres/property/day and 5.42 m3/km of mains/day. The company should clearly set out the evidence and rationale for the revised targets.'

4.130 We discuss our revised proposal for leakage in Section 2 of our main submission document[48]. We are concerned that the Asset Health of our water network is lower quartile. We have the oldest water network in the industry, with the highest burst rate, which has proven not to be fully resilient to weather events such as freeze thaw. The underlying Asset Health, and the cost, timeframe and customer views on improving Asset Health over the medium to long term must be taken into consideration when assessing the level of stretch to service enhancements in AMP7.

4.131 Detailed evidence demonstrating the challenges of maintaining stable bursts whilst reducing leakage is presented in Section 6 (Annex 2) of this document.

4.132 We are employing significant effort to reach 606Ml/d by March 2020. Through a combination of innovation, effort and understanding, we are finding and fixing more leaks, reducing backlogs, speeding up repair times and improving our use of assets and data, compared with our position in 2016/17. However, despite our strenuous efforts to improve, there has been a frustrating disconnect between our efforts and our results, with overall leakage levels not reducing as we had hoped.

4.133 Our performance in 2018/19 has been heavily affected by two challenging weather events: the extreme cold weather in March 2018; and the hot, dry weather between April and July 2018. Both have contributed to increases in leakage and slowed the recovery of our performance to target. Our current risk-adjusted view is that we end the year on 31 March 2019 at a spot value of 663Ml/d, which is 30Ml/d higher than our previous forecast of 633Ml/d.

[48] *TW-RS1 Building a better future: Response to Ofwat's IAP, Section 2D, April 2019.*

4.134 This means we begin 2019/20 at a higher level of leakage than we had expected to, which has a knock-on effect on our ability to reduce leakage during the year. We will continue our efforts to achieve our annual average leakage target in 2019/20 of 606Ml/d, but from our experience of the past year – and the fact that our modelled performance takes us into uncharted territory - a figure of 636Ml/d is more realistic. This performance still surpasses our best ever leakage performance.

4.135 We are maintaining our leakage target as an annual average at 510Ml/d[49] by 2024/25. This means increasing our efforts in our recovery plan, such that the overall leakage reduction in AMP7 is now 20%. The key activities we will undertake in AMP7 are:

- Customer side leakage – currently 28% of leakage is on private pipes on our customer's land. By continuing the roll out of our progressive metering programme, and the installation of bulk meters on blocks of flats, we will have much better ability to target this leakage (and wastage in the customer's property).
- District metering area (DMA) Enhancement: We have close to 1700 DMAs across our region, splitting our network into smaller areas that allow a balance to be calculated between water delivered and water used. The difference between the two can be leakage or high usage by our customers. By improving our understanding of the targeted DMAs, adding further monitoring equipment, including acoustic loggers and installing progressive meters we can greatly improve our targeting of leakage and usage.
- The above two activities will deliver the majority of the reduction in AMP7 (2020-2025) and AMP8 (2025-2030). Once the metering programme is complete and the targeted DMAs are enhanced, the benefit from these activities will decrease. The benefit of other cost-effective options (such as pressure management) will also have been realised at this time.

4.136 We are therefore left with mains rehabilitation as the only realistic option to improve asset health and to reduce leakage further than 20% in AMP7. Whilst mains rehabilitation is a longer term and high benefit option, reducing leakage, bursts, interruptions to supply and potentially improving water quality, it is currently by far the most expensive option.

4.137 We expect that our plans for additional metering and DMA enhancement will improve our understanding of the best areas to target for mains rehabilitation and leakage reduction. The cost benefit of mains rehabilitation will then improve, allowing us to achieve our long-term ambition of a 50% reduction.

4.138 We have revised our annual and three year rolling average targets for leakage. The final year target has remained the same, but the benefit delivered in the planning period has changed as a function of the revised forecast for leakage for 2019-20.

Table 19: Leakage AMP7 performance commitment (3 year rolling average)

Performance Commitment	2020-21	2021-22	2022-23	2023-24	2024-25
Leakage MLD (September 2018)	654	626	607	587	568
Leakage MLD (April 2019)	685	641	613	590	568

Source: Thames Water, App1 Line 13

Effect of underlying asset condition on leakage performance

[49] *Prior to the impact of Ofwat's AMP7 leakage methodology change for the Common PC.*

4.139 We believe that company performance for leakage is due in part to the underlying asset condition. For all companies, the majority of their networks are still assets adopted at the point of privatisation in 1989. This means that a large component of network condition and resulting performance is still a legacy of pre-privatisation issues.

4.140 Companies have not been historically funded for convergent performance in leakage. Leakage targets have been set through the WRMP and are influenced by factors such as water scarcity, population and housing growth, relative costs of other supply demand balance options, relative customer and environmental valuations and underlying asset condition.

4.141 Other circumstances also have significant impact on the condition and performance of the network, including:

- The soil conditions within a company area which are not within the control of the company and have significant impact on mains deterioration rates.
- Density is included within econometric modelling as a factor which impacts efficient cost. It also has an impact on network condition and is clearly outside of management control. But as historic condition/performance (noted above) is not consistent across all companies therefore the allowance from such models cannot be assumed to fund common performance.
- Higher meter penetration rates allow for more efficient detection and management of customer supply pipe leakage and more efficient targeting of mains leakage detection efforts. Meter penetration is again a result of a sequence of decisions made through past WRMPs owing to company circumstance, and reflected in current bills.

TMS.OC.A16 Leakage PC: 'The company should provide further justification of its approach to triangulation of the marginal benefit value for leakage and provide further detail on the adjustments made for overlap across PCs.'

4.142 Our customer preferences research from 2011 to 2017 includes stated preference values measuring the impact of reducing the likelihood of water restrictions and the value in addition to this of reducing leakage.

4.143 These have been assessed against valuations from other industries and, for water restrictions, estimates of disruption to the productivity of non-household customers as part of the triangulation process for customer values.

4.144 The set of triangulated values that are used to value this performance commitment are outlined in the table below:

Table 20: Benefit value for reducing leakage performance commitment

Value	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Leakage	Per Ml/d	355,000	504,000	652,000
Water restrictions - SOSI	Per Ml/d	104,476	152,058	199,591
Total leakage value – Ml/d	**Per Ml/d**	**459,476**	**656,058**	**851,591**

Source: CSD020 PR19 Performance Commitment Values Report

4.145 These values have been adjusted via scaling to account for the crossover with other PCs e.g. SOSI, PCC, mains bursts and water quality events.

4.146 For leakage, this is a two-step process. The first step addresses the overlap for reducing the risk of water restrictions captured by the SOSI PC. This overlap covers leakage, SOSI and PCC, and results in a scaling factor for SOSI of 0.55[50]. The water restrictions value is multiplied by this scaling factor.

4.147 The second step addresses the overlap between performance commitments that use the leakage value, e.g. mains burst and water quality events, and results in a scaling factor of 0.89. The values in the table above are multiplied by this scaling factor to produce values for this performance commitment that address overlaps with both leakage and SOSI. The SOSI scaling only applies to a proportion of the underperformance range. We have therefore calculated a value that excludes SOSI calibration and addresses only the leakage overlap. This value applies the leakage scaling factor to the pre calibration value for this performance commitment.

4.148 The appropriate values for the ODIs differ for underperformance and overperformance payments due to the range over which the SOSI performance commitment applies. The preferred plan target is 100% SOSI and this is achieved with a proportion of the leakage, PCC and water resource investment.

4.149 For overperformance payments, this means that there is no overlap between leakage and SOSI for increasing water savings beyond 100% even though the savings would deliver a further reduction in the risk of water restrictions. The value that is scaled for leakage overlap only is applied.

4.150 For the underperformance payments, a weighted value is required to reflect that the overlap with the SOSI performance commitment only applies to a portion of the investment (59%). Marginal benefit values are given the table below.

Table 21: Final leakage values - post calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Under performance leakage value – Ml/d	**382,328**	**545,229**	**707,135**
Over performance leakage value – Ml/d	**406,716**	**580,726**	**753,805**

Source: CSD020 PR19 Performance Commitment Values Report

4.151 In addition to the research conducted to support our September 2018 draft plan, over the period January 2019 to February 2019 we undertook a series of customer workshops and focus groups to further test our performance commitment targets and ODIs. This involved five half-day customer workshops and five focus groups across our region. In this latest research customers reiterated their message that they thought it was not beneficial for a single measure to dominate the incentive framework. Customers felt that this practise would place too much focus on one area of service, potentially to the detriment of others.

[50] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.*

4.152 For our April submission, we have revised our performance target for leakage and have recalculated our incentive rate using our current view of revised incremental costs based upon the change in benefits delivered during the planning period for the same cost. The bottom up calculation for revised incentive rates resulted in an increase in outperformance payment and penalty rates and resulted in this measure dominating the RORE range. We feel that this change would have increased the dominance of leakage further in our overall package of performance commitments, which was contrary to customers' views. Therefore, we have taken the lower benchmark customer value for leakage for the revision of the incentive rates.

4.153 We have been mindful of Ofwat's benchmarking corridor of industry incentive rates for this measure, and our bottom-up recalculated incentives meet customers' and Ofwat's expectations. We have demonstrated this in Table 2 in Section 3 above and show our revised ODI rates for leakage, which have been normalised using the same approach as Ofwat in the IAP.

Table 22: Leakage P10 and P90 ranges (3 year rolling average)

	P90					P10				
Performance Commitment	20-21	21-22	22-23	23-24	24-25	20-21	21-22	22-23	23-24	24-25
Leakage (September 2018)	630	602	583	564	544	691	663	644	624	605
Leakage (April 2019)	662	608	580	557	535	747	693	664	642	619

Source: Thames Water, App1 line 13

4.154 Our revised incentive rates are detailed below

Table 23: Leakage revised incentive rates

Performance commitment	PC unit	Marginal cost (£m)	Marginal benefit (£m)	Penalty rate (£m/Mld)	Reward rate (£m/Mld)
Leakage (September 2018)	ML/d	0.38	0.55	0.35	0.29
Leakage (April 2019)	ML/d	0.29	0.38	0.24	0.29

Source: TW-OC-A12-ODI Business Plan ODI Model and Thames Water, App1 line 13

4.155 We presented detailed information about out marginal benefit value for leakage in our Leakage Performance Commitment Summary document[51] and supporting technical documents:

- Our triangulation report of customer and society values; and[52]

[51] *Thames Water, CSD005, BW04 Leakage Performance Commitment Summary, September 2018.*

- Our performance commitment values report.[53]

BW05 Per capita consumption

TMS.OC.A17 Per Capita Consumption PC: 'The company should reconsider its proposed service levels and justify that these are stretching or revise them. The company should clearly set out the evidence and rationale for the revised targets.'

4.156 We discuss our revised proposal for PCC in Section 2 of our main submission document[54].

4.157 We have looked carefully at our forecast of PCC. Our September Business Plan forecasts a 4% reduction in PCC from 142 l/hd/day in 2019/20 to 136 l/hd/day on a three-year rolling average basis by 2024/25. This is consistent with the demand assumptions in our revised draft Water Resources Management Plan[55].

4.158 Our current strategy to reduce PCC in AMP7 is to continue with the roll-out of our Progressive Metering Programme (PMP) and to compliment this with Smarter Home Visits to promote the efficient use of water. Our PMP is also a key part of our leakage strategy, targeting customer side leakage to achieve our AMP7 performance commitment.

4.159 We have decided not to change our stretching target in our April Business Plan because:

- our PMP is already at the limit of what is realistically deliverable in AMP7;
- our PMP is already part of a least cost demand reduction programme included in our revised draft Water Resources Management Plan;
- increased meter penetration is needed before PCC can be reduced further;
- customers accept that greater meter penetration is needed before PCC reduces further; and

4.160 We elaborate and provide additional evidence on each of the above points below.

Our PMP is already at the limit of what is realistically deliverable in AMP7

4.161 Our Progressive Metering Programme (PMP) is being delivered as a single initiative across our entire region, for both optant and selective meters. Our current cost per meter installed is therefore calculated as an average across London and the Thames Valley, and incorporates both optant meters and selective meters, although it is dominated by selective meters. Costs for our meter installations have reduced since the start of the PMP, and the costs based on our budgets for FY2018 to FY2020 are equal to £473 per selective meter.

4.162 We have identified the following 'exceptional' aspects that limit the size of the PMP due to the additional costs, but also the deliverability of the programme. These were included in our Water Stressed Area Cost Adjustment Claim[56] that was partially accepted by Ofwat in the IAP:

- The cost of installing Advanced Metering Infrastructure (AMI) 'smart' meters as opposed to Automated Metering Reading AMR or 'dumb' meters, which are being installed by the other companies;

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[52] *Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018.*
[53] Thames Water, *CSD020 PR19 Performance Commitment Values Report, September 2018.*
[54] *TW-RS1 Building a better future: Response to Ofwat's IAP , April 2019, Section 2D.*
[55] *TW-OC-A2 WRMP Update, April 2019.*
[56] *CSD006 WNP-03b-PR19-CA FE Water Stress, September 2018.*

- Costs associated with the different demographics that are present within London; due to transient populations, higher rates of renting (resulting in lower completion rates and higher contact costs), and a much higher rate of flats (which require complex, out of hours, internal installs and more abortive install visits);
- Increased wages in the Thames region compared with industry averages; and
- Traffic Management Act ("TMA") costs when digging meter pits and the delays and productivity impact that requiring the necessary permits incurs.

4.163 Based on our experience to date, a large proportion of the additional costs and productivity constraints are associated with the difficulties of installing meters in flats, and that the presence of flats is indicative of areas with high levels of renting and transient populations.

4.164 Table 24 and Table 25 provide a comparison of the proportion of currently unmeasured housing by type between London and the Thames Valley, along with the ratio of internal to external installs on each housing type.

Table 24 Summary of Unmeasured Customers by Dwelling Type

	London	London Percentage	Thames Valley	Thames Valley percentage
Detached	39,942	2%	56,303	16%
Semi detached	196,677	11%	112,761	32%
Terrace	474,629	27%	108,173	31%
Flat - large block	592,601	34%	24,989	7%
Flat - small block	461,775	26%	49,627	14%

Source: Thames Water billing system

Table 25 Summary of Installation Types by Dwelling Type

Property Type	Type of Installation	
	% Internal meter	**% External meter**
Detached	4.5	95.5
Semi-detached	5.6	94.4
Terraced	5.6	94.4
Large block of flats (dwellings)	82.8	17.2
Small block of flats (dwellings)	34.0	66.0

Source: Thames Water Progressive Metering Programme

4.165 As the Thames Valley is reasonably representative of the housing stock across the country, this results in the property weighted internal install rate in London being more than twice that of water companies such as Southern and Affinity Water (39% compared with circa 14%).

4.166 Based on detailed cost information from the current progressive metering programme, the cost of carrying out a successful install for an internal meter is around 80% of an external install, once the cost and percentage of meter box digs is taken into account for the external meter. However, the rate of install failures is dominated by internal metering needs, and the costs associated with contacting, surveying and arranging visits with internally metered customers are much higher due to the need for access and the complexity of supply arrangements. Once all direct costs are taken into account, internal meter installs cost in the order of 190% of an external install. This also directly impacts on the average installation time.

4.167 Using the detailed cost data from PMP for 2018/18 to 2019/20, we have calculated the proportion of costs associated with meter procurement, actual installations, failed installations, survey/preparation and fixed/corporate overhead. This has allowed us to estimate the impact that the much greater proportion of complex, internal installations and much higher wages that we incur in London has on the overall weighted costs of installation across our region. This is shown in Table 26 below, along with the key assumptions involved.

4.168 Although there are uncertainties in this analysis, this indicates that approximately 27% of our current costs are caused by regional demographic factors and the fact that our proposed programme includes the installation of AMI meters instead of AMR meters (which forms a separate part of the savings and is demonstrably more efficient than the installation of dumb meters).

Table 26 Summary of the Impact of Exceptional Items on Meter Installation Costs

Exceptional Cost Item	Percentage Contribution to Current Cost	Notes and Key Assumptions
AMI meter costs	3%	£16 per meter
Additional costs from install failures on internally metered properties	4%	Internal install failures and costs are 4 times those of externals
Additional pre-install costs	7%	13% externals require an appointment versus all internals
Additional overheads	5%	Overheads are proportional to the 'all in' cost of each meter type
Cost differential due to internal installs	-2%	Proportional calculation
Thames regional wages cost	9%	Taken from the Productivity Special Cost Factor

Source: Thames Water

4.169 Approximately 41% of the metering costs proposed in our September Business Plan are associated with costs that are directly related to our higher proportion of internal installs and productivity in London.

4.170 Moving to a target reduction of, for example, six per cent over AMP7 would incur excessive costs that are significantly higher than customers' willingness to pay for the service improvement they would receive. We provided details of these calculations in our September Business Plan[57];

[57] *Thames Water, CSD005 Per Capita Consumption Performance Commitment Summary, September 2018.*

4.171 We forecast that a six per cent reduction would require an additional 300,000 progressive meters to be installed, followed up by an additional 100,000 Smarter Home visits. Using our AMP6 progressive metering programme as a point of reference, we do not believe that these additional outputs would be deliverable in a five-year period.

Our PMP is already part of a least cost demand reduction programme included in our revised draft Water Resources Management Plan

4.172 The activities within our plan have been optimised against cost and other metrics within the revised draft Water Resources Management Plan[58], achieving a best value plan for customers over the short and longer term. This plan provides a mix of demand and supply options. This aligns with customer preference studies where there was a preference for demand reductions, especially leakage, before further supply options. From the reductions in customer usage and leakage, along with supply options, we will be in water resource surplus by the end of AMP7 to a total of 60Ml/d.

4.173 Committing to even larger reductions than planned in AMP7 runs the risk of affecting quality of the delivery within our metering and water efficiency programmes. Also, larger commitments lead to increased work in future AMPs to stand still due to the Ml/d deterioration in benefits, with a seven-year deterioration gradient. Over time, this will also lead to an unsustainable programme trend of compounding water efficiency savings values.

4.174 It is our belief that further reductions to PCC beyond our proposed AMP7 levels can be achieved, but will require legislative and regulatory changes from central government, in the form of mandatory water labelling on water using products, changes to fitting standards and building regulations. We are currently working with Defra, Waterwise and the industry to pursue these new options, and achieve further sustainable reductions. A number of workstreams across the industry, coordinated through Water UK and Waterwise, are investigating methods to achieve the sustainable long-term PCC reductions in customer usage.

4.175 We have commissioned Artesia to review potential further reductions and develop a PCC Scenario Roadmap for our region. Artesia are using a similar methodology for PCC forecasting as used in Ofwat's report 'the long-term potential for deep reductions in household water demand' (April 2018). The key outputs from this work will quantify the PCC reduction levels possible through our demand reduction efforts and the policy/regulatory changes controlled by government. Using a weighted analysis, the research will also better align the PCC levels for London and Thames Valley areas against other regions with different demographics – showing that PCC in our region is the equivalent to lower PCC levels in other non-London areas.

4.176 Also, the re-circulation of water for non-potable uses will also achieve sustainable reductions. We have a programme of work within AMP7 to progress this delivery activity, especially on new developments. We are commencing new innovative work to prove the Water Neutrality concept, which is defined by the Environment Agency as the "…total demand for water should be the same after new development is built, as it was before. That is the new demand for water should be offset in the existing community by making existing homes and buildings in the area more water efficient". We are also leading the development and delivery of PCC workshops to the Water Resources South East new Advisory Panel.

4.177 In terms of future reductions, by 2050 in our current revised draft WRMP19 we plan to reduce PCC to 120 l/p/d, which is in line with the level promoted by the National Infrastructure Commission (118 l/p/d), and the most ambitious pathway identified by Water UK. This future activity includes financial tariffs when more than 60% of domestic customers are metered through our progressive metering programme.

[58] *TW-OC-A2 WRMP update, April 2019.*

Increased meter penetration is needed before PCC can be reduced further

4.178 Further reductions in PCC will be possible in the future once smart meter penetration increases across our region and we are able to introduce innovative tariffs to influence customer behaviour. In other words, benefits in the short-term don't outweigh the higher short-term costs.

Customers accept that greater meter penetration is needed for PCC reduces further

4.179 In June 2018, when asked specifically about whether they felt that the target we had set for PCC was stretching, customers had mixed views. Some thought the target was stretching, as it represents a significant drop and the continuation of improvement on this measure. Some thought that customers currently waste a lot of water and are relatively uninformed about the need for water saving. We presented comparative information on PCC performance to customers. and they accepted that it might take a while to deliver benefits until smart meter penetration increases.

Conclusion

4.180 In summary, we have one of the most ambitious water efficiency programmes in the industry as part of an optimised overall water resources programme and are already piloting new innovations to water efficiency delivery and incentives for household and retailers, in preparation for AMP7. Further reductions will be achieved through a continued programme of meter installations and collaboration with government to embed new sustainable schemes.

TMS.OC.A18 Per Capita Consumption PC says: 'The company should explain why its proposed rates differ from our assessment of the reasonable range around the industry average (as set out in 'Technical appendix 1: Delivering outcomes for customers') and demonstrate that this variation is consistent with customers' underlying preferences and priorities for service improvements in per capita consumption.'

The company should also provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for per capita consumption and assess the appropriateness of the company's customer valuation evidence supporting its ODI.

The company also should provide further detail on the adjustments made to the marginal benefit values for overlap across PCs and demonstrate that these are appropriate.

4.181 We are unable to provide a critique as to why our ODI rate may be different from other companies, as we do not have access to their detailed calculations to do so. Our response to this Required Action therefore focuses on explaining how our ODI rate aligns with our customer preferences.

4.182 We presented detailed information about our ODI design for our Per Capita Consumption measure in our Performance Commitment Summary document[59] and supporting technical documents:

[59] *CSD005 PR19 TMS BW05 Per Capita Consumption Performance Commitment Summary, September 2018*

Our triangulation report of customer and society values[60], which details the general approach to specifying the customer and societal values, summarises our research and the practical approach for triangulating customer valuation evidence.

Our performance commitment values report[61], which details how our Operational Performance Measures ("OPMs") and triangulated values are map to the performance commitments and the generic process for dealing with overlaps. Our ODI Approach and Principles Report[62], presents the ODI methodology and process that has been followed to ensure the ODI's are credible and customer led.

4.183 Our incentives for PCC have been calculated bottom-up from our triangulated customer willingness to pay and the incremental costs associated with delivering the performance enhancements detailed in the plan.

4.184 The benefit value applied is based on customer and societal valuations for reducing water consumption and the risk of water restrictions.

4.185 Our customer preferences research from 2011 to 2017 includes stated preference values measuring the impact of reducing the likelihood of water restrictions and values of reducing per capita consumption through either metering customers or assisting customers with water efficiency measures.

4.186 These preferences have been assessed against valuations from other industries and, for water restrictions, estimates of disruption to the productivity of non-household customers as part of the triangulation process.

4.187 The set of triangulated values that are used to value this PC are outlined in the table below. The values for the different methods of reducing per capita consumption value are triangulated OPM values. The value for the change in water restrictions is the value for a one Ml/d change, as calculated for the Security of Supply Index PC.

Table 27: Benefit values for reducing PCC

OPM / Values	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Metering	Per MLD	176,000	252,000	326,000
Water efficiency	Per MLD	399,000	544,000	688,000
Water restrictions – SOSI	Per MLD	104,476	152,058	199,591

Source: CSD020 PR19 Performance Commitment Values Report

4.188 The water restriction and each of the PCC method OPM values are divided by 1,000,000 to calculate a value per litre.

Table 28: Benefit values for reducing PCC per litre/day

[60] *Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018.*
[61] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018*, Section 8.1..
[62] *CSD025 -PR19 -ODI Approach and Principles Report, September 2018.*

OPM	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Metering	Per litre/day	0.18	0.25	0.33
Water efficiency	Per litre/day	0.40	0.54	0.69
Water restrictions	Per litre/day	0.10	0.15	0.20

Source: CSD020 PR19 Performance Commitment Values Report

4.189 As the proposed plan benefits will be delivered using a mix of these methods, the values for metering and water efficiency are weighted in proportion to their significance in our plan.

Table 29: Weighted benefit values (excluding water restrictions) for reducing PCC per litre/day

OPM	Unit	% of programme	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Metering	Per litre/day	60%	0.11	0.15	0.19
Water efficiency	Per litre/day	40%	0.16	0.22	0.28
Weighted value for the method	Per litre/day	100%	0.27	0.37	0.47

Source: CSD020 PR19 Performance Commitment Values Report

4.190 The weighted values above are added to the water restriction value to produce a weighted value for one litre reduction in PCC. The value per litre is multiplied by the number of people in the Thames Water region for AMP7, 10,415,284[63], to produce a value for one litre per head per day to give the value in £/litres/head/day.

Table 30: Full benefit value pre calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Total pcc value – litre/day	0.37	0.52	0.67
Total pcc value – litre/head/day	**3,854,590**	**5,430,531**	**6,989,303**

Source: CSD020 PR19 Performance Commitment Values Report

[63] *Annualised to reflect the profile over the AMP.*

4.191 If the benefit and cost of each of the PCs is addressed independently, then the resulting ODIs will lead to double counting and either customers or Thames Water paying double for a reward or penalty. Therefore, the values for this PC have been adjusted via scaling to account for the crossover with other PCs (SOSI, leakage, and customers proactively engaged). Our approach to scaling is simple and has been applied consistently. We calculate a scaling factor from the actual PC unit benefit delivered divided by the aggregate sum of benefits across any overlapping PCs. Multiplying the marginal benefits allocated to each PC by scaling factors using this method avoids a double count. This process and all scaling factors are detailed in Section 8, page 84 of our performance commitment values report.[64]

4.192 For PCC, this is a two-step process. The first step addresses the overlap for reducing the risk of water restrictions captured by the SOSI PC and uses a scaling factor of 0.55. The water restrictions part of the PCC value is multiplied by this scaling factor to produce the step one calibration values for this PC.

4.193 This step one calibration applies to the underperformance benefit value as the SOSI scaling only applies to a proportion of the underperformance range. We have no outperformance payment for SOSI, so this scaling doesn't apply to outperformance.

Table 31: PCC value post calibration step one

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Total PCC value – litre/day	0.32	0.45	0.58
Total PCC value – litre/head/day	**3,365,045**	**4,718,028**	**6,054,078**

Source: CSD020 PR19 Performance Commitment Values Report

4.194 The second step addresses the overlap between PCs that are based on water efficiency investment (PCC and customers proactively engaged). As there is a direct overlap between the water efficiency component of the PCC PC and the customers proactively engaged PC, then the allocation is 50%.

4.195 The water efficiency component (including water restrictions) of the value above is multiplied by this scaling factor to produce values for this PC that address overlaps with both water efficiency and SOSI.

4.196 The SOSI scaling only applies to a proportion of the underperformance range. We have therefore calculated a value excluding the step 1 calibration for SOSI, which addresses the water efficiency overlap only. This value applies the PCC scaling factor of 50% to the pre-calibration value for this PC.

Table 32: PCC value post calibration step two

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Total PCC value addressing overlap for SOSI and water efficiency – MLD	**2,409,775**	**3,404,536**	**4,384,515**

[64] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.*

Total PCC value addressing overlap for water efficiency only – MLD	**2,800,957**	**3,973,877**	**5,131,827**

Source: CSD020 PR19 Performance Commitment Values Report

4.197 The appropriate values for the ODIs differ for underperformance payments and outperformance payments due to the range over which the SOSI PC applies. The preferred plan target is 100% SOSI and this is achieved with a proportion of the leakage, PCC and water resource investment.

4.198 For outperformance payments, this means that there is no overlap between per capita consumption and SOSI for increasing water savings beyond 100% even though the savings would deliver a further reduction in the risk of water restrictions. The value that is scaled for water efficiency only is applied.

4.199 For underperformance payments, a weighted value is required to reflect that the overlap with the SOSI PC only applies to a portion of the investment (59%).

4.200 Following our September 2018 submission, we carried out a comparative analysis of industry ODI rates for PCC. We recognised that we were an industry outlier in terms of our incentives for this measure and therefore we have based the underperformance and outperformance payments for this measure on our revised marginal benefits.

4.201 For our April submission, we have only included the extra benefit that our Water Resources Management Plan delivers in AMP7 in our ODI calculation. We have removed the impact that third party activities (such as the installation of new water efficient devices including washing machines, dishwashers, showers and toilets) are forecast to have on PCC together with water efficiency activities in our base operating costs, this results in an average of 38.3% of the PCC benefit being realised.

4.202 This is consistent with what customers have told us[65]. They said that we should be neither rewarded nor penalised for third party benefits that are not associated with our plan. Therefore, our revised customer benefit values for outperformance and underperformance are as detailed in Table 33 below from our September Business Plan have been multiplied by 38.3% to give the values for our April Business Plan shown in Table 34. The benefit values in Table 34 have been used in our revised ODI calculations for PCC.

Table 33: Final per capita consumption values - post calibration (September 2018)

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Under performance PCC value – l/h/d	**2,571,265**	**3,639,575**	**4,693,025**
Out performance PCC value – l/h/d	**2,800,957**	**3,973,877**	**5,131,827**

Source: CSD020 PR19 Performance Commitment Values Report

Table 34: Final per capita consumption values - post calibration (April 2019)

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.

[65] *TW-CSE-A1 What customers want*, *v13 final, March 2019*

Under performance PCC value – l/h/d	**984,794**	**1,393,957**	**1,797,429**
Out performance PCC value – l/h/d	**1,072,767**	**1,521,995**	**1,965,490**

Source: TW-OC-A12-ODI Business Plan ODI Model

4.203 As discussed previously, we have two central marginal benefit values for this measure, the detailed derivation of which is included in our Performance Commitment Values Report[66]. When the ODI calculation is revised, this results in marginal costs exceeding marginal benefits such that the Ofwat formula produces a negative penalty.

4.204 Therefore, we have based our revised incentive calculations on marginal benefits only. This results in a revised payment of £0.70m for the penalty:

- Totex sharing ratio, 50%, of the central underperformance PCC value * 38.3%

4.205 The underperformance benefit value excludes the benefits allocated to the SOSI PC.

4.206 We have calculated a revised reward rate of £0.76m for the outperformance payment which is based upon:

- Totex sharing ratio, 50%, of the central outperformance PCC * 38.3%

Table 35: Revised per capita consumption incentive rates

Performance Commitment	PC unit	Marginal cost (£m)	Marginal benefit (£m)	Penalty rate £m/unit	Reward rate £m/unit
Per Capita Consumption September	Nr.	3.27	3.64	2.00	1.99
Per Capita Consumption April	Nr.	3.27	1.39	0.70	0.76

Source: TW-OC-A12-ODI Business Plan ODI Model and Thames Water, App1

4.207 The revised incentive rates for our April Business Plan bring us in line with the range that Ofwat has identified in the IAP. We have demonstrated this in Table 2 in Section 3 above and show our revised ODI rates for PCC, which have been normalised using the same approach as Ofwat in the IAP.

BW06 Water Quality CRI

TMS.OC.A19 Water Quality Compliance: CRI PC says: 'The company should add a financial underperformance incentive to this PC and provide evidence to justify the rate that it proposes.'

4.208 Ofwat indicates that it is expecting to see a single Water Quality CRI common PC with a single financial underperformance incentive. Our September submission uses two underperformance incentive rates - one for Metaldehyde and one for other parameters. We are not proposing to change this.

4.209 A number of Required Actions have been raised on this PC:

- TMS.OC.A19 (this response) - we focus on our reasons for retaining two separate underperformance incentives rather than a single combined one.

[66] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.*

- TMS.OC.A20 – we provide evidence to justify the two separate underperformance rates in our September submission.
- TMS.OC.A21 – we explain why Ofwat's proposed intervention on a deadband for a single common PC is unjustified and restate the rationale for the deadband used in our September submission.
- TMS.OC.A33 – we provide reasons for not selecting a CRI sub-measure from Ofwat's Asset Health long list
- TMS.OC.A34 – we repeat our reasons for retaining a separate CRI Metaldehyde sub-measure.

4.210 We have reviewed our original proposal for CRI in response to Ofwat's comments but have retained our original proposal of two underperformance incentive rates, one for Metaldehyde and a separate one for all other parameters. We are not proposing to change to a single CRI PC.

4.211 Following the announcement of the ban on the outdoor use of Metaldehyde, we reviewed our plans accordingly and the associated investment and will scale back on the level of work we will be doing in the catchment once the ban is in place (June 2020)[67].

4.212 Until the ban comes into force in June 2020, Metaldehyde will still be available for use with a heightened risk of a greater number of compliance exceedances, as pesticide stocks are used up.

4.213 Metaldehyde exceedances can have a significant impact on the CRI score. Metaldehyde samples are primarily collected from authorised supply points, and a small number from the water supply zones that receive a bulk import of drinking water from a neighbouring company. Metaldehyde exceedances encountered at our authorised supply points can contribute significantly to the overall CRI score. The majority of our large surface water works abstract from storage reservoirs, and if levels of Metaldehyde accumulate in these water bodies there is a risk that CRI performance in early AMP7 may be adversely impacted.

4.214 Furthermore, there is the potential for the continued illegal use of the pesticide following the ban.

4.215 For these reasons, if Metaldehyde is to be retained in the Water Quality CRI measure, we consider that separate incentives are needed. Alternatively, Metaldehyde could simply be removed from a single CRI performance commitment – this would align the measure with our AMP7 totex forecast which has also had investment associated with Metaldehyde removed.

TMS.OC.A20 Water Quality Compliance: CRI PC says: 'The company should propose an underperformance ODI rate consistent with our assessment of the reasonable range around the industry average (as set out in 'Technical appendix 1: Delivering outcomes for customers') or demonstrate that a rate outside this range is consistent with customers' underlying preferences and priorities for service improvements in CRI'.

'The company should also provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for CRI and assess the appropriateness of the company's customer valuation evidence supporting its ODI'.

'The company should explain and evidence how any proposed ODI rate for CRI is coherent with the rates proposed for other Asset Health PCs.'

[67] *See response to TW-RS2, Ofwat action tracker.*

4.216 Ofwat indicates that it is expecting to see a single Water Quality CRI common PC with a single financial underperformance incentive. Our September submission uses two underperformance incentive rates - one for Metaldehyde and one for other parameters. In our response to TMS.OC.A19, we explain that we are not proposing to change this.

4.217 A number of Required Actions have been raised on this PC:

- TMS.OC.A19 - we focus on our reasons for retaining two separate underperformance incentives rather than a single combined one.
- TMS.OC.A20 (this response) – we provide evidence to justify the two separate underperformance rates in our September submission.
- TMS.OC.A21 – we explain why Ofwat's proposed intervention on a deadband for a single common PC is unjustified and restate the rationale for the deadband used in our September 2018 submission.
- TMS.OC.A33 – we provide reasons for not selecting a CRI sub-measure from Ofwat's Asset Health long list.
- TMS.OC.A34 – we repeat our reasons for retaining a separate CRI Metaldehyde sub-measure.

4.218 We are unable to provide a critique as to why our ODI rate may be different from other companies, as we do not have access to their detailed calculations to do so. Our response to this Required Action therefore focuses on explaining how our two separate ODI underperformance rates align with our customer preferences.

4.219 The two underperformance rates for Metaldehyde and other parameters are driven by the differences in cost and impact on customers from each.

Water Quality Compliance CRI – Metaldehyde

4.220 No benefit values have been allocated, as Metaldehyde has no health or aesthetic value for customers and therefore does not have any significant benefits for customers.

4.221 Therefore, we have calculated the underperformance rate from 50% of incremental costs.

4.222 There are no overlaps with other PCs.

Water Quality Compliance CRI - Other

4.223 The benefit value applied is based on the customer and societal valuations for reducing water quality compliance failures at customers' taps[68].

4.224 Our customer preferences research from 2011 to 2017 provides stated preference valuations that measure the disruption and inconvenience to customers from tap water use notices associated with water quality failures (boil water notices and do not use notices) and aesthetic water quality impacts (discoloured water, taste and smell).

4.225 These water service disruption values have been validated using a number of sources including business disruption costs, revealed preference values, and customer validation focus groups. They have also been assessed against valuations from other companies as part of the triangulation process for customer values.

4.226 The set of triangulated OPMs values for this PC are outlined in table 36:

[68] *Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018.*

Table 36: OPM benefit values for CRI

OPM	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Incident has public health consequences (Boil notice)	Per property	400	900	1,300
Incident has public health consequences (Do not drink notice)	Per property	800	1,900	2,900
Discolouration: Operational event	Per property	17	22	25
Taste and odour: Operational event	Per property	17	22	25

Source: CSD020 PR19 Performance Commitment Values Report

4.227 For the CRI PC value calculation, a zero value has been used for the lead impacts to avoid overlap with the lead PC.

4.228 We have assessed the CRI score using historic CRI data linked to the OPM impacts. To avoid cross-over with the separate Metaldehyde sub-measure, the Metaldehyde failures and impact on the CRI score have been removed from the dataset prior to calculating the value.

4.229 The remaining dataset is summarised for each of the four CRI sub-components and mapped to the impact on customers. The overall mapping and likelihood of an impact is shown in table 37, with the likelihood based on expert judgement.

