



Cost Adjustment Claim Mains Replacement

Version 1

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Executive Summary

In 2021, we defined our Vision for 2050. This followed extensive engagement with customers, key stakeholders and our Board. Achieving our Vision means leakage levels will be halved and significant interruptions to supply will have been eliminated. And we will achieve this in the face of a series of major challenges including climate change, population growth and rising customer expectation. Realising our ambition requires a step-change in the level of mains replacement at PR24 and beyond – an investment requirement that goes well beyond that which we have historically delivered through our base allowances.

This Cost Adjustment Claim is for an increased mains renewal rate. In its final methodology, Ofwat indicated that *“Companies can submit cost adjustment claims where they can evidence that a step change in capital maintenance/renewals is required to maintain asset health.”*

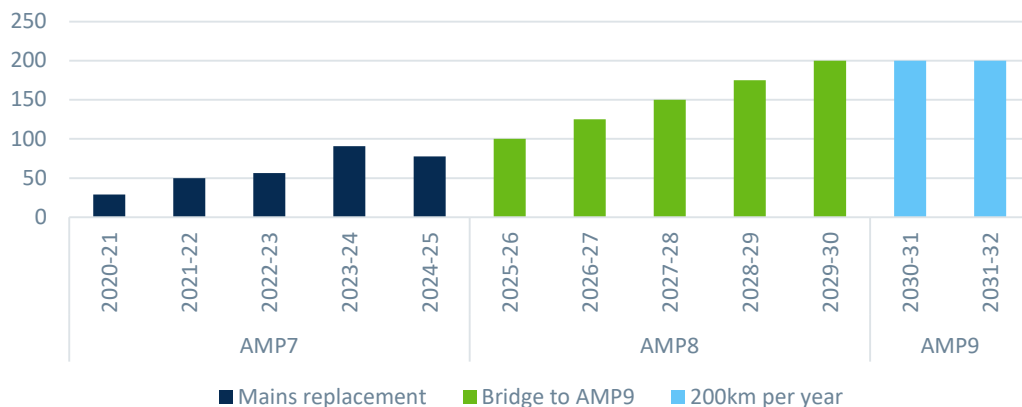
Given the step change needed to deliver the sustainable ongoing level of mains replacement, in this report, we set out our submission for a cost adjustment claim for additional funding requirements for PR24.

We need a cost adjustment to fund this additional activity, since it isn't funded through the cost assessment models. The need for adjustment is predicated on some key features of our network:

- Our water network is the oldest with over 80% of the current pipes installed in London pre-dating privatisation.
- Our network is under the most stress, with the highest hydraulic load and volume per length of main.
- Our network has poor asset health, with the highest levels of leakage and mains repairs compared to other companies.
- Consequentially, we spend significantly more on reactive operating cost activities relative to other companies
- Our base mains replacement activity has varied over time as we have necessarily needed to use base funds to undertake higher levels of short-term fixes to address the immediate network challenges at the expense of longer-term replacement activity.
- Our distribution mains are in asset deficit and asset health will continue to deteriorate further unless there is an increased level of replacement activity

As such, during AMP8 we need to ramp-up our activity to enable us to reach this level of sustainable activity that will be delivered through AMP9 and beyond. In the figure below, we illustrate the bridge required during AMP8 to achieve this level:

Figure 1: Mains replacement activity in AMP8



Our proposed mains replacement programme for PR24 will comprise of 750km of replacement. Our justification for this bridge and a programme of this size is based on 4 key features:

- This volume of activity represents a substantial increase from today's baseline and can realistically be delivered in AMP8.
- 750km of mains replacement will offset our asset deterioration rate and hold our asset deficit for distribution mains steady over AMP8.
- This option will prepare us to deliver 1,000km of replacement in AMP9 to meet our WRMP targets and improve asset health in the long term.
- This option was the best option for customers amongst of the 4 options we considered for our AMP8 mains replacement program based on performance, outcomes, and cost requirements.

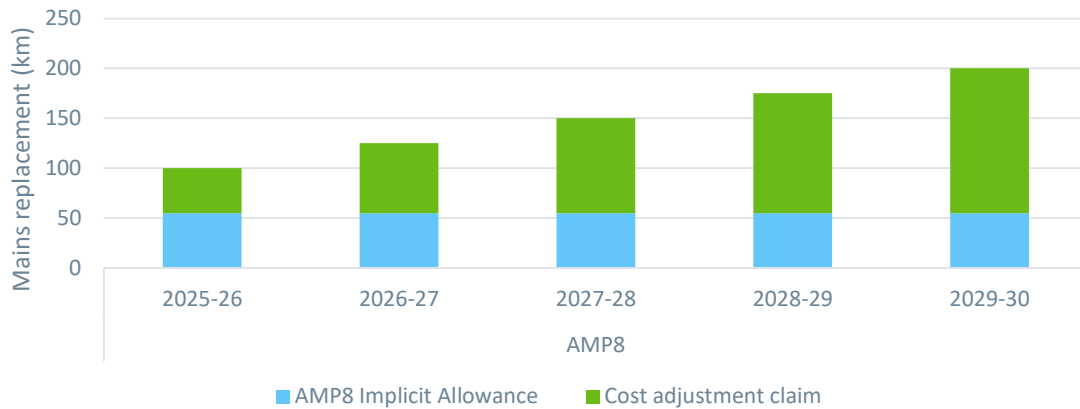
The unit cost rates used in this cost adjustment claim are consistent with those recently agreed with Ofwat for the London Water Improvement Conditional Allowance at Stage Gate 4. We have applied a further efficiency considering the potential for economies of scale, scope and ongoing efficiency that may be achieved.

The approach we adopt to quantification is based on the evaluation of the cost of incremental mains replacement activity, over and above the implicit mains replacement activity.

We have taken a balanced approach to identify the implicit allowance rate for mains replacement in Ofwat's base allowance. We consider that the renewal we have been able to deliver through our base expenditure is the most appropriate and balanced approach to

determining the implicit allowance. Our historical average funded through base was 0.17%. The graph below shows the activity split between the implicit allowance and cost adjustment claim.

Figure 2: Value of the cost adjustment claim



The total funding required for AMP8 stands at £922m, of which we assume the base costs models would provide an implicit allowance of £337.2m. Therefore, the value of our claim is £584m related to the 475km of mains replacement to be funded through enhancement over AMP8.

1. Introduction

1.1 Background and purpose of this report

In 2021, we defined our Vision for 2050. This followed extensive engagement with customers, key stakeholders, and our Board. Our Vision for 2050 combines the key requirements that have been set as a result of government and regulatory policy, with a further set of targets / ambitions determined through our engagement process. We have set 3 long-term outcomes for water services:

- Safe and clean water: Customers trust us to provide safe, clean drinking water;
- Reliable supply: Customers have a reliable supply of water; and
- Always enough water: Our future-proofed water supply can meet the changing needs of our customers and the world around us.

By 2050, this means leakage levels will be halved and significant interruptions to supply will have been eliminated. And we will achieve this in the face of a series of major challenges including climate change, population growth and rising customer expectation. Sir James Bevan (CEO of the Environment Agency) and the Environment Audit Committee have referred to the need for a step-change in infrastructure renewals in order to address some of these challenges¹. Similarly, Sir James Heath, Head of the National Infrastructure Commission, also warned of a brewing water infrastructure crisis in March 2023².

Achieving our turnaround and realising our ambition will require a step-change in the level of mains replacement at PR24 and beyond.

Funding for mains replacement has not been specifically identified historically and is not something directly evident in Ofwat's econometric cost assessment models. Instead, companies have funded base mains replacement activities through the botex granted for the general running of the company, and instances of additional enhancement funding specifically to target mains replacement.

Recent examples of this include:

- Our Victorian Mains Replacement (VMR) programme, where 1,868 km of mains were renewed in AMP4, 368km of which were funded by TW shareholders;

¹ 'Water quality in rivers, Fourth Report of Session 2021–22.' Environmental Audit Committee (2022); page 5

²<https://nic.org.uk/speeches/james-heath-at-water-industry-forum-long-term-solutions-to-fix-too-much-too-little-too-dirty-water/>

- The London Condition Allowance for AMP7, where £300m of additional funding on top of £400m injection from shareholders has been approved to replace 112km of distribution mains and 7 large trunk mains;
- Our WRMP highlights our longer-term need to ramp up to 1000km of mains replacement per AMP from AMP9 to deliver a sustainable and resilient network.

We have historically delivered the maximum possible asset maintenance and replacement within the overall determination. The Economic Insight report, commissioned by Water UK, makes references to the challenges in balancing trade-offs against targets and priorities. The report points to evidence that suggests there is a need for a route to specific funding for increased renewals³.

At PR24 we need to continue to ramp up our activity to deliver a higher level of mains replacement than has historically been funded through base allowances. In its final methodology, Ofwat indicated that “Companies can submit cost adjustment claims where they can evidence that a step change in capital maintenance/renewals is required to maintain asset health.”

Given the step change needed to deliver the sustainable ongoing level of mains replacement, in this report, we set out our submission for a cost adjustment claim for additional funding requirements for PR24.

1.2 Structure of this report

Within the remaining sections of this report we cover the following:

- **In section 2, we cover the need for adjustment.** Our network is one of the oldest in the industry and faces unique circumstances outside of management control that stresses the network due to the highest hydraulic load and volume. Asset health and performance declining compared to other companies and we’ve evidence of an asset deficit. Short-term fixes have taken priority over mains replacement, but there is a need for a sustainable increase in investment. To achieve this, 750km of mains replacements are needed during AMP8, with additional funding at PR24 to bridge the gap.
- **In section 3, we set out our plan for PR24.** We describe our strategy to ensure sustainable service for our distribution mains and our approach to identify options for mains replacement. We have developed 4 options for our AMP8 mains replacement programme, focusing on mains repairs, leakage reduction, and asset deficit reduction. We have assessed these options based on performance, outcomes, and cost requirements to ensure a balanced portfolio for funding and justify why 750km is the right plan.

³ Options for a Sustainable Approach to Asset Maintenance and Replacement, Economic Insight, June 2022

- **In section 4, we quantify the value of the claim.** We set out our view of the cost adjustment required to support the incremental mains replacement activity required to achieve the long-term sustainable level. We consider the appropriate approach for identifying the implicit allowance within Ofwat's base allowance. We summarise the approach we have taken to estimate the required cost adjustment.
- **In section 5, we propose a PCD for customer protection.** We provide a view on the PCD we propose to adopt and how the PCD will work. We will provide further information on PCDs within our Business Plan submission.

1.3 Meeting Ofwat's cost assessment criteria

The table below summarises Ofwat's assessment criteria and provides references to our supporting evidence for each of the criteria set out in Ofwat's final methodology.

Table 1: Ofwat's criteria for cost adjustment claims

Criteria	Sub-criteria	Questions	Thames' evidence	Reference
Need for adjustment	Unique circumstances	(a) Is there compelling evidence that the company has unique circumstances that warrant a separate cost adjustment?	Yes, a step change in activity is required to deliver a long-term sustainable and resilient network. This CAC relates to the additional mains replacement activity above that is funded in Ofwat's base cost models.	Sections 2.1 and 2.2
		(b) Is there compelling evidence that the company faces higher efficient costs in the round compared to its peers?	The CAC is for the incremental mains replacement not funded in Ofwat's base cost models. The unit rate used in the CAC has been agreed upon with Ofwat through the London Conditional Allowance gateway process.	Section 3.2 covers the unit rate and Section 4.1 identifies the implicit allowance.
		(c) Is there compelling evidence of alternative options being considered, where relevant?	Yes, we have considered 4 options for mains replacement activity in AMP8. The chosen option of 750km is the best option for customers and is deliverable within the constraints of the supply chain.	Section 3.1

Criteria	Sub-criteria	Questions	Thames' evidence	Reference
	Management control	(d) Is the investment driven by factors outside of management control?	Yes, there are a set of key features of our network which have contributed to our asset deficit. These features include the age of our network, the stress our network is under and the asset health of the network. Where factors are in management control, the LWI.G2.E1 report sets out our approach to managing these.	Section 2.2 and Section 2.3
		(e) Have steps been taken to control costs and have potential cost savings (eg spend to save) been accounted for?	Yes, we have challenged Ofwat's agreed costs for mains replacement against future efficiency opportunities.	Section 3.2
	Materiality	(f) Is there compelling evidence that the factor is a material driver of expenditure with a clear engineering / economic rationale?	Yes, mains replacement activity is a significant driver of CAC step change in activity is required to deliver a long term sustainable and resilient network and we set out the historical renewal rate in section 4.2.	Sections 2.4 and 4.2
		(g) Is there compelling quantitative evidence of how the factor impacts the company's expenditure?	Yes, we set out evidence on the implicit allowance and the efficient costs we will need to incur to undertake the required investment.	Section 4
	Adjustment to allowances	(h) Is there compelling evidence that the cost claim is not included in our modelled baseline (or, if the models are not known, would be unlikely to be included)? Is there compelling evidence that the factor is not covered by one	The CAC is for the incremental mains replacement not funded in Ofwat's base cost models. We set out our view of the historical mains replacement that is funded through the base models.	Section 4.1

Criteria	Sub-criteria	Questions	Thames' evidence	Reference
		or more cost drivers included in the cost models?		
		(i) Is the claim material after the deduction of an implicit allowance? Has the company considered a range of estimates for the implicit allowance?	Yes, we are currently using a working totex assumption to calculate materiality. In our view, the materiality of the claim is 10%.	Section 4.2
		(j) Has the company accounted for cost savings and/or benefits from offsetting circumstances, where relevant?	Yes, we have carefully considered possibility of offsetting other costs and have outlined these efficiencies in our claim.	Section 3.2
		(k) Is it clear the cost allowances would, in the round, be insufficient to accommodate the factor without a claim?	Yes, the size of the claim is material. Without the incremental claim, we would not be able to undertake the investment required to address our asset deficit.	Section 4.2
		(l) Has the company taken a long-term view of the allowance and balanced expenditure requirements between multiple regulatory periods? Has the company considered whether our long-term allowance provides sufficient funding?	Yes, a step change in renewals is required in AMP8 in order to ensure our distribution mains do not deteriorate further. The proposed replacement in AMP8 is set within the context of our long-term view of mains replacement, enabling us to deliver the long-term sustainable commitments set out in our Water Resource Management Plan.	Section 2
		(m) If an alternative explanatory variable is used to calculate the cost adjustment, why is it superior to the explanatory variables in our cost models?	This criterion is not applicable, we do not propose alternative explanatory drivers.	Not applicable

Criteria	Sub-criteria	Questions	Thames' evidence	Reference
Cost efficiency		(a) Is there compelling evidence that the cost estimates are efficient (for example similar scheme outturn data, industry and/or external cost benchmarking, testing a range of cost models)?	Yes, the unit costs we have used have been approved by Ofwat through the London Condition Allowance gated process. We have challenged Ofwat agreed costs against future efficiency opportunities.	Section 3.2
		(b) Does the company clearly explain how it arrived at the cost estimate? Can the analysis be replicated? Is there supporting evidence for any key statements or assumptions?	Yes, the approach we have taken to calculating the cost estimate is detailed within the CAC.	Section 4
		(c) Does the company provide third party assurance for the robustness of the cost estimates?	Yes, the CAC draws upon costs assured by ARUP for our London Conditional Allowance.	Section 3.2
Need for investment		(a) Is there compelling evidence that investment is required?	Yes, the investment is required to address our asset deficit, the asset health and performance of our network.	Section 2.3,2.4 and 2.5
		(b) Is the scale and timing of the investment fully justified?	Yes, 750km of mains replacement over AMP8 is a deliverable bridge to enable our long term-investment.	Section 3.2
		(c) Does the need and/or proposed investment overlap with activities already funded at previous price reviews?	Yes, we set out our view of the historical mains replacement activity that has been funded through base and enhancement expenditure.	Section 4.1
		(d) Is there compelling evidence that customers support the need for	We asked customers about which approach they support for managing distribution pipes across the network and found	Section 3.2

Criteria	Sub-criteria	Questions	Thames' evidence	Reference
		investment (both scale and timing)?	that 100% of those asked were supportive of a change in approach to a more proactive distribution main replacement.	
Best option for customers	a)	Did the company consider an appropriate range of options to meet the need?	Yes, we considered 4 options for mains replacement. 750km is the option that achieves the aims we set out. It represents a substantial increase from today's baseline, offsetting the deterioration in the network over AMP8 and provides an increasing volume of activity throughout AMP8.	Section 3.1
	b)	Has a cost-benefit analysis been undertaken to select proposed option? There should be compelling evidence that the proposed solution represents best value for customers, communities and the environment in the long term? Is third-party technical assurance of the analysis provided?	Our evaluation considers the long-term risk associated with catastrophic asset failure to water mains outweighs the associated cost. We provide modelled assessment of the asset deficit of different options and how this will be best managed through to 2050.	Section 3.1
	c)	Has the impact of the investment on performance commitments been quantified?	We will provide further detail on the performance commitment impact of our mains replacement programme for AMP8 alongside our Business Plan submission.	To be provided as part of our Business Plan Submission.
	d)	Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed –	We have utilised the unit costs associated with the conditional allowance and explored efficiency levers, resulting in a 6.8% reduction across AMP8. Mains replacement activities	Section 3.2

Criteria	Sub-criteria	Questions	Thames' evidence	Reference
		including where utilisation will be low?	are by nature scalable and modular.	
		e) Has the company secured appropriate third-party funding (proportionate to the third party benefits) to deliver the project?	Mains replacement activity are core assets, and the activity should be managed by Thames Water	Not applicable
		f) Has the company appropriately presented the scheme to be delivered as Direct Procurement for Customers (DPC) where applicable?	Mains replacement activity are core assets, and the activity should be managed by Thames Water. This activity does not pass Ofwat's operational and maintenance discreteness test	Not applicable
		g) Where appropriate, have customer views informed the selection of the proposed solution, and have customers been provided sufficient information (including alternatives and its contribution to addressing the need) to have informed views?	Yes, customer views have informed the development of the options for our mains replacement programme. The majority of customers favoured a high increase in the rate of distribution pipe replacement based on the information they were shown.	Section 3.2
Customer protection		a) Are customers protected (via a price control deliverable or performance commitment) if the investment is cancelled, delayed or reduced in scope?	Yes, we set out a high-level view of the proposed PCD for the incremental mains replacement. We will provide further information on all of our proposed PCDs as part of our Business Plan Submission.	Section 5
		b) Does the protection cover all the benefits proposed to be delivered and funded (eg primary and wider benefits)?	In our PR24 business plan, we will explicitly account for the benefit associated with this mains replacement programme, for example, for forecast leakage and mains repairs.	Section 5.1
		c) Does the company provide an explanation for	Mains replacement activity are core assets, and the activity	Not applicable

Criteria	Sub-criteria	Questions	Thames' evidence	Reference
		<p>how third-party funding or delivery arrangements will work for relevant investments, including the mechanism for securing sufficient third-party funding?</p>	<p>should be managed by Thames Water</p>	

2. Need for Adjustment

In this section, we set out the context of our claim and the need for a cost adjustment.