Table 37: Likelihood of parameter failure causing a service impact

Sub component	Parameter failure	Sum of properties potentially impacted	Boil Water notice	Do not drink	Lead	Colour	Taste & smell
ASP	Clopyralid	600					
	Clostridium perfringens	470,400	0.5%				
Service Reservoir	Coliform bacteria	178,560	0.5%				
Water Supply Zone	Aluminium as Al	31,391		1%		5%	
	Clostridium perfringens	136,203	0.5%				
	Coliform bacteria	2,120,133	0.1%				
	E. coli	222,616	0.1%				
	Iron as Fe	224,141				1%	
	Lead	16,134			60%		
	Manganese as Mn	8,031				1%	

	Nickel as Ni	91,948					0.25%
	Odour	82,929		2%			2%
	Sodium as Na	10,580					0.05%
	Taste	18,666		2%			2%
Water Treatment Works	Nickel as Ni	228,400	0.1%				
	Odour	6,110	0.5%				
	Sodium as Na	60,200				1.5%	

Source: CSD020 PR19 Performance Commitment Values Report

4.230 The values for each failure are combined with the data above to produce a total value for the impact of each parameter and OPM combination. The calculation used is:

- Parameter value = Total properties potentially impacted * Likelihood * OPM value

4.231 The total values summed for each OPM are shown in the table below.

Table 38: Benefit value for total change in CRI score

OPM	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Boil Water	2,566,483	5,774,586	8,341,068
Do not drink	1,876,654	4,457,054	6,802,872
Discoloured water	81,503	105,474	119,857
Taste and smell	38,540	49,875	56,677
Total	**4,563,180**	**10,386,989**	**15,320,474**

Source: CSD020 PR19 Performance Commitment Values Report

4.232 This total value is divided by the CRI score of 2.949 (excluding Metaldehyde) to get a value per CRI unit. This value is taken from 2013 and was the only validated result that was available from the DWI at the time our performance commitment valuation exercise was completed.

Table 39: Full benefit value pre-calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
CRI – 1 unit change in CRI score	**1,547,216**	**3,521,868**	**5,194,641**

Source: CSD020 PR19 Performance Commitment Values Report

4.233 The values for a one unit change in the CRI score shown above have been adjusted via scaling to account for the crossover with other PCs e.g. Water Quality contacts and Water Quality events. The scaling factor we have used is 0.98 for the water quality OPMs, boil water and do not drink notices, and 0.51 for the aesthetic OPMs (discolouration and taste/smell). The values above are multiplied by these scaling factors to produce the final values for this PC.

Table 40: CRI value post calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
CRI - one unit change in CRI score	**1,502,034**	**3,437,773**	**5,078,969**

Source: CSD020 PR19 Performance Commitment Values Report

4.234 These benefit values were used to calculate the incentive using Ofwat's standard formula.

4.235 For incremental costs, we calculate the costs of providing an incremental change in the performance commitment. These are depreciated over the long term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement. The incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels through AMP7.

4.236 In Table 2 of Section 3 we show how our incentive rate for CRI Other is aligned with Ofwat's view of the benchmarked range for CRI across the industry and is grounded in our customer values and priorities for this measure. Ofwat's Agreed Action implies that Water Quality CRI is an Asset Health measure, which it is not. However, the approach that we have outlined above is consistent with the calculation of ODI rates for all Asset Health measure.

TMS.OC.A21 Water Quality Compliance: CRI PC says 'We propose to intervene to ensure companies perform to the regulatory requirement of 100% compliance against drinking water standards. As set out in the methodology we noted a deadband may be appropriate. It is important that the range of underperformance to the collar is adequate to provide clear incentives for companies to deliver statutory requirements. The company should set a deadband at 1.50 and collar at 9.5 for 2020-25'.

4.237 Ofwat indicates that it is expecting to see a single Water Quality CRI common PC with a single financial underperformance incentive. Our September Business Plan uses two underperformance incentive rates - one for Metaldehyde and one for other parameters. We are not proposing to change this.

4.238 A number of Required Actions have been raised on this PC:

- TMS.OC.A19 - we focus on our reasons for retaining two separate underperformance incentives rather than a single combined one.
- TMS.OC.A20 – we provide evidence to justify the two separate underperformance rates in our September submission.
- TMS.OC.A21 (this response) – we explain why Ofwat's proposed intervention on a deadband for a single common PC is unjustified and restate the rationale for the deadband used in our September submission.
- TMS.OC.A33 – we provide reasons for not selecting a CRI sub-measure from Ofwat's Asset Health long list.
- TMS.OC.A34 – we repeat our reasons for retaining a separate CRI Metaldehyde sub-measure.

4.239 Ofwat's proposal for a fixed deadband of 1.5 on a single combined CRI measure would be unreasonably challenging. Recent performance data indicates that we would only have been within the deadband in 2017. For all years other than 2017, we would have failed and received a penalty (regardless of Metaldehyde failures). Table 41 illustrates this point:

Table 41: CRI scores for years 2012 to 2018 (not including contribution from Metaldehyde failures)

Year	CRI minus contribution from Metaldehyde failures
2012	2.421
2013	2.918
2014	2.653
2015	2.162
2016	1.760
2017	1.220
2018	2.242

Source: Thames Water

4.240 We have reforecast our P10 and P1 risk profiles to take into account the change in risk due to the Metaldehyde ban. Incorporating this into a single CRI measure with Ofwat's recommended deadband of 1.5 and collar of 9.5 and our CRI other incentive rate results in a forecast P10 financial risk of a £37m penalty, much of which relates to a banned substance.

4.241 We accept the need for a challenging CRI PC. However, if we were to adopt a deadband of 1.5 on a combined measure, there is a real risk of us undermining customer confidence in the quality of drinking water, when current public perception is excellent.

4.242 In our April submission, we have amended our risk profile for CRI Metaldehyde to take account of the ban. We have retained the targets the deadbands for the two sub-measures that we put forward in our September Business Plan:

Table 42: Water Quality CRI – underperformance penalty deadband

	2020-21	2021-22	2022-23	2023-24	2024-25
Water Quality Compliance: CRI Other	2.11	2.07	2.03	1.99	1.95
Water Quality Compliance: CRI Metaldehyde	3.90	3.40	2.80	1.87	0.94

Source: Thames Water App1

CS01 Treatment works compliance

TMS.OC.A22 Asset Health: Treatment works compliance PC says: 'The company should set the performance target at 100% for the 2020- 25 period. A deadband at 99% may be applied.'

4.243 Our September submission already proposed a target of 100% compliance with a 1% deadband, therefore no further changes are required.

TMS.OC.A23 Asset Health: Treatment works compliance PC says: 'The company should explain and evidence how its proposed ODI rate for treatment works compliance is coherent with the rates proposed for PCs relating to the associated customer facing-impacts of the asset failure (including river water quality) and demonstrate how the package of ODIs across the relevant group of PCs appropriately incentivises performance in the long and short-term'.'The company should also provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for treatment works compliance and assess the appropriateness of the company's customer valuation evidence supporting its ODI.'

4.244 In our September submission, we presented detailed information about our ODI design in our Treatment Works Compliance Performance Commitment Summary document[69] and supporting technical documents:

- Our triangulation report of customer and society values[70]
- Our performance commitment values report[71]

4.245 Our incentives for treatment works compliance have been calculated bottom-up from our triangulated customer willingness to pay and the incremental costs associated with delivering the performance enhancements detailed in the plan.

4.246 The treatment works compliance PC addresses compliance at both water and sewage treatment works sites. The benefit values for this performance commitment are different for water and wastewater. We have calculated the value for water and sewage treatment works sites separately. The final value for the performance commitment is a proportionally weighted value that accounts for the relative number of treatment works failing for water and wastewater.

Sewage treatment works compliance

4.247 For sewage treatment works compliance, the benefit value from our triangulation report is based on the customer and societal valuations for improving river water quality.

4.248 Our customer preferences research from 2011 to 2017 provides stated preference valuations that measure the benefits of improving different aspects of river quality, in terms of plants and wildlife, flow, and aesthetic quality. These valuations are mapped to river assessment parameters in the investment modelling process.

4.249 The set of triangulated OPMs values for the sewage treatment works compliance part of this PC are outlined in Table 43:

Table 43: OPM benefit values for river water quality – effluent quality parameters

OPM	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Ammonia - poor to moderate quality	Per assessment	245,000	310,000	375,000
Ammonia - moderate to high quality	Per assessment	181,000	228,000	276,000

[69] *Thames Water, CSD005 - CS01 Asset Health: Treatment Works Compliance, September 2018.*
[70] *Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018.*
[71] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018,* Section 8.1..

Biological Oxygen Demand (BOD) / Suspended Solids - poor to moderate quality	Per assessment	301,000	380,000	459,000
Biological Oxygen Demand (BOD) / Suspended Solids - moderate to high quality	Per assessment	222,000	281,000	338,000
Phosphate - poor to moderate quality	Per assessment	268,000	339,000	410,000
Phosphate - moderate to high quality	Per assessment	184,000	232,000	280,000

Source: CSD020 PR19 Performance Commitment Values Report

4.250 The valuation is based on the prevention of deterioration in river quality, using the assessment value for changes in river water quality. Effluent consent failures are scored in terms of river impacts. The river impacts are based around the five water quality categories that are applied under the Water Framework Directive (WFD). These are high, good, moderate, poor and bad.

4.251 The 2015 WFD classification data has been used to understand how the Thames Water water bodies are graded using the five WFD quality bands for each of these parameters.

4.252 It is assumed that a consent failure will cause the WFD assessment to decrease one classification. Where this causes an assessment to move within the valuation band we have applied half of the OPM value. The values are multiplied by the number of assessment points in each quality category and the results are summed to calculate the total regional value. Dividing the total regional value by the total number of assessment points for each parameter gives the value for an average assessment point in the Thames Water region.

4.253 The next step is to turn these average assessment values into a value per sewage treatment works failing. To do this, we have calculated the expected number of assessment points per works for each parameter by dividing the number of assessment points for a parameter by the number of works (357).

4.254 For each parameter the average number of assessment points per treatment work site is multiplied by the average value per assessment to produce the value of a sewage treatment works failing. The final values are shown in Table 44. The total value is the value of a sewage treatment works failing.

Table 44: Value per parameter for one sewage treatment works failing

	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Ammonia	121,197	152,773	184,916
BOD / Suspended Solids	165,731	209,651	252,420

Phosphate	141,165	178,384	215,602
Total per STW failure	**428,094**	**540,808**	**652,938**

Source: CSD020 PR19 Performance Commitment Values Report

Water treatment works compliance

4.255 For water treatment works compliance, the benefit value in our triangulation report is based on the customer and societal valuations for improving river water quality and pollution.

4.256 Our customer preferences research from 2011 to 2017 provides stated preference valuations that measure the benefits of improving different aspects of river quality and different severities of pollution incident (categories one, two and three).

4.257 For river water quality the impacts are assessed in terms of plants and wildlife, flow, and aesthetic quality. These valuations are mapped to river assessment parameters in the investment modelling process.

4.258 For pollution the customer preference values have been assessed against indicative response and clean-up costs for the Environment Agency (Categories one and two only). Both set of values have been compared to other companies' values as part of the triangulation process for customer values.

4.259 The water treatment works compliance part of the PC uses the Ammonia and BOD/suspended solids average assessment values that have been calculated for sewage treatment works compliance. These values are shown in Table 45.

Table 45: Compliance values per assessment parameter water treatment compliance

Parameter	*Unit*	*Lower, £ p.a.*	*Central, £ p.a.*	*Upper, £ p.a.*
Ammonia	Per assessment	105,018	132,379	160,231
BOD / Suspended Solids	Per assessment	140,871	178,204	214,557

Source: CSD020 PR19 Performance Commitment Values Report

4.260 The additional set of triangulated OPMs values for the water treatment works compliance part of this PC are outlined in Tables 46 and 47.

Table 46: Additional OPM benefit values for water treatment compliance

OPM	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Flow - poor to good quality	Per assessment	300,640	379,528	458,416
Water pollution incidents - category 3	Per incident	19,000	136,000	251,000

Source: CSD020 PR19 Performance Commitment Values Report

4.261 The calculations for water treatment works compliance covers chlorine, metals, flow and turbidity failures. To apply the assessment values as a value per water treatment works failing, the expected number of assessment points per works is calculated for each parameter.

Table 47: Translation of assessment points in each WFD category to water treatment works

Data/Calculation	Ammonia	Dissolved Oxygen	Flow
Number of assessment points	412	420	445
Number of TW water treatment works	167	167	167
Average number of assessments per water treatment works	2.47	2.51	2.66

Source: CSD020 PR19 Performance Commitment Values Report

4.262 The mapping of the values to the parameter failures are shown in Table 48 with the values per water treatment works failure. The values are summed to produce the value of one works failing compliance.

Table 48: Value per works

Parameter	Value applied	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Chlorine	Pollution – category 3	19,000	136,000	251,000
Metals	Ammonia plus BOD/SS	613,374	774,763	934,904
Flow	Flow	801,106	1,011,317	1,221,528
Turbidity	BOD/SS	354,287	448,177	539,605
Value per water treatment work failing		**1,787,768**	**2,370,257**	**2,947,037**

Source: CSD020 PR19 Performance Commitment Values Report

4.263 To produce the final treatment works compliance value the water and wastewater values are combined into one weighted value using the number of works failing. This approach captures the likelihood of failure. The weighted value per works is then converted into a value for a percentage failure.

Table 49: Weighted value per works - water and sewage treatment works combined

Works type	Number works failing	Relative proportion	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Sewage treatment works	7.5	0.79	337,940	426,918	515,434

Water treatment works	2	0.21	376,491	499,159	620,625
Weighted value per works			**714,431**	**926,077**	**1,136,059**

Source: CSD020 PR19 Performance Commitment Values Report

Table 50: Treatment works compliance – final value

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Treatment works compliance - %	**3,743,620**	**4,852,643**	**5,952,949**

Source: CSD020 PR19 Performance Commitment Values Report

4.264 No further adjustments are applied to this PC value as there is no cross-over with other PCs. Our incentive rate for treatment compliance is grounded in our customer values and priorities for this measure.

4.265 In our April submission, for treatment works compliance we have moved the estimate of marginal benefit to the upper level of our estimated WTP range from the table above. This increases the impact of these measures on our RORE range and brings the incentive into alignment with other companies. We have demonstrated this in Table 2 in Section 3 and show our revised ODI rates for treatment works compliance normalised using the same approach as Ofwat in the IAP. Given how important these measures are to our customers, we consider this revised incentive still to be in line with their views.

4.266 In summary, this PC and its ODI form part of an overall package that appropriately incentivises our performance in the long and short-term because:

- The marginal benefits that we had calculated and triangulated from a customer research dating from 2011 to 2017 – this is now a business as usual exercise and we have a substantial dataset to draw from.
- We calculate the costs of providing an incremental change in the performance commitment. These are depreciated over the long-term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement.
- The incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels through AMP7.
- We use scaling to ensure that we do not double count benefits delivered by performance commitments.

CS02 Sewer collapses

TMS.OC.A24 Asset Health: Sewer collapses PC says: 'The company should propose an underperformance ODI rate consistent with our assessment of the reasonable range around the industry average (as set out in 'Technical appendix 1: Delivering outcomes for customers') or demonstrate that a rate outside this range is consistent with customers' underlying preferences and priorities for service improvements in CRI'.

'The company should also provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for sewer collapses and assess the appropriateness of the company's customer valuation evidence supporting its ODI.'

'The company should explain and evidence how its proposed ODI rate for Sewer collapses is coherent with the rates proposed for all other sewerage performance commitments (including internal sewer flooding and pollution incidents) and demonstrate how the package of ODIs across the relevant group of performance commitments appropriately incentivises performance in the long and short-term.'

4.267 We are unable to provide a critique as to why our ODI rate may be different from other companies', as we do not have access to their detailed calculations to do so. Our response to this Required Action therefore focuses on explaining how our ODI rate aligns with our customer preferences.

4.268 In our September submission we presented detailed information about our ODI design in our Sewer Collapses Performance Commitment Summary document[72] and supporting technical documents:

- Our triangulation report of customer and society values[73]
- Our performance commitment values report[74]

4.269 The value for sewer collapses is based on the likelihood that a collapse will cause internal and external sewer flooding and pollution incidents. The weighted severity value for each impact is multiplied by the likelihood value to get an expected value given a collapse. Values are summed to get a total value per collapse occurring.

Table 51: Value of a collapse

Impact type	Likelihood	Lower, £p.a.	Central, £p.a.	Upper, £p.a.
External flooding	16.9%	1,525	1,954	2,382
Internal flooding	7.9%	4,412	5,738	7,011
Pollution	2.2%	616	4,685	8,755
Total value per collapse		**6,553**	**12,377**	**18,148**

Source: CSD020 PR19 Performance Commitment Values Report

4.270 To convert this to the final units for the PC the value per collapse is multiplied by the length of the network in thousands of kilometres (108.838).

Table 52: Full benefit value pre-calibration

[72] *Thames Water, CSD005 - CS02 Asset Health: Sewer collapses,September 2018.*
[73] *Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018.*
74 Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Sewer collapses – Per collapse per 1,000 km	**714,130**	**1,348,878**	**1,977,768**

Source: CSD020 PR19 Performance Commitment Values Report

4.271 These values have been adjusted via scaling to account for the cross-over with other PCs e.g. internal flooding, pollution, blockages, SPS availability and surface water. Our triangulation report uses a scaling factor of 0.65 for internal flooding and 0.79 for pollution. The values above are multiplied by these scaling factors to produce the final values for this PC.

Table 53: Sewer collapses value post calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Sewer collapses – Per collapse per 1,000 km	**532,080**	**1,023,148**	**1,510,325**

Source: CSD020 PR19 Performance Commitment Values Report

4.272 In the recalculation of our incentive rates for our April resubmission, we have taken the upper customer value from Table 53 above.

4.273 We have been mindful of Ofwat's benchmarking corridor of industry incentive rates for this measure. In Table 2 in Section 3, we compare our normalised ODI rates for sewer collapses with Ofwat's ODI benchmark. Although our April Business Plan rate brings us into line with other companies, we have not increased our incentive to the rate that Ofwat has identified for the IAP, because to go further would break the line of sight to our customer research and customer preferences.

4.274 In summary, this PC and its ODI form part of an overall package that appropriately incentivises our performance in the long and short-term because:

- The marginal benefits that we had calculated and triangulated from a customer research dating from 2011 to 2017 – this is now a business as usual exercise and we now have a substantial dataset to draw from.
- We calculate the costs of providing an incremental change in the performance commitment. These are depreciated over the long-term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement.
- The incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our performance commitment levels through AMP7.
- We use scaling to ensure that we do not double count benefits delivered by performance commitments.

CS03 Internal sewer flooding

TMS.OC.A25 Internal sewer flooding incidents PC says: 'For this common PC we expect all companies' service levels to reflect the values we have calculated for each year of the 2020 to 2025 period.'

4.275 In Section 2 of our main submission document[75], we have set out our revised proposal for reducing incidents of internal sewer flooding.

4.276 Our September Business Plan envisaged reducing the annual number of incidents from 1,244 in 2019/20 to 1,052 by 2024/25. We are now proposing to achieve a 20% reduction in incidents (995 incidents by 2024/25). We have chosen to increase our ambition because:

- Reducing sewer flooding incidents is valued highly by customers; and
- We are assuming that we will be able to rollout a new, as yet untested, innovative approach, using low-cost sewer monitors in combination with machine learning from alarms to proactively deploy gangs to clear potential blockage build-ups before internal flooding occurs. If this is successful, we will be able to stretch performance while keeping customers' willingness to pay broadly in line with the additional costs incurred.

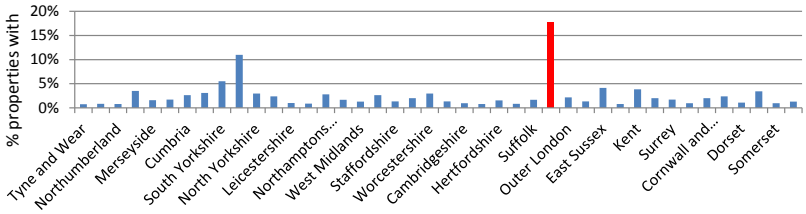
4.277 We are increasing our ambition to this level and not to the upper quartile profile set out in the IAP (for Thames Water equivalent to 848 incidents by 2024/25), because:

- We have the highest blockage rate in the industry, driven in part by the highest density of food service establishments. Initial findings show that the amount of fat in our raw sewage is higher than in other parts of the country.
- The high blockage rate, combined with the greatest proportion of properties with basements in the country, makes it more likely that internal flooding will occur, if a sewer blocks.
- Moving to upper quartile by 2024/25 would require approximately a 50% reduction in internal flooding from other causes, compared with our current performance.
- Our research shows that customers would not be willing to pay for such a service improvement over such a short period, (estimated to cost in excess of £200m on top of our revised AMP7 totex forecast).
- Nor do we believe that a programme to reduce flooding from other causes by this extent would be deliverable within a 5-year period, (we are forecasting to exceed Ofwat's 2024/25 IAP upper quartile view by mid-AMP8 at the earliest); and
- As with pollution, our revised proposal for sewer flooding presents a significant risk to our operation and our innovative approach has yet to be proven in practice.

4.278 The 2001 census contains detailed regional information about the proportion of houses with basements. Almost 18% of properties in inner London have a basement – the figure below shows that this is around 6 times higher than the national average.

Figure 8: Percentage of properties with basements across England

[75] *TW-RS1 Building a better future: Response to Ofwat's IAP, April 2019.*



Source: 2001 Census Data

4.279 Historically, homes in London were constructed with basements for either storage or to act as a septic tank. In recent years, the value of land and property across the capital has risen markedly, and there is pressure for more habitable space. Many basements have now been converted to habitable areas with kitchens and bathrooms – most are below the sewer line and are prone to flooding internally when a sewer blocks.

4.280 There is also a growing amount of evidence to suggest that the amount of fat in raw sewage in our London sewage treatment works catchments is much higher than in other parts of the country, which in part explains the higher blockage rate. This is in part due to the high concentration of food service establishments across the capital. Over the past 2 years, Thames Water's Innovation Team has been working closely with food service establishments in our key catchment areas to reduce the amount of fat, oil and grease in our sewage, including the deployment of grease traps to prevent fat entering the network in the first place. Moreover, we have developed an internal team to prosecute Food Service Establishments that repeatedly abuse our sewer network, as a stronger deterrent. We have also proactively attempted to reduce sewer misuse via our successful "Bin it, don't block it" campaign designed to educate customers. Despite some early successes with our proactive interventions, research has shown that fats, oils and grease are still entering our wastewater network at high levels[76]. Initial findings from a current UKWIR project and a PhD student's research further suggests the sewerage in London has a greater proportion of FOG in comparison to other regions within the UK[77].

TMS.OC.A26 Internal sewer flooding incidents PC says: 'The company should explain why its proposed rates differ from our assessment of the reasonable range around the industry average (as set out in 'Technical appendix 1: Delivering outcomes for customers') and demonstrate that this variation is consistent with customers' underlying preferences and priorities for service improvements in internal sewer flooding.'

[76] *UWKIR 15.SW.01.13 Fats oils and grease, where are we and where could we be?, (2014).*
77 Cranfield University PhD Thesis on fats, oils and grease, ongoing.

'The company should also provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for internal sewer flooding and assess the appropriateness of the company's customer valuation evidence supporting its ODI'.

'The company should explain and evidence how its proposed ODI rate for internal sewer flooding is coherent with the rates proposed for all other sewerage performance commitments (including sewer collapses and pollution incidents) and demonstrate how the package of ODIs across the relevant group of performance commitments appropriately incentivises performance in the long and short-term.'

4.281 We are unable to provide a critique as to why our ODI rate may be different to those of other companies, as we do not have access to their detailed calculations to do so. Our response to this Required Action therefore focuses on explaining how our ODI rate aligns with our customer preferences.

4.282 We have used the standard Ofwat formula for calculation of our incentive rates for internal flooding incidents. Our costs are whole life costs and our benefit values are based upon whole life sustained benefits. Therefore our assessments address whether these levels of performance are appropriate for the short and long term.

4.283 In our September submission, we presented detailed information about our ODI design in our Internal Sewer Flooding Performance Commitment Summary document[78] and supporting technical documents:

- Our triangulation report of customer and society values.79
- Our performance commitment values report.[80]

4.284 Our customer preferences research from 2011 to 2017 states preference valuations that measure the disruption, inconvenience, stress and anxiety to customers from sewer flooding incidents. The values have been assessed against valuations for damage costs from flooding and other companies' values as part of the triangulation process for customer values.

4.285 Internal sewer flooding events have two main causes:

- Hydraulic incidents – flooding due to weather events.
- Other causes – flooding due to collapses and blockages.

4.286 The overall internal sewer flooding value is based on weighting the values for these areas in proportion to the number of expected properties addressed by the preferred plan. The values for the incidents of flooding from other causes are the blockages and collapses PC values for flooding. The values for hydraulic flooding incidents are calculated separately for properties with return periods of 1 in 20 years or more frequent, and those that only flood in severe weather (less frequently than in 1 in 20 years).

4.287 The two tables below show the weighted values for the properties flooded due to hydraulic events, based on the properties on the sewer flooding register. Data on properties flooding below ground has been split evenly between flooding in a converted basement and flooding in a cellar. The sensitive customers are based on the number of schools and hospitals experiencing flooding, plus the expected number of customers over 65 years of age.

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[78] Thames Water,CSD005 CS03 Internal Sewer Flooding Performance Commitment, September 2018.
[79] Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018.
[80] Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.

Table 54: Weighted values for hydraulic excluding severe weather

OPM	Unit	Profile	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Flooding of sensitive customer properties	Per property	17.9%	32,383	42,223	51,526
Flooding in living space / habitable area - ground level	Per property	68.1%	107,612	140,305	170,954
Flooding in converted basement	Per property	14.0%	16,380	21,280	26,040
Flooding in cellar / attached garage/unoccupied building space	Per property	14.0%	11,620	15,120	18,480
Seepage in cellar / basement (not a living space)	Per property	0%	-	-	-
Weighted value			**167,995**	**218,927**	**267,000**

Source: CSD020 PR19 Performance Commitment Values Report

Table 55: Weighted values for hydraulic - severe weather only

OPM	Unit	Profile	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Flooding of sensitive customer properties	Per property	21.2%	38,416	50,089	61,126
Flooding in living space / habitable area - ground level	Per property	59.8%	94,446	123,138	150,037
Flooding in converted basement	Per property	19.0%	22,230	28,880	35,340
Flooding in cellar / attached garage/unoccupied building space	Per property	19.0%	15,770	20,520	25,080
Seepage in cellar / basement (not a living space)	Per property	0%	-	-	-
			170,862	**222,627**	**271,583**

Source: CSD020 PR19 Performance Commitment Values Report

4.288 The weighted values are further adjusted by the OPM frequency scalars and the updated values are shown in Table 56. The severe weather frequency scalar is 0.65, which assumes a return period of 1 in 20 years. The hydraulic flooding excluding severe weather frequency scalar is 1.14. This is a weighted average of the customer preference frequency scalars for return periods 1 in 20 years, 1 in 10 years and 2 in 10 years or greater.

Table 56: Values for hydraulic flooding

Programme area	Unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Hydraulic flooding excluding severe weather	Per property	192,004	250,215	305,158
Hydraulic flooding severe weather	Per property	111,335	145,066	176,965

Source: CSD020 PR19 Performance Commitment Values Report

4.289 Applying these values to the preferred programme profile gives the following:

Table 57: Weighted values for internal flooding

Programme area	Unit	Profile	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Other causes	Per property	90.6%	50,360	65,487	80,026
Hydraulic flooding excluding severe weather	Per property	5.7%	6,302	8,211	10,017
Hydraulic flooding severe weather	Per property	3.8%	7,245	9,442	11,515
Total value for internal flooding	Per property	100%	**63,907**	**83,141**	**101,558**

Source: CSD020 PR19 Performance Commitment Values Report

Table 58: Full benefit value pre calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Internal flooding – Per property	**63,907**	**83,141**	**101,558**

Source: CSD020 PR19 Performance Commitment Values Report

4.290 The full benefit values have been adjusted via scaling to account for the cross-over with other PCs e.g. internal flooding, pollution, blockages, SPS availability and surface water management. In our performance commitment values report, we show that the scaling factor is 0.65 for internal flooding. The values above are multiplied by this scaling factor to produce the final values for this PC.

Table 59: Internal flooding value post calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Internal flooding – Per property	**41,587**	**54,102**	**66,087**

Source: CSD020 PR19 Performance Commitment Values Report

4.291 We calculate the costs of providing an incremental change in the performance. These are depreciated over the long term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement.

4.292 The incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels through AMP7.

4.293 For our April Business Plan, we have revised our performance target for sewer flooding in each year of the planning period. We have recalculated our incentive rate using our current view of risk associated with revised incremental costs to achieve the target and the change in incremental benefits delivered during the planning period.

4.294 In our revision of marginal costs, we have included our assessment of risk costs associated with delivering the target. This assessment of risk costs is not derived from Ofwat's assessment of allowed costs, but our current best view of the costs required to assure the delivery of the programme. As a result, we have revised our marginal costs and benefits, and recalculated our incentive rates.

4.295 The bottom-up calculation for revised incentive rates resulted in a marginal change in outperformance and underperformance incentive rates which did not result in a change in materiality of this measure in the overall balance of our risk and reward framework.

4.296 We have been mindful of Ofwat's assessment of industry incentive rates for this measure and our bottom up recalculated incentive rates meet customer and Ofwat's expectations for benchmarked rates. We demonstrate that our revised ODI rates for internal sewer flooding are within the range that Ofwat has identified for the IAP in Table 2 of Section 3.

4.297 Our revised targets, collars and caps and incentive rates are detailed below. The normalised targets, risk profiles and incentive rates are detailed in App1b. Line commentary is provided in Section 5 (Annex 1) of this document.

4.298 The revised P10 and P90 and the revised ODI rates are shown in the Tables 60 and 61.

Table 60: Internal sewer flooding performance commitment P10/P90 range

	P90					P10				
Performance	20/21	21/22	22/23	23/24	24/25	20/21	21/22	22/23	23/24	24/25

Commitment										
Internal sewer flooding incidents (September 2018)	867	867	835	803	773	1477	1477	1445	1413	1383
Internal sewer flooding incidents (April 2019)	867	829	792	754	716	1477	1439	1402	1364	1326

Source: Thames Water App1

Table 61: Internal sewer flooding incentives

Performance commitment	PC unit	Marginal cost (£m)	Marginal benefit (£m)	Penalty rate	Reward rate
Internal sewer flooding incidents (September 2018)	Nr	0.033	0.054	0.038	0.027
Internal sewer flooding incidents (April 2019)	Nr	0.038	0.054	0.035	0.027

Source: TW-OC-A12-ODI Business Plan ODI Model and Thames Water App1

4.299 The normalised targets, risk profiles and incentive rates are detailed in Table App1b.

4.300 In summary, this PC and its ODI form part of an overall package that appropriately incentivises our performance in the long and short term because:

- the marginal benefits that we had calculated and triangulated from customer research dating from 2011 to 2017 – this is now a business as usual exercise and we have a substantial data set to draw from;
- we calculate the costs of providing an incremental change in the performance commitment. These are depreciated over the longterm to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement;
- the incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels through AMP7; and

- we use scaling to ensure that we do not double count benefits delivered by performance commitments.

DS01 Risk of sewer flooding in a storm

TMS.OC.A27 Risk of sewer flooding in a severe storm PC says: 'The company should adopt the standard definition in full, providing full details of any assumptions in its measurement and reporting methodology, including all the information set out in section 3.6 of Developing and Trialling Wastewater Resilience Metrics, Atkins.'

4.301 This is a common definition agreed across the industry and with the Environment Agency and Ofwat to ensure that company performance levels can be easily understood and compared.

4.302 We will reduce the number of customers at risk of a 1 in 50 year flood event[82] by 0.35% compared with the predicted position at the end of AMP6. For AMP7 this will be a trial which we would look to embed as part of the Drainage and Wastewater Management Plans for PR24.

4.303 We confirm our intention to adopt the standard definition in full. Further details were included in our Performance Commitment Summary document[83].

4.304 We will include in our annual reports the breakdown of where our methodology is maturing against the requirements of the Ofwat methodology.

DW01 Risk of severe restrictions in a drought

TMS.OC.A28 Risk of severe restrictions in a drought PC says: 'The company should review its proposed service levels for 2020-25 and ensure that they are stretching. The company should explain its level of stretch and submit the intermediate calculation outputs as shown in the common definition guidance published on our website for the drought resilience metric.'

4.305 The service level we provided for this PC (for protection to a 1 in 200 year drought) has been calculated using the common definition guidance published by Ofwat. This has been calculated separately for each of our six water resource zones (WRZ), with only London WRZ not delivering protection to a one in 200 year drought in AMP7. The London WRZ drives our AMP7 performance position, as London has approximately 77% of the population we supply, therefore causing a similar percentage score for the commitment.

4.306 Due to the method of calculation, the improvement in protection for our customers stays at a similar position throughout AMP7 and AMP8, with variations due to increasing population and climate change impacts, balanced by improvements due to demand and smaller supply options being delivered.

4.307 In the London WRZ, a further volume of 140 Ml/d is required to protect our customers from restrictions in a 1 in 200 year drought. The surplus from our AMP7 and AMP8 demand programmes provides part of this volume, but requires supply options to reach the total 140 Ml/d. The supply options are Oxford Canal transfer (11 Ml/d) and Deephams Re-Use (46 Ml/d), with a delivery lead time of six years. Protection for our customers from 1 in 200 year drought restriction is therefore achieved in 2030/31 across all of our water resource zones.

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[82] *This is based on the Industry agreed methodology, which includes other cause flooding.*

[83] *Thames Water, CSD005-DS01 - Risk of sewer flooding in a 1 in 50 year storm, September 2018.*

4.308 When customers were asked their preference on timing at 2030/31, there was limited feedback to move our programme forward from 2030/31.

4.309 It is worth noting, against our 1 in 100 year level of service, we end AMP7 with a supply and demand surplus of 114.7 Ml/d, and AMP8 with 151.7 Ml/d, with the majority of the surplus being in London. Due to the calculation method of this performance commitment, this benefit is not seen, as it only includes the population within the water resource when 1 in 200 year drought protection is achieved.

4.310 In January and February 2019, we conducted some further deliberative research with customers about planning for more extreme droughts up to 1 in 500 years[84]. In this early research, there was general support from customers for this, which will need to be tested qualitatively to determine willingness to pay for this service level, to inform future price reviews.

ES01 Pollution incidents

TMS.OC.A29 Pollution incidents PC says: 'For this common PC we expect all companies' service levels to reflect the values we have calculated for each year of the 2020 to 2025 period.'

4.311 In Section 2 of our main submission document[85], we have set out our revised proposal for reducing pollution incidents.

4.312 Our September Business Plan set a stretching target of achieving 23 incidents per 10,000km of sewer by 2024/25. We are now proposing to meet the upper quartile profile set by Ofwat in the IAP, stretching our performance from 28 incidents per 10,000km in 2018/19 to 19.5 incidents per 10,000km of sewer by 2024/25. We have chosen to improve our ambition to this level because:

- Reducing pollution is valued highly by customers and by our key stakeholders;
- The target of 19.5 incidents per 10,000km by 2024/25 meets the Water Industry Strategic Environmental Requirements (WISER) condition of a 40% reduction from the 2016 calendar year performance;
- We are assuming that we will be able to roll out a new, as yet untested, innovative approach, using low-cost sewer monitors in combination with machine learning from alarms to proactively deploy gangs to clear potential blockage build-ups before pollution occurs from a foul sewer. If this is successful, we will be able to stretch performance while keeping customers' willingness to pay broadly in line with the additional costs incurred.

4.313 However, our new approach is as yet untested, and reverting to conventional approaches to reduce pollution, such as sewer cleaning, sewer rehabilitation and customer education (including our 'bin it don't block it' campaign) would be prohibitively expensive.

4.314 Furthermore, we are able to commit to upper quartile performance for pollution but not for internal sewer flooding, because our statistical analysis of historical data shows that internal sewer flooding can potentially occur across large parts of our sewerage network, whereas pollution incidents from foul sewers tend to be more limited to low lying areas close to watercourses. Consequently, we believe that our proposed approach of low cost alarms combined with machine learning is likely to have more success at reducing pollution than internal sewer flooding in its earlier stages of roll-out.

4.315 Our revised targets, collars and caps are detailed in Table 61.

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[84] Britain Thinks 2019, TW-CSE-A3-CR69- Drought resilience and chalk streams, 2019.
[85] TW-RS1 Building a better future: Response to Ofwat's IAP, April 2019.

Table 62: Pollution revised stretch

Performance Commitment	PC unit	2020	2021	2022	2023	2024
Wastewater category 1-3 incidents per 10,000 km of sewer (September 2018)	Nr/10,000 km	27	26	25	24	23
Wastewater category 1-3 incidents per 10,000 km of sewer (April 2019)	Nr/10,000 km	24.5	23.7	23.0	22.4	19.5

Source: Thames Water App1

TMS.OC.A30 Pollution incidents PC says: 'The company should provide further evidence to justify the use of outperformance payments for this ODI. The company should demonstrate how going against customer preferences will benefit customers.'

4.316 We have set a financial, annual, incentive for this performance commitment, which has been calculated in line with the Ofwat guidance[86]. We have allowed for under- and out-performance payments using annual revenue adjustments. This is justified because this:

- sets a good level of customer priority and valuation;
- protects customers' interests;
- promotes efficiency;
- reduces the risk of the environmental consequences for customers;
- stretches our performance;
- is fair; and
- is transparent.

4.317 Customers see this as a very important measure and as such they want a penalty imposed if we do not meet targets. In the research that we conducted in June 2018, some customers feel that an out-performance incentive is not needed and that a reputational incentive is sufficient. However, when this research was carried out, our proposals did not take us as far as upper quartile. Going beyond upper quartile would reflect truly exceptional performance and it is therefore reasonable that it is rewarded.