- Our water network is the oldest with over 80% of the current pipes installed in London pre-dating privatisation. In section 2.1 we summarise the unique features of our water network, including the age and make-up of the current pipeline stock and how it has changed since 1990.
- Our network is under the most stress, with the highest hydraulic load and volume per length of main. In section 2.2 we compare these network characteristics against other companies showing our worsening position.
- Our network has poor asset health, with highest levels of leakage and mains repairs compared to other companies. In section 2.3, we discuss our network performance relative to other companies and highlight how network age and stress are exacerbating the performance challenge.
- Consequentially, we spend significantly more on reactive operating cost activities relative to other companies. The costs of serving our network are higher. In section 2.4 we highlight our relative expenditure on water networks driven by these factors.
- Our mains replacement activity has varied over time as we have needed to prioritise reactive activity. In section 2.5 we describe the evolution of mains replacement investment.
- Our distribution mains are in asset deficit and asset health will continue to deteriorate further unless there is an increased level of replacement activity. In section 2.6 we summarise this asset deficit.
- As such, during AMP8 we need to ramp up our activity over and above the level funded through base. In section 2.7, we set out the need for a bridge for additional funding at PR24 to enable us to deliver additional mains replacements.

2.1 Our water network is the oldest with over 80% of the current pipes installed in London pre-dating privatisation

Our network and current asset stock

We are responsible for over 31,000km of water mains across London and Thames Valley.

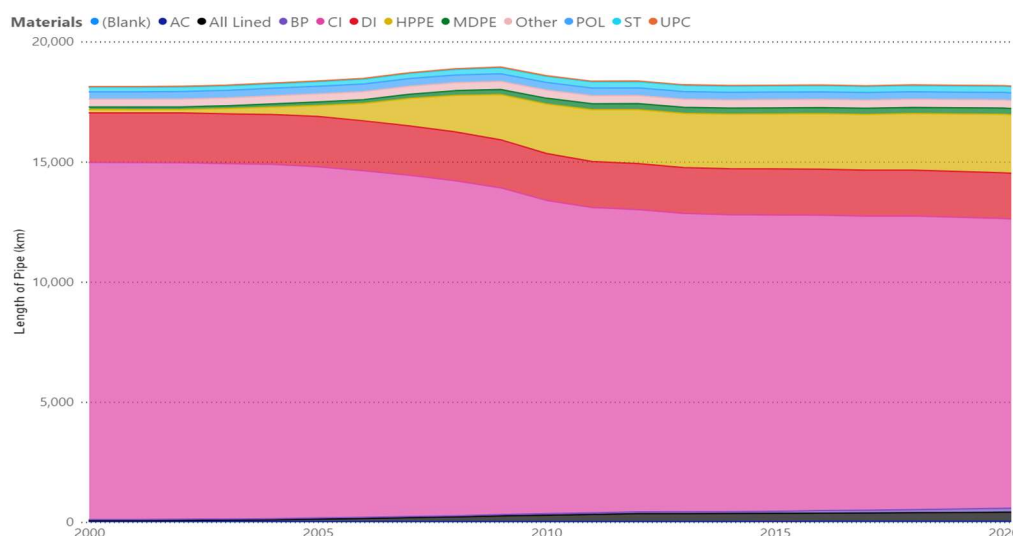
London's water supply system has been evolving for centuries. Private water companies were established in the 18th and 19th centuries and were nationalised in 1903 to form the Metropolitan Water Board. Thames Water Authority and Thames Water are its successors. Today, many of the pipes we manage date back to the 1800s.

Based on available data, 3,501km of pipe (primarily HDPE) has been installed in London since privatisation in 1990 and is still in use, which represents 19.3% of the current pipe stock. This means that 80.7% of the current pipes in London were installed before privatisation.

Figure 3 shows the pipe stock in London since 2000. The proportion of cast iron pipes in London has decreased since 2005, with high-performance polyethylene (HPPE) pipes replacing

them. This is primarily driven by the Victorian Mains Renewal (VMR) programme in AMP4 (2005 to 2010) in which whole District Metering Areas (DMAs) of cast iron pipes in the worst condition were replaced in North and South London with HPPE pipe.

Figure 3: Material of our pipes from 2000 to 2020



The figure also shows that our water mains are mainly composed of ferrous materials such as cast iron, spun iron, and ductile iron. Despite advancements in manufacturing and jointing methods, many of the pipes which are still in use today were installed before the advancements in manufacturing processes, improvements in material selections, changes to joint technology and industry standardisation.

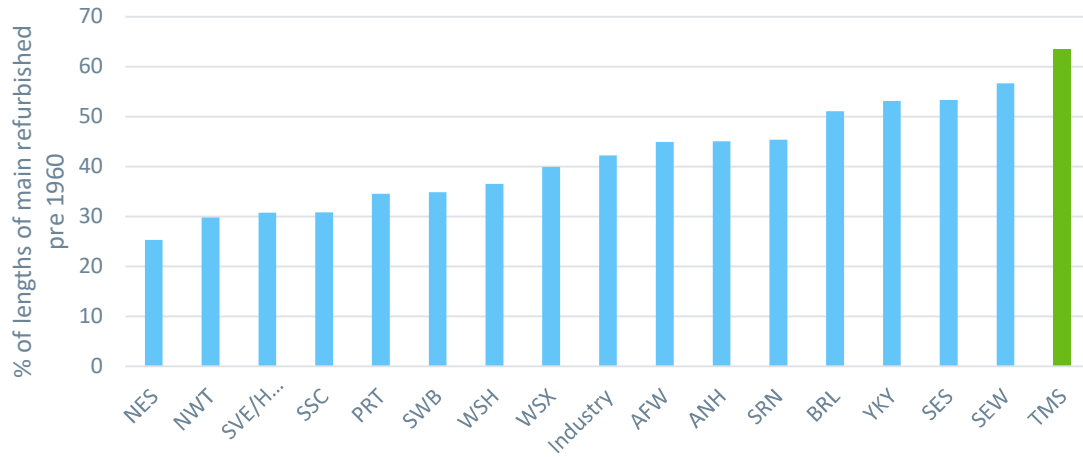
Comparison of our network age versus other water companies

One of the reasons for the poor health of London's water network is the high rate of deterioration of our ferrous pipes and the large number of exogenous factors driving this deterioration. A report by Mott Macdonald⁴ highlighted these factors, as summarised below;

- Many of our pipes are made of cast iron, which is prone to corrosion, as seen in Figure 4. The length of pipes installed before 1960 serves as a good indicator of the percentage of cast iron pipes. This is because cast iron was the primary material used before this period, and while other materials such as Asbestos Cement, uPVC, and Lead were also used, their lengths are limited. Our GIS asset records confirm that cast iron constitutes 60% of our network, which is only slightly different from the estimated 63% based on the pre-1960 metric. Thus, using the pre-1960 metric as a proxy seems reasonable.

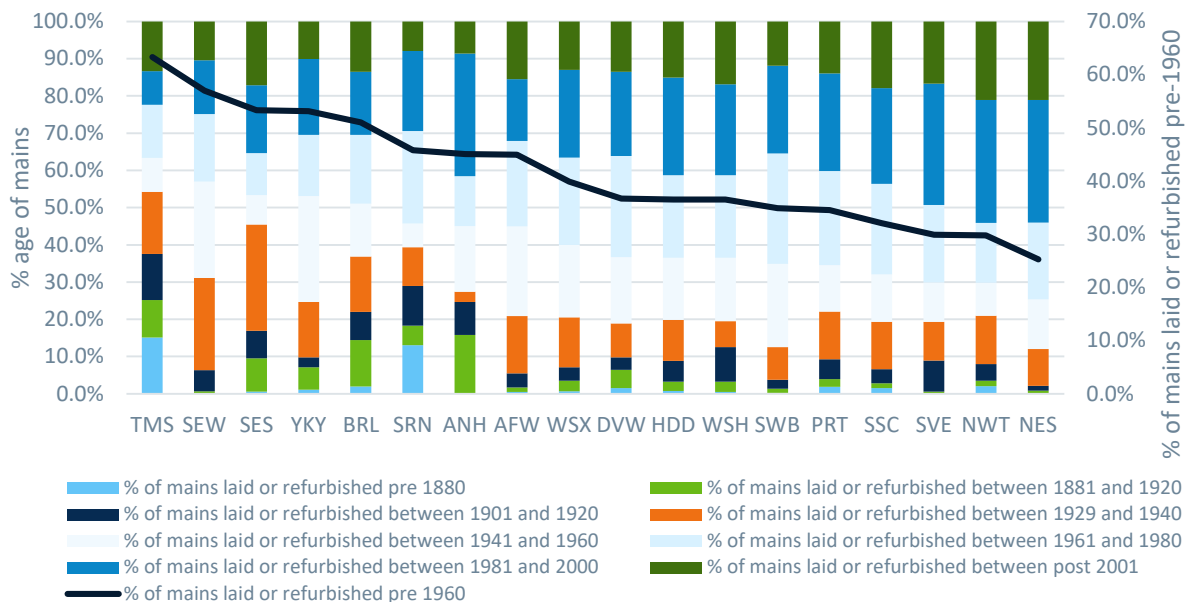
⁴ LWI.G2.E1 - Rationale for London Additional Expenditure Factors Affecting Performance and Costs

Figure 4: % of lengths of mains laid or refurbished pre-1960



- Our pipe network in London is the oldest in England and Wales, with a high percentage of pipes being over 100 years old. Circa 21% of our network is pre-1920, which is quite significant. Before that time, pipes were made with varying dimensional and metallurgical standards. Southern Water has the next oldest water network with 16% of its network being pre-1920, but their pipes do not face corrosive clay soils as ours do. It's worth noting that no other company has more than 2% of its pipes older than 1880.