[86] *Joint Regulators Group, 2012, "Discounting for CBAs involving private investment, but public benefit", 2012.*

4.318 In the additional customer research[87] that we conducted in January and February 2019, there was also broad support for Thames Water to pursue enhanced incentive rates for those areas where Thames Water is currently performing well, including reducing pollution incidents and the health of the sewer network.

4.319 As well as enhanced rates for out-performance, customers do want to see that there are sufficient penalties in the framework. However, there were no strong views that additional penalties are needed (i.e. standard penalties are suitable).

"Customer wins overall" – Business (feedback form)

"Powerful incentive, within the cap mechanism" ABC1 Household (feedback form)

4.320 Therefore, we believe we have strong customer support to include standard out-performance payments in this area. Customers would also support enhanced incentives if we were to apply them to this measure.

4.321 We note that in the risk and return IAP feedback section, Ofwat states "…we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[89]. We conclude that removing this incentive would place our overall RORE range more at odds with the feedback Ofwat has provided on the risk and return IAP test area.

4.322 We have also agreed to protect customers from excessive outperformance payments and propose to do this by:

- Agreeing to a sharing mechanism to protect customers, with customers sharing (50:50) for RORE returns >3%; and
- Applying individual reward caps to PCs, such that no single measure exceeds 0.25% RORE (c.£15m) in any one year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important.

TMS.OC.A31 Pollution incidents PC says: 'The company should provide the additional information set out in 'Technical appendix 1: Delivering outcomes for customers' to allow us to better understand the causes of variation in ODI rates for pollution incidents and assess the appropriateness of the company's customer valuation evidence supporting its ODI'.

'The company should explain and evidence how its proposed ODI rate for pollution incidents is coherent with the rates proposed for all other sewerage performance commitments (including internal sewer flooding and sewer collapses) and demonstrate how the package of ODIs across the relevant group of performance commitments appropriately incentivises performance in the long and short-term.'

4.323 We are unable to provide a critique as to why our ODI rate may be different from other companies', as we do not have access to their detailed calculations to do so. Our response to this Required Action therefore focuses on explaining how our ODI rate aligns with our customer preferences.

4.324 We have used the standard Ofwat formula for calculation of our incentive rates for pollutions. Our costs are whole life costs and our benefit values are based upon whole life sustained benefits. Therefore our assessments address whether these levels of performance are appropriate for the short and long term.

[87] *TW-CSE-A1 What Customers Want v13 (final), January – Feburary 2019 PC & ODI Research, March 2019.*
[89] *Ofwat. Thames Water test area assessment, Jan 2019, Aligning risk and return, page 4.*

4.325 In our September submission, we presented detailed information about our ODI design in our Pollution Performance Commitment Summary document[90] and supporting technical documents:

- Our triangulation report of customer and society values.91
- Our performance commitment values report.[92]

4.326 Our customer preferences research from 2011 to 2017 stated preference valuations that measure the impact of different severities of pollution incident (categories one, two and three). These have been assessed against indicative response and clean-up costs for the Environment Agency (category one and two only) and valuations from other companies as part of the triangulation process for customer values.

4.327 The Annual Return data for 2015 to 2017 for the number of incidents of each type has been used to estimate a weighted value for pollution incidents.

Table 63: Full benefit value per pollution incident

OPM	Unit	Proportion	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Category 1	Per incident	0.5%	575	4,380	8,180
Category 2	Per incident	3.0%	1,579	11,905	22,231
Category 3	Per incident	96.5%	25,080	190,997	356,913
Pollution – weighted value	Per incident	100%	**27,235**	**207,282**	**387,324**

Source: CSD020 PR19 Performance Commitment Values Report

4.328 To convert this to the final units for the PC the value per incident is multiplied by the length of the network in ten thousands of kilometres (10.9).

Table 64: Pollution value pre calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Pollution – per incident category 1 to 3 per 10,000km	**296,803**	**2,258,956**	**4,221,055**

Source: CSD020 PR19 Performance Commitment Values Report

[90] *Thames Water, CSD005 ES01 Wastewater Pollution Incidents,September 2018.*
[91] *Eftec and ICS, CSD019, Triangulation Report - Customer & Societal Valuations, June 2018.*
[92] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.*

4.329 The weighted value for one pollution incident shown in Table 63 has been adjusted via scaling to account for the cross-over with other PCs e.g. sewer collapses, sewer blockages, SPS availability and surface water. Our performance commitment values report[93] shows that the scaling factor is 0.79 for pollution incidents. The values above are multiplied by this scaling factor to produce the final values for this PC.

Table 65: Pollution value post calibration

Performance commitment and unit	Lower, £ p.a.	Central, £ p.a.	Upper, £ p.a.
Pollution – per incident category 1 to 3 per 10,000km	**234,409**	**1,784,075**	**3,333,699**

Source: CSD020 PR19 Performance Commitment Values Report

4.330 We calculate the costs of providing an incremental change in the performance. These are depreciated over the long-term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life Totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement.

4.331 The incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels through AMP7.

4.332 The approach that we have outlined above is coherent with the rates proposed for all other sewerage performance commitments (including internal sewer flooding and sewer collapses)

4.333 We have revised our ambition for pollutions in each year of AMP7 and they now align with Ofwat's expectations for industry annual upper quartile performance.

4.334 We have recalculated our incentive rate using our current view of additional risk cost associated with the revised glide path of benefits and incremental benefits. This leads to a change in marginal costs for the performance commitment.

4.335 The bottom-up calculation for revised incentive rates resulted in a marginal change in outperformance and under-performance incentive rates which did not result in a change in materiality of this measure in the overall balance of our risk and reward framework.

4.336 We have been mindful of Ofwat's assessment of industry incentive rates for this measure. In Table 2 of Section 3, we demonstrate that our revised normalised ODI rates for pollution incidents is on the boundary of the normalised range that Ofwat has identified for the IAP, whilst also aligning with customer preferences.

4.337 Our revised incentive rates are detailed below. Further details are included in our line commentary, Section 5 (Annex 1) of this document.

Table 66: Revised pollution incentive rates

	Marginal cost £m / unit	Marginal benefit £m / unit	Penalty £m / unit	Reward £m / unit
Pollution September 2018	1.32	1.78	1.12	0.89

[93] *Thames Water, CSD020 PR19 Performance Commitment Values Report, September 2018, Section 8.1.*

Pollution April 2019	1.84	1.78	0.87	0.89

Source: TW-OC-A12-ODI Business Plan ODI Model and Thames Water, App1

4.338 In summary, this PC and its ODI form part of an overall package that appropriately incentivises our performance in the long and short term because:

- The marginal benefits that we had calculated and triangulated from customer research dating from 2011 to 2017 – this is now a business as usual exercise and we have a substantial dataset to draw from;
- We calculate the costs of providing an incremental change in the performance commitment. These are depreciated over the long term to develop the annualised incremental costs. We use the Spackman approach to determine the annualised incremental costs, using the whole life totex costs, which are discounted with the Social Time Preference Rate (STPR) over a 40-year period as the revenue requirement;
- The incremental costs are aligned with the incentivised performance range for AMP7, where the incentivised performance range is the difference between our baseline performance at the end of AMP6 and our commitment performance levels through AMP7;
- We use scaling to ensure that we do not double count benefits delivered by performance commitments; and
- We have revised our incentive rates to reflect our April Business Plan and improved ambition. The incentive rates now align with the range that Ofwat has identified in the IAP.

TMS.OC.A32 Pollution incidents PC says: 'The company should provide further evidence to support its use of a cap and a collar for this specific PC, whilst also considering how its use of these features aligns with its broader approach to customer protection. The company's evidence should include justification for the levels at which the cap and collar are set, with the company explaining why these levels are appropriate and in customers' interests.'

4.339 We provided evidence on the use of caps and collars for this PC in our Performance Commitment Summary Report[94]. We applied caps and collars to this incentive at P10 and P90.

4.340 We accept that, in our June 2018 research, customers had mixed views about caps and collars. Whilst customers understand that extreme weather events may affect performance, views of whether Thames Water should be 'protected' from this with a collar varies. Some felt that Thames Water should be increasing the resilience of the system to extreme weather events and so do not want a cap / collar. Others felt that it would be unfair for Thames Water to be punished for unpredictable weather events. In our September submission, on balance, we concluded that caps and collars were appropriate.

4.341 In addition to the research conducted to support our September plan, over the period January 2019 to February 2019 we undertook a series of customer workshops and focus groups to further test our performance commitment targets and ODIs. This involved five half-day customer workshops and five focus groups across our region. In this latest research, customers reiterated their message that they thought it was not beneficial for a single measure to dominate the incentive framework. Customers felt that this practise would place too much focus on one area of service potentially to the detriment of others.

[94] *Thames Water, CSD005 ES01 Wastewater Pollution Incidents Performance Commitment Summary, September 2018.*

4.342 We note that in the risk and return IAP feedback section, Ofwat states "…we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[95]. We conclude that removing the cap on underperformance for this PC would further increase Ofwat's concerns on the risk and return IAP test area.

4.343 We have also committed to include a collar on outperformance to protect customers from payments. Our proposals are to:

- Agree to an overall sharing mechanism to protect customers, with customers sharing (50:50) for RORE returns >3%; and
- Apply individual reward caps to PCs, such that no single measure exceeds 0.25% RORE (£15m) in any one year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important.

4.344 Our revised P10 and P90 caps and collars are set out in tables 67 and 68 below.

Table 67: Pollution P10 underperformance caps

	2020/21	2021/22	2022/23	2023/24	2024/25
Wastewater category 1-3 incidents per 10,000 km of sewer (September 2018)	37	37	37	37	37
Wastewater category 1-3 incidents per 10,000 km of sewer (April 2019)	35	34	33	32	30

Source: Thames Water App1

Table 68: Pollution P10 outperformance collars

	2020/21	2021/22	2022/23	2023/24	2024/25
Wastewater category 1-3 incidents per 10,000 km of sewer (September 2018)	16	16	16	16	16
Wastewater	16	15	14	13	11

[95] *Ofwat, Thames Water test area assessment, January 2019, Aligning risk and return, page 4.*

category 1-3 incidents per 10,000 km of sewer (April 2019)					

Source: Thames Water App1

BW06 Water Quality CRI Other

TMS.OC.A33 Water Quality Compliance: CRI Other PC says: 'The company should consider if it is still appropriate to have sub measures of CRI, taking into account the announced ban on the outdoor use of Metaldehyde. If it continues to propose sub measures it should select appropriate CRI sub-measure from the Asset Health long list.'

4.345 Ofwat indicates that it is expecting to see a single Water Quality CRI common PC with a single financial underperformance incentive. Our September submission uses two underperformance incentive rates - one for Metaldehyde and one for other parameters. We are not proposing to change this.

4.346 A number of Required Actions have been raised on this PC:

- TMS.OC.A19 - we focus on our reasons for retaining two separate underperformance incentives rather than a single combined one
- TMS.OC.A20 – we provide evidence to justify the two separate underperformance rates in our September submission.
- TMS.OC.A21 – we explain why Ofwat's proposed intervention on a deadband for a single Common PC is unreasonable and restate the rationale for the deadband used in our September 2018 submission
- TMS.OC.A33 (this response) – we provide reasons for not selecting a CRI sub measure from Ofwat's Asset Health long list
- TMS.OC.A34 – we repeat our reasons for retaining a separate CRI Metaldehyde sub-measure

4.347 We do not consider the use of the CRI sub-measure as set out in the Asset Health long list appropriate, as this does not accurately reflect the issue associated with Metaldehyde. We monitor for Metaldehyde both in specific water supply zones and at supply points. It is more relevant for us, therefore, to have two separate underperformance incentive rates for CRI, one specifically targeted for the Metaldehyde risk.

4.348 Until the ban comes into force in June 2020, Metaldehyde will still be available for use with a heightened risk of a greater number of compliance exceedances, as pesticide stocks are used up. Metaldehyde exceedances can have a significant impact on the CRI score.

BW06 Water Quality CRI Metaldehyde

TMS.OC.A34 Water Quality Compliance: CRI Metaldehyde PC : 'The company should consider if it is still appropriate to have sub measures of CRI, taking into account the announced ban on the outdoor use of metaldehyde. If it continues to propose sub measures it should select appropriate CRI sub-measure from the Asset Health long list.'

4.349 Ofwat indicates that it is expecting to see a single Water Quality CRI common PC with a single financial underperformance incentive. Our September submission uses two underperformance incentive rates - one for Metaldehyde and one for other parameters. We are not proposing to change this.

4.350 A number of Required Actions have been raised on this PC:

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- TMS.OC.A21 – we explain why Ofwat's proposed intervention on a deadband for a single Common PC is unreasonable and restate the rationale for the deadband used in our September 2018 submission
- TMS.OC.A33 – we provide reasons for not selecting a CRI sub measure from Ofwat's Asset Health long list
- TMS.OC.A34 (this response) – we repeat our reasons for retaining a separate CRI Metaldehyde sub-measure

4.351 Following the announcement of the ban on the outdoor use of Metaldehyde, we reviewed our plans accordingly and the associated investment and will scale back on the level of work we will be doing in the catchment once the ban is in place (June 2020)[96].

4.352 Until the ban comes into force in June 2020, Metaldehyde will still be available for use with a heightened risk of a greater number of compliance exceedances, as pesticide stocks are used up.

4.353 Metaldehyde exceedances can have a significant impact on the CRI score. Metaldehyde samples are primarily collected from authorised supply points, and a small number from the water supply zones that receive a bulk import of drinking water from a neighbouring company. Metaldehyde exceedances encountered at our authorised supply points can contribute significantly to the overall CRI score. The majority of our large surface water works abstract from storage reservoirs and if levels of Metaldehyde accumulate in these water bodies, there is a risk that CRI performance in early AMP7 may be adversely impacted.

4.354 Furthermore, there is the potential for the continued illegal use of the pesticide following the ban.

4.355 For these reasons we feel strongly that separate incentives are needed for Metaldehyde.

In recognition of the potential Metaldehyde ban, we have updated our P1 and P10 risk profile for the CRI Metaldehyde ODI. This is shown in the Table 69.

Table 69: Updated P1 and P10 risk profile for CRI Metaldehyde

PC short name	2020-21	2021-22	2022-23	2023-24	2024-25
CRI-Metaldehyde (September 2018)	35.88	35.88	35.88	35.88	35.88
CRI-Metaldehyde	15.32	6.58	3.29	0.00	0.00

[96] *See response to TMS.CE.A4 – Appendix 1, p.61.*

(April 2019)					

Source: Thames Water App1

AR02 Households on a payment plan

TMS.OC.A35 Households on a payment plan PC says: 'The company should provide further information on whether its customers support this PC.'

4.356 We have removed this PC from our plan.

4.357 Customers did not support this PC - they worried that it would preclude customer choice about when they pay their bill and were not sure whether it is in customers' best interests. We are therefore proposing the removal of this performance commitment and maintaining this as an internal KPI , as we recognise that it remains an important indicator with regards to our overall affordability approach.

AR03 Household accounts on our new billing system

TMS.OC.A36 Household accounts on our new billing system PC says: 'The company should reflect the feedback that we provided in July 2018 and provide a definition of an "active account".'

4.358 Ofwat has requested that we clarify the definition of an active account. An "active" account is defined as an account that is live and eligible for billing. This information was provided in our September submission in our Performance Commitment Summary report for this PC[97].

TMS.OC.A37 Household accounts on our new billing system PC says: 'The company should consider the proposed ODI rates and either increase the rates (absolute terms) in line with customer evidence so that the ODI rates provide sufficient incentive or provide compelling evidence why the ODI rates are considered appropriate. In either case the company should set out its evidence and rationale.'

4.359 In order to protect customers, and to reaffirm our commitment to deliver the CRMB system, we are proposing a penalty only ODI to appropriately reimburse household customers if we do not migrate accounts onto the CRMB system. The new CRMB system is a household billing solution and therefore reimbursement will only apply to household accounts. Any reimbursement would be in the form of a revenue adjustment in-period.

[97] *Thames Water, CSD005-AR03 Household accounts on our new billing system, September 2018.*

4.360 We have taken on board Ofwat's feedback and reviewed the proposed ODI rates, and we consider that there remains a sufficient incentive in the ODI rates we have previously proposed.

4.361 Our PR14 Willingness to Pay research demonstrated that customers valued the improvements that are enabled by the implementation of the system across the life of the asset[98]. As part of our PR19 performance commitment and ODI testing, customers told us that they supported the CRMB performance commitment measure for inclusion in our plan, but they stated that they saw it as an internal indicator for Thames Water, rather than a measure that customers should evaluate. Following this feedback and discussion with our CCG, we decided that it would not be appropriate to ask customers about proposed ODIs rates relating to this performance commitment.

4.362 We have used a straightforward calculation to determine appropriate ODI rates; the AMP7 allowed cost adjuster claim plus a ten per cent 'premium' to ensure that the penalty rate exceeds avoided costs.

AR05 Customers recommending priority services

TMS.OC.A38 Customers recommending Priority Services PC: The company should provide additional evidence on the sample size and provide external assurance that the survey will be conducted in line with social research best practice.

4.363 We have removed this PC from our plan for the reasons detailed in Section 2 of this document. This performance commitment has now been removed and replaced with performance commitment AR07 - Achieving British Standard BS18477 for Inclusive Service Provision.

4.364 TMS.OC.A39 Ofwat notes that no concern against this Required Action.

AWS02 Proactive customer engagement

TMS.OC.A40 Proactive customer engagement PC: The company should review the price control allocation and reconsider its approach to aggregating sub-measures into the PC. It should clearly set out the evidence and rationale for the revision.'

4.365 We explained our price control allocation in our Performance Commitment Summary report for this PC[99] in our September submission.

4.366 AMP7 totex totalling £42m has been allocated 100% to the Water Resources price control, recognising that nearly all activity is aimed at reducing water usage.

TMS.OC.A41 Proactive customer engagement PC says: 'The company should clarify why the target is stretching and additionally provide further evidence of customer views. If the company cannot do this it should set more stretching targets.'

4.367 Our PC is for the number of targeted, proactive contacts we make with our customers through the following initiatives: smarter home visits, smarter business visits, local authority and housing association water efficiency visits, school water audits and customer side leakage repairs.

[98] *PR14 June 2014 GAR H RBR6.*
[99] *Thames Water, CSD005 - AWS02 Proactive customer engagement, September 2018.*

4.368 Further, our engagement programme for lead pipe replacement is by far the largest in the UK, being almost as much as all the other water companies put together.

4.369 We have initiated new approaches to engage customers about water awareness and demand reduction and led the development of more accurate water efficiency measurement and integration with external partner programmes. We also have a large number of area-based, targeted demand reduction activities for both household and non-household water users. We have used independent assessments to ensure we focus on the activities that add most value for customers.

AWS03 Business retailer measure of experience

TMS.OC.A42 Business retailer measure of experience PC says: 'The company should clarify if it will be in a position to implement the measure and report on performance by the start of the 2020-25 period.'

4.370 We have reviewed and improved the definition of our Business retailer measure of experience (R-MeX) performance commitment, to set out the dependencies in terms of our ability to measure performance at the start of the 2020, building on the industry work currently under way to define a baseline position during 2019/20. It is from this baseline we will make year on year improvements in R-MeX for each year during AMP7.

4.371 It is fair to say that the market is relatively immature and diverse and therefore there is significant industry work and collaboration required to baseline a retailer satisfaction measure that appropriately captures the impact of wholesaler performance on end customers.

4.372 We believe this is the right thing to do in terms of supporting positive end customer outcomes and we are committed to driving this measure forward to incentivise industry collaboration as opposed to removing it on the basis that there is at this stage a lack of certainty regarding measurement.

4.373 In addition to the above Required Action, as part of its IAP feedback, Ofwat has expressed concern that "there is ambiguity in the performance measure, which does not define what it means to have 'adopted' an R-MeX measure by the start of the 2020-25 period"

4.374 We have taken a lead through chairing an industry-wide working group, as part of the Retailer Wholesaler group of the Non-Household market, to review good practice across the market and to propose the adoption of a common R-MeX measure, where this is what market participants want.

4.375 Our preference is to agree and adopt a common measure across all parts of the market, but failing that we will develop our own. We will set the baseline for this in the final year of this AMP, when piloting of the proposed market R-MeX approach should have concluded, and plan to improve year on year in subsequent years of the AMP.

4.376 We have reflected this, as follows in our updated data table App1:

Table 70: Forecast profile of our level of R-MeX performance

AMP6 forecast	AMP7 targets					AMP8 targets	AMP9 targets
Yr5	Yr1	Yr2	Yr3	Yr4	Yr5	Yr5	Yr5
Set baseline	improvement on 2019/20 baseline	improvement on 2020/21	improvement on 2021/22	improvement on 2022/23	improvement on 2023/24	no detriment on 2025/26	no detriment on 2030/31

Source: Thames Water table APP1

4.377 By committing to an improvement in each year of the AMP, we are aiming to continually improve services we provide to our Retailer customers.

AW01 Improving customer engagement concerning leaks on customers pipes

TMS.OC.A43 Improving customer engagement concerning leaks on customers' pipes PC: The company should clarify both the definition and the level of performance. It should also change the measure to be based on customer outcomes.

4.378 We have removed this PC from our plan for the reasons outlined in Section 2, above. Customers saw this as a relatively small project and there was little support for it.

TMS.OC.A44 Improving customer engagement concerning leaks on customers' pipes PC says: 'The company should provide evidence that levels of stretch for this PC were tested with its customers.'

4.379 We have removed this PC from our plan for the reasons outlined in Section 2, above. Customers saw this as a relatively small project and there was little support for it.

BW07 Properties at risk of receiving low pressure

TMS.OC.A45 Properties at risk of receiving low pressure PC says: 'The company should provide further evidence to justify the use of outperformance payments for this ODI.'

4.380 This performance commitment has a financial incentive which has been calculated in line with Ofwat guidance[100]. It is appropriate that we are incentivised to deliver our performance commitment in this area and that customers are compensated for benefits foregone for performance that is not delivered.

4.381 A financial ODI is appropriate for low pressure because it:

- Protects customers' interests
- Promotes efficiency
- Stretches our performance
- Is fair
- Is transparent
- Customers want us to do more

4.382 In our June 2018 research, customers had mixed views on this incentive type. Some customers felt that it should be underperformance only.

[100] *Ofwat: Delivering Water 2020: Our final methodology for the 2019 price review, December 2017.*

4.383 Our performance for ensuring customers have a solution to sustained low pressure is upper quartile within the industry. We wish to maintain that and set an ambition for reducing this further, as customers want us to do more. We have included outperformance payments as a means to recover some of the money we will need to invest in order to innovate and reduce instances of sustained low customer for customers further. We feel that this is fair, as we would only receive a small outperformance payment should the investment in our programmes be proven as successful through demonstrable improvements in service

4.384 In January 2019, we carried out supplementary customer research, which included customer views on the headline ODI RORE range. Fifty-three per cent of respondents thought the ODI bill impact range we proposed should stay broadly the same, seeing it as a fair balance between outperformance incentives and the potential increase in bills. Whereas, 44% of respondents indicated that the range should be amended. When comparing the ranges of all WASCs, ours was most popular[101].

4.385 The ODI range that we submitted in September 2018 was weighted towards underperformance because we followed Ofwat's ODI formulae in almost all cases; and our P10/P90 ranges have long tails towards underperformance in many cases.

4.386 In the Delivering Outcomes for Customers IAP feedback, numerous challenges are raised on the use of outperformance payments. However, in the Risk and Return IAP test area, Ofwat states:

4.387 "…while there is high quality and convincing evidence in the company's assessment of risk for the notional company in its RoRE analysis in the round, we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[102].

4.388 From a top-down perspective, we surmise that our selection of outperformance ODIs is consistent with customer preferences. Removing this incentive would be at odds with Ofwat's feedback on the risk and return IAP test area.

4.389 We agree that customers should be protected from excessive outperformance payments. We proposed to do this by:

- Agreeing to an overall sharing mechanism to protect customers, with customers sharing (50:50) RORE returns >3%; and
- Applying individual reward caps to PCs, such that no single measure exceeds 0.25% RORE (c.£15m) in any one year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important.

4.390 We provided the evidence for this Required Action in the Performance Commitment Summary included with our September submission[103].

BW08 Acceptability of water to customers

TMS.OC.A46 Acceptability of water to consumers PC says: 'The company should revise its definition so that it covers the scope of appearance, taste and odour in line with the PCs set out in the Asset Health long list and the information published on Discover Water and remove the inclusion of incidents related to illness.'

[101] *TW-CSE-A1 What Customers Want v13 (final), March 2019.*
[102] *Ofwat, Thames Water test area assessment, January 2019, Aligning risk and return, page 4.*
[103] *Thames Water, CSD005-BW07 Properties at risk of receiving low pressure, September 2019*

4.391 Supplying high quality drinking water to our customers is of critical importance to us and we are proud of our good performance on this measure when compared to the industry.

4.392 When consulted about water quality:

- 91% of customers are satisfied with the safety of water.
- 81% of customers are satisfied with the taste and smell of their water
- Fewer than one per cent of customers said they had experienced a problem with the taste, smell or colour of their tap water in the last five years.
- 45% of customers say that any problems with the taste, smell and colour of tap water would have quite a lot or a lot of impact on their households' day to day activities.

4.393 In our September submission, we chose the performance commitment of the acceptability of water to consumers as it is such an important measure of our customers' assessment of the appearance, taste and smell of their water. Additionally, it is the well-established measure used by the Drinking Water Inspectorate (DWI). Their measure incorporates customer data (both residential and business) for all drinking water quality contacts relating to three categories: appearance, taste/odour, and illness. These categories are described in the DWI Information Letter 1/2006. Performance of all companies against this single measure is published by the DWI in their annual report on their website[104].

4.394 We have explained and discussed this measure, how it is valued and our targets with customers. We have also discussed the types of programme that might be employed to improve performance. Customers understand and value the measure and are happy for it to be included in our plan.

4.395 Therefore we believe that this is an appropriate bespoke measure. Customers also think reporting a measure which included reported performance for illness associated with drinking water is important and this has a high customer value.

4.396 We recognise, however, that Ofwat may have proposed this approach to ensure greater commonality across the industry. Therefore, we have included a provisional view of what our forecast target or performance might be for PR19. This may be useful supporting information for Ofwat in the instance that it wants to enhance its PR19 benchmark for the Industry as a whole. Our forecast is provided in Table 71.

Table 71: Forecast of water quality customer contacts

Parameter	2020-21	2021-22	2022-23	2023-24	2024-25
Customer contacts about water quality (appearance) Contacts per 1000 population	0.36	0.36	0.36	0.36	0.36
Customer contacts about water quality (taste and odour) Contacts per 1000 population	0.19	0.19	0.19	0.19	0.19

Source: Thames Water, DT01, App1

[104] *For the annual report see: www.dwi.gov.uk*

4.397 Therefore, we have retained the performance commitment as set out in the September Business Plan as we feel that covering the scope of appearance, taste, smell and illness fully reflects the acceptability of the water customers' experience. Moreover, it aligns completely with the single acceptability measure used by the DWI as previously described and as set out in IL 1/2006.

TMS.OC.A47 Acceptability of water to consumers PC says: 'The company should provide further evidence to justify the use of outperformance payments for this ODI.'

4.398 We provided the evidence for this Required Action in the Performance Commitment Summary included with our September submission[105].

4.399 This performance commitment has a financial incentive which has been calculated in line with Ofwat guidance[106]. It is appropriate that we are incentivised to deliver our performance commitment in this area and that customers are compensated for benefits foregone for performance that is not delivered.

4.400 The financial ODI, with in period revenue adjustments for outperformance and underperformance, is justified because of the:

- high-level of customer priority and valuation;
- risk of the significant consequences for customers; and
- findings of our customer research.

4.401 The incentive rewards outperformance because our customers have shown support that:

- this is a priority area;
- the target is stretching and they want us to go further if we can;
- any outperformance should be incentivised; and
- they are willing to pay for outperformance

4.402 We have included outperformance payments as a means to recover some of the money we will need to invest in order to reduce instances of customer contacts for water acceptability further still. We feel that this is fair, as we would only receive an outperformance payment should the investment in our programmes be proven as successful through demonstrable improvements in service. This potential outperformance payment only represents a potential £80K payment across the AMP7 period for achieving P90 performance.

4.403 In January 2019, we carried out supplementary customer research, which included customer views on the headline ODI RORE range. Fifty-three per cent of respondents thought the ODI bill impact range we proposed should stay broadly the same, seeing it as a fair balance between outperformance incentives and the potential increase on bills. Whereas, 44% of respondents indicated that the range should be amended. When comparing the ranges of all WASCs,ours was most popular[107].

4.404 The ODI range that we submitted in September 2018 was weighted towards underperformance because we followed Ofwat's ODI formulae in almost all cases; and our P10/P90 ranges have long tails towards underperformance in many cases.

4.405 In the Delivering Outcomes for Customers IAP feedback, numerous challenges are raised on the use of outperformance payments. However, in the Risk and Return IAP test area, Ofwat states:

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[105] *Thames Water, CSD005-BW08 Acceptability of water to customers, September 2019.*
[106] *Ofwat, Delivering Water 2020: Our final methodology for the 2019 price review, December 2017.*
[107] *TW-CSE-A1, What Customers Want v13 (final), March 2019.*

4.406 "…while there is high quality and convincing evidence in the company's assessment of risk for the notional company in its RoRE analysis in the round, we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[108].

4.407 From a top-down perspective, we surmise that our selection of outperformance ODIs is consistent with customer preferences. Removing this incentive would be at odds with Ofwat's feedback on the risk and return IAP test area.

4.408 We agree that customers should be protected from excessive outperformance payments. We proposed to do this by:

- Agreeing to an overall sharing mechanism to protect customers, with customers sharing (50:50) RORE returns >3%; and
- Applying individual reward caps to PCs, such that no single measure exceeds 0.25% RORE (c.£15m) in any one year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important.

BW11 Responding to trunk mains bursts

TMS.OC.A48 Responding to major trunk mains bursts PC says: 'The company should provide more stretching targets that improve upon recent past performance before the end of the period 2020-25. If the company cannot do this it should provide compelling evidence setting out why not.'

4.409 We have included a more stretching target in line with our revised proposal to reduce supply interruptions by 20% over AMP7.

4.410 Details have been provided in App1 and in the line commentary for this table.

BW12 Improving system resilience of North East London water supply

TMS.OC.A49, TMS.OC.A50, TMS.OC.A51

Improving system resilience of North East London water supply PC say: 'The company should take the actions listed below;

1) It should provide a timeframe for the completion of the detailed feasibility studies of the proposed schemes, and how the definition of the PC will be agreed.
2) The company should confirm that its customers and the CCG have been presented with the updated information on the schemes, and that their views have been incorporated into the design of the PC and its related outcome delivery incentive.
3) The company should clarify the timeframe for the high lift pumping station scheme and how this scheme will be reflected in the PC.'

[108] *Ofwat, Thames Water test area assessment, January 2019, Aligning risk and return, page 4.*

TMS.OC.A52 Improving system resilience of North East London water supply PC says: 'The company should finalise the number of schemes for the PC and provide evidence supported by its customer engagement that this PC is stretching.'

4.411 Following the submission of our September 2018 Business Plan, we have continued to engage our customers. One key area has been to engage on improving system resilience of North East London water supply. Based on this engagement and our previous engagement we are confident this PC is in line with their views, with a stretching value for money target.

4.412 Over the period December 2018 to January 2019 we undertook 12 focus groups across the whole of our region: North East London, South London, West London and Thames Valley to understand their views on the risks to service in North East London. A number of these customers had been affected by the Beast from the East Freeze Thaw and were able to share their experiences of significant disruption over a wide geographical area.

4.413 When shown our assessment of the risks to water supplies in North East London, the near universal view of our customers was that the risks are too high and need to be addressed quickly and comprehensively. Our proposed resilience strategy over the next 25 years has been discussed with customers and was found to be highly valuable and in line with their views. Bill impacts to 2025, and beyond to 2045, were found to be affordable. Overall, customers saw the reduction in risk and customer benefits to be excellent value for money and they supported the proposals in full. Moreover, they would like to see mechanisms in place that allow for a speedy implementation and delivery.

- "It's a can of coke a month", North East London pilot
- "I think that's an amazing reduction from 640,000 impact to 20,000… it's not zero but I'm not expecting it to be. The reduction is much bigger than I'd expect" West London ABC1
- "I'd rather pay more if it meant it got done quicker" South London ABC1

TMS.OC.A53 Improving system resilience of North East London water supply PC says: 'The company should provide further evidence to justify the use of outperformance payments for this ODI and evidence of customer support for this approach.'

4.414 We are using the ODI for this PC to adjust for scope and timing of the programme, not to 'reward' ourselves for outperformance.

4.415 As part of our September Business Plan, we committed to providing further information on our NE London Cost Adjustment Claim (CAC) for the 1st April. Within this document we confirm:

- The proposal to complete feasibility/design work within the first two years of AMP7 before reviewing the solutions as part of a 'gateway' process where the final deliverables for AMP7 will be agreed.
- Customer engagement forums and interviews were held in January and February 2019. We have kept the CCG updated on the findings. We have also presented the PC to the CCG and taken on board any views provided.
- We are planning to do further work to design the High Lift Pumping Station and local site reconfiguration during AMP7 with a view to construct a new pumping station or alternative solution in AMP8.

4.416 Since September 2018, we have continued to engage our customers on our plans. We are confident this PC is in line with their views, with a stretching value for money target.

4.417 We undertook 12 focus groups across the whole of our region to understand their views on the risks to service in North East London. When shown our best assessment of the risks to water supplies in North East London, the view of most of our customers was that the risks are too high and need to be addressed quickly and comprehensively. The proposed resilience strategy over the next 25 years has been discussed with customers and was found to be highly valuable and in line with their views. Bill impacts to 2025, and beyond to 2045, were found to be affordable.

4.418 Overall customers saw the reduction in risk and benefits to be excellent value for money and they supported the proposals in full. Moreover, they would like to see mechanisms in place that allow for a speedy implementation and delivery.

4.419 We are currently proposing three schemes for further development within AMP7 with a gateway planned by December 2021 as a checkpoint for ensuring value for money for our customers before committing to construction.

4.420 In January 2019, we carried out supplementary customer research, which included customer views on the headline ODI RORE range. Fifty-three per cent of respondents thought the ODI bill impact range we proposed should stay broadly the same, seeing it as a fair balance between outperformance incentives and the potential increase on bills. Whereas, 44% of respondents indicated that the range should be amended. When comparing the ranges of all WASCs ours was most popular[109].

4.421 The ODI range that we submitted in September 2018 was weighted towards underperformance because we followed Ofwat's ODI formulae in almost all cases and our P10/P90 ranges have long tails towards underperformance in many cases.

4.422 In the Delivering Outcomes for Customers IAP feedback, numerous challenges are raised on the use of outperformance payments. However, in the Risk and Return IAP test area, Ofwat states:

4.423 "…while there is high quality and convincing evidence in the company's assessment of risk for the notional company in its RoRE analysis in the round, we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[110].

4.424 From a top-down perspective, we surmise that our selection of outperformance ODIs is consistent with customer preferences. Removing this incentive would be at odds with Ofwat's feedback on the risk and return IAP test area.

4.425 We agree that customers should be protected from excessive outperformance payments. We proposed to do this by:

- Agreeing to an overall sharing mechanism to protect customers, with customers sharing (50:50) RORE returns >3%; and
- Applying individual reward caps to PCs, such that no single measure exceeds 0.25% RORE (c.£15m) in any one year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important.

CS05 Sewage pumping station availability

[109] *TW-CSE-A1 What Customers Want , v13 final, March 2019*
[110] *Ofwat. Thames Water test area assessment, January 2019, Aligning risk and return, page 4.*

4.426 TMS.OC.A54 Sewage pumping station availability PC says: 'The company should provide further clarity on how the annual availability of the sewage pumping station will be measured and reported.'

4.427 The sewage pumping station availability PC aims to track the average annual asset availability of sewage pumps across our wastewater catchments.

4.428 The calculation is based on the percentage availability of all pumps in sewage pumping stations across our wastewater catchments that are reported and monitored in the Supervisory Control and Data Acquisition (SCADA) system. The calculation is made on a weekly basis and then averaged over the 52 weeks to give an annual average value every financial year.

4.429 The performance commitment includes all of our 2,600 large network sewerage pumping stations that are reported on the SCADA system. It excludes terminal sewage pumping stations within the boundary of our sewage treatment works; pumping stations where asset availability is not reported through SCADA, such as newly adopted S105a pumping stations with limited current real-time monitoring capability or telemetry and where the consequences of failure are generally low; and local package sewage pumping stations that are designed to protect individual properties from flooding following heavy rainfall.

4.430 Our performance commitment is to increase the annual average availability of sewage pumping stations to 98.5%. This will reduce the number and consequences of any pollution and flooding incidents resulting from sewage pumping station failures. It supports our long-term objectives of eradicating pollution incidents by 2050 and halving sewer flooding incidents by 2040.

4.431 We provided the evidence for this Required Action in the Performance Commitment Summary included with our September submission[111].

TMS.OC.A55 Sewage pumping station availability PC says: 'The company should provide further evidence to justify the use of outperformance payments for this ODI. Alternatively, the company should remove the outperformance payments.'

4.432 This performance commitment has a financial incentive which has been calculated in line with Ofwat guidance[112]. It is appropriate that we are incentivised to deliver our performance commitment in this area and that customers are compensated for benefits foregone for performance that is not delivered.