Figure 5: Comparison of mains age across the industry



- A high percentage of pipes have no corrosion protection and/or the original coal-tar lining has been lost and many of these pipes sit in corrosive clay soils and have become heavily corroded. The report by Mott Macdonald provides substantial evidence on hazardous soils. The report contains analysis to compare geohazards across the industry to show that London and Thames Water, as a whole, is affected by hazardous soil conditions more than other companies. The report also demonstrated a correlation between hazardous soils in our region and repair density, showing that aggressive soil conditions are an important factor in causing pipe failure and leakage and one which affects our region more than other parts of the country.

2.2 Our network is under the most stress, driven by factors outside of management control

Our network in London is experiencing declining performance compared to other water companies due to certain characteristics which are outside management control, in particular:

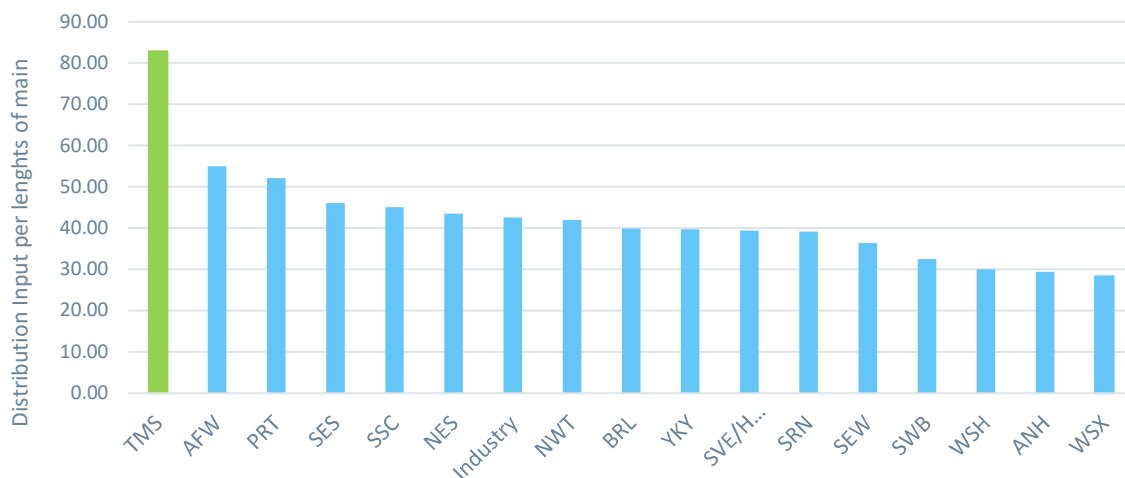
- we are pumping more water relative to the size of our network;
- our demand growth is out-pacing network growth; and
- our soil types damage our network more than others.

We provide further information on these issues below.

We are pumping the largest volume of water relative to the size of our network

The population and density of London requires a higher volume of water to be pumped through our mains network compared with other water companies. As highlighted in the Mott Macdonald report, this requires higher pressures and friction across the network and one of the factors that results in increasing levels of leakage and mains repairs. Figure 6 below illustrates the volume of Distribution Input per length of main and shows that we are a clear outlier with a significant difference to the second water company and twice the level compared to the industry average.

Figure 6: Volume of Distribution Input per length of main

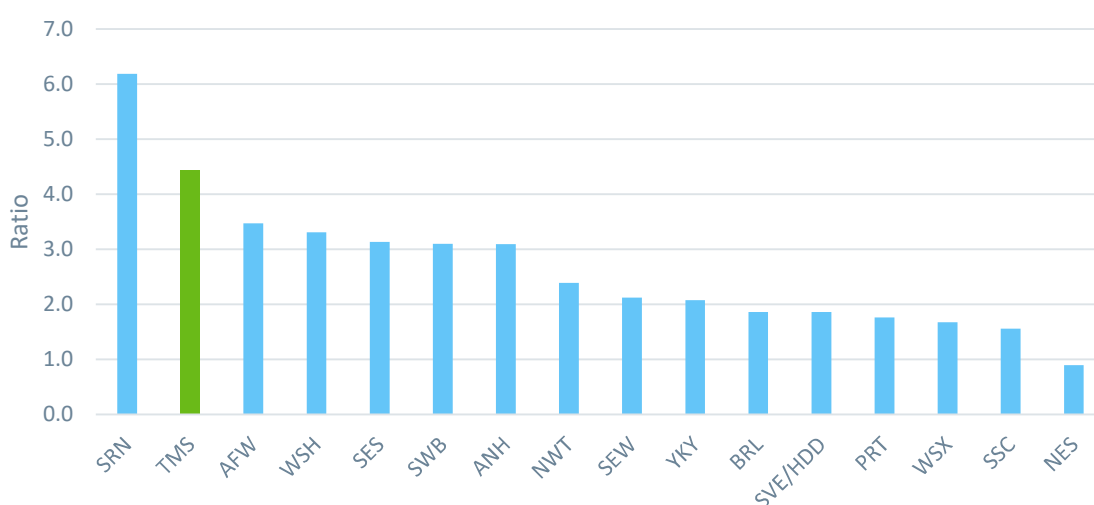


Source: Thames Water analysis of APR data

Demand growth is outstripping network growth, increasing pressure on our network

Over time we have experienced a significant increase in growth in the number of properties connected to our network. This is outpacing the growth of our network's capacity which is limited by the density of London. This demand growth is consequently putting a strain on the system and causing it to deteriorate at an accelerated rate. This is illustrated in Figure 7, which shows the ratio of the percent growth of connected properties to lengths of main between 2011/12 and 2021/22. This shows our connected property growth was 4.4x the growth in our network during this time.

Figure 7: Ratio of growth rate of connected properties to growth of lengths of main



Source: Thames Water analysis of APR data

Our soil type adds significant stress to our network relative to others

The soil types in London differ to that in other parts of the country. In particular:

- Our soils have highly aggressive corrosive characteristics that damage our network.
- Many of the clay soils are also elastic and shrink and swell with changing moisture content. Soil movement then leads to breakage of brittle cast-iron pipes.

The tables below illustrate these two soil related factors that increasing impact our network stress.

Table 2: Analysis of soil corrosivity

Corrosivity Class	London	Rest of England and Wales	Variance
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

Table 3: Analysis of soil fractivity

Fractivity Class	London	Rest of England and Wales	Variance
Very Low	43.0%	39.9%	3.1%
Low	14.7%	23.4%	-8.7%
Medium	0.7%	14.9%	-14.2%
High	19.1%	12.4%	6.7%
Very High	15.0%	0.8%	14.2%
High (Alluvial)	7.0%	8.6%	-1.6%

Source: TSD358-SSLRC Dataset

2.3 Our network has poor asset health, with the highest levels of leakage and mains repairs compared to other companies

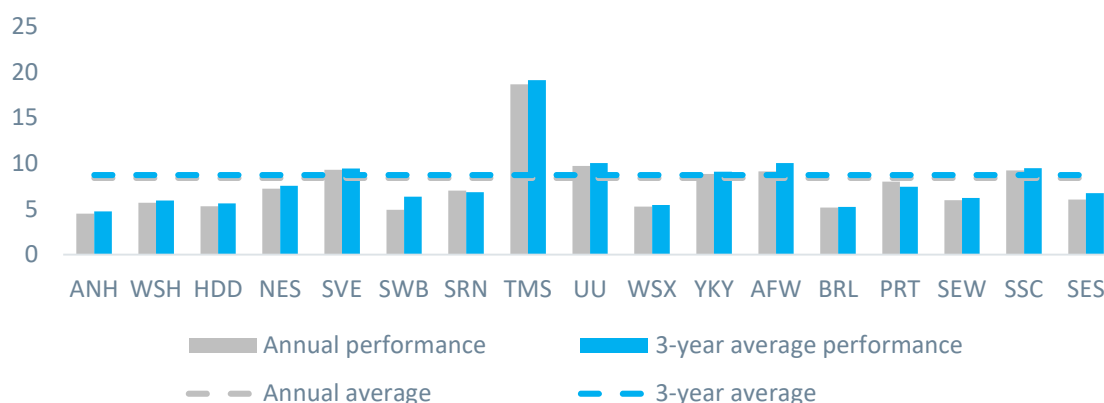
Due to the factors above, our network is experiencing deteriorating asset health. This can be seen in the performance out of network, outlined below.

Evidence of poor asset health

We consider there is good comparative evidence that our water network assets are in poor health because of the factors outlined above. Thames Water is an industry outlier against a range of performance dimensions, including mains burst and leakage.

Figure 8 shows the 3-year average leakage per km of potable main for 21/22. We are a clear outlier for performance despite meeting our performance commitment target and delivering a 10.2% reduction in 21/22.

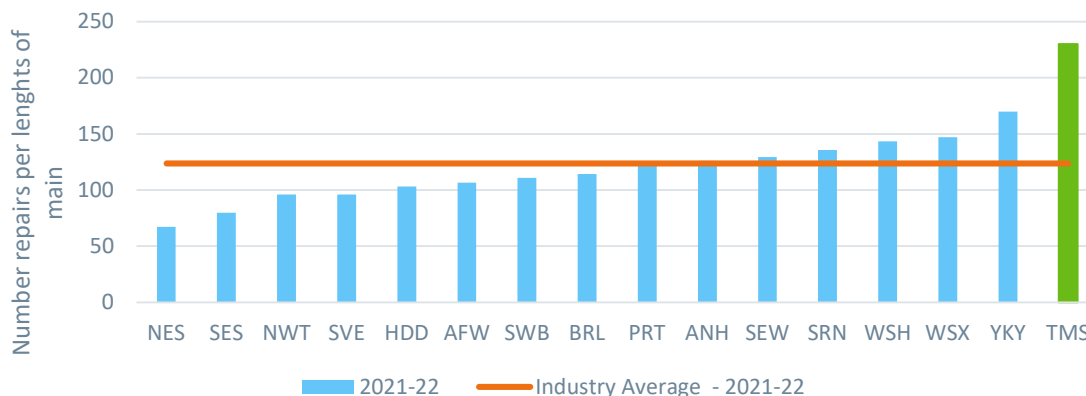
Figure 8: 21/22 3-year average leakage per km of potable main



Source: Thames Water analysis of APR data

Figure 9 shows we are a significant outlier on mains repairs performance. We are 122% above upper quartile performance and 91% above the industry average.