4.433 Customers showed strong support for a financial incentive and particularly an underperformance incentive, as they felt that sites being available should be the norm and, if not, then penalties should apply. There were some mixed views on outperformance incentive payments, which we chose to include because:

- we intend to go further if our assessment shows that it is cost beneficial for customers for us to do so;
- there is evidence that an outperformance payment incentive could drive innovation that benefits customers over the long-term; and
- customers have shown support for the target being stretching and want us to make more sites available.

[111] *Thames Water, CSD005-CS05 Pumping Stations Availability, September 2018.*
[112] *Ofwat: Delivering Water 2020: Our final methodology for the 2019 price review, December 2017.*

4.434 In January 2019, we carried out supplementary customer research, which included customer views on the headline ODI RORE range. Fifty-three per cent of respondents thought the ODI bill impact range proposed by Thames Water should stay broadly the same, seeing it as a fair balance between outperformance incentives and the potential increase on bills. Whereas, 44% of respondents indicated that the range should be amended. When comparing the ranges of all WASCs ours was most popular[113].

4.435 The ODI range that we submitted in September 2018 was weighted towards underperformance because we followed Ofwat's ODI formulae in almost all cases and our P10/P90 ranges have long tails towards underperformance in many cases.

4.436 In the Delivering Outcomes for Customers IAP feedback, numerous challenges are raised on the use of outperformance payments. However, in the Risk and Return IAP test area, Ofwat states:

4.437 "…while there is high quality and convincing evidence in the company's assessment of risk for the notional company in its RoRE analysis in the round, we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[114].

4.438 From a top-down perspective, we surmise that our selection of outperformance ODIs is consistent with customer preferences. Removing this incentive would be at odds with Ofwat's feedback on the risk and return IAP test area.

4.439 We agree that customers should be protected from excessive outperformance payments. We proposed to do this by:

- Agreeing to a sharing mechanism to protect customers, with customers sharing (50:50) for RORE returns >3%; and
- Applying reward caps to PCs, such that no single measure exceeds 0.25% RORE (£15m) in any one year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important.

4.440 We provided the evidence for this Required Action in the Performance Commitment Summary included with our September submission[115].

DS02 Surface water management

TMS.OC.A56 Surface water management PC says: 'The company should provide further evidence to justify the use of outperformance payments for this ODI and evidence of customer support for this approach.'

4.441 This performance commitment has a financial incentive which has been calculated in line with Ofwat guidance[116]. We have allowed for under-performance penalties and out-performance payments with end of AMP revenue adjustments.

4.442 A financial ODI is appropriate because it:

- customers want us to do more.
- is supported by customers;

[113] *TW-CSE-A1 - What Customers Want, v13 final, March 2019.*
[114] *Ofwat, Thames Water test area assessment, January 2019, Aligning risk and return, page 4.*
[115] *Thames Water, CSD005-CS05 Pumping Stations Availability, September 2018.*
[116] *Ofwat: Delivering Water 2020: Our final methodology for the 2019 price review, December 2017.*

- protects customers' interests;
- promotes efficiency;
- stretches our performance;
- is fair; and
- is transparent.

4.443 Customers and stakeholders have shown strong support for surface water management approaches – sustainable drainage systems in particular. An outperformance payment will allow us to go beyond our target of 65 hectares and deliver more schemes in partnership with Lead Local Flood Authorities and third parties. This incentive is therefore entirely justified.

4.444 An end of AMP revenue adjustment is appropriate because realising the benefitsis so dependent on completion of obligations by third parties. It is not in customers' interests for performance to be assessed earlier than the end of the AMP.

4.445 In January 2019, we carried out supplementary customer research, which included customer views on the headline ODI RORE range. Fifty-three per cent of respondents thought the ODI bill impact range proposed by Thames Water should stay broadly the same, seeing it as a fair balance between outperformance incentives and the potential increase on bills. Whereas, 44% of respondents indicated that the range should be amended. When comparing the ranges of all WASCs ours was most popular[117].

4.446 The ODI range that we submitted in September 2018 was weighted towards underperformance because we followed Ofwat's ODI formulae in almost all cases and our P10/P90 ranges have long tails towards underperformance in many cases.

4.447 In the Delivering Outcomes for Customers IAP feedback, numerous challenges are raised on the use of outperformance payments. However, in the Risk and Return IAP test area, Ofwat states:

"…while there is high quality and convincing evidence in the company's assessment of risk for the notional company in its RoRE analysis in the round, we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[118].

4.448 From a top-down perspective, we surmise that our selection of outperformance ODIs is consistent with customer preferences. Removing this incentive would be at odds with Ofwat's feedback on the risk and return IAP test area.

4.449 We agree that customers should be protected from excessive outperformance payments. We proposed to do this by:

- Agreeing to an overall sharing mechanism to protect customers, with customers sharing (50:50) RORE returns >3%; and
- Applying individual reward caps to PCs, such that no single measure exceeds 0.25% RORE (c.£15m) in any one year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important.

[117] *TW-CSE-A1, What Customers Want v13 (final), March 2019.*
[118] *Ofwat, Thames Water test area assessment, January 2019, Aligning risk and return, page 4.*

4.450 We provided the evidence for this Required Action in the Performance Commitment Summary included with our September submission[119].

DW02 Security of supply index SoSI

TMS.OC.A57 Security of supply index SoSI PC says: 'The company should provide further information on why the rate is notably smaller than the comparable PR14 measure and why the rate is in the best interest of its customers.'

4.451 As we have introduced an additional PC for per capita consumption, the scaling between this measure and SOSI means that the PR19 rate is lower than the PR14 rate.

4.452 Please refer to section BW05 Per capita consumption above and our response to Action TMS.OC.A18 for further information about per capita consumption scaling.

DWS01 Power resilience

TMS.OC.A58 Power resilience PC says: 'The company should revise the definition so that its headline measure is clear to customers, (would a measure based on the percentage of total sites be more readily understandable?) and, in any case, provide clarity on the basis of the three hour resilience threshold and how the resilience of the sites is assessed.'

4.453 The proposed performance commitment is defined as the number of key power-dependent sites that are resilient to power disturbances or interruptions over three hours from the distribution network operators up to the end of AMP7.

4.454 To provide a performance commitment that is clear to customers and was not significantly affected by changes that we could not reasonably predict, we propose a numeric measure of an increase in the number of key power-dependent sites made more resilient. Feedback from customers showed they felt that delivery of a set number of sites for this performance commitment was totally within our control. They also understood that the risk of power outages may change within the planning period.

4.455 We operate many thousands of sites that are dependent to a greater or lesser extent on the power supply from the power transmission/distribution network. Resilience of the systems to disruptions that affect customer service is provided by a mix of approaches of which the security of the power supply is only one component. A water treatment works may have the hydraulic capacity to gravity feed through the works for a limited time before filter beds have to be taken out of service to maintain water quality. There may be interconnectivity in the water supply system that could provide alternative sources of water to customers. A gravity sewerage system will have a level of hydraulic capacity and therefore a time before complete failure of a pumping station through power loss would cause an internal or external flood. The level of risk to customer service caused by a disruption or interruption of the power supply is also dependent on the customer service or weather demands on the system.

[119] *Thames Water, CSD005-DS02 – Surface Water Management, September 2018.*

4.456 To provide a Performance Commitment that reflected the effect the disruption or interruption of the power supply has on the resilience of the system, a process called PAFLI (probability of asset failure leading to customer impact) was used. The number of customers that would be affected, and type of that impact, were also assessed. This allowed the sites where disruption or interruption of the power supply would have significant customer impact to be identified.

4.457 The sites were then prioritised based on the customers' willingness to pay to improve resilience and the cost required to make the sites resilient. This identified the key power-dependent sites.

4.458 The key power-dependent sites consist of water and sewage treatment works, and water booster stations and sewerage pumping stations with greater than 500 kW installed power and water booster stations without standby generation and with more than 200 directly fed properties.

4.459 The key power dependent sites were assessed to understand the number of customers and type of impact over different time periods after a power disturbance or interruptions. For example, the water treatment works without alternative power supplies could operate under gravity feed for three hours before filter beds would have to be taken out of service to maintain water quality with the reduced throughput. The Band five sewerage pumping station (stations with greater than 500 kW installed power) on the whole would not cause customer flooding in the first three hours after power disturbances or interruptions. The bulk of the directly fed properties would suffer reduced pressure over the first three hours rather than interruption to supply. In each of the cases the customer impact rises significantly after three hours. A three hour threshold is therefore proposed for this performance commitment.

TMS.OC.A59 Power resilience PC says: 'The company should provide further evidence to justify the end-of-period incentive proposed for this PC, or propose to apply incentives in-period.'

4.460 The maximum resilience benefitsfrom the power resilience enhancements in integrated system,are obtained when delivered alongside other work at the sites or on the systems. To allow for the flexibility of delivery date needed to integrate with the other works on a site or system an end-of-period incentive for this performance commitment is proposed.

DWS02 SEMD - securing our sites

TMS.OC.A61 SEMD - Securing our sites PC says: 'The company should consider the proposed ODI rates and either increase the underperformance rates in line with customer evidence so that the ODI rates provide sufficient incentive or provide further evidence in support of the existing rate. In either case the company should set out the evidence and rationale.'

4.461 Detailed evidence and rationale for our SEMD ODI underperformance rates was provided in the Performance Commitment Summary document[120].

4.462 SEMD (Security and Emergency Measures Directive, 1998) compliance is audited every 12 months on behalf of Defra, to complement the six monthly Defra reporting process, for progress against plan and costs.

4.463 A selection of sites is also audited for continuing compliance by an independent specialist auditor on the Register of Security Engineers and Specialists (RSES) and their reports are sent to Defra.

[120] *Thames Water, CSD005 - DSW02, SEMD Securing Our Sites, September 2018, section 5: 'Design of the ODI'.*

4.464 Compliance with Advice Notes (ANs) is a legislative requirement, which will provide our customers with a safe and reliable water service, which in turn aligns with our water and wastewater strategies. With regard to security, our long-term strategy is to comply with the ANs in as cost effective a manner as possible. The risk profile, against which we determine the measures to employ to meet the ANs is frequently reviewed to take into account the level of threat posed and the impact of a security incident at site or asset level. We will continue to review and revise our risk profile to ensure we are targeting our investment in line with actual threats and likely impact so we maintain an economic and efficient level of investment.

4.465 Our customers want a secure service now and in the future that is not vulnerable to impact from criminal activities. Customers think this is an important area and were happy for the measure to be included in the business plan. This is an important area as in recent years customers have become more aware of the potential for disruptive criminal and terrorist activities.

4.466 They have confidence that this is work that we would do anyway and therefore it is in our interests to complete the programme. Therefore, they thought a reputational-only incentive was adequate.

4.467 In our April Business Plan, our Totex is limited to the programme that is clearly defined and costed in our plan at this stage. As additional scope is defined and agreed with DEFRA, this will form part of a cost adjustment subject to gateway and will result in an RCV adjustment at the end of the AMP.

4.468 The Totex allowance for this performance commitment is ring-fenced in our business plan. This means that the programme may be re-prioritised, but the allowed Totex will be spent on prioritised security Advice Notes in line with this performance commitment. Therefore, we do not have to compensate customers for the benefits foregone as a result of a reduction in Totex, as Advice Notes to the value of the allowed Totex in the plan will be delivered. If there is a delay in programme outputs, the expenditure is ring-fenced and will be spent in the following AMP.

4.469 However, in acknowledgement that we have in the past not been able to deliver the full programme within the AMP period, in the event that the full Totex allocation is not effectively used for security measures, we believe that customers should be compensated for the benefits that have been delayed.

4.470 Therefore, the Outcome Delivery Incentive is an end of AMP7 revenue adjustment based upon the incremental costs to customers for expenditure that has been delayed to the following AMP.

4.471 We have not followed Ofwat's standard formula to set penalty rates, as the variation in costs between different types of projects means this could inadvertently drive behaviour that is not in customers' interests. Due to the current lack of standardised costs per site and the changing requirements from Defra for standards for solutions, the output quantities and sites for individual sections of work will be renegotiated on an ongoing basis.

4.472 This will be based upon the summation of annual assessments for years one to four of AMP7 and forecast position for the final year of AMP7. The assessment will be subject to independent scrutiny and assurance.

4.473 We are setting a penalty rate for SEMD compliance to ensure that customers are compensated for delays in delivering the SEMD programme.

4.474 Further details on the calculation, individual solution costs and cost sharing can be found in the SEMD Performance Commitment Summary document[121] and our SEMD update document[122].

[121] *Thames Water, CSD005-SW02, SEMD Securing Our Sites, September 2018,Section 5 'Design of the ODI'.*
[122] *TW-OC-A5 SEMD PC update, April 2019.*

TMS.OC.A62 SEMD - Securing our sites PC says: 'The company should clarify whether it proposes to apply an underperformance collar to this PC. If it does propose to apply a collar, the company should provide a convincing justification for why a collar is necessary. This should include justification for the level at which the collar is set, with the company explaining how this compensates customers adequately for poor service performance.'

4.475 We have not applied a dead band or a penalty collar for this PC. However, the size of any penalty in the AMP is limited by the physical size of the agreed programme with Defra.

ER01 Unregistered household properties

TMS.OC.A63 Unregistered Household Properties PC says: 'The company should provide further evidence to justify the use of a non-financial incentive by demonstrating why a financial incentive would not be in the interests of customers.

'Alternatively, the company should formulate a financial ODI reflecting the reduction in customer bills that would result from an improvement in the identification of gap sites.'

4.476 We have reflected on the IAP feedback and are now applying a financial incentive to this PC.

4.477 We reviewed the feedback that customers provided in June 2018. This showed that, with regards to incentive type, customers have mixed views, with some preferring underperformance only, and others saying outperformance and underperformance was appropriate, because additional verification could benefit customers (in terms of bill impact)[123].

4.478 We are therefore now proposing a financial (underperformance only) ODI with an in-period incentive.

4.479 The PC that we are proposing is a process-related commitment and we do not have customer willingness to pay information. Our incentive is therefore based on the cost of delivery, with the incentive designed to ensure that the penalty is maximised to equal any expected benefit.

4.480 We estimate the costs of running this process to be as follows:

Table 72: Costs related to managing unregistered household properties

Cost item	Explanation	Cost per year	Estimated cost over AMP
FTE cost – data manipulation	*Dedicated team of 3-4 FTE engaged to manipulate and analyse external data to identify gaps leads*	£30K	£150K
	Process to take place on a quarterly basis		
	Forecast timeframe of 3 weeks per quarter to conduct analysis		

[123] *Thames Water, TSD019-CR27 PCs and ODIs, September 2018.*

FTE cost – properties in to charge	*Resources to process the gap sites (as per BAU)*	£12K	£60K
External data cost	*Estimated cost of external data (3 sources)*	£30K	£150K
Bad debt cost	*Revenue not collected on new the properties billed*	£170K	£850K
	Taking in to account assumed year 2 collection		
Billing	*Cost to bill forecasted gap sites to be identified*	£26K	£132K
Total		**£268k**	**~£1.4M**

Source: Thames Water

4.481 As explained in the Performance Commitment Summary for this performance commitment[124] that we submitted in September 2018, it is impossible to know the exact number of unregistered properties we will find each year as a result of this process. However, in order to calculate a proposed benefit, we have made an assumption based on our previous maximum number of gap sites found in a year (ca. 1100) and added an assumed uplift to provide a maximum number of sites found of 1500.

4.482 We are assuming that a gap site is a property that has remained unbilled for a period of one year. Therefore, our calculation is based on lost revenue for 1500 sites at an average bill value of £405 (19/20 at outturn prices). However, our previous experience tells us that only 68% of these sites are actually converted to billing (e.g. because it is a duplication). We have also applied a 45% collection rate, which is in line with the rate we see for our empty properties (voids).

4.483 We have used these figures to calculate the benefits of this process as follows:

Table 73: Additional revenue forecast from addressing unregistered households

Benefit item	Explanation	Benefit per year	Estimated Benefit over AMP
Additional revenue billed and collected through increased connected properties	•*Forecast average of 1500 HH gaps identified each year (based on previous performance and assumed uplift)*	£211k	£1053k
	•*Conversion rate from data: 68% (as per current empty property process)*		
	•*Collection rate: 51% (as per current empty property process)*		
	•*Avg bill figure: £405*		

Source: Thames Water

Table 74: Benefits of unregistered household process

Marginal benefit £m	Marginal cost £m	Totex sharing ratio	Penalty only £m
0.210681	0.268400	0%	0.210681

[124] *Thames Water, CSD005 - ER01 Unregistered Household Properties, September 2018.*

Source: TW-OC-A12-ODI Business Plan ODI Model and Thames Water App1

4.484 As can be seen, the cost of delivery of this process exceeds the benefit that we might expect. This is a retail performance commitment and therefore the Totex cost sharing mechanism is set to zero. Therefore, the Ofwat formula reverts to a marginal benefit only formula.

4.485 We will verify by means of independent audit whether the process has been completed satisfactorily. In years where we do not pass this audit and are not deemed to be delivering the process, customers will be compensated for the benefits lost and the penalty will be equal to the marginal benefit that should have been delivered.

4.486 This means that customers will not be disadvantaged if we fail to complete our gap site verification process.

Table 75 : Calculation of penalty rate for App1. CPIH inflation calculated based on data in App23.

Marginal benefit £m	Marginal cost £m	Totex Sharing ratio	Penalty only £m	P90 reward	P10 Penalty	P99 reward	P1 penalty
0.210681	0.268400	0%	0.210681	0	0.211	0	0.421

Source: Thames Water internal analysis

ER02 Empty household properties

TMS.OC.A64 Empty household properties PC says: 'The company should provide further evidence to justify the use of a non-financial incentive by demonstrating why a financial incentive would not be in the interests of customers'.

'Alternatively, the company should formulate a financial ODI reflecting the reduction in customer bills that would result from a reduction in the proportion of occupied properties classified as voids.'

4.487 We have reflected on the IAP feedback and are now applying a financial incentive to this PC.

4.488 We have reviewed the feedback that our customers provided in June 2018. This showed that, with regards to incentive type, customers had mixed views, with some preferring underperformance-only and others saying outperformance and underperformance was appropriate, because additional verification could benefit customers (in terms of bill impact)[125].

4.489 We are therefore now proposing a financial (out and underperformance) ODI with an in-period revenue incentive, reflecting the reduction in customer bills that would result from a reduction in the proportion of occupied properties classified as voids. We are basing this on the Residential Retail element of the customer bill, in order to reflect the allocation to price control and the fact that the Wholesale element is limited by the Wholesale revenue cap.

[125] *Thames Water, TSD019-CR27 PCs and ODIs, September 2018.*

4.490 We have based our calculation on the directly-billed proportion of our customer base, despite the fact that our overall empty property percentage target is based on our total property base (i.e. including those billed on our behalf by water-only companies). This reflects both the fact that only this element is directly within our control, as well as the fact that water only companies are already proposing financial ODIs around their empty (void) properties. There is therefore the danger of duplication, which is not in the interests of customers.

4.491 We have made the following assumptions when calculating our ODI rate:

- Each empty property results in a year's worth of lost revenue – based on forward projections of our average combined bill in that year;
- Collection rates for empty household properties have historically been lower than our collection rate overall; we have therefore applied a multiplier of 45% to reflect this; and
- Finally, the ODI is based on the Residential Retail element of the customer bill (11%), in order to reflect the fact that the Wholesale element is limited by the Wholesale revenue cap.

4.492 This results in the following calculations:

Table 76: Empty household properties supporting calculations

	2020/21	2021/22	2022/23	2023/24	2024/25
Total Directly billed Residential Property Population (from table R1)	3,583,401	3,631,836	3,677,720	3,723,765	3,762,746
PC target - percentage empty household properties (from table App1)	3.75%	3.75%	3.63%	3.63%	3.60%
Total number of empty properties (line 1 x line 2)	134,378	136,194	133,501	135,173	135,459
Average bill per property	**407.1**	**415.4**	**424.0**	**432.5**	**441.1**
Total value of average bill for empty properties	£54,711,070	£56,573,178	£56,605,753	£58,459,673	£59,755,486
Total value of average bill for 0.1% of empty properties	£1,458,962	£1,508,618	£1,559,387	£1,610,459	£1,659,875
45% collection rate	£656,533	£678,878	£701,724	£724,707	£746,944
Retail proportion of bill (@11%)	£72,219	£74,677	£77,190	£79,718	£82,164

Source: Thames Water internal analysis

4.493 Ofwat requires the overall reward/penalty to be expressed in 2017/18 prices. We have therefore deflated the figures above by a CPIH factor taken from table App23.

Table 77 :Empty household properties outperformance and underperformance rates

Marginal benefit £m	Marginal cost £m	Penalty rate £m/unit	Reward rate £m/unit
0.071838	0.071838	0.07	0.07

Source: Thames Water App1

Table 78: Empty household properties P10 and P90 ranges

	2020/21	2021/22	2022/23	2023/24	2024/25	Sum 2020-2025
p10	3.90	3.90	3.78	3.78	3.75	
p90	3.60	3.60	3.48	3.48	3.45	
Target	3.75	3.75	3.63	3.63	3.60	
£m p10 penalty	0.01078	0.01078	0.01078	0.01078	0.01078	0.0539
£m p90 reward	0.01078	0.01078	0.01078	0.01078	0.01078	0.0539

Source: Thames Water DT01 App1

4.494 As our PC target is expressed to two decimal places. We will round up or down as appropriate when calculating the appropriate ODI.

ES02 Environmental measures delivered (wastewater)

TMS.OC.A65 Environmental measures delivered (wastewater) PC says: 'The company should revise the definition of the PC to provide appropriate incentives for the company to deliver the statutory programme of schemes. Changes in cost allowances will be considered through the cost adjustment mechanism.'

4.495 Details of the definition of this PC and an explanation of the ODI design were provided in our September 2018 submission in the Performance Commitment Summary document[126].

4.496 Beyond the ODI and totex incentive mechanism, we are unaware of any other cost-adjustment mechanisms. The ODI we proposed already accounts for the ODI sharing rate with a rate of:

- (1- Totex $sharing\ rate$) * allowed costs reduced as a function of net agreed scope reduction and
- (1- Totex $sharing\ rate$) * allowed costs reduced as a function of net agreed scope increase

4.497 This therefore does not duplicate any cost adjustment mechanism we are aware of. It enables full cost recovery for additional regulatory requirements confirmed beyond those in our plan, and full customer protection should schemes no longer be required.

[126] *Thames Water, CSD005 – ES02, Environmental Measures Delivered (wastewater),September 2018.*

4.498 We disagree that this is not an appropriate incentive. Failure to deliver schemes would incur the same ODI adjustment - 100% of the associated totex penalty through a combination of the Totex sharing rate and the ODI itself. We are also legally bound to deliver these schemes; failure to deliver them would put us in breach of the various pieces of environmental legislation underpinning them, most likely leading to enforcement action taken against us. Furthermore, our performance for this investment area forms part of the Environment Agency (EA)'s Environmental Performance Assessment (EPA) which is published annually with material reputational damage for non-delivery. We have publicly stated our aim to reach and maintain a position as a 4* company under EPA before the end of AMP6. As such, we do not believe there is need for a further incentive to deliver the programme.

4.499 We do recognise that this proposed ODI does not offer incentives for outperformance. Our customers and stakeholders have told us that they do not wish for us to be rewarded for delivering our legal obligations and, as such, we have not proposed any outperformance incentives. By definition, any scope that qualifies to be under this enhancement case is legally required.

4.500 The EA have previously stated they would accept companies receiving rewards for early delivery of schemes compared to their regulatory deadline. We believe, however, that we should not be rewarded for profiling schemes to start early, as that will be necessary to deliver the programme, regardless of incentive.

TMS.OC.A66 Environmental measures delivered (wastewater) PC: The company should provide further evidence to justify the use of outperformance payments for this ODI including the additional benefit to customers resulting from outperformance and evidence of customer support for this approach.

4.501 A full explanation of this PC and evidence of the need for outperformance payments was provided in our September 2018 submission in the Performance Commitment Summary document[127].

4.502 In the context of these PCs, outperformance relates to delivering more environmental measures or benefit than required and specified on the WINEP. As any scope that qualifies to be under this enhancement case is legally required and will therefore be added to the WINEP, there is very limited scope for outperformance. Consequently, we are not proposing an outperformance payment for this PC in line with our customer and stakeholder preferences.

4.503 The proposed ODI is principally designed as a full cost-adjustment mechanism to account for the uncertainty around the plan, adjusting the totex allowance (as an RCV adjustment) to match the final confirmed list of obligations. We do not consider changes made to the scope this way should be considered as under- or outperformance. We would not stand to gain or lose from adjustments to scope made by our environmental regulators.

TMS.OC.A67 Environmental measures delivered (wastewater) PC says: 'The company should provide evidence to justify how its ODI rates are reflective of customer valuations once inputs are obtained'.

The company should provide evidence to justify and clearly demonstrate the calculations for the ODI rates.

4.504 A full explanation of the ODI rates for this PC was provided in our September 2018 submission in the Performance Commitment Summary document[128].

4.505 As our proposed ODI is designed to provide a cost-neutral cost adjustment mechanism to account for the uncertainty around the programme, we have not sought to set rates based on customer valuations. Setting rates on customer valuations would cause unintended consequences:

[127] *Thames Water, CSD005 - ES02 Environmental Measures Delivered (wastewater), September 2018.*
[128] *Thames Water, CSD005 - ES02 Environmental Measures Delivered (wastewater), September 2018.*

- Changes in scope for schemes that have positive cost-benefit would result in either excess totex being awarded for scope increases, or excess totex returned for scope decreases.
- Changes in scope for schemes that have negative cost-benefit would result in either insufficient totex being awarded for scope increases, or insufficient totex returned for scope decreases.
- A very significant proportion of the measures in this investment area have indirect customer benefit; they are for installing monitors or conducting investigations. As such, it would not be possible to ascribe customer valuations at an acceptable level of confidence.

4.506 We are not proposing any additional incentive beyond the cost adjustment mechanism component. This is a very similar approach to the one we are currently and successfully employing to manage uncertainty and protect customers in AMP6.

ES04 Compliance with bioresource environmental permits

TMS.OC.A68 Compliance with bioresource environmental permits PC says: 'The company should provide a further evidence to justify the use of outperformance payments for this ODI and evidence of customer support for this approach.'

4.507 We have removed this PC from our plan, because the Environment Agency has now provided certainty that the Industrial Emissions Directive does apply to sludge treatment centres, and therefore we no longer need a mechanism to protect customers should a site not require a permit.

ET01 Readiness to receive tunnel flow at Beckton

TMS.OC.A69 Readiness to receive tunnel flow at Beckton STW PC says: 'The company should clarify the benefits of the level of stretch presented in the plan and that this level of stretch is in the interests of its customers and key stakeholders, such as Tideway'.

4.508 Please refer to our update on the TTT price control[129] for further information and evidence in response to these Required Actions.

TMS.OC.A70 Readiness to receive tunnel flow at Beckton STW PC says : 'The company should provide further evidence to demonstrate and justify the calculation of this ODI rate.'

4.509 Please refer to our update on the TTT price control[130] for further information and evidence in response to these Required Actions.

ET02 Effective stakeholder engagement

TMS.OC.A71 Effective stakeholder engagement PC says: 'The company should provide clear evidence of how the proposed levels are stretching and include evidence of customer support for these levels from its customer engagement . If the company cannot do this it should improve the proposed service levels.'

[129] *TW-CE-A17 TTT Price Control Update, April 2019.*
[130] *TW-CE-A17 TTT Price Control Update, April 2019.*

4.510 Please refer to our update on the TTT price control[131] for further information and evidence in response to these Required Actions.

ET03 Timely return to customers from land sales

TMS.OC.A72, TMS.OC.A73, TMS.OC.A74 TMS.OC.A75 TMS.OC.A76 say: 'Timely return to customers from land sales PC says: 'The company should revise the definition of the PC to ensure that it addresses the concerns we provided in July 2018'

'The company should also provide further evidence to clarify the following:

1) The programme, as well as the interlinkages with the other Tideway Tunnel measures.
2) The dependencies on the Tideway system commissioning date.
3) The evidence around customers not supporting speculation with the value of the land
4) What happens if no land is released and therefore none is sold, in any year'

4.511 Please refer to our update on the TTT price control[132] for further information and evidence in response to these Required Actions.

TMS.OC.A77, TMS.OC.A78, TMS.OC.A79 TMS.OC.A80

Timely return to customers from land sales PC say:

1) 'The company should revise the PC, ensuring that it clearly explains why it is stretching.
2) The company should demonstrate customer and key stakeholder, such as Tideway, support for the proposed method of assessing stretch for this PC as well as the levels of stretch for the PC targets.
3) The company should provide:

'Sufficient clarity on the interdependencies with the other Thames Tideway PCs. In particular the timing of any land releases with respect to the system commissioning readiness on a site by site basis, should be made clear. Additionally, the company should consider revising the PC to ensure outperformance payments are contingent on 100% of all the land being sold within a specified time.

4. There company should include an incentive to promote early hand back of sites from Tideway to Thames and subsequent disposal of land.'

4.512 Please refer to our update on the TTT price control[133] for further information and evidence in response to these Required Actions.

ET04 Establish an effective system operator for the London Tideway Tunnels

[131] *TW-CE-A17 TTT Price Control Update, April 2019.*
[132] *TW-CE-A17 TTT Price Control Update, April 2019.*
[133] *TW-CE-A17 TTT Price Control Update, April 2019.*

TMS.OC.A81, TMS.OC.A82, TMS.OC.A83, TMS.OC.A84

Establish an effective system operator for the London Tideway Tunnels (LTT) PC says: 'The company should revise the definition of the PC to ensure that the interlinkages with the other Tideway Tunnel measures are clearly spelt out.

'The company should revise the scope for this PC to ensure that it is more representative of the company's overall readiness and ensure that assets and systems are sufficiently considered. The company should include the following targets or provide compelling evidence why these would not be appropriate and in the best interests of customers:

1) 'Completion and delivery against an Integrated Operating Plan, setting out how the company will operate the London Tideway Tunnel assets in a timely, coordinated and integrated manner, and in compliance with relevant environmental permits, consents and London Tideway Tunnel operating techniques.
2) 'Demonstrate that critical assets are ready to operate in compliance to the London Tideway Tunnels Operating Techniques and support timely system commissioning.
3) 'Report readiness in line with the Tideway Tunnel Interface Agreement.'

TMS.OC.A85, TMS.OC.A86

Establish an effective system operator for the London Tideway Tunnels (LTT)

PC say: 'The company should revise the rates to reflect the impact upon Tideway's costs, which would ultimately be passed through to customers, as well as the need to incentivise the company appropriately to ensure completion of critical work and activities.

'The company should provide further evidence to justify the ODI underperformance rate proposed and demonstrate the calculations used to formulate these rates.

'Including explanation of how this would impact Tideway's costs and therefore subsequently customers.'

4.513 Included with our April resubmission, we have produced an update on the TTT price control[134] that provides further information and evidence to show how the proposed levels are stretching.

4.514 The document explains how we will:

- Complete and deliver against an Integrated Operating Plan, setting out how we will operate the London Tideway Tunnel assets in a timely, coordinated and integrated manner, and in compliance with relevant environmental permits, consents and London Tideway Tunnel operating techniques.
- Demonstrate that critical assets are ready to operate in compliance to the London Tideway Tunnels Operating Techniques and support timely system commissioning.
- Report readiness in line with the Tideway Tunnel Interface Agreement

EW02 Environmental measures delivered (water)

[134] TW-CE-A17 TTT Price Control Update, April 2019.

TMS.OC.A87 Environmental measures delivered (Water) PC says: 'The company should revise the definition of the PC to provide appropriate incentives for the company to deliver the statutory programme of schemes. Changes in cost allowances will be considered through the cost adjustment mechanism.'

4.515 Details of the definition of this PC and an explanation of the ODI design were provided in our September 2018 submission in the Performance Commitment Summary document[135].

4.516 Beyond the ODI and totex incentive mechanism, we are unaware of any other cost-adjustment mechanism. The ODI we proposed already accounts for the ODI sharing rate with a rate of:

- (1- Totex $sharing\ rate$) * allowed costs reduced as a function of net agreed scope reduction

  and

- (1- Totex $sharing\ rate$) * allowed costs reduced as a function of net agreed scope increase

4.517 This therefore does not replicate any cost adjustment mechanism we are aware of. It enables full cost recovery for additional regulatory requirements confirmed beyond those in our plan and full customer protection should schemes no longer be required.

4.518 We disagree that this is not an appropriate incentive. Failure to deliver schemes would incur the same ODI adjustment - 100% of the associated totex penalty through a combination of the Totex sharing rate and the ODI itself. We are also legally bound to deliver these schemes; failure to deliver them would put us in breach of the various pieces of environmental legislation underpinning them, most likely leading to enforcement action taken against us. Furthermore, our performance for this investment area forms part of the EA's Environmental Performance Assessment (EPA). This is published annually with material reputational damage for non-delivery. We have publicly stated our aim to reach and stay as a 4* company under EPA before the end of AMP6. As such, we do not believe there is need for further incentive to deliver the programme.

4.519 We do recognise that this proposed ODI does not offer incentives for outperformance. Our customers and stakeholders have told us that they do not wish for us to be rewarded for delivering our legal obligations. As such, we have not proposed any outperformance incentives, as by definition any scope that qualifies to be under this enhancement case is legally required.

4.520 The EA have previously stated they would accept companies receiving rewards for early delivery of schemes compared to their regulatory deadline. We believe, however, that we should not be rewarded for profiling schemes to start early as that will be necessary to deliver the programme, regardless of incentive.

TMS.OC.A88 Environmental measures delivered (Water) PC: The company should provide further evidence to justify the use of outperformance payments for this ODI including the additional benefit to customers resulting from outperformance and evidence of customer support for this approach.

4.521 A full explanation of the need for an outperformance payment for this PC was provided in our September 2018 submission in the Performance Commitment Summary document[136].

4.522 In the context of this PC, outperformance relates to delivering more environmental measures or benefit than required and specified on the WINEP. As any scope that qualifies to be under this enhancement case is legally required and will therefore be added to the WINEP, there is very limited scope for outperformance. Consequently, we are not proposing an outperformance payment for this PC in line with our customer and stakeholder preferences.

[135] Thames water, CSD005 EW02, Environmental Measures Delivered (water), September 2018.
[136] *Thames Water, CSD005 - ES02, Environmental Measures Delivered (water), September 2018.*

4.523 The proposed ODI is principally designed as a full cost-adjustment mechanism to account for the uncertainty around the plan, adjusting the totex allowance (as an RCV adjustment) to match the final confirmed list of obligations. We do not consider changes made to the scope this way should be considered as under- or outperformance. We would not stand to gain or lose from adjustments to scope made by our environmental regulators.

TMS.OC.A89 Environmental measures delivered (Water) PC: The company should provide evidence to justify how its ODI rates are reflective of customer valuations once inputs are obtained. The company should provide evidence to justify and clearly demonstrate the calculations for the ODI rates.

4.524 A full explanation of the ODI rates for this PC was provided in our September 2018 submission in the Performance Commitment Summary document[137].

4.525 As our proposed ODI is designed to provide a cost-neutral cost adjustment mechanism to account for the uncertainty around the programme, we have not sought to set rates based on customer valuations. Setting rates on customer valuations would cause unintended consequences:

- Changes in scope for schemes that have positive cost-benefit would result in either excess totex being awarded for scope increases, or excess totex returned for scope decreases.
- Changes in scope for schemes that have negative cost-benefit would result in either insufficient totex being awarded for scope increases, or insufficient totex returned for scope decreases.
- A very significant proportion of the measures in this investment area have indirect customer benefit; they are for installing monitors or conducting investigations. As such, it would not be possible to ascribe customer valuations to these at an acceptable level of confidence.

4.526 We are not proposing any additional incentive beyond the cost adjustment mechanism component. This is a very similar approach to the one we are currently and successfully employing to manage uncertainty and protect customers in AMP6.

EWS01 Enhancing biodiversity

TMS.OC.A90 Enhancing biodiversity PC says : 'The company should provide evidence of why the proposed PC levels are sufficiently stretching and further evidence of customer support for the proposed levels of stretch. The company should also provide explanation on why it did not evaluate the proposed stretch against all the approaches for challenging stretch as required by the PR19 methodology.'

4.527 In our June 2018 research, we acknowledge that customers were unsure whether our target is adequately stretching, as they had difficulty understanding how material a biodiversity unit is. We will need to address this in future engagement.

4.528 This PC is defined as the net gain in biodiversity at our 253 Sites of Biodiversity Interest (SBI's) plus any net change from additional land where specific biodiversity offsetting has been implemented. Further detail is given in Section 7, Annex 3 of this document.

4.529 This is a new bespoke PC that supports our outcome to 'be a responsible company'. It is part of our response to address one of the outcome's key themes - to protect and enhance the environment.

[137] *Thames Water, CSD005 - ES02, Environmental Measures Delivered (water), September 2018.*

4.530 This measure is a water industry first, so there are no historical or inter-company comparisons.

4.531 We are committing to increase the total number of biodiversity units on our SBIs and offsetting sites by 2,455 (5%), from a baseline of 49,110 at the end of AMP6 to 51,565 at the end of AMP7. We believe that this target is stretching as our investment specific to enhancing habitats will be 10% higher in AMP7 compared with AMP6. The will be achieved alongside significant population growth and climate change.

4.532 Our key activities to deliver this performance commitment have been selected because they prioritise investment, mitigate risk and expand on previous initiatives. They have customer support, help comply with wildlife legislation and demonstrate our role in society.

4.533 In AMP7, we intend to invest £2.1m to enhance customer engagement in biodiversity on our sites, plant trees as longer-term enhancements, maintain and improve priority habitats and to survey and mitigate the impact of invasive species. The activities are all intended to enhance the biodiversity value of habitats, which will in turn correlate with an improvement in the "condition" of these habitats. An increase in condition will equate to an increase in biodiversity units for a defined area of habitat.

4.534 We will need to innovate to deliver our target, including enhanced partnerships with our leaseholders and communities; using modern social media and other communication channels to better engage customers and communities; employing technology such as drones to assess and monitor biodiversity at our SBIs using remote sensing techniques; and developing a cutting edge protocol/tool to quantitatively measure the impact of our actions on the environment.

4.535 The targets that we have set within this performance commitment are the most appropriate at this time as they are cost beneficial and stretching to help motivate and facilitate continuous improvement and innovation. The targets are supported by customers and align with our long-term aspiration to positively benefit biodiversity on our landholdings and the wider environment.

4.536 The Performance Commitment Summary document[138] for this PC included with our September Business Plan explains why our proposed levels are stretching.

EWS02 Smarter Water Catchments

TMS.OC.A91 Smarter Water Catchment Initiatives PC says: The company should provide a further evidence to justify the use of outperformance payments for this ODI and evidence of customer support for this approach.

4.537 Evidence and justification of the need for outperformance payments for this PC was provided in our September submission in the Performance Commitment Summary[139].

In developing this ODI we have not deviated from Ofwat guidance. We have set the ODI to be financial and in-period. We have allowed for under- and out-performance payments using annual revenue adjustments. A financial ODI is appropriate for Smarter Water Catchment Initiatives because it:

- is supported by customers
- protects customers' interests
- promotes efficiency

[138] *Thames Water, CSD005-EWS01 Enhancing biodiversity, September 2018.*
[139] *Thames Water, CSD005-EWS02 Smarter Water Catchment, September 2018.*

- stretches our performance
- is fair
- is transparent
- customers want us to do more

4.538 The addition of further catchments could only be accommodated with the provision for outperformance payments in the definition of this ODI. The totex mechanism would only enable part of the necessary funds to deliver this, and the outperformance payments are designed as a mechanism to facilitate the remaining necessary funds, not to enable us to profit from expanding the number of schemes. Evidence is presented to demonstrate customer support for catchment management as an option for provision of water resources and for wider environmental improvements, and recognition of the approach as a first of its kind by leading environmental NGO's Evidence is also presented to explain that, in reality, there will be a natural cap on the expansion of this initiative (1-2 more catchments) which will protect customers from substantially greater additional expense.

4.539 The Smarter Water Catchments initiative has purposefully selected three catchments which are representative of the different types of challenges and environments that we face as a business. They span from a truly rural setting where agricultural land management plays a large factor, to a rare chalk stream experiencing low flows and finally a diverse urban environment in west London with a different set of complex issues. Work has already begun to establish the relationships necessary to deliver the initiative in each of the three selected catchments – Evenlode, Chess and Crane. This enhanced profile has already stimulated further requests for additional catchments to be included in the initiative, for example the River Brent. The addition of further catchments could only be accommodated with the provision for outperformance payments in the definition of this ODI. The totex mechanism would only enable part of the necessary funds to deliver this, and the outperformance payments are designed as a mechanism to facilitate the remaining necessary funds, not to enable us to profit from expanding the number of schemes.

4.540 While there is no current intention to extend the initiative to include further catchments, it is possible that, as the initiative progresses, data gaps may be revealed that cannot be filled through the work in the three selected catchments. Given that the purpose of the initiative is to build the evidence base from which to demonstrate where application of the Catchment-Based Approach is an effective and efficient mechanism for delivery of environmental improvements throughout the area served by Thames Water, the facility to add further catchments to fill these data gaps would be beneficial.

4.541 Our customers reference that the river environment is not just the river itself but the area around it as well[140]. Given that they support activities that enhance the environment[141] and value improving river water quality[142], it follows that they would be supportive of an approach that did just that, by going above and beyond to fill any outstanding evidence gaps regarding the efficacy of a Catchment-Based Approach which led to multiple societal and environmental outcomes.

[140] *CSD002 – PR19 – "What customers want" p.83.*
[141] *CSD002 – PR19 – "What customers want" p.82.*
[142] *CSD002 – PR19 – "What customers want" p.77.*

4.542 With respect to the provision of water resources, customers have explicitly said that they prefer Catchment Management as this option provides wider benefits to the environment, and that we should consider collaborating with other organisations in order to deliver this[143]. Subsequently, this initiative has gained additional support from environmental NGOs and has been recognised as a stand-out innovative initiative for protecting and restoring our river catchments[144]. As a first of its kind in the water industry, if proving to be beneficial to customers and stakeholders towards the end of the AMP period, we would want to expand this so that other local communities had the opportunity to benefit from it as well.

4.543 However, in practice the potential for additional catchments will be naturally limited. The process is reliant on fully engaging with local stakeholders in order to get to a stage where we have established relationships for collaboration. To date, this process will have taken three years (up to the beginning of AMP7) before we would have agreed on the interventions within the Catchment Plan. The opportunity window for beginning this process for additional catchments ahead of AMP8 is limited and would only be possible where sufficient collaborative relationships already existed. Furthermore, we will need to have begun implementation of the catchment plan before we can identify whether significant evidence gaps exist, and if the full effects were realised. This intuitively would not leave a great deal of time left in the AMP period to implement many more schemes beyond the three selected catchments. We believe that these combining factors mean that there is a natural cap in place, and we do not anticipate expanding the number of catchments beyond 1 or 2.

4.544 We also note that in the risk and return IAP feedback section, Ofwat states "…we have concerns that the company's presentation of likely totex outcomes is weighted towards underperformance on a notional basis"[145]. We conclude that removing this incentive would place our overall RORE range more at odds with the feedback that Ofwat has provided in the risk and return IAP test area.

4.545 We have also agreed to protect customers from excessive outperformance payments and proposed to do this by:

- Agreeing to an overall sharing mechanism to protect customers, with customers sharing (50:50) RORE returns >3%; and
- Applying individual reward caps to PCs, such that no single measure exceeds 0.25% RORE (c.£15m) in any one year. This ensures that no measure will unduly dominate the framework at the expense of others which customers view to be equally important.

EWS08 Empty Business Properties

TMS.OC.A92 Empty business properties PC: The company should provide further evidence to justify the use of a non-financial incentive by demonstrating why a financial incentive would not be in the interests of customers.

Alternatively, the company should formulate a financial ODI reflecting the reduction in customer bills that would result from a reduction in the proportion of occupies properties classified as voids.

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[143] *170831 TW Stage 2 Customer Preferences Study Water Resources Options Draft Final Report 3.0 page 63 and TW WRMP_Stage 1_Debrief page 86 & 87.*
[144] *Blueprint for Water PR19 assessment of plans. page 5.* https://www.wcl.org.uk/docs/assets/uploads/BLUEPRINT_ENVIRONMENTAL_ASSESSMENT_PR19_SCORECARD.pdf
[145] *Ofwat, Thames Water test area assessment, January 2019, Aligning risk and return, page 4.*

4.546 We are now proposing a financial ODI with in period incentive for this PC.

4.547 We have reviewed our position in the light of Ofwat's feedback and further developed our thinking through assessment of a significant pilot programme of work we have undertaken on empty business properties since our submission.

4.548 Although, under the statutory market codes, retailers have the obligation to maintain accurate occupancy data in the non-household market, we agree that it is in customers' interests that wholesalers take action to reduce the number of premises incorrectly identified as vacant. The customer benefit from correcting occupancy status is that there are more customers paying bills, so reducing bill levels for customers in general. Placing financial incentives on wholesalers therefore makes sense for customers, notwithstanding that our customers do not believe that we should be subject to financial penalties where we do not have control over outcomes[146]. In this case, as retailers both have this obligation under the market codes and control this data item in the market, we do not have control. The most appropriate form of financial incentive therefore is a reward-only financial ODI and we have set our target level at zero.

4.549 Taking on board Ofwat's feedback, we are therefore now proposing a financial (reward-only) ODI with an in-period incentive, reflecting the reduction in customer bills that would result from a reduction in the number of occupied non-household properties classified as voids.

4.550 Since our September submission, we have completed a pilot programme, testing a range of wholesaler-led interventions including: sourcing external data under different models; desktop data review; carrying out site visits; and vacancy challenges. Out of 23,200 vacant premises targeted, our pilot has led to the status of 3,562 premises being changed to occupied, with the resultant benefit for all other customers arising from the corresponding increase in revenue from those customers.

4.551 This has enabled us to calculate the revenue benefit and the cost of carrying out this work. In developing this financial ODI we have set the reward at the level of 40% of the average in-year revenue benefit (£114 per premises), with the customer benefit being 60% average in-year revenue benefit, plus the full revenue benefit in subsequent years where the premises remains occupied (annualised benefit £572 per premises). This ensures that benefits are at all times weighted towards customers.

4.552 While the higher the number of vacant premises that are changed to occupied the bigger the benefit for customers, we have included a cap on the reward element of this financial ODI. We have set this at what we consider a reasonable P90 level, which is where the proportion of vacant premises is returned to the level before market opening.

Table 79: Empty business properties ODI profile

	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7 total
PC target – premises changed to occupied (zero as retailer responsibility)	0	0	0	0	0	0

[146] *Thames Water, TSD019-CR27 PCs and ODIs, September 2018.*

Reward rate per premises changed to occupied (£)	£114	£114	£114	£114	£114	£114
Volume cap for reward - number of premises	4814	4814	4814	4814	4814	24,070
Reward cap (£ million)	£0.549	£0.549	£0.549	£0.549	£0.549	£2.744

Source: Thames Water App1

We have based our calculations on the profile of premises that have become vacant since the market opened in April 2017, excluding those already vacant before the market opening.

Section 5

Annex 1: Line commentary for App1

5.1 In this annex we provide our line commentary for data tables App1, App1a and App1b

New, Replaced and Removed Performance Commitments		
Table	**Column**	**Reason for change/New Commentary**
App1	Column 1-6 for the following PCs	
	AR02 Households on a payment plan	Removed due to low level of customer support when tested in June 2018.
	AR04 Number of customers on the priority service register	Replaced by AR06 Priority Service Register, the new common performance commitment. See document TW-OC-A4.
	AR05 Customers recommending priority services	Replaced by AR07 BSI for fair, flexible inclusive services as we are adopting Ofwat's recommendation. See document TW-OC-A3.
	AW01 Improving engagement on leaks on customers' pipes	Removed as customers perceive this to be a relatively small project and we have taken on-board Ofwat's feedback that it is too output focused.
	ES04 Compliance with Bioresources environmental permits	Removed as the Environment Agency has now provided certainty that the Industrial Emissions Directive does apply to sludge treatment centres
	EWS05 Financial Transparency	Removed due to lack of support from customer research and our Customer Challenge Group.
	EWS06 Driving cultural change through employee engagement.	Removed due to lack of support from customer research and our Customer Challenge Group.
	EWS07 Financial Resilience	Removed due to lack of support from customer research and our Customer Challenge Group.
	DW03 Strategic regional solution development	Added following feedback from Ofwat to work with 5 other companies to consistently and transparently investigate, plan and develop strategic options for water resources. See document TW-OC-A1.
	AR06 Households on the Priority Services Register	This is a new common performance commitment. We have amended our targets in line with Ofwat's requirements for this commitment. Further detail is included in document TW-OC-A4
	AR07 BSI for fair, flexible, inclusive services	This is a new performance commitment included at Ofwat's suggestion and commits Thames Water to achieving and maintaining British Standard BS18477 for inclusive service provision. Further detail is included in document TW-OC-A3.

Source: Thames Water


Thames
Water

App1 – Performance commitments and outcome delivery incentives

Additional Protection for customers which impact all financial ODI's

Section 2 of our April submission explains our proposals to protect customers from excessive outperformance payments and our revised ODI package. Further customer engagement has shown that our customers' view is that no single measure should dominate either the outperformance or underperformance framework. We are therefore proposing:

i) outperformance payment collars on individual PCs, set at 0.25% of RORE per individual performance commitment, and

ii) sharing outperformance (50:50) for >3% of RORE

To be consistent with our customers' views, the 0.25% RORE cap should be applied symmetrically to include penalties.

EWS08 – Empty Business Properties

We are proposing a financial (reward-only) ODI with an in-period incentive, reflecting the reduction in customer bills that would result from a reduction in the number of unoccupied non-household properties classified as voids.

We have reviewed our approach to incentivising our performance through a financial ODI in order to reduce the number of business premises incorrectly identified as vacant. Since this is a retailer obligation in market codes the performance of this process is not fully in our control. For that reason we have proposed a reward-only financial ODI. We have calculated the level of the reward (£114 per premise) based on insight and learning from a significant vacancy pilot programme we have completed during 2018/19. We consider this approach to be fair and reasonable since it ensures that end customers keep the majority of in-year benefits as well as benefits in subsequent years as a result of more customers being in charge. We have further proposed that any reward is capped at a P90 level which is baselined at the vacancy rate from before the market opened.

The financial ODI therefore is set out as per the table below.

	2020/21	2021/22	2022/23	2023/24	2024/25	AMP 7 total
PC target – premises changed to occupied (zero as retailer responsibility)	0	0	0	0	0	0
Reward rate per premises changed to occupied (£)	£114	£114	£114	£114	£114	£114
Volume cap for reward - number of premises	4814	4814	4814	4814	4814	24,070
Reward cap (£ million)	£0.549	£0.549	£0.549	£0.549	£0.549	£2.744

AWS03 – Retailer Measure of Experience (R-MeX)

We have reviewed and improved the definition of our R-MeX performance commitment to set out the dependencies in terms of our ability to measure performance at the start of the 2020, building on the industry work currently under way to define a baseline position during 2019/20. It is from this baseline we will make year-on-year improvements in R-MeX for each year during AMP7. It is fair to say that the market is relatively immature and diverse and therefore there is significant industry work and collaboration required to baseline a retailer satisfaction measure that appropriately captures the impact of wholesaler performance on end customers. We believe this is the right thing to do in terms of supporting positive end customer outcomes and we are committed to driving this measure forward to incentivise industry collaboration, as opposed to removing it on the basis that there is at this stage a lack of certainty regarding measurement.

Our preference is to agree and adopt a common measure across all parts of the market, but failing that we will develop our own. We will set the baseline for this in the final year of this AMP, when piloting of the proposed market R-MeX approach should have concluded, and plan to improve year on year in subsequent years of the AMP.

We have reflected this as follows in our updated data table App1:

AMP6 Forecast	AMP7 Targets (R-MeX score)					AMP8 Targets	AMP9 Targets
Yr5	Yr1	Yr2	Yr3	Yr4	Yr5	Yr5	Yr5
Set baseline	improvement on 2019/20 baseline	improvement on 2020/21	improvement on 2021/22	improvement on 2022/23	improvement on 2023/24	no detriment on 2025/26	no detriment on 2030/31

By committing to an improvement in each year of the AMP, we are aiming to continually improve services we provide to our Retailer customers.

BW02 - Asset Health Unplanned Outage

We are developing an action plan to comply with the standard definition of this measure, which we can share on the 15th May as part of the update requested for this measure. We are committed to working with the industry to develop the processes and data required for reporting Unplanned Outage. We took part in a Water UK workshop on the 8th February with company experts to discuss this common performance measure. Due to the clarification still needed to define this measure and the wide range of variation across the industry, at this stage we can only provide forecasts based on our definition and expect these to change/be adapted as the final definitions are approved by Ofwat.

Performance Commitment Revisions

CS03 Internal sewer flooding incidents (including severe weather)

We have revised our performance target for sewer flooding in each year of the planning period and have recalculated our incentive rate using our current view of risk associated with revised incremental costs to achieve the target and the change in incremental benefits delivered during the planning period.
The bottom up calculation for revised incentive rates resulted in a marginal change in outperformance and underperformance incentive rates which did not result in a change in materiality of this measure in the overall balance of our risk and reward framework.

We have been mindful of Ofwat's assessment of industry incentive rates for this measure and our bottom up recalculated incentives meet customer and Ofwat's expectations for benchmarked rates.

Our September submission incentives were also within expected ranges when normalised.

Our revised targets collars and caps are detailed below.

e Commitment	PC unit	2020-21	2021-22	2022-23	2023-24	2024-25
Internal sewer flooding incidents (including severe weather) September	Nr.	1146	1146	1114	1082	1052
Internal sewer flooding incidents (including severe weather) April	Nr.	1146	1108	1071	1033	995

	P90					P10				
Performance Commitment	2020-21	2021-22	2022-23	2023-24	2024-25	2020-21	2021-22	2022-23	2023-24	2024-25
Internal sewer flooding incidents September	867	867	835	803	773	1477	1477	1445	1413	1383
Internal sewer flooding incidents April	867	829	792	754	716	1477	1439	1402	1364	1326

As a result, the benefits that we are delivering in Amp7 have changed our level of ambition and the benefits delivered in the planning period have increased.

In our revision of marginal costs, we have included our assessment of risk costs associated with delivering the target. This assessment of risk costs is not derived from Ofwat's assessment of allowed costs, but our current best view of the costs required to assure the delivery of the programme. As a result, our marginal costs and benefits have been revised and our incentive rates recalculated.

Performance Commitment	PC unit	Marginal cost (£m)	Marginal benefit (£m)	Penalty rate £m/unit	Reward rate £m/unit
Internal sewer flooding incidents (including severe weather) September	Nr.	0.033	0.054	0.038	0.027
Internal sewer flooding incidents (including severe weather) April	Nr.	0.038	0.054	0.035	0.027

The normalised targets, risk profiles and incentive rates are detailed in App1b.

BW03 Interruptions to supply

We have recently engaged with customers further on supply interruptions. Based on this engagement and previous engagement we have adjusted our supply interruptions target to a 20% reduction over AMP7 and are confident our target and ODI are in line with their views and represents a stretching value for money target.

Thames revised Target	2020-25 performance commitment levels					
	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Revised Target and glide path	00:10:35	00:10:10	00:09:45	00:09:20	00:08:55	00:08:30

The collars and caps and risk profiles have been adjusted accordingly.

Collars and caps

P90 performance commitment levels					P10 performance commitment levels				
2020-21	2021-22	2022-23	2023-24	2024-25	2020-21	2021-22	2022-23	2023-24	2024-25
00:07:31	00:07:11	00:06:51	00:06:31	00:06:11	00:14:17	00:13:44	00:13:11	00:12:39	00:12:06

As a result our marginal costs and benefits have been revised and our incentive rates recalculated.

PC unit	Marginal cost (£m)	Marginal benefit (£m)	Penalty rate £m/min	Reward rate £m/min
Supply Interruptions Time: mins per prop September	6.08	6.58	3.54	3.29
Supply Interruptions Time: mins per prop April revision	2.26	2.83	1.70	1.41

ES01 Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km

We have revised our ambition for pollutions in each year of AMP7, which now aligns with Ofwat's expectations for industry annual upper quartile performance.

We have recalculated our incentive rate using our current view of additional risk cost associated with the revised glide path of benefits and incremental benefits. This leads to a change in marginal costs for the performance commitment.

The bottom up calculation for revised incentive rates resulted in a marginal change in outperformance and underperformance incentive rates which did not result in a change in materiality of this measure in the overall balance of our risk and reward framework.

We have been mindful of Ofwat's assessment of industry incentive rates for this measure and our bottom up recalculated incentives meet customer and Ofwat's expectations.

Our revised targets collars and caps are detailed below.

Performance Commitment	PC unit	2020-21	2021-22	2022-23	2023-24	2024-25
Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km September submission	Nr./10,000km sewer	27	26	25	24	23
Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km April submission	Nr./10,000km sewer	24.5	23.7	23.0	22.4	19.5

Our revised P10 Collars are detailed below

Performance Commitment	2020-21	2021-22	2022-23	2023-24	2024-25
Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	37	37	37	37	37
Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	35	34	33	32	30

Our revised P90 Collars are detailed below

Performance Commitment	2020-21	2021-22	2022-23	2023-24	2024-25
Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	16	16	16	16	16
Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	16	15	14	13	11

Our revised incentive rates are detailed below.

Marginal cost £m / unit	Marginal benefit £m/ unit	Penalty £m/ unit	Reward £m/unit
1.32	1.78	1.12	0.89
1.84	1.78	0.87	0.89

BW04 Leakage

Our current best view is that we have ended the year on 31 March 2019 at a spot value of 663Ml/d, which is 30Ml/d higher than our previous forecast of 633Ml/d. We are maintaining our leakage target as an annual average at 510Ml/d[147] by 2024/25. This means increasing our efforts in our recovery plan, such that the overall leakage reduction in AMP7 is now 20%. We have revised our annual and three year rolling average to reflect this.

Therefore, as the benefit value has changed for AMP7 the marginal cost, or cost per unit benefit, has changed. We have recalculated our incentive rate using our current view of revised incremental costs based upon the change in incremental benefits delivered during the planning period. We have not included any additional risk cost in our assessment as the final end of AMP annual target has remained the same. The bottom up calculation for revised incentive rates resulted in an increase in outperformance payment and penalty rates from our September submission.

This change would have moved our incentive rates further outside of Ofwat's benchmarked range and would result in this measure having increased materiality in our RORE range, which was contrary to customers' views.

In addition to the research conducted to support our September 2018 draft plan, over the period January 2019 to February 2019 we undertook a series of customer workshops and focus groups to further test our performance commitment targets and ODIs. Customers reiterated their message that they thought it was not beneficial for a single measure to dominate the incentive framework. Customers felt that this practise would place too much focus on one area of service potentially to the detriment of others.

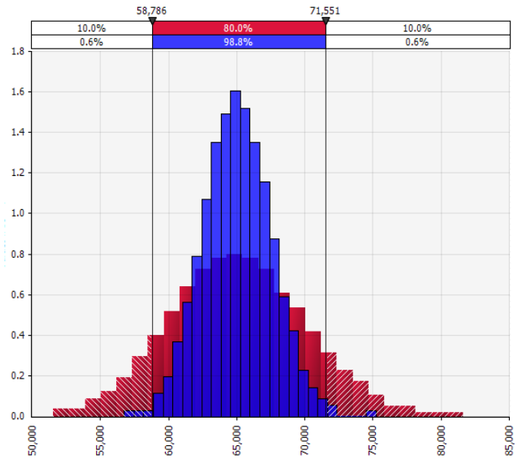
Therefore, we have taken the lower benchmark customer value for leakage for the revision of the underperformance incentive rate. We have been mindful of Ofwat's assessment of industry incentive rates for this measure and we believe our bottom up recalculated incentives are aligned with customer and Ofwat's expectations.

Performance Commitment	2020-21	2021-22	2022-23	2023-24	2024-25
Leakage September submission	654	626	607	587	568
Leakage April submission	685	641	613	590	568

We have revised our risk profile for leakage. The risk profile for our September submission was based upon @risk uncertainty modelling using performance data from 2012 to 2016.

We have updated the risk profile using AMP6 actual data and year 4 and 5 forecast performance. This has provided additional information to refine revised the uncertainty modelling. By incorporating the whole AMP6 5-year performance together with historic records since 2011, the updated risk distribution indicates wider uncertainty. This revised profile was used to adjust the P10,P90, P1, P99 distributions around the target.

[147] *Prior to the impact of Ofwat's AMP7 leakage methodology change for the Common PC*



	P90					P10				
Performance Commitment	2020-21	2021-22	2022-23	2023-24	2024-25	2020-21	2021-22	2022-23	2023-24	2024-25
Leakage September submission	630	602	583	564	544	691	663	644	624	605
Leakage April submission	662	608	580	557	535	747	693	664	642	619

Our revised incentive rates are detailed below

Performance Commitment	PC unit	Marginal cost (£m)	Marginal benefit (£m)	Penalty rate	Reward rate
Leakage September Submission	ml/d	0.38	0.55	0.35	0.29
Leakage April Submission	ml/d	0.29	0.38	0.24	0.29

BW05 Per Capita Consumption

We have been mindful of Ofwat's IAP benchmarked rates for this performance commitment and that in our September incentive rates our incentives were industry outliers for this measure.

We have reviewed our approach to marginal benefits for this measure. In doing so we have applied a multiplier of 38.3% to the marginal benefits for per capita consumption– for both outperformance and underperformance benefit rates. We have done this after a bottom up assessment of our per capita consumption benefits where we have differentiated between benefit being delivered by our programmes and benefits being delivered as a function of external factors. This analysis which was done comparing:

The forecast change in PCC including the our AMP7 programme and the total forecast change from a revised baseline that would be observed without our programme.

In recent research our customers have told us that Thames should be neither rewarded nor penalised for delivery of benefits which are not associated with their programme. Therefore the benefits from this long term forecast have been excluded from our benefit values.

When the calculation is revised this results in marginal costs exceeding marginal benefits such that the Ofwat formula produces a negative penalty.

We have recognised that we are an industry outlier in terms of our incentives for this measure and therefore we have based the underperformance and outperformance payments for this measure on our revised marginal benefits.

We have two marginal benefits for this measure the detailed derivation of which is included in CSD020

Therefore we have calculated a revised penalty of **£0.70m** for the penalty based upon:

- 50% of Marginal Benefit 1 * 38.3%

The lower benefit value Marginal Benefit 1 excludes the benefits allocated to the SOSI PC.

We have calculated a revised reward rate of £0.76m for the outperformance payment which is based upon:

- 50% of Marginal Benefit value 2 * 38.3%

Performance Commitment	PC unit	Marginal cost (£m)	Marginal benefit (£m)	Penalty rate £m/unit	Reward rate £m/unit
Per Capita Consumption September	Nr.	3.27	3.64	2.00	1.99
Per Capita Consumption April	Nr.	3.27	1.39	0.70	0.76

Therefore, our table commentary has been adjusted to state that this is a marginal benefit calculation as marginal costs exceed marginal benefits.

BW06 Water Quality Compliance: CRI

Ofwat has indicated that we should have a single CRI common measure with a financial underperformance incentive rather than have the two CRI measures put forward in our original submission. Additionally, Ofwat has proposed a fixed deadband of 1.5 and collar of 9.5 - this is industry wide.

However, we do not feel that it is appropriate to adopt a single incentive for this measure with a generic industry collar and deadband as companies face very different individual risks and challenges within the measure.

We have revised our DWI legal instrument for Metaldehyde for AMP7 to reflect the ban. This was submitted to the DWI by the deadline of 31 March 2019. In the legal instrument, we have set out our proposal to scale back on the level of work we will do in the catchment for Metaldehyde once the ban is in place (June 2020). This has resulted in a reduction to our proposed costs for Metaldehyde.
With regard to a performance commitment and ODI, we have reviewed our original proposal for CRI in response to Ofwat's comments but the decision has been taken to reject a single CRI and retain the original proposal of two ODI measures for CRI, one for Metaldehyde and a separate one for all other parameter failures. This reflects the ongoing risk from Metaldehyde in the AMP7 period until the full effect of the ban is seen. However, as recognition of the Metaldehyde ban, we have updated our P1 and P10 risk profile for CRI Metaldehyde ODI.

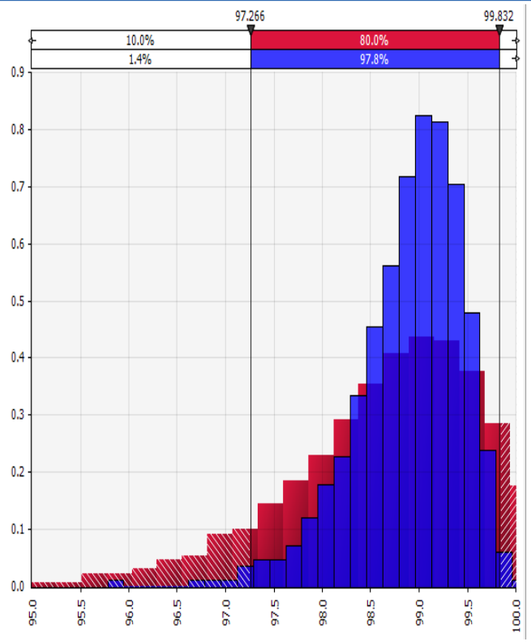
PC short name	2020-21	2021-22	2022-23	2023-24	2024-25
CRI-Metaldehyde – September submission	35.88	35.88	35.88	35.88	35.88
CRI-Metaldehyde- April submission	15.32	6.58	3.29	0.00	0.00

BW11 Responding to major trunk mains bursts

Our September Business Plan included a 5.6% improvement in responding to trunk mains bursts performance by the end of Amp 7. For our April 2019 submission, we will stretch our improvement to 20% as this is a sub measure of supply interruptions and we are mirroring the % improvement each year in the supply interruptions performance commitment (BW03).

Performance Commitment	PC unit	2020-21	2021-22	2022-23	2023-24	2024-35
Responding to major trunk mains bursts – April 2019	time	00:01:43	00:01:39	00:01:35	00:01:30	00:01:26
Responding to major trunk mains bursts – September 2018	time	00:01:47	00:01:46	00:01:44	00:01:43	00:01:42

CS01 Asset Health: Treatment works compliance



The risk profile for our September submission was based upon @risk uncertainty modelling using performance data from 2013 to 2018. The updated view for has included the additional AMP6 actual data and a forecast for years 4 and 5 of the current planning period. By incorporating the whole AMP6 5-year performance together with historic records since 2011, the updated risk distribution indicates wider uncertainty. This revised profile was used to adjust the P10,P90, P1, P99 distributions around the target.
For treatment works compliance we have moved the estimate of marginal benefit to the upper level of our estimated WTP range. This increases the impact of these measures on our RORE range and brings the incentive into alignment with other companies. Given how important these measures are to our customers – we consider the revised incentives to still be in line with their views.

Performance Commitment	PC unit	Marginal cost (£m/ unit)	Marginal benefit (£m/ unit)	Penalty rate £m/ unit	Reward rate £m/ unit	P90 reward £m	P10 penalty £m
Treatment works compliance September	%	5.78	4.85	1.96			- 9
Treatment works compliance April	%	5.78	5.95	3.06			- 26

The revised incentive rates are above Ofwat's minimum rates.

CS02 Asset Health: Sewer collapses (no.) per 1000km of sewers

For collapses we have moved the estimate of marginal benefit to the upper level of our estimated WTP range. This increases the impact of these measures on our RORE range and brings the incentive into alignment with other companies. Given how important these measures are to our customers – we consider the revised incentives to still be in line with their views.

Performance Commitment	PC unit	Marginal cost (£m/ unit)	Marginal benefit (£m/ unit)	Penalty rate £m/ unit	Reward rate £m/ unit	P90 reward £m	P10 penalty £m
Sewer collapses (no.) per 1000km of sewers September	Nr./1000km sewers	1.09	1.02	0.48	0.51	1.8	- 1.4
Sewer collapses (no.) per 1000km of sewers : April	Nr./1000km sewers	1.09	1.51	0.97	0.76	2.6	- 2.9
Sewer collapses (no.) per 1000km of sewers Ofwats rates		1.09	1.02	1.46	0.28	1.0	- 4.4

Given the importance of this measure for our customers – we consider our revised incentives to still be in line with customer's views.

BW01 Asset Health Mains Bursts (no.) per 1000km

For mains burst we have increased the central marginal benefit estimate by 10% – this is still inside the confidence intervals from customers. We have not opted for the value from the upper range, as this would mean this measure would exceed the RORE cap that customers want for this measure, and would therefore be disproportionate for our customers.

The targets and assessments of P10, P90, P1 and P99 remain unchanged from our September submission. Our incentive rates have changed as a function of the increase in marginal benefit only.

Performance Commitment	PC unit	Marginal cost (£m/ unit)	Marginal benefit (£m/ unit)	Penalty rate £m/ unit	Reward rate £m/ unit	P90 reward £m	P10 penalty £m
Mains Bursts (no.) per 1000km September	Nr./1000km mains	0.54	0.41	0.14	0.20	54	-56
Mains Bursts (no.) per 1000km April	Nr./1000km mains	0.54	0.45	0.18	0.22	59	-73
Mains Bursts (no.) per 1000km – Ofwat's benchmark	Nr./1000km mains	0.54	0.41	0.34	0.27	72	-142

Ofwat's benchmarked rate would also mean that this would be a disproportionate in our risk framework which is against our customers wishes. This measure would also have a disproportionate value compared to other associated service measures such as leakage and supply interruptions. Therefore, this would not be in line with our customers' views.

BW02 Asset Health Unplanned Outage

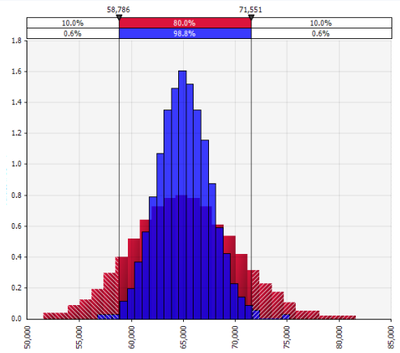
For unplanned outage we have not made any change, on the basis that this measure already accounts for a sizeable percentage of our RORE range, and there is little evidence that increasing this further is in line with our customer views. Moreover, this is a measure where the industry is maturing in its measurement –confidence in industry data is low and we have confidence in the calculation of our incentive rate for this measure.

Performance Commitment	PC unit	Marginal cost (£m/ unit)	Marginal benefit (£m/ unit)	Penalty rate £m/ unit	Reward rate £m/ unit	P90 reward £m	P10 penalty £m
Unplanned Outage September/ April	%	1.44	1.58	0.86	0.79	31	-52
Unplanned Outage Ofwats benchmark	%	1.44	1.58	3.24	0.79	31	- 197

CS04 Clearance of blockages

We have revised our risk profile for blockages. The risk profile for our September submission was based upon @risk uncertainty modelling using performance data from 2012 to 2016.

We have updated the risk profile using AMP6 actual data and year 4 and 5 forecast performance and has provided additional information to refine revised the uncertainty modelling. By incorporating the whole AMP6 5-year performance together with historic records since 2011, the updated risk distribution indicates wider uncertainty. This revised profile was used to adjust the P10,P90, P1 and P99 distributions around the target.



	P90					P10				
Performance Commitment	2020-21	2021-22	2022-23	2023-24	2024-25	2020-21	2021-22	2022-23	2023-24	2024-25
Blockages Nr September submission	71795	66795	66795	66795	61795	78134	73134	73134	73134	68134
Blockages Nr April submission	68788	63788	63788	63788	58788	81518	76518	76518	76518	71518

ET01 Readiness to receive tunnel flows at Beckton STW

We have given further consideration as to how we may balance this underperformance payment with an outperformance payment. We already have a challenging programme, if we were to target an earlier delivery date now it would result in a sub-optimal allocation of resources and adversely impact project costs. Hence, we consider 'on-time' delivery of a resilient scheme, which is 'future-proofed', with space around it that facilitates further expansion in years to come, to be the optimal outcome. We propose the inclusion of a £1.16m ODI outperformance payment for on-time delivery of the proposed 'future-proofed' scheme, in addition to the £1.16m p.a. underperformance payment for late delivery.

ET03 Timely return to customers from land sales

To incentivise the early hand back of land hand back it is proposed for agreed land handed back from Tideway to Thames Water, which is subsequently sold within a twelve month period, the purchase price will be reflected in our RCV until 31 March 2025. This enables Thames Water to earn a return, which equates to:

- Value of land sale * Regulatory WACC (2.8%) * (time from land sale in months until 31 March 2025 / 12 months)
- Maximum value of outperformance payment **capped at £13.8m**

An underperformance payment will apply where Thames Water fails to accept land at handback on > 4 occasions. The underperformance payment **will be capped at £15.9m** and equates to the greater of

- Value of land sale * Regulatory WACC (2.8%) * (time from land sale in months until 31 March 2025 / 12 months)

or

- The value of the cost of delay to Tideway, which will be agreed by the Tideway / Thames Water Liaison Committee.

ET04 Establish an effective system operator for the London Tideway Tunnels (LTT)

The System Operator (SO) PC now includes reference to the critical assets in the WWN+ price control that support timely system commissioning. This removes the need for reference in the WWN+ price control.

- We have updated this commitment to include clear measures that relate to completion of critical work and activities that will ensure we are ready to commission,y as detailed in our response to actions TMS.OC.A82, TMS.OC.A83 and TMS.OC.A84.
- The target for establishing our system operator function is set as the Tideway System Commissioning Commencement Date (SCCD), October 2022.
- Taking into account the financial impact on Tideway for delays in their programme linked to our readiness we have revised the ODI rates as follows:
- We have given further consideration as to how we may balance this penalty with reward. There is no quantifiable benefit of early delivery for Tideway or our customers. Hence, we consider 'on-time' delivery to be the optimal

outcome and propose inclusion of a £15m ODI outperformance payment for on-time delivery. Failure to deliver on time will result in an underperformance payment, which will be capped at £15m.

- We believe that this revised proposal appropriately incentivises us to establish the System Operator Function and ensure our assets are commissioning ready by SCCD.
- To ensure optimal allocation of resources and an efficient outcome from a customer perspective if, as a result of Tideway delays in tunnel construction, the system commissioning commencement will not start in October 2022, both the outperformance and underperformance payment dates associated with this performance commitment will be re-set.

ET04 – New short definition

The PC will ensure appropriate investment is made in AMP7 in the organisation design, asset management, systems and capability development to deliver the London Tideway Tunnel Operating Technique (LTTOT) and ensure we are commissioning ready at the SCCD.

The PC is linked to the ET01 and ET03 Tideway PCs and includes clear measures relating to completion of critical work and activities (included in the WWN+ price control). The PC demonstrates critical assets are ready to operate in compliance with LTTOT.

Thames Water will be the system operator. BTL will own TTT, the main asset TTT. This performance commitment assures the completion of TWUL activities prior to the TTT commissioning.