Figure 9: 21/22 Number of mains repaired per 1,000km water main network



Source: Thames Water analysis of APR data

A report by Mott Macdonald⁵, submitted as part of our London Conditional allowance submission at PR19, details the bottom-up evidence that London’s water mains are in poor health. The bottom-up evidence covers the follow features of our network:

- There is a high number of reported (visible) leaks on mains compared with other companies
- Pipe samples show heavy corrosion with through-wall corrosion in many cases
- The lead-pack joints on many older cast iron pipes have become locked with corrosion, making them vulnerable to fracture when water temperatures drop in winter
- There is high leakage recurrence in the worst performing DMAs, indicating that the pipes are in very poor condition
- The network responds poorly to periods of cold or dry conditions, with leakage outbreaks
- There are high numbers of repairs at road junctions, suggesting vulnerability to traffic loading
- There were a high number of high-profile trunk-main failures in AMP6.

Our network has not changed significantly since the report was produced in 2021, we consider that the factors are still relevant in evidencing the condition of our network. The report also outlines the factors that affect the network, which we outline above (i.e. network age and stress).

Furthermore, the report by Mott MacDonald considers the investment decisions which are within management control. The report provides substantial detail on our organisational capability in managing our water network. The report demonstrates we have made effective historical investment decisions, including outlining the benefits of past investment in reducing

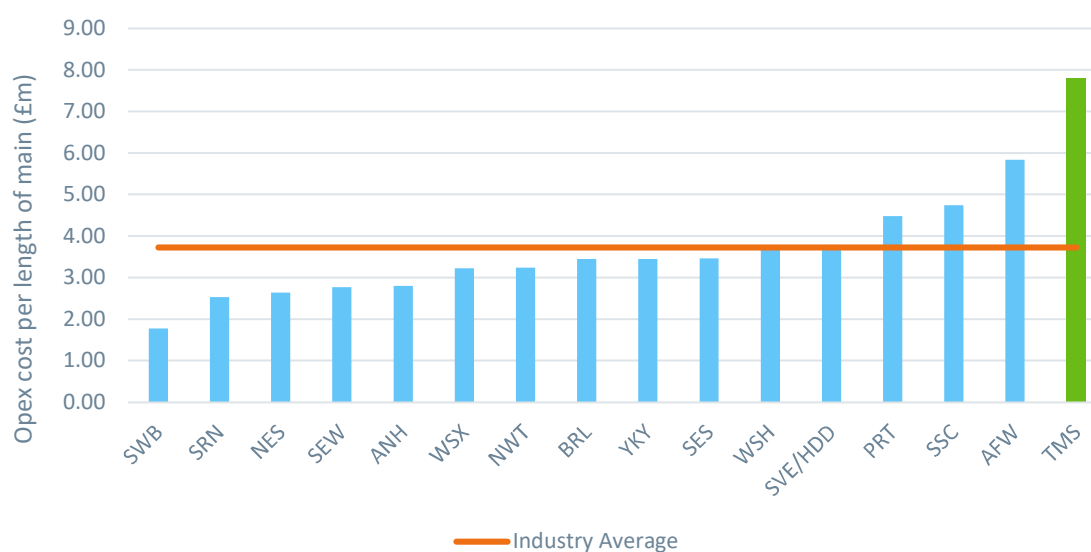
⁵ LWI.G2.E1 - Rationale for London Additional Expenditure Factors Affecting Performance and Costs

leakage and bursts and the quality of our asset knowledge and the insight gained from our analysis tools.⁶

2.4 We spend significantly more on reactive operating cost activities relative to other companies

The consequence of our network age, stress and condition is that we spend significantly more than other companies on operating costs – that is reactive activities relating to leakage and mains bursts.

Figure 10: Average water network operating cost per length of main 2011-12 to 2021-22 (£m, 22/23 prices)



Source: Thames Water analysis of APR data

We have consistently overspent our cost allowances for water networks during AMP5, AMP6 and AMP7, to deliver improvements to leakage performance. Our approach has been to deliver substantial performance improvement through find and fix leakage activity (opex) alongside network optimisation techniques such as pressure management. This approach is not sustainable over the long-term – it leaves the network vulnerable to weather events such as freeze thaw and drought, which will become more frequent as the climate changes. Leakage recovery plans following weather events then require further opex to restore performance over the short-term and this displaces our ability to deliver mains replacement. Delivering a resilient network for customers requires us to break this cycle.

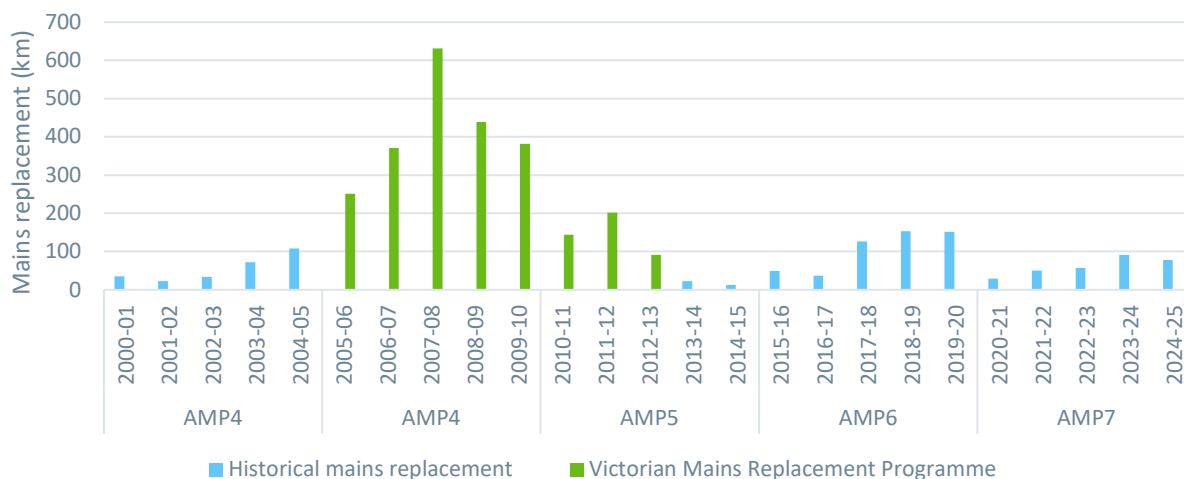
2.5 Our base mains replacement activity has varied over time

Figure 11 shows our historical mains replacement. In AMP8, we will sustainably increase our mains replacement activity each year. In taking this staged approach to increase our mains

⁶ LWI.G2.E1 - Rationale for London Additional Expenditure Factors Affecting Performance and Costs – Section 5

renewal rate, we are confident we will be able to deliver a yearly replacement of 200km by AMP9.

Figure 11: Mains replacement km, AMP4 to AMP7



Source: Thames Analysis of historical APR data

Below, we explain the context of our historical expenditure on mains replacement, noting the challenge we have faced from high levels of operating activity required to service our network.

Historical mains replacement

The 1991 Water Act requires us to maintain a cost-effective and efficient water supply system. Ofwat previously monitored our compliance with the Water Act in maintaining a cost-effective and efficient water supply system through serviceability. We successfully delivered stable serviceability in AMP4 and AMP5, but the condition of the assets remained very similar to that inherited upon privatisation.

- The programme from 2003 to 2010 replaced many of the worst-performing pipes in the worst-performing DMAs, affecting a reduction in failure rate in the following period (2010 to 2015). This reduction extended into AMP6 with continued targeting of poor-performing pipes and other measures to reduce bursts and leakage such as pressure management.
- For AMP6, regulatory processes and control mechanisms were changed significantly with the introduction of Totex allowances and outcome delivery incentives (ODIs). The requirements for AMP6 posed a challenge, as a large portion of our network consisted of old, deteriorating cast iron pipes, making it difficult to improve performance within affordability constraints.
- During AMP6, we faced issues with trunk main failures. Deteriorating asset health, supply interruptions, missed leakage targets, and inefficient delivery were identified as reasons for the decline in performance. External factors like cold weather and the "Beast from the East" also impacted our performance.

- For AMP7, our mains replacement programme is modest. The conditional allowance allows us to make inroads into the renewal of our network, but is still not enough to offset asset deterioration and address our asset deficit.

Current mains replacement programme and the London conditional allowance

Our strategy for distribution mains is to secure overall asset health at a standard that ensures long-term sustainable provision of a socially acceptable and economically viable level of service.

Our AMP7 investment programme for distribution mains incorporates both our base programme and the conditional allowance funding. **The conditional allowance funding was granted by Ofwat at PR19 in recognition that we needed to undertake additional mains replacement activity over base.** We have proceeded through the PR19 gates in justifying the additional funding for this.

Our AMP7 programme comprises a blend of two main elements:

- DMA based interventions, where all or most of the DMA pipework is replaced in a single intervention. These interventions work towards our long-term strategic aim to replace our existing stock of aging cast iron mains but are relatively expensive to implement in terms of money spent per burst 'saved'.
- Specific mains length interventions that are targeted at particular lengths of main which have a clear history of high burst rates. These tightly focused interventions are highly efficient in terms of money spent per burst 'saved' in the short term but deliver less towards our long-term strategy. There is also the possibility that bursts may be 'displaced' from the replaced main to adjacent assets rather than fully eliminated.

The complementary blend of these two approaches is used to generate a balanced and cost-efficient overall programme that allows progression towards our long-term aims while delivering value-for-money to our customers in the short to medium term.

By the end of AMP7, we will have delivered 102.5km of mains replacement through the conditional allowance. We expect this will deliver 20.8MI/d of leakage benefit and burst benefits of 208 bursts per year⁷.

Long-term mains replacement

Our WRMP outlines our strategic approach to developing a long-term strategy for our network. This envisages significant increases in renewal rates to 2050 and beyond, which are necessary to achieve performance improvements and make the network much more resilient to weather events than it is now.

Mains replacement forms the basis of our long-term sustainable commitments in our Water Resource Management Plan (WRMP) to reduce leakage by 50% (from 2017-18 levels) by 2050 and to create a deliverable, resilient and ambitious programme⁸.

⁷ LWI.G4.A5 Estimate of the impact of the proposed work on existing PR19 performance commitments

⁸ Draft Water Resource Management Plan 2024: Section 8 – Demand Options

Table 4 shows the total length of mains forecast that we will need to replace to meet the requirements of our WRMP and address our asset deficit.

Table 4: Mains replacement and leakage benefit from WRMP

	AMP9	AMP10	AMP11	AMP12
Total mains replacement forecast (km)	1000	1500	1500	1500
Of which required from WRMP to balance supply demand (km)	634	753	723	804
Leakage (ML/d)	14.7	13.3	10.7	10.3

In later AMPs, mains replacement has no existing competition from other known options, so will be the dominant solution. In AMP9, our programme will include over 1,000km of mains replacement, a significant increase from historical renewals rates seen across the sector.

2.6 Asset deficit analysis indicates that 2800km of our distribution network is at the end of its useful asset life

In this section, we provide a summary of the work we have undertaken to assess the asset deficit of our distribution network, which has previously been shared with Ofwat.

Our asset deficit calculations provide a good indication of the state of our network and required future investment to improve our asset performance. It considers the age of assets relative to the useful life to evaluate asset lives that have expired (the asset deficit) and the rate of change (the deterioration rate).

As can be seen from the outputs, a large proportion of our distribution mains are at the end of their useful asset life. In particular, the analysis indicates that 2800km of distribution mains network is at the end of its useful asset life at AMP7, and that this is deteriorating at a rate of 750km per 5-year period.

Asset Deficit Analysis

During AMP5 and AMP6, we commissioned projects to review the material deterioration rate of our ferrous water mains. The analysis utilised nearly 1,000 pipe samples and used pit depth analysis to calculate remaining pipe wall thickness. This was used to establish the average remaining life of the ferrous network, which was 101 years.

The table below shows the historical cumulative asset deficit in km from AMP3 to AMP7 based on the project output model.

Lengths in km	AMP3 and before	AMP4	AMP5	AMP6	AMP7
Pipe life-expired	2,763	1,244	967	760	737
Cumulative life expired	2,763	4,007	4,794	5,734	6,471
AMP renewal	269	2,074	507	523	300
Cumulative renewal	269	2,343	2,850	3,373	3,673
Asset deficit km	2,494	1,664	2,124	2,361	2,798

Source: Thames Water analysis

Methodology for evaluating asset deficit

Life-expired ferrous mains are calculated to total 2,798 km at end of AMP7 (out of a ferrous mains stock of 21,000 km and a total distribution mains stock of 28,300 km). We have used this length to quantify the asset deficit for water distribution mains (i.e., our deficit is assumed to only be on life-expired ferrous mains in this analysis). The assessed deficit was reduced to 1,664km at the end of AMP4 following our Victorian Mains Replacement programme but has been increasing each AMP period thereafter.

We applied the current version of our Engineering Estimating System (EES) to our distribution mains decision support tool to price the average renewal rate for our distribution mains in London and Thames Valley Home Counties. We then applied these average unit costs to the 2,798 km and rebased the EES models to 2017-18 prices using CPIH indices.

This resulted in the 2,798 km having an estimated asset deficit valuation of £1,892m⁹ in 2017-18 prices. We note that this is likely to be a lower-bound estimation of the asset deficit as it assumes only 133 km of replacement in Central London, where the unit rates are the highest.

In this current appraisal of asset deficit, we have not included our estimated stock of 1.2 million lead communication pipes or customer lead supply pipes. At company level, the deterioration rate between 2020 and 2030 was calculated to be 1,680 km or 0.53% per annum (based on our total mains length of 31,750 km on 31 March 2021). For trunk mains, this gives a 5-year deterioration rate of 90 km when applied to our whole trunk mains length and for distribution mains a 5-year rate of 750 km.

This asset deficit analysis provides a fundamental insight for changing our approach to mains replacements - it's evident that our network resilience is deteriorating and the only viable solution for a sustainable network is to deliver a step change in mains replacement activity. We will provide further information on asset deficit to Ofwat.

⁹ Excluding design, procurement, and general overheads.

2.7 As such, during AMP8 we need to ramp up our activity to hold our asset deficit stable and enable us to achieve the step change in mains replacement activity that is required

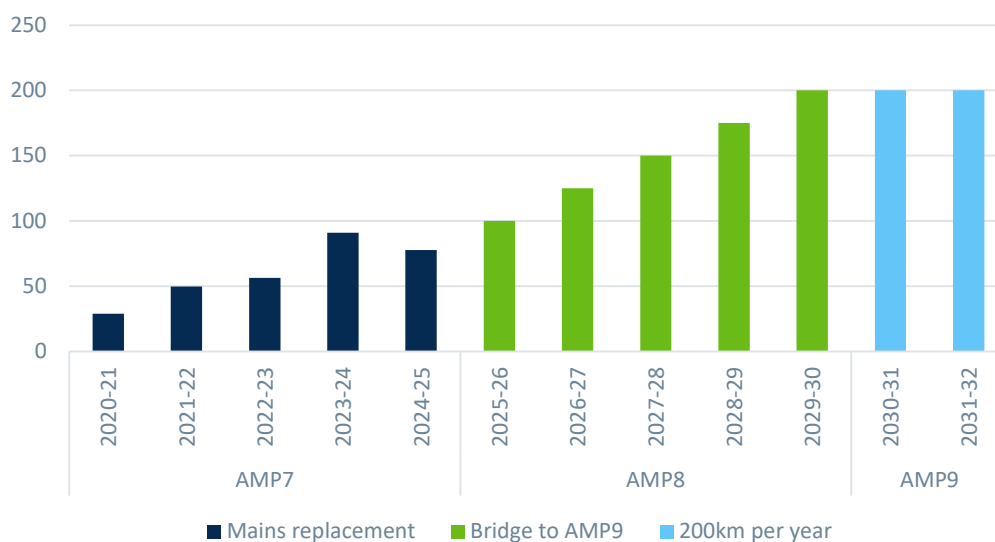
We consider our AMP8 plan for mains replacement to be the key enabler for our long-term strategy for our network. We want to continue to build on the progress made through the conditional allowance, ramping up our mains replacement programme in AMP8.

Increasing our mains replacement to 750km will prevent further deterioration of our distribution network, holding our asset deficit steady in preparation to deliver continued increases in mains replacement over AMP9 and beyond which will reduce our deficit.

We envisage that 275km will be delivered through our base allowance in AMP8 and the remaining 475km through expenditure funded outside of Ofwat's base cost models. We expect to have completed 102km allowed for in the Conditional Allowance in AMP7.

Figure 12 shows our historical and future planned mains replacement. In AMP8, we will sustainably increase our mains replacement activity each year. In taking this staged approach to increase our mains renewal rate, we are confident we will be able to deliver a yearly replacement of 200km by AMP9.

Figure 12: Mains replacement km, AMP7 to AMP9



Our AMP8 mains replacement represents a step change in renewals in order to begin reducing our asset deficit in AMP9

We need to continue to capitalise on the London conditional allowance programme in AMP8 to deliver a stretching but deliverable level of mains replacement that offsets our asset deterioration. A ramp-up into AMP8 will enable us to deliver the run rate level of mains replacement required to deliver the longer-term activity required to maintain a sustainable network.

In the next section we set out our proposed approach for mains replacement at PR24.

3. Mains replacement plans at PR24

3.1 We have considered a range of options for mains replacement in AMP8

In this section, we set out our business-as-usual (BAU) approach to the identification and development of prioritised programmes for both base and additional funding interventions for mains replacement. Covering the strategic objectives of the distribution mains investment programme, we have utilised our decision support tools to support the decision-making process we have used to identify the programme of interventions for distribution mains for AMP8.

Our strategy for distribution mains

Our strategy for distribution mains is to secure overall asset health at a standard that ensures the long-term sustainable provision of a socially acceptable and economically viable level of service.

This level of service is measured and defined by not only the traditional, network related and internal KPIs such as leakage levels, burst rates, low pressure, and interruptions to supply to our customers but also wider societal measures such as the impact on traffic, air pollution and embedded and operational carbon. As would be expected, these levels of service indicators are closely aligned with the investment programme drivers.

Our distribution mains strategy goes beyond the approach of maintaining stable serviceability that was widely employed by UK water companies as far as AMP5. It recognises that historical performance levels are unsustainable going forward due to the impact of various external influences including climate change and demand growth. This means that, while network interventions that address asset health symptoms – such as find and fix and pressure management – may provide cost-effective short to medium term benefit, extensive replacement of deteriorating distribution mains will ultimately be required across the entire network to address the root cause and thus achieve the ‘long-term sustainable provision’ element of our strategy.