In summary, we propose to:

		September BP Incentive rates		**April submission Incentive rates**		**Document reference**
Ref #	PC name	Under	Out	Under	Out	
ET01	Readiness to receive tunnel flow at Beckton STW	-1.159434	None	-1.159434	1.159434	TW-CE-A17
ET02	Effective stakeholder engagement	None	None	None	None	No Change
ET03	Timely return to customers from land sales	None	None	-15.9	13.8	TW-CE-A17
ET04	Establish an effective system operator for the London Tideway Tunnels (LTT)	-3.243403	None	-15.0	15.0	TW-CE-A17

Impact on P10 and P90:

P10	**September BP**					
Ref #	2020-21	2021-22	2022-23	2023-24	2024-25	**2020-25**
ET01				-1.1594		
ET03						**-2.3000**
ET04				-3.2434		

P10	**April submission**					
Ref #	2020-21	2021-22	2022-23	2023-24	2024-25	**2020-25**
ET01						**-1.159434**
ET03						**-15.9**
ET04						**-15**

P90	**September BP**					
Ref #	2020-21	2021-22	2022-23	2023-24	2024-25	**2020-25**
ET01						
ET03						
ET04						

P90	**April submission**					
Ref #	2020-21	2021-22	2022-23	2023-24	2024-25	**2020-25**
ET01						**1.159434**
ET03						**13.8**
ET04						**15**

Previously App1 did not include any maximum standard underperformance or outperformance penalties/payments. We have now included:

	Column 114						**Column 120**					
Ref #	2020-21	2021-22	2022-23	2023-24	2024-25	**2020-25**	2020-21	2021-22	2022-23	2023-24	2024-25	**2020-25**
ET01						**-1.159434**						**1.159434**
ET02												

ET03						**-15.9**						**13.8**
ET04						**-15**						**15**

ET02 Effective stakeholder engagement

We have revised our performance commitment for this non-financial incentive. This measure is of primary interest to our Tideway Stakeholders who are involved in shaping the questionnaire.
As a result of discussions with our stakeholders, we propose a target score of 4.0 for AMP7 which is a more stretching continuation of the performance commitment we have applied in AMP6.

In summary, changes to App1 column 41 are:

Performance Commitment	PC unit	2020-21	2021-22	2022-23	2023-24	2024-35
Effective stakeholder engagement - September	score	3.5	3.5	3.5	3.5	3.5
Effective stakeholder engagement - April	score	4.0	4.0	4.0	4.0	4.0

Refer to TW-CE-A17 TTT Price Control update for further information.

DWS02 SEMD - Securing our sites

In our June submission our Totex is limited to the programme which is clearly defined and costed in our plan at this stage. As additional scope is defined and agreed with DEFRA this will form part of a cost adjustment subject to gateway and will result in an RCV adjustment at the end of the AMP.

Additionally, we incorporated an outcome delivery incentive, penalty only mechanism, which is an end of AMP revenue adjustment based upon recompensing customers the incremental annual costs, related to the allowed costs for schemes which have not been delivered or have been delayed to the following AMP.
The size of the penalty is calculated from the size of the programme and benefits that are delayed.

Note, the percentage split between water and waste in the Totex allocation cells is reflective of our projected SEMD programme, as are the P10 and P90 values. These are not consistent with the reduced totex reported in tables WS2 and WWS2.

New financial measures

ER02 Empty Household Properties

The unit for this performance commitment is £m 0.1% of properties. This is an underperformance and outperformance incentive. Customers are compensated for lost benefits where the target has not been delivered. The company receives an outperformance payment when it exceeds its target, however this results in sustained benefits for all customers when "empty properties" are billed. We have included P10 and P90 collars and caps for customer protection.

	2020/21	2021/22	2022/23	2023/24	2024/25
P10	3.90	3.90	3.78	3.78	3.75
P90	3.60	3.60	3.48	3.48	3.45
Target	3.75	3.75	3.63	3.63	3.60
£m P10 penalty	0.01078	0.01078	0.01078	0.01078	0.01078
£m P90 reward	0.01078	0.01078	0.01078	0.01078	0.01078

ER01 Unregistered Household Properties

The incentive is based upon the financial benefits of delivering the process. The unit of performance is delivering the process each year. There is no willingness to pay benefits customer values for this measure but a financial benefit. The Totex sharing mechanism is zero for retail measures therefore the Ofwat formula defaults to marginal benefits for underperformance incentives. This is a penalty only measure.

Marginal Benefit	Marginal cost	Totex sharing ratio	Penalty only
0.210681	0.268400	0%	0.210681

EWS08 Empty business properties

We are proposing a financial (reward-only) ODI with an in-period incentive, reflecting the reduction in customer bills that would result from a reduction in the number of unoccupied non-household properties classified as voids.

We have reviewed our approach to incentivising our performance through a financial ODI in order to reduce the number of business premises incorrectly identified as vacant. Since this is a retailer obligation in market codes the performance of this process is not fully in our control. For that reason we have proposed a reward-only financial ODI. We have calculated the level of the reward (£114 per premise) based on insight and learning from a significant vacancy pilot programme we have completed during 2018/19. We consider this approach to be fair and reasonable since it ensures that end customers keep the majority of in-year benefit as well as benefit in subsequent years as result of more customers in charge. We have further proposed that any reward is capped at a P90 level which is baselined at the vacancy rate from before the market opened.

DW03 Strategic regional solution development

We have created a new performance commitment to measure our progress against developing water resource solutions for South East England. We are working with five other companies to develop consistent and transparent approaches for decision making on which solutions progress, and how the PC and ODI mechanism should function. This work is ongoing and the six companies will provide further information to Ofwat in mid-May 2019.

The performance commitment definition, the ODI mechanism and targets are still to be clearly defined.
Based on the joint work to date, we have identified four gates for our solution development:

AMP7 targets (provisional for 1 April)

2020-21	2021-22	2022-23	2023-24	2024-25
		Gate 1	Gate 2	Gate 3

AMP8 forecast target (provisional for 1 April)

2025-26	2026-27	2027-28	2028-29	2029-30
	Gate 4			

We will develop scheme specific incentive rates once a detailed project costing exercise is completed in April. The relevant sections in App1 are blank.

Further information in document TW-OC-A1, the methodology statement and the joint response from the six companies for 1 April.

New Non-Financial measures

AR06 Households on the Priority Services Register

Ofwat's new common performance commitment around the Priority Services Register challenges companies to have 7% of their overall household base registered for priority services by the end of AMP7, as well as ensuring 90% of data is checked every two years.

By the end of AMP7, we plan to grow our register to include more than 410,000 households. This represents 7% of the total households within our region.

Following clarification at the Ofwat workshop in relation to this performance commitment on 14th March 2019, we are including both the PSR reach and PSR data checking elements of this performance commitment in the App1 data table. This is in the format of [percentage reach] / [percentage data check] both shown in the same cell, as follows:

Measure AR06	Performance at end of AMP6	AMP7 Targets				
	Yr5	Yr1	Yr2	Yr3	Yr4	Yr5
Target as reported in data table App1:	2 / 50	3 / 90	4 / 90	5 / 90	6 / 90	7 / 90

This is a reputational performance commitment.

AR07 BSI for fair, flexible inclusive services

In a response to the IAP feedback, we have developed this measure to incentivise obtaining accreditation to BS18477 for inclusive service provision.

In 2018 we discussed a phased implementation of certification. However, the BSI has subsequently changed their approach so that an entire company's operation is required to be demonstrating the required standard in order to be certified. We will undertake staged audits for sections of the business that deliver distinct customer services, prioritised where customer need is greatest, namely Revenue, Water and Waste services as we implement capability. Therefore, our targets for this performance commitment are as follows:

AMP6 Forecast	AMP7 Targets					AMP8 Targets	AMP9 Targets
Yr5	Yr1	Yr2	Yr3	Yr4	Yr5	Yr5	Yr5
Commence implementation	BSI Audit Revenue and Water Operations	BSI Audit Waste Operations	Achieve BS18477	Maintain BS18477	Maintain BS18477	Maintain BS18477	Maintain BS18477

This is a reputational performance commitment.

ER03 – Households on the Thames Water social tariff

Columns 7 – Price control allocation (%)

Columns 114 - Maximum standard underperformance penalty & 120 - Maximum standard outperformance payment

The calculations have been manually overwritten in columns 114 and 120 due to the following reasons:

1) App1 table formula for column 108-126 (maximum penalty/payment) only works when performance commitments have set enhanced cap/collar, standard cap/collar, and dead band. However, most of our PCs do not have any cap/collar/dead band, as the guidance provided by Ofwat discourages this.

App1 table does not set formula for P10/P90 penalty/payment.

Columns 144 - 154 – Marginal costs and benefits

Marginal Benefits

Household values included in the App1 marginal benefit columns are produced using the triangulated household only values.
The values differ from the values used to calculate the incentive rates as they exclude the non-household value for the performance commitment.
The total household value per unit change for each performance commitment is calculated in line with the PC values methodology.
To calculate the value per household the total household value per unit (£ for all households) is divided by the appropriate number of household customers.
For water performance commitments we have used the total number of water customers (3,574,707) and for wastewater performance commitments we have used the total number of wastewater customers (5,530,848).

For three performance commitments (treatment works compliance, power resilience and biodiversity) we have applied a mixed approach.
For power resilience and treatment works compliance the values for water and waste water components have been divided by the appropriate number of customers prior to weighting in line with the PC value calculation to produce the value for the PC.
For biodiversity the total number of joint, water only and waste only customer's (5,580,488) has been applied.
The household customer numbers quoted are aligned with the values used to calculate the triangulated benefit values used in business planning.

Performance Commitment	Type of household used for normalisation
AWS02 Proactive customer engagement	Divided by the number of water households
BW01 Asset Health Mains Bursts (no.) per 1000km	Divided by the number of water households
BW02 Asset Health Unplanned Outage	Divided by the number of water households
BW03 Interruptions to supply	Divided by the number of water households
BW04 Leakage	Divided by the number of water households
BW05 Per Capita Consumption The benefit value has been adjusted by a factor of 0.383, to account for the benefits delivered by Thames Water and to	Divided by the number of water households
BW06 Water Quality Compliance: CRI Water Quality Compliance: CRI Other Water Quality Compliance: CRI Metaldehyde	Left blank as value broken down into Water Quality Compliance: CRI Other and Water Quality Compliance: CRI Metaldehyde Divided by the number of water households Marginal cost allocated to household based on revenue, divided by the number of water households
BW07 Properties at risk of receiving low pressure	Divided by the number of water households
BW08 Acceptability of water to consumers	Divided by the number of water households
BW09 Water quality events	Divided by the number of water households
BW10 Reducing risk of lead	Divided by the number of water households. Median set same as mean.
CS01 Asset Health: Treatment works compliance	Average value for a WTW failing is divided by the number of water households, the average value for a STW failing is divided by the number of

	wastewater households. The two values are weighted proportionally to the number of failures and converted into a percent compliance based on the combined total of WTW and STW.
CS02 Asset Health: Sewer collapses (no.) per 1000km of sewers	Divided by the number of wastewater households
CS03 Internal sewer flooding incidents (including severe weather)	Divided by the number of wastewater households
CS04 Clearance of blockages	Divided by the number of wastewater households
CS05 Sewage pumping station availability	Divided by the number of wastewater households
DS01 Risk of sewer flooding in a storm: 1 in 50 year storm	Divided by the number of wastewater households
DS02 Surface water management	Divided by the number of wastewater households
DW02 Security of supply index SoSI	Divided by the number of water households
DWS01 Power resilience	Average value for a WPS is divided by the number of water households; the average value for a SPS is divided by the number of wastewater households. The two values are weighted proportionally to the number of pumping stations in the programme.
ES01 Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	Divided by the number of wastewater households
ES03 Sludge treated before disposal	Divided by the number of wastewater households
EW01 Abstraction Incentive Mechanism (AIM)	Marginal cost allocated to household based on revenue, divided by the number of water households
EWS01 Enhancing biodiversity	Divided by the combined number of customers
EWS02 Smarter Water Catchment Initiatives	Divided by the number of wastewater households

EWS03 Renewable energy produced	Divided by the number of wastewater households

: BW05 Per Capita Consumption

benefit value for Per Capita Consumption has been adjusted by a factor of 0.383, to account for the benefits delivered by Thames Water's initiatives and not delivered by others. Our customer engagement indicates that customers believed that Thames Water should not be receiving outperformance payments or underperformance payments for programmes which are delivered or influenced by others.

Marginal costs

alculated the marginal costs in the form required in the APP1 table. We have used as a starting point
narginal costs as '£m per unit for all customers served', consistent with how we have calculated our incentive rates. These Tables are included for reference in the commentary.

We have then calculated the proportion of the costs that should be allocated to household customers only based upon 2017-18 actual costs.

Water Household = 74.6%
Waste Household = 81.1%
Total wholesale household = 78.0%

alculate the marginal costs per household for water performance commitments we have used the total number of water customers (3,574,707) and for wastewater performance commitments we have used the total number of wastewater customers (5,530,848). Where the performance commitment is a service to both water and wastewater customers we have used the total number of joint, water only and waste only customer's (5,580,488) has been applied. The household customer numbers quoted are aligned with the values used to calculate the triangulated benefit values used in business planning.

Performance Commitment	Type of household used for normalization
AWS02 Proactive customer engagement	Divided by the number of water households
BW01 Asset Health Mains Bursts (no.) per 1000km	Divided by the number of water households
BW02 Asset Health Unplanned Outage	Divided by the number of water households
BW03 Interruptions to supply	Divided by the number of water households
BW04 Leakage	Divided by the number of water households
BW05 Per Capita Consumption	Divided by the number of water households
BW06 Water Quality Compliance: CRI Water Quality Compliance: CRI Other Water Quality Compliance: CRI Metaldehyde	Divided by the number of water households
BW07 Properties at risk of receiving low pressure	Divided by the number of water households
BW08 Acceptability of water to consumers	Divided by the number of water households
BW09 Water quality events	Divided by the number of water households
BW10 Reducing risk of lead	Divided by the number of water households.

CS01 Asset Health: Treatment works compliance	Divided by the combined number of customers
CS02 Asset Health: Sewer collapses (no.) per 1000km of sewers	Divided by the number of wastewater households
CS03 Internal sewer flooding incidents (including severe weather)	Divided by the number of wastewater households
CS04 Clearance of blockages	Divided by the number of wastewater households
CS05 Sewage pumping station availability	Divided by the number of wastewater households
DS01 Risk of sewer flooding in a storm: 1 in 50 year storm	Divided by the number of wastewater households
DS02 Surface water management	Divided by the number of wastewater households
DW02 Security of supply index SoSI	Divided by the number of water households
DWS01 Power resilience	Divided by the combined number of customers
ES01 Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	Divided by the number of wastewater households
ES03 Sludge treated before disposal	Divided by the number of wastewater households
EW01 Abstraction Incentive Mechanism (AIM)	Refer to Table APP3
EWS01 Enhancing biodiversity	Divided by the combined number of customers
EWS02 Smarter Water Catchment Initiatives	Divided by the number of wastewater households
EWS03 Renewable energy produced	Divided by the number of wastewater households

The following measures “household” fraction of the marginal costs have been updated for the following measures

Performance Commitment	Reason
BW03 Interruptions to supply	Benefit delivered and costs changed
BW04 Leakage	Benefits delivered changed

CS03 Internal sewer flooding incidents (including severe weather)	Benefit delivered and costs changed
ES01 Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	Benefit delivered and costs changed
ER01 Unregistered Household Properties	Previously reputational
ER02 Empty Household Properties	Previously reputational
EWS08 Empty business properties	Previously reputational

ODI calculations

In our ODI calculations, the unit used for marginal cost and benefit's is '£m per unit for all customers served', consistent with our incentive rate units, and calculations.

In our September submission we provided a separate table 'PR19 BP commentary – Marginal Benefits' and 'PR19 BP commentary – Marginal Costs' which includes these figures.

There are some changes to these numbers which will be detailed in the App1a commentary tables. These values are used to calculate our incentive rates.

Please note that there are different benefit rates applied to the outperformance and underperformance calculations for the following performance commitments.

BW04 Leakage
BW05 Per Capita Consumption

The process for mapping benefits for all performance commitments and our detailed ODI Methodology are included in the following documents for further information.

- Performance Commitments values report :
- ODI Approach & Principals report :
- Details of ODI changes and our response to Ofwat's IAP questions are included in TW-OC-A1

Scheme performance commitments

The following scheme performance commitments do not have marginal costs or marginal benefits in the App1 table. Refer to the performance commitment summary documents for these.

BW12 North East London Resilience
DWS02 SEMD – Securing our sites
ES02 Environmental measures delivered (wastewater)
ES04 Delivery of Environmental Permitting Regulations ("EPR") programme for bio-resources – Removed

ET01 Asset resilience of receiving works
ET03 Timely return to customers from land sales
ET04 Establish an effective system operator for the London Tideway Tunnels (LTT)
EW02 Environmental measures delivered (Water)
EWS08 Empty business properties
ER01 Unregistered Household Properties
ER02 Empty Household Properties
DW03 Strategic regional solution development

The performance commitments for empty business properties, unregistered household properties and empty household properties do not use willingness to pay but an assessment of the financial benefits to customers in the performance commitments. Therefore these benefit values have not been included in App1.

App1a.

Marginal Benefits

The marginal benefits values in App1a are those used to calculate the incentive rates as they include both household and he non-household triangulated values for the performance commitment.
The total value per unit change for each performance commitment is calculated in line with the PC values methodology.
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BW03 Interruptions to supply	Divided by the number of water households
BW04 Leakage	Divided by the number of water households
BW05 Per Capita Consumption The benefit value has been adjusted by a factor of 0.383, to account for the benefits delivered by Thames Water and to	Divided by the number of water households
BW06 Water Quality Compliance: CRI Water Quality Compliance: CRI Other Water Quality Compliance: CRI Metaldehyde	Left blank as value broken down into Water Quality Compliance: CRI Other and Water Quality Compliance: CRI Metaldehyde Divided by the number of water households Marginal cost allocated to household based on revenue, divided by the number of water households
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CS05 Sewage pumping station availability	Divided by the number of wastewater households
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EW01 Abstraction Incentive Mechanism (AIM)	Marginal cost allocated to household based on revenue, divided by the number of water households
EWS01 Enhancing biodiversity	Divided by the combined number of customers
EWS02 Smarter Water Catchment Initiatives	Divided by the number of wastewater households
EWS03 Renewable energy produced	Divided by the number of wastewater households
ER01 Unregistered Household Properties	Divided by the combined number of customers
ER02 Empty Household Properties	Divided by the combined number of customers
EWS08 Empty business properties	Divided by the combined number of non-household customers

Note: BW05 Per Capita Consumption
benefit value for Per Capita Consumption has been adjusted by a factor of 0.383, to account for the benefits delivered by Thames Water's initiatives and not delivered by others. Our customer engagement indicates

that customers believed that Thames Water should not be receiving outperformance payments or underperformance payments for programmes which are delivered or influenced by others.

Marginal costs

alculate the marginal costs in the form required in the APP1a table, we have used as a starting point our marginal costs as '£m per unit for all customers served', consistent with how we have calculated our incentive rates. These Tables are included for reference in the commentary.

alculate the marginal costs per household for water performance commitments, we have used the total number of water customers (3,574,707) and for wastewater performance commitments we have used the total number of wastewater customers (5,530,848). Where the performance commitment is a service to both water and wastewater customers we have used the total number of joint, water only and waste only customer's (5,580,488) has been applied. The household customer numbers quoted are aligned with the values used to calculate the triangulated benefit values used in business planning.

Performance Commitment	Type of household used for normalization
AWS02 Proactive customer engagement	Divided by the number of water households
BW01 Asset Health Mains Bursts (no.) per 1000km	Divided by the number of water households
BW02 Asset Health Unplanned Outage	Divided by the number of water households
BW03 Interruptions to supply	Divided by the number of water households
BW04 Leakage	Divided by the number of water households
BW05 Per Capita Consumption	Divided by the number of water households
BW06 Water Quality Compliance: CRI Water Quality Compliance: CRI Other Water Quality Compliance: CRI Metaldehyde	Divided by the number of water households
BW07 Properties at risk of receiving low pressure	Divided by the number of water households
BW08 Acceptability of water to consumers	Divided by the number of water households
BW09 Water quality events	Divided by the number of water households
BW10 Reducing risk of lead	Divided by the number of water households.
CS01 Asset Health: Treatment works compliance	Divided by the combined number of customers
CS02 Asset Health: Sewer collapses (no.) per 1000km of sewers	Divided by the number of wastewater households
CS03 Internal sewer flooding incidents (including severe weather)	Divided by the number of wastewater households
CS04 Clearance of blockages	Divided by the number of wastewater households

CS05 Sewage pumping station availability	Divided by the number of wastewater households
DS01 Risk of sewer flooding in a storm: 1 in 50 year storm	Divided by the number of wastewater households
DS02 Surface water management	Divided by the number of wastewater households
DW02 Security of supply index SoSI	Divided by the number of water households
DWS01 Power resilience	Divided by the combined number of customers
ES01 Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	Divided by the number of wastewater households
ES03 Sludge treated before disposal	Divided by the number of wastewater households
EW01 Abstraction Incentive Mechanism (AIM)	Refer to Table APP3
EWS01 Enhancing biodiversity	Divided by the combined number of customers
EWS02 Smarter Water Catchment Initiatives	Divided by the number of wastewater households
EWS03 Renewable energy produced	Divided by the number of wastewater households
ER01 Unregistered Household Properties	Divided by the combined number of customers
ER02 Empty Household Properties	Divided by the combined number of customers
EWS08 Empty business properties	Divided by the combined number of non-household customers

The following measures have updated marginal costs from the September submission.

Performance Commitment	Reason
BW03 Interruptions to supply	Benefit delivered and costs changed
BW04 Leakage	Benefits delivered changed
CS03 Internal sewer flooding incidents (including	Benefit delivered and costs changed

severe weather)	
ES01 Wastewater pollution incidents: Total cat 1-3 incidents from sewage related premises per 10,000km	Benefit delivered and costs changed
ER01 Unregistered Household Properties	Previously reputational
ER02 Empty Business Properties	Previously reputational
EWS08 Empty Business Properties	Previously reputational

App1b.

We have provided normalised data for sewer flooding incidents and annual PCC data for Per Capital Consumption.

We have not included CRI as whilst we have forecast our risk against this measure we have included a CRI measure in App1 (which excludes Metaldehyde and includes all other sub measures and parameters.

The other measures detailed are either included in our AMP7 plan in the required format for comparison or are not included as one of our measures. We have included some additional information on Customer cont
water quality (taste and odour) Contacts per 1000 population in the context of our IAP query on Acceptability of Water to customers.

BW08 Acceptability of water to consumers

We have explained and discussed this measure and our targets with customers, how it is valued and what our targets are. We have also discussed the types of programme which might be employed to improve performance. Customers understand and value the measure and are happy for it to be included in our plan. This measure is a long standing DWI measure where comparative data is available on the DWI website.

Therefore we believe that the measure is an appropriate bespoke measure. Our customers think that reporting a measure which includes illness associated with drinking water is important and this has a high customer value. The exclusion of illness as a determinant will therefore reduce the customer value and materiality of the performance commitment.

We recognise however that Ofwat may have proposed this approach to ensure greater commonality across the industry. Therefore whilst customer contacts about water quality appearance and customer contacts for water quality taste and odour are not included in our bespoke performance commitments. We have included a provisional view of what our forecast target or performance might be for PR19.

This may be useful supporting information for Ofwat in the instance that it wants to enhance its PR19 benchmark for the Industry as a whole.

Parameter	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**
Customer contacts about water quality (appearance) Contacts per 1000 population	0.36	0.36	0.36	0.36	0.36
Customer contacts about water quality (taste and odour) Contacts per 1000 population	0.19	0.19	0.19	0.19	0.19

Section 6

Annex 2: Bursts and leakage evidence

Introduction

6.1 This is a technical appendix to TW-OC-A1 Outcomes supporting evidence. It discusses the factors that drive both bursts and leakage and provides supporting evidence as to why these are higher for Thames Water than other companies.

6.2 'Bursts' for the purposes of regulatory reporting incorporate all repair activities carried out on the distribution system. Bursts cover both reported leaks that are detectable at the surface ('reported bursts') and leaks that are detected as part of our active leakage control activities. 'Reported' mains bursts fluctuate from year to year with weather conditions, but over a number of years provide a good indicator of network condition, as they are generally independent of leakage control activities.

6.3 Leakage itself can similarly be categorised as "background" (a large number of small leaks such as leaking joints that are hard to detect and uneconomical to repair), and "bursts" (more significant, detectable leaks). Mains condition affects both the level of background leakage and the rate at which bursts break out. This means that reported bursts also correlate well with total leakage across water companies.

6.4 Since privatisation of the UK water industry, approximately 30% of mains have been renewed or relined. This means that 70% of the current network was inherited by companies at privatisation and as a result the nature of a significant proportion of the network is outside the control of the company. Whilst the condition of mains is not related directly to age, there is a relationship between burst rate and the age of mains. In particular, it is well understood that ferrous mains suffer from corrosion, thus the condition of these mains and rate of deterioration is affected by soil conditions combined with the age of mains. We provide a range of evidence to show that bursts and mains condition are related to these external, environmental factors.

6.5 In relation to leakage control, leakage at a stable level forms a significant element of base totex for Wholesale water network plus. Ofwat's Wholesale water network plus model has been developed from the historic costs (which have included managing leakage). Ofwat's model does not include all the factors we consider necessary to model water network costs in a consistent manner, but it does include a network density term. Given that maintaining leakage is a significant component of the Wholesale water network plus totex, Ofwat's inclusion of a density term indicates that the cost of maintaining leakage is affected by density. Our view is that network density affects the level of leakage that can be achieved cost effectively, and evidence for this is presented.

6.6 Customer metering facilitates the early identification of customer-side leakage, and also efficient targeting of network leakage. Although we have extensive metering plans, our current level of leakage is much lower than 'frontier' companies such as Anglian Water, which provides them with a comparative advantage in managing leakage. Whilst the meter penetration rate is governed to some extent by the companies, it has been set for each company in conjunction with the Environment Agency and Ofwat, taking the level of water stress, sustainable level of leakage and customer willingness to pay into account.

6.7 In conclusion, we do not consider it valid to compare our burst or leakage rates against other water companies without adequately considering the factors that are outside of management control and affect those two, interlinked, performance metrics. These are:

- Significantly worse than average mains condition
- Significantly higher than average network density
- Meter penetration rates that are lower than frontier companies.

Review of Burst Drivers

Asset Condition and Bursts Explanatory Factors

6.8 In this section we identify factors which are beyond management control which lead to poor condition of network assets. We have evidence from both our burst model and from detailed analysis of pipe samples that soil corrosivity has a significant impact on bursts and mains condition, particularly in London. When considered in conjunction with soil corrosivity, age has an impact and we also consider that traffic loading influences burst rate.

6.9 We used our burst and pipe attribute data to fit a statistical model to predict bursts[148]. The Bayesian tuner was then applied to 'tune' the predictions to the observed bursts over the last 5 years. The regression coefficients from this model are shown in the table below. Low P values in the right-hand column indicate that the predictor is statistically significant. From this we can conclude that soil corrosivity (SOIL-…) is significant, and that the more aggressive soils lead to higher burst rates. In a similar manner age (DATE-INSTALL-...) is also significant with greater age leading to a higher likelihood of bursts. Intuitively this makes sense, and we provide further evidence from detailed pipe samples to further reinforce and explain this. Soil shrink/swell coefficients are also statistically significant, although only for low and high categories.

Table 80: Regression coefficients from the burst model

Predictor	Estimate	Std Error	t value	Pr(>|t|)
INTERCEPT	-3.3776	0.0443	-76.2601	0.0000
SURFACE_TYPE ROADSIDE	-0.1341	0.0094	-14.3072	0.0000
SURFACE_TYPE UNKN	-18.9012	24667.81	-0.0008	0.9994
SURFACE_TYPE UNKNOWN	-18.9902	6170.23	-0.0031	0.9975
SURFACE_TYPE WATER	-0.73247	0.2259	-3.2421	0.0012
SOIL_CORR_FEB03_SLIGHT_AGGR	0.3150	0.0112	28.1591	0.0000
SOIL_CORR_FEB04_MOD_AGGR	0.2752	0.0070	39.5180	0.0000
SOIL_CORR_FEB05_SLIGHT_TO	0.5031	0.0282	17.8323	0.0000

[148] Water Infrastructure Statistical Models Refresh

_HI_AGGR				
SOIL_CORR_FEB06_HI_AGGR	0.3008	0.0172	16.8854	0.0000
SOIL_CORR_FEB07_MOD_TO_V_HI_AGGR	0.6397	0.0139	46.0616	0.0000
SOIL_CORR_FEB08_HI_TO_V_HI_AGGR	0.5042	0.0147	34.2402	0.0000
IL_SHRINK_SWELLB02_LOW	0.0463	0.0075	6.2054	0.0000
SOIL_SHRINK_SWELLB03_MODERATE	-0.0272	0.0237	-1.1476	0.2511
SOIL_SHRINK_SWELLB04_HIGH	0.0502	0.0130	3.8745	0.0001
SOIL_SHRINK_SWELLB05_VERY_HIGH	-0.0072	0.0175	-0.4100	0.6818
PRESSURE	0.0044	0.0002	25.3007	0.0000
SOIL_CORR_FEB02_IMPERMEABLE_ROCK	0.3367	0.0755	4.4581	0.0000
REGIONPROVINCES	-0.8221	0.0076	-107.851	0.0000
REGIONSOUTH LONDON	-0.5478	0.0062	-87.7428	0.0000
ASSET_FUNCTION_BINTRUNK	-0.2573	0.0157	-16.3677	0.0000
log(DIAM)	-0.9173	0.0073	-125.140	0.0000
MATERIAL_BIN_COARSEMetal	-0.0866	0.0159	-5.4881	0.0000
MATERIAL_BIN_COARSEOther	-2.4940	0.4453	-5.6010	0.0000
MATERIAL_BIN_COARSEPlastic	-0.7771	0.0181	-43.0360	0.0000
MATERIAL_BIN_COARSEUNKN	-0.9796	0.0541	-18.1015	0.0000
DATE_INSTALL_BINBIN_02_1870	0.0528	0.0145	3.6400	0.0003
DATE_INSTALL_BINBIN_03_1880	-0.1501	0.0150	-10.0001	0.0000
DATE_INSTALL_BINBIN_04_1890	-0.2053	0.0168	-12.1869	0.0000
DATE_INSTALL_BINBIN_05_1900	-0.2877	0.0148	-19.4458	0.0000
DATE_INSTALL_BINBIN_06_1910	-0.3723	0.0176	-21.2061	0.0000
DATE_INSTALL_BINBIN_07_1920	-0.5503	0.0150	-36.7863	0.0000
DATE_INSTALL_BINBIN_08_1930	-0.4079	0.0157	-25.9677	0.0000
DATE_INSTALL_BINBIN_09_1940	-0.2996	0.0146	-20.5242	0.0000
DATE_INSTALL_BINBIN_10_1950	-0.0120	0.0168	-0.7122	0.4764
DATE_INSTALL_	-0.1758	0.0156	-11.3007	0.0000

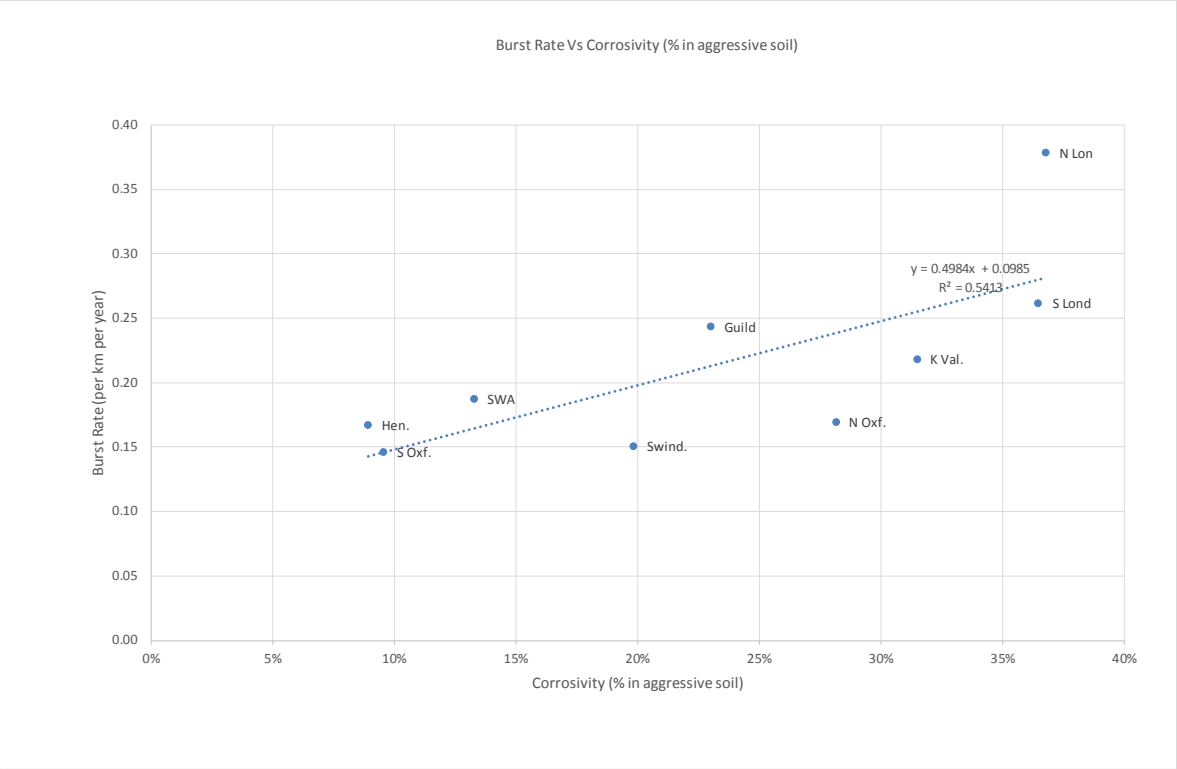
BINBIN_11_1960				
DATE_INSTALL_BINBIN_12_1970	-0.4108	0.0151	-27.1515	0.0000
DATE_INSTALL_BINBIN_13_1980	-0.6962	0.0159	-43.7761	0.0000
DATE_INSTALL_BINBIN_14_1990	-0.8385	0.0179	-46.9579	0.0000
DATE_INSTALL_BINBIN_15_2000	-1.4361	0.0187	-76.6708	0.0000
DATE_INSTALL_BINBIN_16_2010	-1.3720	0.0317	-43.3497	0.0000
SALINEY	0.18296	0.0089	20.4478	0.0000
log(PROP_DENSITY + 1)	0.0642	0.0024	26.5042	0.0000
log(PROP_CONNECTED_TOTAL/ASSET_LENGTH + 1)	0.3259	0.0140	23.2088	0.0000
SURFACE_TYPEBROAD	0.0997	0.0152	6.5689	0.0000
SURFACE_TYPEBUILDING	0.2220	0.0322	6.9029	0.0000
SURFACE_TYPELAND	-0.1966	0.0118	-16.6438	0.0000
SURFACE_TYPEMINORROAD	0.1242	0.0091	13.6594	0.0000
SURFACE_TYPEMOTORWAY	0.0173	0.1849	0.0934	0.9256
SURFACE_TYPEPATH	-0.2691	0.0176	-15.2858	0.0000
SURFACE_TYPERAIL	-0.0327	0.0869	-0.3764	0.7066

Source: Thames Water

6.10 We have also analysed soil corrosivity and burst data for each of the Asset Planning Areas within the Company to further demonstrate the relationship between soil corrosivity and bursts. We compare the proportion of pipes in “highly aggressive” soils or worse with average burst rates over the last ten years as shown in Figure 8 and this confirms a correlation between soil corrosivity and burst rate.

6.11 It should be noted that the relationships between bursts and soil type depends on the material and age of the assets, so we could only apply this to our own assets, as cross company comparisons would require multi factor regression models that cannot be produced given the data that are currently available.

Figure 9: Burst Rate versus corrosivity by Asset Planning Area

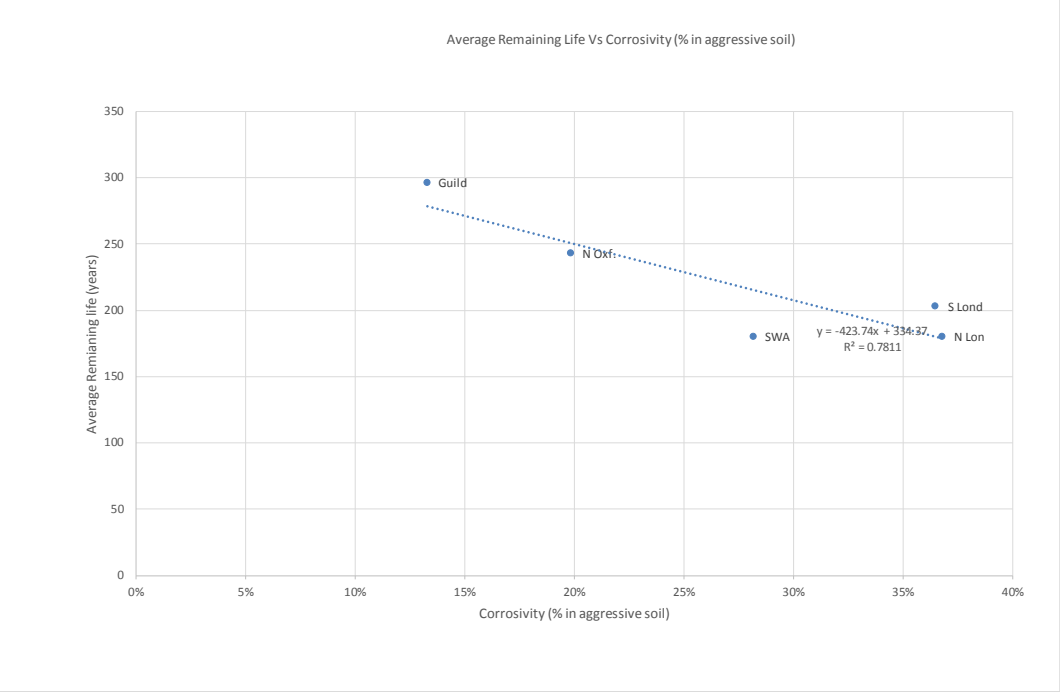


Source: Thames Water

6.12 The relationship between soil corrosivity and burst rate can also be seen by considering the findings from physical pipe condition assessments. We analysed the condition (providing estimates of remaining life and deterioration rate), of ferrous mains from 925 pipe samples by Asset Planning Zone (APZ)[149]. Figure 8 indicates a strong correlation (as would be expected between soil corrosivity the rate of deterioration and condition). As a national comparison, In London, 40% of the soils are 'highly' or 'very highly' corrosive to iron mains compared with 23% nationally (see Table 84 below).

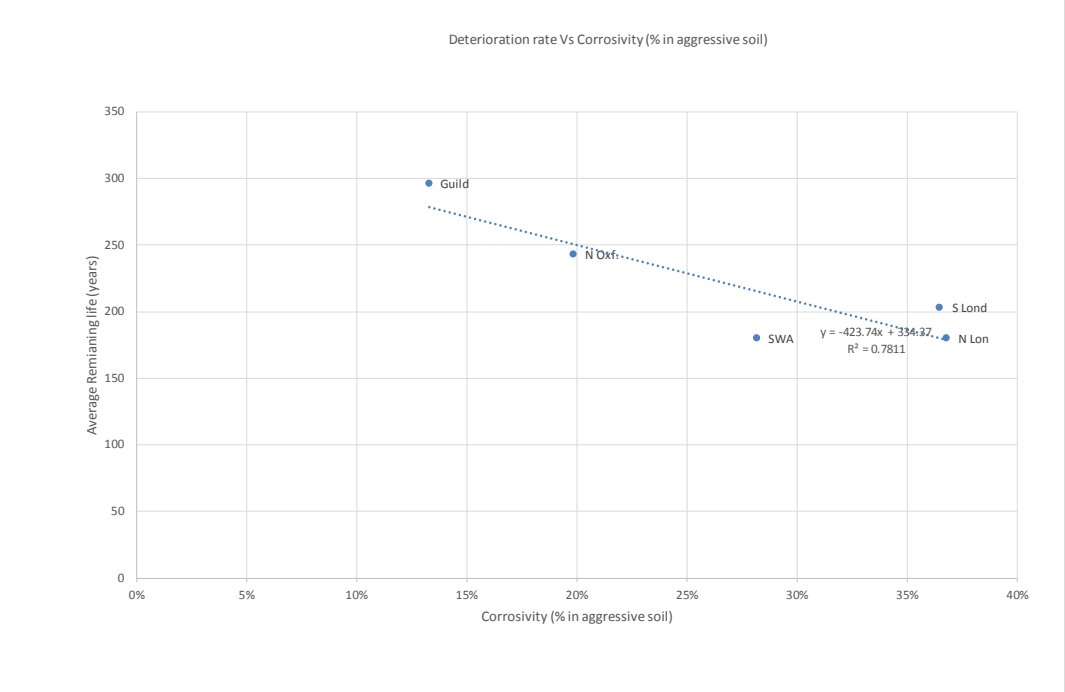
[149] DNV-GL's report Water Mains Material Deterioration update (16/6/17)

Figure 10: Average remaining life versus corrosivity by Asset Planning Area



Source: Thames Water

Figure 11: Rate of deterioration versus corrosivity by Asset Planning Area



Source: Thames Water

Table 81: Analysis of Soil Corrosivity

Corrosivity class	London	Rest of England and Wales	Variance[150]
Non-aggressive	37.9%	38.6%	- 0.7%
Slightly aggressive	5.5%	10.2%	- 4.7%
Moderately aggressive	16.1%	24.6%	- 8.5%
Highly aggressive	34.7%	16.7%	+ 18.0%
Very highly aggressive	4.8%	5.9%	- 1.1%
Other	0.0%	4.1%	- 4.1%

Source: TSD358 -SSLRC dataset

6.13 As noted above, our pipe burst model also indicates that the age of mains affects failure rate in combination with environmental conditions. This is reinforced by the analysis of pipe samples which confirms that ongoing corrosion of ferrous mains leads to material deterioration and hence increases leakage and the risk of bursts. Thus ferrous mains (which were generally used for distribution mains until the late twentieth century) will leak more and burst more frequently as they get older. Whilst age is not the only factor that affects the condition of pipes, it does play a part. The Ofwat Cost Assessment ("CA")[151] industry data shows that in 2016/17 the average age of treated water distribution pipes for the industry is around 55 years,[152] whilst in London it is 89 years old.[153] London includes a large proportion of very old mains. For example, half the mains in London were laid before 1920 (see Figure 10 below).

6.14 Since privatisation of the UK water industry, approximately 30% of mains have been renewed or relined. This means that 70% of the current network was inherited by companies at privatisation and as a result the age and type of a significant proportion of the network is outside the control of the company.

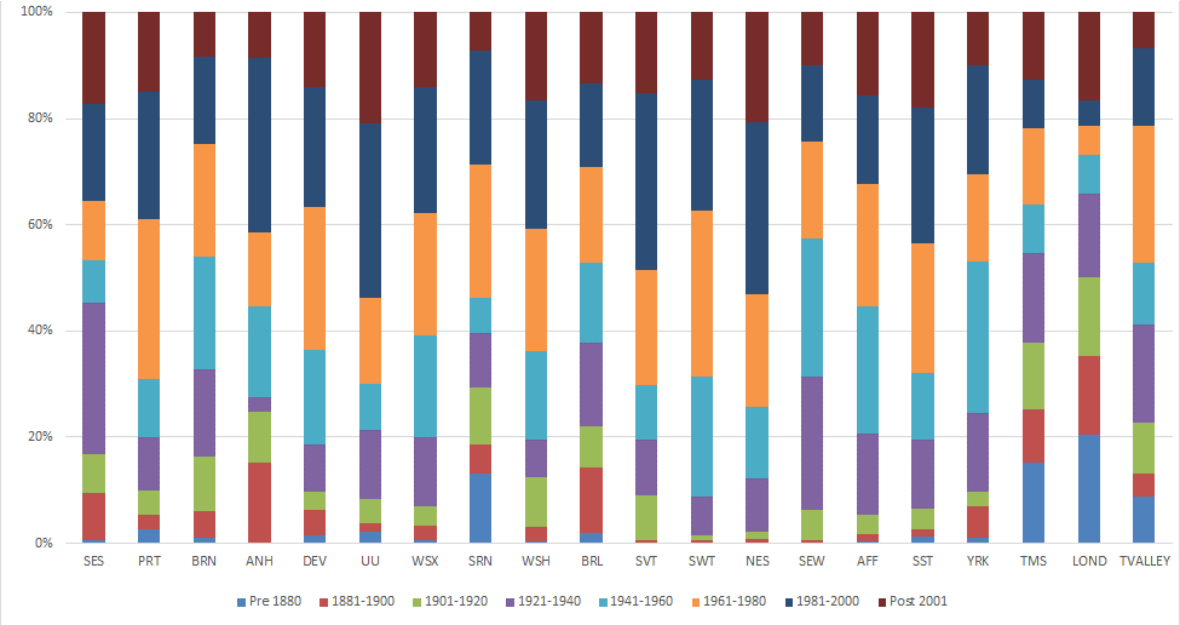
[150] Positive numbers indicate where London is higher than the national average. The variance shows that the largest variances are in highly aggressive soils where London has more than the national average and slightly to moderately aggressive soils where London has less than the national average.

[151] Ofwat, Cost assessment for PR19: a consultation on econometric cost modelling, March 2018.

[152] Using the assumption that pipe ages are evenly distributed across the cohorts used for reporting in CA table 5, lines 27-34.

[153] Using data from the asset inventory which is part of our Graphical Information System ("GIS") which is the source used to populate our CA pipe age data.

Figure 12: Comparison of Mains Ages across the Industry



Source: Ofwat, Cost Assessment Return, Table 5, Lines 27-34

6.15 High traffic loading leads to greater transfer of breaking and accelerating forces to mains and fittings, and therefore contribute to mains failures and hence leakage. Traffic flows in London are nearly twice that in the North and Midlands, and nearly three times that in rural areas such as Wales and the South West (see Table 85).

6.16 Overall it is clear that the explanatory factors that lead to higher burst rates, and hence network leakage, are largely outside of a water company's management control.

Table 82 : Average daily motor vehicle flows by road class (2016)

Department for Transport statistics
Traffic (www.gov.uk/government/organisations/department-for-transport/series/road-traffic-statistics)

Table TRA0302

Motor vehicle flow by road class and region and country in Great Britain, 2016 (revised) [1]

Thousand vehicles per day

	Major roads					Minor roads			
		'A' roads							
	Motorway [2]	Rural	Urban [3]	All 'A' roads	All major roads	Rural	Urban [3]	All minor roads	All roads
North East	55.5	14.8	22.1	16.8	18.0	0.6	2.1	1.3	**3.2**
North West	81.1	10.9	17.7	13.7	23.1	1.0	1.8	1.5	**4.2**
Yorkshire and the Hum	75.7	12.2	18.9	14.4	21.2	1.1	1.9	1.4	**3.8**
East Midlands	95.1	14.9	19.5	15.7	19.5	1.1	2.1	1.4	**3.8**
West Midlands	84.7	12.5	20.3	14.9	22.4	1.0	2.5	1.7	**4.2**
East of England	101.7	20.2	18.8	19.9	25.0	1.3	2.5	1.7	**4.1**
London	112.4	30.6	26.0	26.2	29.1	1.2	2.2	2.2	**5.4**
South East	99.1	18.9	19.2	19.0	27.9	1.5	2.3	1.8	**5.0**
South West	78.3	11.8	19.9	12.9	17.0	0.8	2.3	1.2	**2.8**
England	87.2	14.8	20.4	16.5	22.6	1.1	2.2	1.6	**4.0**
Wales	71.1	8.8	17.9	9.9	11.9	0.6	1.9	0.9	**2.3**
Scotland	46.9	5.1	16.8	6.1	7.8	0.5	1.9	0.9	**2.1**
Great Britain	**81.6**	**11.6**	**20.0**	**13.6**	**18.5**	**0.9**	**2.1**	**1.4**	**3.6**

1 The calculation for the average daily flow is estimated by dividing the annual traffic estimate by the road length and the number of days in the year.
2 Includes trunk motorways and principal motorways
3 Urban roads: Major and minor roads within an urban area with a population of 10,000 or more. These are based on the 2001 urban settlements. The definition for 'urban settlement' is in 'Urban and rural area definitions: a user guide' which can be found on the

Source: DfT National Road Traffic Survey
Last updated: July 2018
Next update: June 2019

Source: Department for Transport, TSD357-Road traffic statistics, Table TRA0302: 2016

Review of Leakage Drivers

Impact of Density on Leakage

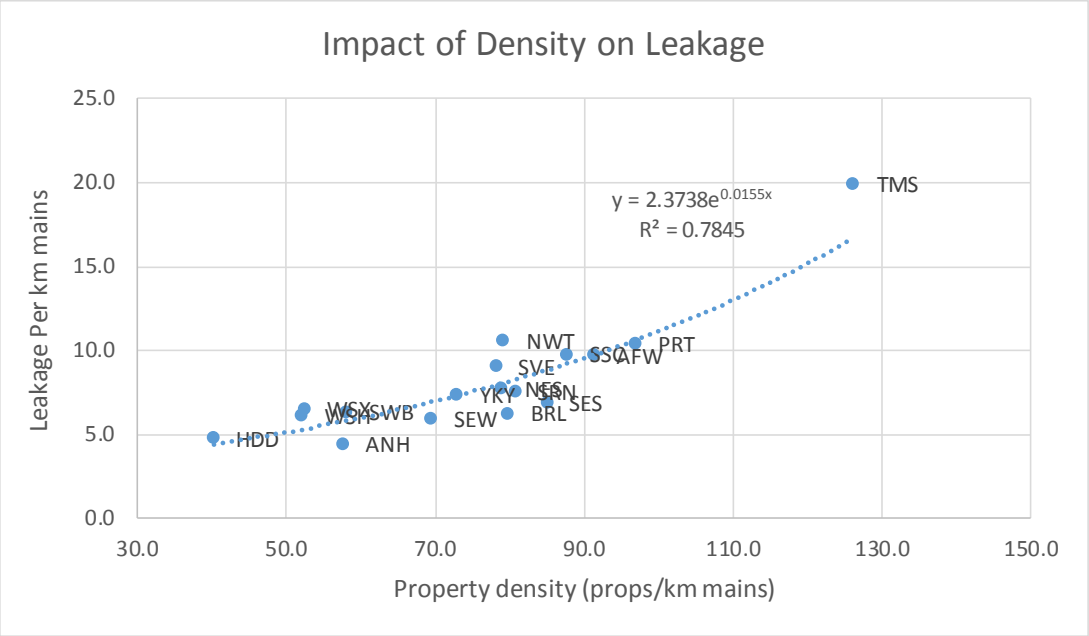
6.17 Ofwat's Wholesale water network plus model has been developed from historic costs (which have included managing leakage). Ofwat's model includes a network density term which was found to be significant in the correlation. The cost of find and fix activity just to maintain stable leakage represents around 7% of our forecast wholesale water network plus cost in AMP7 and is therefore a significant cost component in this model. This supports the view that density affects the level of expenditure required to maintain leakage. This may be explained by explanatory factors such as:

- Higher network density indicates there are more connections per km of main. Each connection represents a point of weakness in the main and represents a risk of generating a leak;
- Greater density coincides with higher traffic loading which puts additional loads on pipes causing them to fail;
- Undertaking find and fix activity in urban areas is made more difficult and due to noise (which affects the ability to detect leaks) and more expensive (due to both restricted working and higher reinstatement costs);

6.18 The relationship between leakage and density for each of the companies in England and Wales is shown below[154]. Figure 11 indicates there is a high degree of correlation between density and leakage per km of main. This still indicates a degree of variability from the expected (mean) trend line. However, not all companies will have had the same historic incentives in relation to leakage, and we are aware that Anglian Water, like us, have historically had significant water resource reasons to reduce leakage, which is not necessarily the case for other water companies. If the leakage levels versus density for companies that are considered to be 'water stressed' – i.e. they have historically had pressure on the supply/demand balance are considered, then the correlation is extremely strong, as shown in Figure 12 below, and we fall along the same trend line as 'frontier' companies such as Anglian.

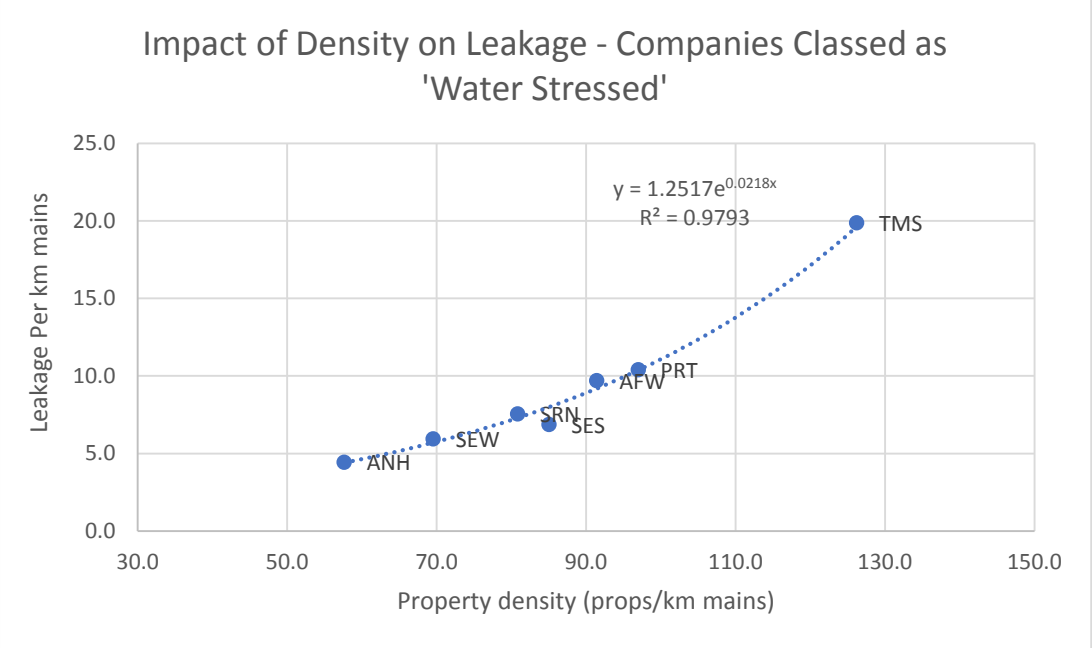
[154] *Based on Ofwat data tables extract for 2019/2020 forecast data*

Figure 13: Leakage and density (expressed per km of main)



Source: Thames Water

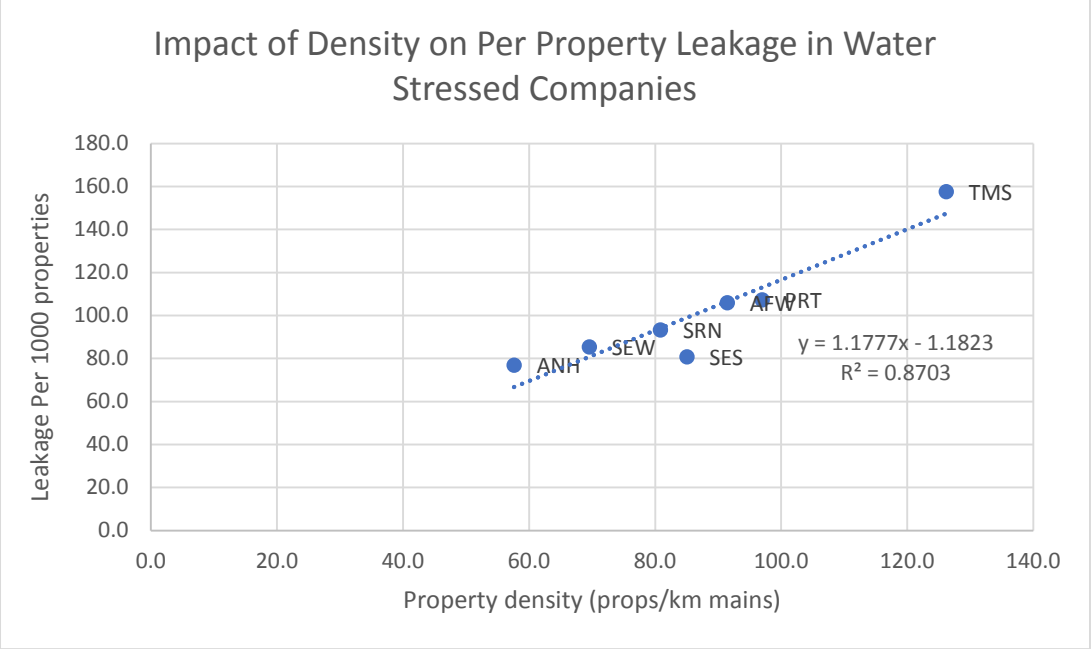
Figure 14: Leakage and density (expressed per km main for water stressed companies)



Source: Thames Water

6.19 This correlation assumes a non-linear relationship between leakage and density, which is influence by Thames Water as an outlier value. However, as shown in *Figure* 1513 below, there is a strong correlation between leakage as expressed per property, and density, which supports the assumption that the relationship is non-linear.

Figure 15: Leakage and density (expressed per property for water stressed companies)



Source: Thames Water

6.20 In this case 'water stressed' is as defined by the EA 2013 report[155], as reflected in the Table below.

Table 83: Water companies classified as water stressed

	2013 Classification					
Water Company Area	Current Stress	Future Scenario 1	Future Scenario 2	Future Scenario 3	Future Scenario 4	Final Stress
Affinity Water (formerly Veolia Water Central)	S	S	S	S	S	Serious
Affinity Water (formerly Veolia Water East)	S	S	S	S	S	Serious
Affinity Water (formerly Veolia Water South East)	S	S	S	S	S	Serious
Anglian Water	S	S	S	S	S	Serious
Bristol Water	M	M	M	M	M	Not Serious
Cambridge Water	M	M	M	M	M	Not Serious
Cholderton & District Water	M	M	M	M	M	Not Serious
Dee Valley Water	M	M	M	M	M	Not Serious
Dwr Cymru Welsh Water	M	M	M	M	M	Not Serious
Essex & Suffolk Water	S	S	S	S	S	Serious
Northumbrian Water	M	M	M	M	M	Not Serious
Portsmouth Water	M	S	M	S	M	Not Serious
Sembcorp Bournemouth Water	L	M	M	M	L	Not Serious
Severn Trent Water	M	M	M	M	M	Not Serious
South East Water	S	S	S	S	S	Serious
South Staffordshire Water	M	M	M	M	M	Not Serious
South West Water	M	M	M	M	M	Not Serious
Southern Water	S	S	S	S	S	Serious
Sutton & East Surrey Water	S	S	S	S	S	Serious
Thames Water	S	S	S	S	S	Serious
United Utilities	M	M	M	M	M	Not Serious
Veolia Water Projects	M	M	M	M	M	Not Serious
Wessex Water	M	M	M	M	M	Not Serious
Yorkshire Water	M	M	M	M	M	Not Serious

Source: Environment Agency

6.21 Based on the above, our view is that when comparing leakage performance on a like-for-like basis, density must be taken into account. If water stressed companies are analysed and density is taken into account, our performance is much closer to upper quartile than is apparent through a simple

[155] *Environment Agency, report on water stressed areas, 2013*

analysis of per property leakage rates. Even if all companies are taken into account using a non-linear relationship, then our performance is much closer to average than is apparent through simple comparisons.

Correlation between bursts (condition) and leakage

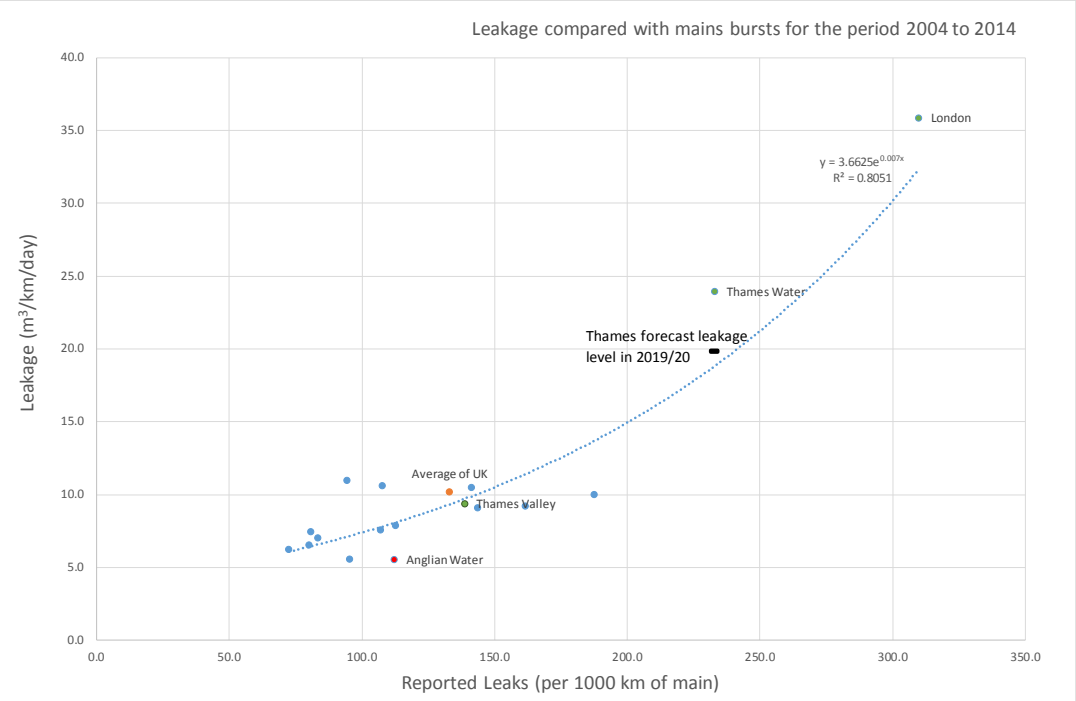
6.22 Leakage can be categorised as “background” (a large number of small leaks such as leaking joints that are hard to detect and uneconomical to repair), and “bursts” (more significant, detectable leaks). Mains condition affects both the level of background leakage and the rate at which bursts break out, and hence affects both the minimum level of leakage that can be achieved and the level of effort required to achieve a given level. For our own network we have detailed pipe deterioration and condition models, but to enable comparisons with other companies, mains repair records provide a means of comparing condition. We have therefore reviewed burst data for all companies to assess the strength of the relationship between bursts as a surrogate for condition, and leakage, and also detail from physical assessments of our own network.

6.23 Reported mains bursts (i.e. mains leaks repaired following a report of a visible leak as opposed to invisible leaks which are found by leak detection activity) provide an indicator of the condition of water mains that is relatively independent of water company activity in relation to leakage. The relationship between reported bursts and leakage for each of the companies in England and Wales is shown below156. This analysis is based on ten years of data from 2004 to 2014 which ensures any short-term factors such as weather are eliminated. Figure 14 indicates there is a good correlation between the burst rate (representing condition) and leakage per km of main, andSource: Thames Water

6.24 Figure 15 shows reasonable correlation with leakage per property. The purpose of these graphs is to demonstrate that historic leakage levels achieved is related to mains condition, but the graphs should not be used to assess relative leakage performance as leakage levels presented are average levels between 2004 and 2014; we show our forecast leakage performance in 2019/20 to demonstrate the impact of leakage reductions since 2004.

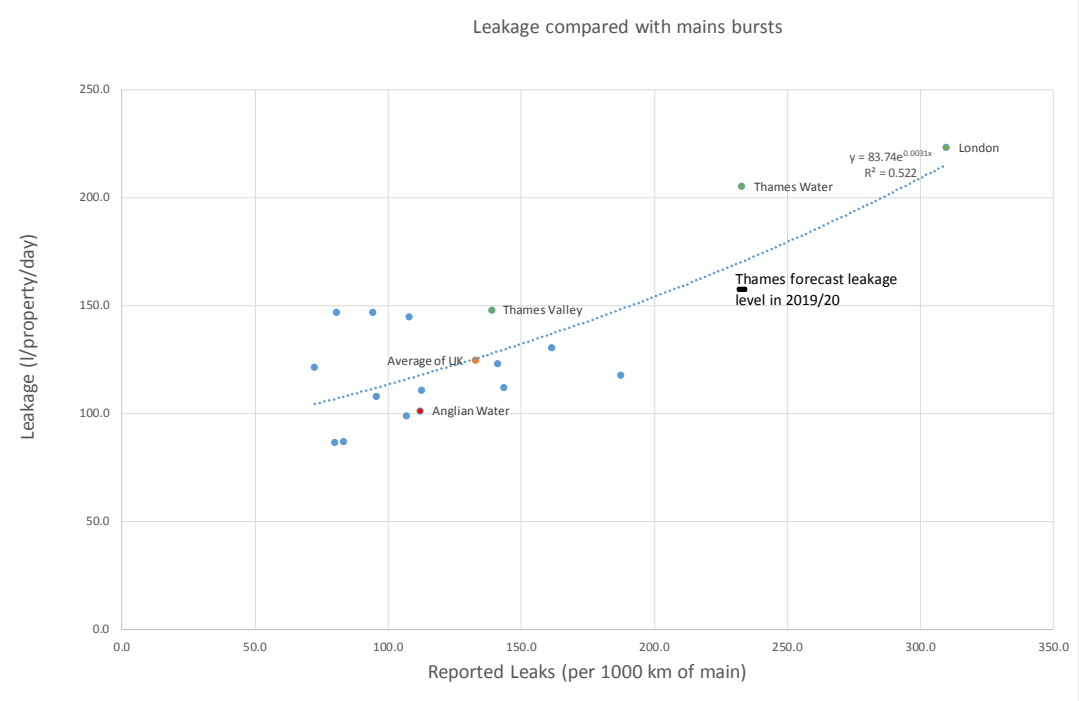
[156] *Water UK, Leakage Performance Indicator Dataset*

Figure 14: Leakage and bursts (expressed per km of main)



Source: Thames Water

Figure 15: Leakage and bursts (expressed per property)



Source: Thames Water

6.25 We acknowledge that the above graphs include Thames Water, and whilst there is still a clear relationship between bursts and leakage expressed in per km of mains without Thames Water, the relationship is weaker and there is a great deal of uncertainty in the relationship between leakage and reported bursts for very high burst rate areas such as London.

6.26 We therefore also carried out statistical analysis of leakage and bursts based on data from our GIS and leakage monitoring system based on DMA data for the reporting years JR 2013 to 2016[157]. In this report we assessed the strength of relationship between total leakage and reported bursts based on DMA data, which confirmed overall a correlation between higher burst rates and higher leakage, as shown in Figure 16.

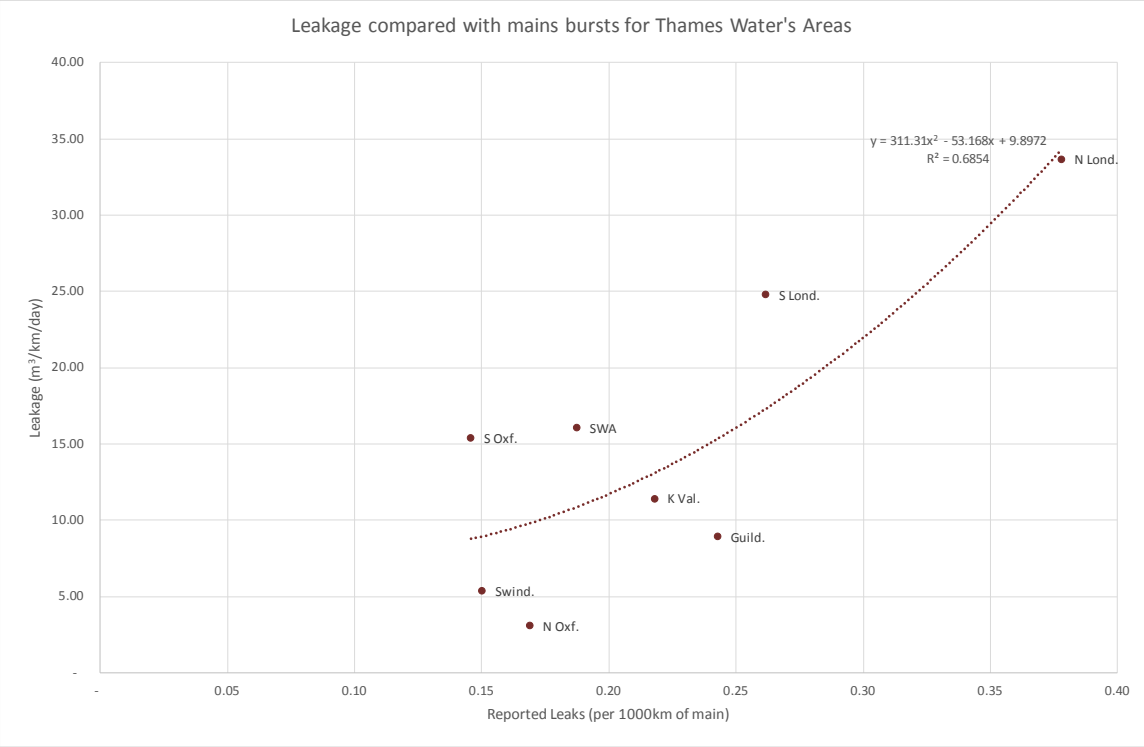
Figure 16: Leakage versus Mains Bursts both normalised by length. Note the log scale for both axes

Source: Thames Water

6.27 We have also analysed recent leakage and burst data for each of the Asset Planning Areas within the Company to further demonstrate the relationship between leakage and bursts (and hence mains condition). We have compared our recent leakage level (based on the average between 2015 and 2018) with average burst rates over the last ten years as shown in Figure 17, and this confirms a correlation between leakage and burst rate.

[157] Distribution Mains Statistical Model – DMA Leakage Model Enhancement, November 2017.

Figure 17: Leakage versus Mains Bursts by Asset Planning Area



Source: Thames Water

6.28 Based on the above it is apparent that our mains condition and associated burst rates are having a significant impact on our relative leakage performance, which is not accounted for in simple per property or per km of mains based analyses.

Meter Penetration

6.29 Customer side leakage (CSL) forms a significant component of total leakage, in our case we estimate it is at least 25%. Customer metering facilitates the early identification of customer-side leakage, and also efficient targeting of network leakage. We will be able to reduce CSL when customers are metered as a result of the availability of measured data, which allows us to identify 'points of interest' amongst customers, where high usage indicates possible leaks. This reduction in CSL is common to all Water Resources Management Plan (WRMP) submissions, and the difference in CSL between measured and unmeasured customers forms an integral part of the reported water balance for all water companies.

6.30 Historically we have had the lowest rate of meter penetration amongst the WASCs, whilst 'frontier' companies such as Anglian Water have the highest rate of non-household metering (see table below). Whilst the meter penetration rate is governed to some extent by the companies, it has been set for each company in conjunction with the Environment Agency and Ofwat, taking the level of water stress, sustainable level of leakage and customer willingness to pay into account.

Table 84: Meter penetration (2017/18 data)

	SWW	SOU	THM	DWR	SVT	ANG	YKS	NWL	UU
% of residential connections metered	78.1%	83.6%	37.4%	40.5%	42.6%	78.9%	50.2%	43.7%	38.9%
% non-domestic connections metered	90.0%	86.2%	74.6%	79.7%	82.7%	91.7%	75.5%	78.7%	75.3%

Source: Ofwat

6.31 Our WRMP19 draft submission includes plans over AMP7 to AMP9 to reduce leakage significantly through the use of smart (AMI) metering. Companies such as Anglian Water and Southern Water already have a much higher meter penetration rate than us, but this has been through the use of 'dumb' metering. Based on our Annual Return water balance calculations, we estimate that the difference between unmeasured customers and customers on a 'dumb' meter is 43 litres/property/day. That means we would anticipate that our leakage levels would reduce by 0.27% (of the 2019/20 target position) for each 1% of additional meter penetration that we achieve from our current position.

6.32 Currently our household meter penetration is forecast to reach 49.4% by 2019/20. Anglian Water's meter penetration rate is forecast to be 84% by 2019/20, which is similar to Southern Water. Overall this difference therefore accounts for around 9.3% of our forecast 2019/20 leakage level.

Conclusion

6.33 Our mains burst model demonstrates strong correlation between bursts and soil corrosivity. Data from 925 pipe samples also confirms that soil corrosivity affects the condition and rate of deterioration of ferrous mains across our region, so age and environmental factors are interlinked. In London, 40% of the soils are 'highly' or 'very highly' corrosive to iron mains compared with 23% nationally. Corrosion of ferrous mains leads to failure (bursts) but also background leakage, hence the age of ferrous mains is material in the level of leakage which can be achieved for given effort. Half the mains in London were laid before 1920, which is much higher than any other water company. We therefore consider that our high burst rate is a feature of the environment that we operate in, and the age of the networks that we inherited at privatisation.

6.34 Comparison of burst and leakage data for the period 2004 to 2014 also demonstrates a correlation between the number of reported (visible) bursts and leakage. Reported bursts are accepted as a good indicator of mains condition, and higher burst rates are therefore indicative of higher background leakage as well as higher leakage from bursts. Both a statistical analysis of our data at District Meter Area level, and an analysis at Asset Planning Area level demonstrate the same correlation. A simple comparison of leakage based on normalised values does not recognise mains condition which affects the relative levels of leakage companies are able to achieve cost effectively.

6.35 A cross-company comparison of forecast leakage levels for 2019/20 and their connection density also reveals a strong correlation between density and leakage, and we suffer from high network density. It should be noted that Ofwat's econometric model does confirm that density is a significant parameter in wholesale water totex. The reason density affects leakage levels may be explained by the fact that connections represent points of weakness in the network leading to leaks, and high density is indicative of more difficult working conditions and higher traffic loading (traffic flows in London are

nearly twice that in the North and Midlands, and nearly three times that in rural areas such as Wales and the South West).

6.36 Based on the trend analyses of leakage versus density and mains condition (burst rates), it is apparent that our leakage rate would be very close to other 'water stressed' companies if those factors are taken into account.

6.37 As well as mains condition and density we note that, although we have a significant programme of meter installations, in terms of historic comparisons we have the lowest rate metering of all of the Water and Sewerage Companies, which presents us with a disadvantage in managing leakage. We estimate that if our metering was at the same level as companies such as Anglian or Southern then our current leakage would be over 9% lower on a comparable basis.

Section 7

Annex 3- Biodiversity Tool – Net Gain

7.1 The Defra biodiversity offsetting tool is a new way of measuring biodiversity in a quantitative way, first piloted in 2013 with training courses released in 2015. Guidance on how to use the tool was released in February 2019[158], with the Thames Water example at Woodberry Wetlands, Stoke Newington, included as a case study.