Approach to identifying options

We will provide further detail of our proposed mains replacement programme in our PR24 business plan, which is submitted later this year. We summarise our general approach below.

The Distribution Mains Risk model is used to establish an initial strategic-level budget for distribution mains replacement, taking into account the range of risks that impact the portfolio and that are incorporated into the model. We also make use of other systems and approaches such as DMA Fingerprinting to support and validate the business planning process.

Historically, our distribution network budget was based on a regulatory strategy to maintain stable serviceability and performance. However, since the start of AMP7, there has been an industry wide objective to deliver significant performance improvement, some of which will be supported by the implementation of our Conditional Allowance interventions.

The scope of interventions for our AMP8 mains replacement will be focused on improving DMA performance and improving levels of service and asset performance. This will incorporate DMA based interventions, whereby all or most of the DMA pipework is replaced in a single intervention.

These interventions work towards our long-term strategic aim to replace our existing stock of aging cast iron mains and will be a key enabler to achieve our long-term leakage targets.

Deliverability is a key issue to be considered in the process, in particular for the London network. In the first case, we identify a significantly larger number of DMAs for consideration than will ultimately be deliverable in the final programme. These DMAs are then assessed individually in greater detail by the Capital Delivery team before a final set of schemes is identified to be taken forward to meet the outcomes outlined in the options.

Alongside our business plan submission, we'll provide a detailed view of our mains replacement programme for AMP8. The selection of DMAs for asset replacement implementation remains subject to review, both now and potentially also over the course of the delivery programme. This is driven by potential for new information to emerge against individual DMAs that would change their relative priority for asset replacement, either positively or negatively. We are undertaking further analysis on priority DMAs for replacement as part of our wider business planning process.

We identified four intervention options

Using the approach outlined above, we developed a set of four options for our AMP8 mains replacement programme. The options meet different outcomes, and we summarise the 4 options in the table below.

Table 5: Options for AMP8 mains replacement

	Length of mains replaced in AMP8	Outcome	Approach	Region
Option 1	274km	No adjustment above base. Set by average annual mains renewal rate from base over the last 10 years	Mains replacement – focus on reducing mains repairs only	Split 50:50 Thames Valley and London
Option 2	500km	Stretching but deliverable volume of activity, targeted at leakage reduction and a bridge to AMP9	Full DMA replacement – focus on reducing mains repairs and leakage	Split 50:50 Thames Valley and London
Option 3 (proposed)	750km	Mains repairs reduction and the minimum required to arrest the asset deficit increasing further still	Targeted approach at street level - focus on reducing mains repairs and leakage	Split 50:50 Thames Valley and London
Option 4	1,000km	Reduce asset deficit and provide leakage reduction	Full DMA replacement – focus on reducing mains repairs and leakage	Split 50:50 Thames Valley and London

The options were initially assessed against our asset management framework and underlying methodologies. We then selected from this priority listing the preferred investment based on what we can deliver that satisfies the performance, outcomes and cost requirements of our programme and ensures a balanced portfolio for funding.

A further core component of any programme is the deliverability opportunities and constraints. There are three core challenges that impact deliverability of our Water Infrastructure Programme: Street works access constraints, Resources, and Cost. We have undertaken an assessment of the detailed activities against criteria these to identify a plan that is deliverable and enables us to achieve the ambition to prevent deterioration in the network.

Following the assessment against the factors, 750km is the option that achieves the aims set out. It represents a substantial increase from today's baseline, offsetting the deterioration in the network over AMP8 and provides an increasing volume of activity throughout AMP8. Continuing to increase our yearly renewals through AMP7 and AMP8 will allow us to prepare and engage the supply chain to deliver 1,000km of replacement in AMP9 to meet the targets set out in our WRMP.

The mix of work across Thames Valley and London is split 50:50. This mix has been informed by our analysis of performance across the regions. Thames Valley performs better on mains repairs whereas London has slightly lower leakage. Over the last year, Thame Valley has had higher customer supply interruption hours, predominantly driven by a large event in Oxford (Heyford Hill). This mixed picture on performance indicates that, on balance, across the package of ODIs, 50:50 work split is a reasonable assumption.

3.2 750km of mains replacement is the best option for customers

We consider our AMP8 plan of 750km represents the required step change from historical mains renewals to offsets our deterioration rate whilst also being deliverable within the constraints outlined above. This will also enable us to maintain and improve asset health in the long term as we increase the level of mains further in AMP9 and beyond.

750km is a deliverable bridge, offsetting predicted deterioration that would otherwise occur in AMP8, whilst enabling our long term-investment in mains replacement to reduce asset deficit

Throughout AMP7, we have been working with our supply chain to employ technically competent mains replacement gangs to deliver our base programme and the 102km agreed for the conditional allowance. Today, we have 39 gangs working across London to deliver our AMP7 programme. It has taken time to build these gangs up and embed efficient and safe ways of working to satisfactory productivity rates and avoiding 'service strikes' (i.e. damaging other utilities such as power – a real health and safety risk when carrying out streetworks, particularly in London). We would very much like to retain these skilled gangs as we move from AMP7 and mobilise for AMP8.

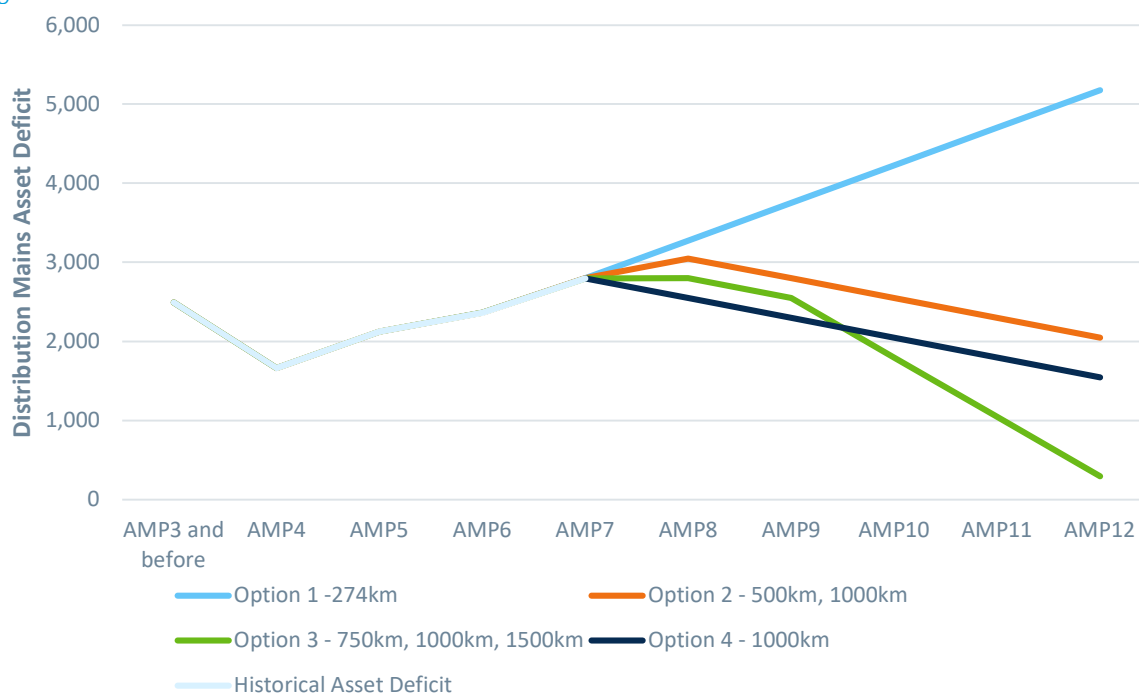
Delivering 750km in AMP8 would require us to increase the number of gangs from 39 to around 75. Early discussions with the supply chain suggest that this is a stretching but realistic objective, assuming that we adopt a delivery profile that continues to ramp up to 2030.

Key to delivering this programme is our relationship with Local Authorities. Recent experience on our London conditional allowance has demonstrated that Local Authorities appreciate as much notice as possible about planned programmes of work and expect us to work in collaboration with other utilities to minimise disruption to customers and communities. Committing to a long-term programme of work will help us to mitigate this risk and build constructive relationships with Local Authorities.

As well as being deliverable within the constraints set out, 750km of mains replacement will prevent further deterioration of our distribution network over AMP8. This is consistent with the analysis we have undertaken on the asset deficit of our network.

Figure 13 sets out the options we considered for our mains replacement programme and the impact on our asset deficit. 750km (option 3) represents a continued increase in mains replacement to AMP9 where we will deliver 1,500km of mains replacement in order to ensure we meet our 2050 ambition to significantly reduce our asset deficit. The long-term plan under option 3 will ensure that the vast majority of iron mains would be condition Grade 1-3 by 2050.

Figure 13: Distribution Mains Asset Deficit to 2050



We have challenged Ofwat agreed costs against future efficiency opportunities

The mains replacement unit cost rates used in this cost adjustment claim are consistent with those recently agreed with Ofwat for the London Water Improvement Conditional Allowance at Stage Gate 4. Indeed, we have applied a further efficiency considering the potential for economies of scale, scope and ongoing efficiency that may be achieved. We have considered these lenses of efficiency through the continuous improvement programme, which ramps-up during AMP8. We

have taken this approach to applying an efficiency challenge, as the catch-up efficiency challenge has not yet been set by Ofwat. In this section, we explain why these costs are efficient.

We have a six-stage process for approving expenditure, with our Engineering & Asset directorate leading stages 0-1 and our Capital Delivery directorate leading from stage 1 onwards. The design and scope are refined at each stage, and pricing is based on our Engineering Estimating System (EES) with a combination of bottom-up costing as needed. EES holds over 2,750 cost models and is recognised as a robust cost-capturing tool in the Water industry. A standard work breakdown structure is used for costing activities, and risk is managed through a complexity matrix and risk register.