7.2 Furthermore, net gain is a relatively new concept within planning guidance with the Government releasing a public consultation[159] in December 2018 on whether biodiversity net gain should be a mandatory requirement for all projects requiring planning permission. In particular the consultation focused on ideas of how the Government could implement the approach, how to standardise the approach so that it's simpler and clearer to use, and ideas on how the Government should measure and monitor the net gain to ensure delivery.

7.3 Prior to the introduction of the Defra biodiversity offsetting tool there was no quantitative way in which to measure biodiversity. Given this and the relative novelty of the biodiversity net gain concept, there is no existing dataset against which to evaluate the targets set within this performance commitment.

7.4 Thames Water has been involved in discussions on net gain with the current Secretary of State for the Environment and we have been advising the Government on how net gains are achievable in the real world.

7.5 Using the tool to baseline our sites where we want to enhance biodiversity, the theoretical maximum percentage enhancement across the sites, over the five years of AMP7 is 8.5 % (given in table below).

7.6 There are many reasons why 8.5% is an unachievable target in practice. If we were to enhance the condition of all of the biodiversity at all of our Sites of Biodiversity Interest, from poor to moderate, or moderate to good, then we could theoretically achieve 8.5% net gain on biodiversity over the 253 sites. However, some of these 253 sites have operational and growth needs and 31 have no suggested enhancements at this time. For example a number of sites are in our current growth plan for waste water, delivering major sludge improvements at four sites which will require new assets on 'green' land, and preventing biodiversity enhancements being delivered in these land areas.

7.7 Also, some of these sites or areas within a site are identified for potential future disposal (for example sold for property development) and will leave our ownership during the AMP.

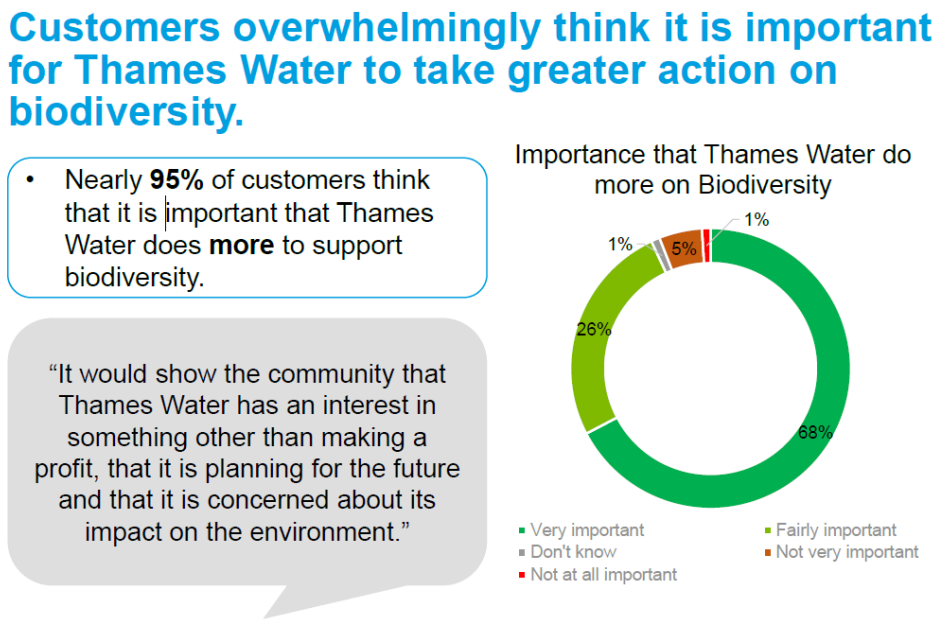
7.8 Given the lack of historic experience of delivering quantified net gain using the Defra tool and the potential limitation to delivery driven by planned operational changes on site and property disposals 5% is considered to be a stretching and challenging target for AMP7.

7.9 Section 4.2.4 of Ofwat's final methodology requests that we look at our challenge level compared to industry and not just Thames Water. As mentioned above calculating biodiversity net gain is a new concept and we are unable to find identical comparators – both within the water industry and others,

[158] https://cieem.net/biodiversity-net-gain-guidance-published/
[159] https://www.gov.uk/government/consultations/biodiversity-net-gain-updating-planning-requirements

for example rail. No other company to date has committed to enhancing biodiversity on their landholdings.

7.10 Due to the Performance Commitment being a late addition to the suite of performance commitments, based on the timings of the delivery of the Defra tool as explained above, unfortunately we are unable to provide further evidence of customer support for the proposed level of stretch. However, we commissioned bespoke research in January 2018 to support our ambition for enhancing biodiversity as a performance commitment. As set out in the main Performance Commitment document[160], bespoke customer research underpins our commitment to delivering biodiversity enhancements on our landholdings and the full research results can be read here. [161] An extract from the research is given below.



[160] Thames Water, CSD005-EWS01 - Enhancing biodiversity, September 2018
[161] Thames Water,TSD019-CR12d-PR19-Biodiversity page 20, September 2018

Net Gain Target - Thames Water Ecological Enhancement sites

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Abbey Mills	38.02	Improved grassland	1.76	Poor	Moderate	5.9	2.4	5.9
Adderbury SPS	24.70	Improved grassland	0.55	Poor	Moderate	3.40	1.4	5.36
		Poor semi-improved grassland	0.31	Poor	Moderate			
Addington	7.20	Poor semi-improved grassland	0.54	Poor	Moderate	2.70	1.2	14.29
Alderbrook Reservoir	2.10	Improved grassland	0.43	Poor	Moderate	1.40	0.5	19.23
Amwell End Water PS New River	48.20	Poor semi-improved grassland	2.91	Poor	Moderate	14.50	5.8	10.74
Amwell Hill Water	51.10	Amenity grassland	0.04	Poor	Moderate	0.14	7.5	12.72
		Poor semi-improved	3.70	Poor	Moderate	18.51		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
PS New River		grassland						
Andoversford STW	4.00	Hedges: intact hedge	0.10	Moderate	Good	1.00	0.3	6.98
Arborfield Bridge	78.70	broad-leaved parkland	0.70	Moderate	Good	10.60	2.2	2.72
Ardley Reservoir	22.10	N/A - all habitats in good condition (except buildings & hardstanding)				0.00	0.0	0.00
Ascot STW	38.80	Poor semi-improved grassland	1.13	Poor	Moderate	5.7	2.3	5.6
Ash Ridge Wokingham	25.40	Improved grassland	1.01	Poor	Moderate	3.40	1.4	5.22
Ash Vale STW	43.80	Improved grassland	1.10	Poor	Moderate	3.67	4.9	10.00
		Semi-improved neutral grassland	1.60	Moderate	Good	16.00		
Ashbury	7.90	Amenity grassland	0.10	Poor	Moderate	0.33	1.5	16.25

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Reservoir		Semi-improved neutral grassland	0.70	Moderate	Good	7.00		
Ashford Common AWTW	382.80	Improved grassland	12.65	Poor	Moderate	42.20	16.9	4.23
Ashford Hill SPS	1.40	Bare ground	0.06	Poor	Moderate	0.20	0.0	0.00
Aston Rowant SSSI	19.75	No enhancement possible				0.0	0.0	0.0
Aylesbury STW	258.20	Amenity grassland	7.08	Poor	Moderate	23.60	87.9	25.40
		Improved grassland	6.77	Poor	Moderate	22.57		
		Poor semi-improved grassland	21.83	Poor	Moderate	109.15		
Badgemore Reservoir	10.16	Semi-improved neutral grassland	0.46	Moderate	Good	4.6	0.0	0.0
Banbury Reservoir	745.80	Improved grassland	7.31	Poor	Moderate	24.40	9.8	1.30
Banbury STW	205.10	Improved grassland	5.99	Poor	Moderate	20.0	45.6	18.2

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		Poor semi-improved grassland	18.76	Poor	Moderate	93.8		
Barford St Michael STW	7.20	Improved grassland	0.70	Poor	Moderate	2.30	1.0	12.20
Barkway STW	15.30	Semi-improved neutral grassland	1.01	Moderate	Good	10.10	2.0	11.56
Basingstoke STW	80.20	Improved grassland	1.43	Poor	Moderate	4.77	10.1	11.15
		Poor semi-improved grassland	4.06	Poor	Moderate	20.30		
Bearwood	6.70	Semi-improved neutral grassland	0.26	Moderate	Good	2.60	0.5	6.94
Beckton STW	169.30	Improved grassland	8.57	Poor	Moderate	28.60	11.4	6.31
Beddington STW	49.80	Improved grassland	8.25	Poor	Moderate	27.50	11.0	18.09
Berkhampstead STW	55.40	Improved grassland	1.00	Poor	Moderate	3.30	1.4	2.46
Bexley PS	51.50	Improved grassland	1.90	Poor	Moderate	6.33	6.8	11.61

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		Semi-improved neutral grassland	0.60	Moderate	Good	6.00		
		Amenity grassland	2.20	Poor	Moderate	7.33		
Bicester STW	117.20	Improved grassland	2.56	Poor	Moderate	8.55	8.2	6.55
		Poor semi-improved grassland	2.39	Poor	Moderate	11.97		
Bishop Strortford STW	115.30	Poor semi-improved grassland	2.98	Poor	Moderate	14.9	6.0	4.9
Bishops Green WPS	1.30	Improved grassland	0.13	Poor	Moderate	0.42	0.3	19.94
		Semi-improved neutral grassland	0.06	Moderate	Good	0.60		
Blackdown	7.20	No enhancement possible						
Blockley (Batsford Estate) WPS	12.20	Improved grassland	0.10	Poor	Moderate	0.33	0.3	2.66
		Semi-improved neutral grassland	0.20	Moderate	Good	2.00		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Bordon	47.60	Improved grassland	1.80	Poor	Moderate	6.00	3.1	6.11
		Semi-improved neutral grassland	0.20	Moderate	Good	2.00		
Bourton on the Water	9.50	Semi-improved neutral grassland	0.60	Moderate	Good	6.00	1.4	12.84
Bowerdean	6.90	N/A - grassland habitat already good condition				0.00	0.0	0.00
Bowsey Hill	5.50	Semi-improved neutral grassland	0.50	Moderate	Good	5.00	1.4	20.29
Boxford SSSI	3.06	No enhancement possible						
Box Hill SPS	13.80	N/A - no grassland. Woodland in good condition. Tall ruderal in moderate.				0.00	0.0	0.00
Bracknell	426.70	Semi-improved neutral grassland	9.00	Moderate	Good	90.00	23.7	5.25

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		Improved grassland	4.10	Poor	Moderate	13.67		
Bramfield STW	6.60	Improved grassland	0.54	Poor	Moderate	1.80	0.8	10.81
Brickenden STW	0.80	Amenity grassland	0.20	Poor	Moderate	0.70	0.4	33.33
Brockhampton	0.37	No enhancement possible					0.0	7.50
Broughton	13.00	Improved grassland	0.60	Poor	Moderate	2.00	0.8	5.80
Broxbourne (New river)	9.65	Poor semi-improved grassland	1.12	Poor	Moderate	5.60	5.7	36.93
Burghfield Reservoir	10.78	Semi-improved neutral grassland	0.82	Moderate	Good	8.20	8.2	43.26
Burnt Hill Reservoir	12.44	Semi-improved neutral grassland	0.66	Moderate	Good	6.60	1.4	9.86
Caddington STW	31.62	Improved grassland	0.91	Poor	Moderate	3.02	18.0	36.26
		Semi-improved neutral grassland	0.60	Moderate	Good	5.99		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Camberley STW	81.20	Semi-improved neutral grassland	2.24	Moderate	Good	22.4	4.5	5.3
Castlewood Reservoir	9.59	Improved grassland	0.05	Poor	Moderate	0.17	2.0	17.20
		Semi-improved neutral grassland	0.90	Moderate	Good	9.02		
		Poor semi-improved grassland	0.06	Poor	Moderate	0.28		
Chalgrove STW	8.70	Improved grassland	0.20	Poor	Moderate	0.70	0.3	3.33
Chapman Lane Reservoir	3.08	No enhancement possible					0.0	0.00
Chapmore End STW	3.00	Semi-improved neutral grassland	0.50	Poor	Moderate	3.3	2.1	41.2
Charlbury STW	11.60	Amenity grassland	0.70	Poor	Moderate	2.30	0.9	7.20
Chelsfield Reservoir	6.35	Semi-improved neutral grassland	0.65	Moderate	Good	6.50	1.3	16.45
Chievely STW	7.38	Semi-improved neutral	0.59	Moderate	Good	5.90	1.2	14.19

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		grassland						
Chinnor Reservoir	8.70	Improved grassland	0.06	Poor	Moderate	0.20	0.1	1.14
Cirencester STW	260.60	Improved grassland	14.60	Poor	Moderate	48.70	19.5	6.96
Clanfield STW	2.60	Semi-improved neutral grassland	0.16	Moderate	Good	1.60	0.3	10.34
Claremont Square	4.60	Poor semi-improved grassland	0.40	Poor	Moderate	2.00	0.8	14.81
Cleeve Reservoir	10.70	No enhancement possible					0.0	0.00
Cockfosters	58.40	Semi-improved neutral grassland	3.40	Moderate	Good	34.00	7.2	10.98
Cold Ash PS	82.90	Semi-improved neutral grassland	1.60	Moderate	Good	16.00	3.4	3.94
Cranleigh STW	55.50	Improved grassland	0.20	Poor	Moderate	17.70	3.5	5.93
		Semi-improved neutral grassland	1.70	Moderate	Good			

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Crawley (West Sussex) STW	101.49	Poor semi-improved grassland	1.60	Poor	Moderate	8.00	3.2	3.07
Crondall STW	37.10	Semi-improved neutral grassland	0.30	Moderate	Good	3.00	0.6	1.59
Crossness STW	421.30	Semi-improved neutral grassland	10.81	Poor	Moderate	72.07	161.3	27.68
		Semi-improved neutral grassland	30.18	Poor	Moderate	201.20		
Cuddesdon STW	5.33	Poor semi-improved grassland	0.45	Poor	Moderate	2.20	0.9	14.03
Cuddington	5.90	N/A no grassland habitats				0.00	0.0	0.00
Dancers End WPS	119.90	Amenity grassland	0.05	Poor	Moderate	0.17	10.3	7.92
		Semi-improved neutral grassland	0.23	Moderate	Good	2.30		
		Poor semi-improved	4.87	Poor	Moderate	24.35		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		grassland						
Darenth WPS	35.96	Improved grassland	0.23	Poor	Moderate	0.77	0.4	1.12
		Semi-improved neutral grassland	0.07	Moderate	Good	0.70		
Darnicle Hill Reservoir	17.77	Semi-improved neutral grassland	1.37	Moderate	Good	13.70	2.8	13.53
		Poor semi-improved grassland	0.03	Poor	Moderate	0.15		
Dorking STW	126.80	Semi-improved neutral grassland	24.90	Poor	Moderate	166.00	123.7	49.39
		Semi-improved neutral grassland	1.70	Poor	Moderate	11.33		
Dorney WPS	15.90	Semi-improved neutral grassland	0.35	Moderate	Good	3.50	2.2	11.91
		Poor semi-improved grassland	0.71	Poor	Moderate	3.55		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Dovedale	5.90	Improved grassland	0.00	Poor	Moderate	0.00	0.0	0.00
Dropmore	6.05	No enhancement possible						
Ealing Reservoir	7.03	Semi-improved neutral grassland	0.46	Moderate	Good	4.60	2.6	27.15
		Poor semi-improved grassland	0.87	Poor	Moderate	4.35		
Earley Reservoir	12.68	Improved grassland	2.46	Poor	Moderate	8.20	3.9	23.61
		Semi-improved neutral grassland	0.30	Moderate	Good	3.00		
East Hampstead Park	19.94	Improved grassland	0.12	Poor	Moderate	0.40	2.4	10.58
		Semi-improved neutral grassland	1.11	Moderate	Good	11.10		
Elstead STW	25.30	Semi-improved neutral grassland	1.82	Moderate	Good	18.20	3.7	12.76
Emmer Green	12.70	Semi-improved neutral	0.99	Moderate	Good	10.70	2.3	15.33

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Reservoir		grassland						
		Poor semi-improved grassland	0.16	Poor	Moderate			
Epsom Downs Reservoir	17.70	N/A existing grassland is good condition				0.00	0.0	0.00
Eton WPS	17.70	Improved grassland	0.12	Poor	Moderate	1.10	0.5	2.75
		Poor semi-improved grassland	0.14	Poor	Moderate			
Eynsford PS	23.40	Improved grassland	1.21	Poor	Moderate	4.02	2.6	9.86
		Semi-improved neutral grassland	0.47	Moderate	Good	4.74		
Fairford Spring	2.90	Improved grassland	0.10	Moderate	Good	0.48	0.3	9.88
		Poor semi-improved grassland	0.01	Moderate	Good	0.04		
Farringdon STW	39.62	Semi-improved neutral grassland	1.84	Moderate	Good	18.4	3.7	8.5

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Farley Hill Tower	2.82	Semi-improved neutral grassland	0.06	Moderate	Good	0.60	0.1	2.76
Farmoor AWTW	3130.99	Improved grassland	19.51	Poor	Moderate	65.03	68.9	2.15
		Semi-improved neutral grassland	1.21	Moderate	Good	12.10		
		Poor semi-improved grassland	20.25	Poor	Moderate	101.25		
Farnborough Reservoir	21.20	Amenity grassland	0.27	Poor	Moderate	0.91	5.0	19.16
		Semi-improved neutral grassland	2.30	Moderate	Good	23.02		
Farnham STW (Surrey)	54.44	Improved grassland	1.34	Poor	Moderate	4.47	12.8	19.07
		Poor semi-improved grassland	5.50	Poor	Moderate	27.50		
Finstock STW	1.60	Improved grassland	0.34	Poor	Moderate	1.1	0.5	23.8
		Semi-improved neutral grassland	0.04	Moderate	Good	0.4		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Fleet STW	85.00	Improved grassland	0.26	Poor	Moderate	0.90	0.4	0.47
Fobney	53.90	Amenity grassland	1.99	Poor	Moderate	6.64	3.2	5.66
		Semi-improved neutral grassland	0.31	Moderate	Good	3.09		
Frilsham Tower	1.64	Improved grassland	0.01	Poor	Moderate	0.03	0.0	0.00
Furneux Pelham STW	6.06	Semi-improved neutral grassland	0.48		Good	4.8	0.9	13.4
Gloucester Road	29.65	Semi-improved neutral grassland	3.62	Moderate	Good	36.20	7.3	19.76
		Poor semi-improved grassland	0.05	Poor	Moderate	0.25		
Glyme Farm	23.31	No enhancement possible					0.0	0.0
Goose Green	2.48	Semi-improved neutral grassland	0.09	Moderate	Good	0.90	0.2	8.15
Greenford	0.40	Improved grassland	0.22	Poor	Moderate	0.70	0.3	42.86

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Greenwich Park Disused	5.00	Semi-improved neutral grassland	0.19	Moderate	Good	1.90	0.4	7.41
Grimsbury Reservoir	288.32	Improved grassland	21.50	Poor	Moderate	71.70	28.7	9.05
Guildford Road (Bedwyn)	1.16	Semi-improved neutral grassland	0.10	Moderate	Good	1.0	0.2	17.1
Hackpen Hill Res	5.42	Improved grassland	0.11	Poor	Moderate	0.37	1.4	21.07
		Semi-improved neutral grassland	0.65	Moderate	Good	6.50		
Hambleden Water PS	3.68	No enhancement possible					0.0	0.00
Hampden Water (Bottom) PS	3.28	Improved grassland	0.31	Poor	Moderate	1.00	0.4	11.35
Hampstead Norreys STW	11.20	Improved grassland	0.54	Poor	Moderate	1.80	0.8	6.67
Hampton - Stain	248.40	Semi-improved neutral	1.24	Moderate	Good	12.40	2.5	1.00

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Hill		grassland						
Harpenden STW	38.90	Semi-improved neutral grassland	1.49	Moderate	Good	14.90	3.0	7.16
Hartley Whitney STW	23.30	Improved grassland	1.38	Poor	Moderate	4.60	1.9	7.54
Haslemere STW	41.00	Amenity grassland	0.29	Poor	Moderate	1.00	0.4	0.97
Haslemere Water Sturt Rd	4.84	Semi-improved neutral grassland	0.16	moderate	Good	1.60	0.4	6.92
Hedsor Res	13.06	Semi-improved neutral grassland	0.23	moderate	Good	2.30	0.4	3.26
Henley STW	34.80	Semi-improved neutral grassland	0.93	Moderate	Good	9.30	1.9	5.18
Heyford	6.46	Improved grassland	0.40	Poor	Moderate	1.50	0.6	9.01
High Knowl Reservoir	7.48	Semi-improved neutral grassland	0.10	Poor	Good	0.80	0.1	1.58
High Wycombe	0.42	No enhancement					0.0	0.0

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		possible						
Hockford STW	73.76	Improved grassland	0.50	Poor	Moderate	1.80	0.7	0.99
Hoe Lane South Borehole	4.70	Amenity grassland	0.01	Poor	Moderate	0.03	0.3	6.62
		Semi-improved neutral grassland	0.15	Moderate	Good	1.50		
Hogs Back	3.00	No enhancement possible					0.0	0.0
Hogsmill Valley	123.88	Improved grassland	3.58	Poor	Moderate	12.60	5.0	3.89
		Poor semi-improved grassland	0.14	Poor	Moderate			
Hollister	0.90	No enhancement possible					0.0	0.0
Holmwood STW	36.34	Semi-improved neutral grassland	1.60	Moderate	Good	15.80	3.2	8.00
Horley STW	46.27	Improved grassland	0.35	Poor	Moderate	13.70	5.4	10.50

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		Poor semi-improved grassland	2.51	Poor	Moderate			
Hornsey Lane	6.70	Semi-improved neutral grassland	0.23	Moderate	Good	2.3	1.6	19.3
		Poor semi-improved grassland	0.56	Poor	Moderate	2.8		
Hurtwood Reservoir	5.74	No enhancement possible					0.0	0.0
Hydon Ball Reservoir	4.66	No enhancement possible					0.0	0.0
Ide Hill	14.83	Semi-improved neutral grassland	0.14	Moderate	Good	1.40	0.3	1.79
Island Barn Reservoir	1086.67	Improved grassland	0.80	Poor	Moderate	2.66	36.8	3.27
		Semi-improved neutral grassland	17.86	Moderate	Good	178.57		
Isleworth Ait	61.60	No enhancement					0.0	0.0

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		possible						
Iver South STW	31.16	Semi-improved neutral grassland	2.31	Moderate	Good	23.1	4.6	13.0
Jockey End STW	16.42	Semi-improved neutral grassland	0.05	Moderate	Good	0.5	0.1	0.5
Kempton Park East Reservoir	508.86	Improved grassland	8.54	Poor	Moderate	28.5	24.5	4.6
		Semi-improved neutral grassland	6.57	Moderate	Good	65.7		
King George V	3213.92	Improved grassland	4.43	Poor	Moderate	14.80	6.0	0.19
King George VI	3071.80	Semi-improved neutral grassland	10.80	Poor	Moderate	72.00	41.8	1.34
Kings Mead	965.02	Improved grassland	0.51	Poor	Moderate	1.71	98.9	9.29
		Semi-improved neutral grassland	49.12	Moderate	Good	491.19		
Kingwood Common	8.12	Semi-improved neutral grassland	0.70	Moderate	Good	6.80	1.4	14.53

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Knight and Bessborough	1030.52	Semi-improved neutral grassland	12.94	Moderate	Good	129.4	25.9	2.4
Knitbury STW	7.02	Improved grassland	0.54	Poor	Moderate	1.8	0.7	8.8
Lambswood Res	3.66	Semi-improved neutral grassland	0.22	Moderate	Good	2.20	0.4	10.73
Leaden Roding STW	1.32	Improved grassland	0.10	Poor	Moderate	0.30	0.1	5.71
Lewknor	2.00	No enhancement possible					0.0	0.0
Lightwater STW	72.84	Amenity grassland	1.40	Poor	Moderate	6.10	2.1	2.75
		Semi-improved neutral grassland	0.20	Moderate	Good			
Little Berkhampstead STW	23.00	Improved grassland	0.23	poor	Moderate	0.8	0.3	1.3
Littlemoor SPS	110.70	Semi-improved neutral	0.80	Moderate	Good	7.70	1.5	1.34

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		grassland						
Littleton	24.14	Improved grassland	0.50	Poor	Moderate	6.80	1.8	6.80
		Semi-improved neutral grassland	0.50	Moderate	Good			
Long Reach STW	57.20	Improved grassland	4.42	poor	Moderate	14.7	8.9	13.5
		Semi-improved neutral grassland	1.50	Moderate	Good	15.0		
Long Wittenham STW	6.71	Improved grassland	0.20	Poor	Moderate	0.70	0.3	4.14
		Poor semi-improved grassland	0.00	Poor	Moderate			
Low Mill Wroughton Reservoir	1.06	Semi-improved neutral grassland	0.08	Moderate	Good	0.80	0.1	11.67
Lullingstone PS	40.60	Semi-improved neutral grassland	0.10	Moderate	Good	0.50	0.1	0.25
Luton (East Hyde)	114.22	Improved grassland	2.40	Poor	Moderate	19.70	5.5	4.58

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		Semi-improved neutral grassland	1.20	Moderate	Good			
Maiden Lane	13.48	Amenity grassland	0.91	poor	Moderate	3.0	3.9	22.5
		Semi-improved neutral grassland	1.36	Moderate	Good	13.6		
Maidenhead	9.82	Improved grassland	2.40	Poor	Moderate	8.00	3.2	24.46
Malt House Farm Stud	22.05	Improved grassland	7.37	poor	Moderate	24.6	9.9	30.9
Maple Lodge STW	437.40	Semi-improved neutral grassland	6.64	Poor	Moderate	44.30	24.3	5.26
Marlow Common Reservoir	12.64	Semi-improved neutral grassland	0.60	Moderate	Good	6.40	1.3	9.06
Medmanham	25.49	Poor semi-improved grassland	0.35	Poor	Moderate	1.8	0.7	2.7
Merrow Reservoir	4.09	Semi-improved neutral grassland	0.14	Moderate	Good	1.4	0.3	7.0

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Merstham	15.06	No enhancement possible					0.0	0.0
Merton Shaft	2.38	No enhancement possible					0.0	0.00
Middle Barton STW	6.43	Improved grassland	0.30	poor	Moderate	1.0	0.37	5.4
Mill Hill Reservoir	16.85	Semi-improved neutral grassland	0.58	Moderate	Good	5.8	1.2	6.4
Mogden STW	240.02	Amenity grassland	0.31	Poor	Moderate	1.0	9.2	3.7
		Improved grassland	1.00	Poor	Moderate	3.3		
		Semi-improved neutral grassland	3.77	Moderate	Good	37.7		
Mount Reservoir	229.94	Amenity grassland	0.31	Poor	Moderate	1.0	8.1	3.4
		Improved grassland	0.10	Poor	Moderate	0.3		
		Semi-improved neutral grassland	3.77	Moderate	Good	37.7		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Munstead Reservoir	6.14	Semi-improved neutral grassland	0.25	Moderate	Good	2.5	0.5	7.0
Netley Plantation	67.78	Semi-improved neutral grassland	6.69	Moderate	Good	66.9	13.4	16.5
New River 2012 (New River A)	312.60	Broad-leaved parkland	1.51	Moderate	Moderate	330.1	17.5	5.3
		Broad-leaved semi-natural woodland	3.57	Good	Good			
		Buildings / hardstanding	0.01	Poor	Moderate			
Russel Hill Reservoir	23.92	Poor semi-improved grassland	0.11	Poor	Moderate	0.57	0.3	1.16
Rye Common	3.58	Improved grassland	0.10	Poor	Moderate	0.30	0.1	3.24
Rye Meads STW	892.20	Improved grassland	3.80	Poor	Moderate	13.60	5.3	0.59
		Semi-improved neutral grassland	0.10	Moderate	Good			
Sandhurst STW	53.94	Improved grassland	1.60	Poor	Moderate	10.50	3.2	5.53

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		Semi-improved neutral grassland	0.50	Moderate	Good			
Selbourne STW	7.76	Improved grassland	0.10	Poor	Moderate	4.10	0.8	9.77
		Semi-improved neutral grassland	0.40	Moderate	Good			
Seven Springs	46.62	Semi-improved neutral grassland	0.10	Moderate	Good	1.10	0.2	0.38
Sewardstone Green Reservoir	39.66	Semi-improved neutral grassland	3.40	Moderate	Good	33.70	6.7	14.53
Shalford	100.20	Improved grassland	0.90	Poor	Moderate	3.00	1.2	1.18
Shirley Hills (Addington Res)	12.17	Poor semi-improved grassland	0.04	poor	Moderate	0.20	0.1	1.06
Shotover	19.50	Poor semi-improved grassland	0.60	poor	Moderate	3.00	1.2	5.80
Shutford STW	19.04	Improved grassland	0.76	Poor	Moderate	2.53	1.1	5.27
Silchester STW (1)	34.62	Improved grassland	2.10	Poor	Moderate	20.10	5.4	13.45

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		Semi-improved neutral grassland	1.30	Moderate	Good			
SilchesterWT(2)	2.08	No enhancement possible						0.00
Speen WPS	181.86	Improved grassland	1.30	Poor	Moderate	94.60	19.7	9.79
		Semi-improved neutral grassland	9.00	Moderate	Good			
St Martha's Old And New	1.00	No enhancement possible					0.0	0.00
Staines Aqueduct (A)	124.30	Semi-improved neutral grassland	9.31	Moderate	Good	93.10	18.6	13.01
Staines Aqueduct (B)	30.82	Semi-improved neutral grassland	2.40	Moderate	Good	24.10	4.8	13.40
Stains Aquaduct (C)	27.75	Semi-improved neutral grassland	0.79	Moderate	Good	7.90	1.6	5.30
Staines Aqueduct	163.44	Semi-improved neutral	9.30	Moderate	Good	125.10	25.1	13.3

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
(D)		grassland						
		Semi-improved neutral grassland	2.40	Moderate	Good			
		Semi-improved neutral grassland	0.80	Moderate	Good			
Staines Reservior North and South	3307.28	Semi-improved neutral grassland	23.40	Moderate	Good	233.80	46.7	1.39
Standford Rivers STW	21.94	Amenity grassland	1.80	Poor	Moderate	6.10	2.5	10.08
Standlake STW	4.66	Semi-improved neutral grassland	0.23	Moderate	good	2.30	0.4	8.6
Stanmore Reservoir	1.28	Semi-improved neutral grassland	0.16	Poor	Moderate	1.10	-0.2	-16.4
Stoke Newington East	172.14	Improved grassland	2.34	Poor	Moderate	7.80	3.2	1.8
Stokewood	42.99	Semi-improved neutral	0.93	Moderate	good	9.30	1.9	4.3

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Reservoirs		grassland						
		Poor semi-improved grassland	0.01	Poor	Moderate	0.05		
Streatham Hill Reservior	6.63	Semi-improved neutral grassland	0.40	Moderate	Good	9.70	3.1	31.7
		Poor semi-improved grassland	1.13	Poor	Moderate			
Studham	4.28	Improved grassland	0.30	Poor	Moderate	1.00	0.4	8.9
Sundridge PS	60.58	Improved grassland	0.80	Poor	Moderate	2.50	1.0	1.66
Swindon STW	242.86	Improved grassland	3.80	Poor	Moderate	73.70	17.3	6.66
		Semi-improved neutral grassland	6.10	Moderate	Good			
Swinford AWTW	38.64	Improved grassland	1.30	Poor	Moderate	15.40	4.0	9.30
		Semi-improved neutral grassland	1.10	Moderate	Good			

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Tadley Tower & Booster	12.00	Amenity grassland	0.30	Poor	Moderate	0.80	0.3	2.44
Taplow Court (Source)	31.22	Improved grassland	0.30	Poor	Moderate	0.90	0.4	1.20
Tewinbury	249.64	Semi-improved neutral grassland	6.70	Moderate	Good	67.00	13.4	5.08
Thorpe Mandeville STW	0.24	Improved grassland	0.10	Poor	Moderate	0.30	0.2	40.00
Tilehurst reservoir	55.15	Semi-improved neutral grassland	3.90	Moderate	Good	39.30	7.9	12.46
Tring STW	148.92	Improved grassland	0.60	Poor	Moderate	24.90	5.4	3.49
		Semi-improved neutral grassland	2.30	Moderate	Good			
Unstead (Godalming)	33.54	Improved grassland	1.74	Poor	Moderate	5.80	10.4	23.6
		Poor semi-improved grassland	4.00	Poor	Moderate	20.00		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Upper Green	1.02	No enhancement possible					0.0	0.0
Upper Swell WPS	10.38	Semi-improved neutral grassland	0.60	Moderate	Good	6.30	1.2	10.52
Upton	8.15	Semi-improved neutral grassland	0.40	Moderate	Good	9.20	2.9	25.9
		Poor semi-improved grassland	1.00	Poor	Moderate			
Walthamstow Reservoirs	1269.25	Improved grassland	5.48	poor	Moderate	18.27	68.8	5.1
		Semi-improved neutral grassland	7.66	Moderate	good	76.60		
		Poor semi-improved grassland	2.96	Poor	Moderate	14.80		
		Improved grassland	0.05	Moderate	good	0.25		
		Semi-improved neutral grassland	8.71	Moderate	good	87.10		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
		Poor semi-improved grassland	11.39	Poor	Moderate	56.95		
Walton	118.18	Amenity grassland	0.50	Poor	Moderate	41.60	8.7	6.87
		Semi-improved neutral grassland	4.00	Moderate	Good			
Wantage	45.94	Amenity grassland	0.0	Poor	Moderate	15.10	6.1	11.65
		Improved grassland	4.5	Poor	Moderate			
Wargrave STW	16.12	Amenity grassland	2.00	Poor	Moderate	6.60	2.7	14.26
Warmington STW	5.16	Semi-improved neutral grassland	0.12	Moderate	good	1.20	0.2	4.44
Watlington SSSI	13.92	No enhancement possible					0.0	0.00
West Hagbourne	9.02	Semi-improved neutral grassland	0.20	Moderate	Good	1.6	0.3	3.01
Westerham Hill	21.26	Poor semi-improved grassland	0.03	Poor	Moderate	0.20	0.1	0.65

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Weybridge STW	83.94	Semi-improved neutral grassland	2.30	Moderate	Good	23.40	4.7	5.26
Whitchurch Booster	8.08	Improved grassland	1.80	Poor	Moderate	6.00	3.2	28.50
		Poor semi-improved grassland	0.40	Poor	Moderate	2.00		
White Waltham STW	2.60	Improved grassland	0.87	Poor	Moderate	2.90	1.2	31.58
Whitefield A Reservoir	2.47	Poor semi-improved grassland	0.33	Poor	Moderate	1.65	0.6	20.32
Whiteleaf Reservoir	3.30	No enhancement possible					0.0	0.00
Widdenton Park Reservoir	11.60	Semi-improved neutral grassland	0.26	Moderate	Good	2.60	0.5	4.13
Wigwell	108.44	Improved grassland	1.65	poor	Moderate	5.50	5.8	5.04
		Semi-improved neutral grassland	1.77	Moderate	good	17.70		

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
William Girling	2969.46	Semi-improved neutral grassland	34.50	Moderate	Good	344.90	68.9	2.27
Winchester Wood Reservoir	39.46	No enhancement possible					0.0	0.00
Windsor STW	189.36	Amenity grassland	3.02	Poor	Moderate	10.07	15.8	7.72
		Improved grassland	8.85	Poor	Moderate	29.50		
		Semi-improved neutral grassland	0.15	Moderate	good	1.50		
Winterbourne	0.82	Semi-improved neutral grassland	0.05	Moderate	Good	0.50	0.1	8.89
Wisley STW	38.54	Improved grassland	1.96	Poor	Moderate	6.53	3.1	7.36
		Semi-improved neutral grassland	0.20	Moderate	good	2.00		
Witheridge Hill	3.38	Semi-improved neutral grassland	0.00	Moderate	Good	0.40	0.1	3.43

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Woodcote Reservoir A	49.8	Amenity grassland	0.20	Poor	Moderate	0.67	1.3	2.48
		Semi-improved neutral grassland	0.32	Moderate	Good	3.20		
		Poor semi-improved grassland	0.18	Poor	Moderate	0.90		
Woodford High	20.83	Improved grassland	0.47	Poor	Moderate	1.57	2.7	11.36
		Semi-improved neutral grassland	1.04	Moderate	poor	10.40		
Woolwich Common Disused	2.60	Semi-improved neutral grassland	0.28	Moderate	Good	2.80	0.6	18.75
Worminghall STW	11.9	Improved grassland	1.05	Poor	Moderate	3.5	1.4	10.53
Worsham Reservoir	9.8	Improved grassland	0.53	Poor	Moderate	1.8	0.8	7.55
Wraysbury	4155.52	Semi-improved neutral grassland	48.80	Moderate	Good	488.00	97.6	2.29

Site	Baseline Biodiversity Units	Enhanced habitat	Area (ha)	Current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
Wroughton	154.7	Improved grassland	0.19	Poor	Moderate	0.63	0.6	0.38
		Poor semi-improved grassland	0.13	Poor	Moderate	0.65		
Yew Tree	6.66	No enhancement possible					0.0	0.00
	Baseline Biodiversity Units		Area (ha)	current conditon	Target Condition	Enhanced habitats Biodiversity Units	Potential Increase in Biodiversity Units	% increase
TOTAL	36957.24		819.72			5945.62	AVERAGE	8.57