In the early stages of the design process, we achieve efficiency through this process though:

- using a wide range of options to tender work.
- benchmarking and challenging every price from the market using base cost and on cost comparison tools.
- ensuring risk is being managed by the right entity, i.e. Contractor or client.
- administering the contract using the Cemar Contract Management tool.
- having rigorous monthly audit and final account audit processes.

Our six-stage process was followed as we prepared for the Stage Gate 4 London Water Conditional Allowance submission. For London, we have used these market-tested and benchmarked rates and have applied further efficiencies as described below. For forecast work in the Thames Valley, we have used a blended rate using recently completed work in rural locations combined with the London mains replacement rate, recognising that some of the replacement work we will need to do (from DMA upgrade projects in development) will be in city centres and urban areas.

We have also completed an exercise to identify further efficiencies as part of a commitment to continuous improvement in AMP8 and a ramp-up to a larger mains rehabilitation programme in AMP9. Eleven 'efficiency levers' have been identified and in the table below we summarise the opportunity for each:

Table 6: Efficiency Lever Opportunities

Efficiency Lever	Opportunity
1. Asset Standards	We are exploring the use of spray lining to extend the life of pipes. Trails need to be implemented, but we are aware that spray lining is used by other water companies and can reduce the amount of time on site by 75%. The reduction in excavation, lifting and plant movement is also safer for operatives on site. Our early assessment is that 5-10% of our 750km programme could use spray lining, but we currently have a low confidence in this.
2. Programme Optimisation	Early visibility of the AMP8 mains rehabilitation programme would allow us to continue to improve ways of working and gangs put in place for the London Conditional Allowance.

3. Solution Optimisation	Using more innovative 'no dig' solutions to limit disruption and improving efficiency. Note that we have an innovation project on no dig solutions that we are about to submit for consideration for funding via Ofwat's competitive process set up at PR19.
4. Productisation / Standardisation	Considered, but limited opportunity identified for pipes.
5. Off-site manufacturing	Considered, but limited opportunity identified for pipes – more suitable for above ground assets.
6. Strategic Procurement	Early visibility of the AMP8 programme with a Tier 2 contractor could allow procurement benefits to be realised
7. Continuous improvement	Focus on cost per bursts reduction rather than cost per km. Valve operations are currently limited to our own staff and we are exploring broadening this.
8. Innovation	Further workshops planned with our supply chain on this (see note on no dig solutions above). Through the conditional allowance, we are also trialling in situ pipe condition assessment technologies including ePulse.
9. Digital & Data	Reporting assurance and integration is approved between Thames Water and contractor systems. For example, GIS updates become less time consuming
10. Quality and right first time	Considered, but limited opportunity for mains replacement
11. Collaborative planning	Working with GLA, Transport for London and Local Authorities via our Thames Connect app to explore synergies with other utility infrastructure programmes

Applying the above levers resulted in a 6.8% efficiency challenge to recently tendered rates:

Table 7: Unit rates for mains replacement

Region	Pre efficiency	% reduction	Post efficiency
London unit rate	£1,565/m	6.8%	£1458/m
Thames Valley unit rate	60% x £742/m	6.8%	£999/m
	40% £1,565/m		
	=£1,071/m		

Within Thames Valley, the unit rate has been estimated as a blend of the urban rate and the rural Thames Valley rate. This blended rate is informed by our assessment of the top 20 priority DMAs in Thames Valley and represents the areas where we will undertake the replacement of the mains.

Given that these rates are the results of projects that have followed our six-stage design process, have been market tested and have had an additional efficiency challenge applied to them, we consider that they are efficient.

[Customer views support our proposed option](#)

We have conducted research to understand our customer, community and stakeholder views on the need and as well as their preference of proposed solutions, where appropriate.

Our engagement approach has combined an ongoing, iterative triangulation of insights over the course of AMP7 as well as targeted research on specific enhancement cases for our PR24 plan. A full list of sources used is available in our What Customers, Communities and Stakeholders Want (WCCSW) document, which is our single unifying customer insight framework, underpinned by detailed insight.

Across our package of proposed investments, customers were generally supportive of the potential enhancements to service in 2025-2030, with greater support given to initiatives impacting core service delivery.

We asked customers about which approach they support for managing distribution pipes across the network and found that 100% of those asked were supportive of a change in approach to a more proactive distribution main replacement.

We shared information on our proposal to increase distribution pipe replacement, presenting four options to customers:

- Maintain the responsive approach to replacing pipes when they leak or burst
- Low increase in proactive replacement by replacing pipes identified in areas with more leaks and bursts
- High increase in proactive replacement by replacing pipes identified in areas with more leaks and bursts
- A midpoint between any two choices

The majority of customers favoured a high increase in the rate of distribution pipe replacement based on the information they were shown.

All customers, except for two ('maintain' and 'don't know') favoured an increase in the rate of mains replacement. Almost three-quarters of those taking part felt that a high increase in mains replacement was the preferred option. This is attributed to the need to getting a grip on a problem that is clearly getting out of hand, and one which will only cause additional problems, disruption, and cost in the future otherwise. Those that do not favour a high increase in mains replacement favour a less rapid solution largely based on uncertainties around the costs. One business stated that they would be happy to accept a higher rate and even pay the accompanying costs.

4. Quantifying the adjustment

In this section, we set out our view of the cost adjustment required to support the incremental mains replacement activity required to achieve the long-term sustainable level. We set out our view as follows:

- Firstly, we consider the appropriate approach for identifying the implicit allowance within Ofwat's base allowance. In section 4.1 we set out our views on the implicit allowance rate, considering the challenges with identifying it and showing the historical mains replacement levels funded through base.
- Secondly, we summarise the approach we have taken to estimating the required cost adjustment. In section 4.2 we set out the key assumptions underpinning our evaluation and demonstrate that this is a material claim.

4.1 Identifying the implicit allowance rate for mains replacement within Ofwat's base allowance

We have sought to undertake a balanced approach to identifying the implicit allowance. We considered the degree to which the models explicitly provide allowances for mains replacement, and alternative approaches. The approach we have taken aligns with the assessment of the unit costs relating to the claim.

Evaluating implicit allowances in the base cost models

The base costs models do not explicitly account for mains replacement, be it through a cost category, a cost driver or another variable. Identifying the implicit allowance through the econometric models is not simple, as there is not an explicit cost driver or cost category that one can directly assess.

We recognise the base cost models capture an element of our higher unit costs through the inclusion of the squared density variable. The addition of the squared term of density enables to capture the relatively higher costs a company operating in relatively high dense areas faces to access the network for replacement activity. However, this driver does not adequately account for our specific network conditions and our relatively higher level of deterioration in the network.

Alternative approaches to evaluating the implicit allowance

We consider that there are benefits to adopting more simplistic approaches utilising the historical replacement rates that have been observed. In particular, we consider the following approaches:

- Ofwat's stated mains renewal rate
- The industry's historical average
- Our historical average
- Our historical average funded through base.

These different approaches result in differing level of replacement rates, as summarised in the table below.

Table 8: Replacement rates

Period	Replacement rate (%)
Ofwat's 0.4% target	0.40
Industry historical average (last 11 years)	0.33
Our average (last 11 years)	0.27
Our average funded through base	0.17

Our view is that the most appropriate approach is to adopt is a 0.17% rate in line with our historical base expenditure. We explain our rationale below.

Ofwat's stated main renewal rate

In its PR24 final methodology, Ofwat stated that *"at PR19 companies were funded on the basis of plans to renew an average of 0.4% of water mains per year."*¹⁰ We consider that 0.4% mains replacement per annum was not explicitly funded at PR19.

Firstly, we haven't been able to reconcile the quoted 0.4% renewals per year with any of our or the industry's data.

Secondly, we undertook an analysis of the implied cost of companies' historical mains renewal activity using an industry unit cost. The analysis demonstrated the lack of robustness in using the dataset to identify an implicit allowance, as there were many anomalies in the data – for example, it implied that some companies would have spent more on mains renewal than their entire botex programme. Clearly, there is a mix of activity within the dataset which undermines the assumption that Ofwat identified.

Thirdly, the analysis also highlighted the clear differences between WaSCs and WoCs in mains renewal unit rates. Our analysis indicated that using the industry average unit rate for smaller companies likely overestimated this unit rate. Using the approach outlined above, mains replacement costs accounted for an average of 41% of WoCs botex costs compared to 24% for WaSCs water botex.

Given the arguments outlined above, we consider it inappropriate to use 0.4% as the benchmark for mains replacement activity for Thames Water. We consider more appropriate benchmarks in the following section.

Industry historical average renewal rate

¹⁰ [PR24 final methodology Appendix 9 Setting Expenditure Allowances.pdf \(ofwat.gov.uk\)](#), page 51

The actual level of mains renewal is a better indicator of what the industry as a whole can achieve with the funding provided at PR19. We calculated the historical average renewals rate over the period 2011-12 to 2021-22 to be 0.33% renewals per year.

Although this provides a better indication of what the sector can achieve, this renewal rate conflates base and enhancement funding. It is difficult to identify how this rate of renewals has been funded historically, and we consider the actual rate of renewal funded through base expenditure to be lower.

Furthermore, for the reasons set out in section 2, relating to the condition of our network and poor asset health, we consider that the industry average renewal rate overestimates the renewal rate we can achieve through base funding alone.

Our historical renewal rate

Given the challenges of managing our network, we consider that the historical renewal rate we have been able to deliver is a better starting point for disentangling enhancement and base-funded mains renewal.

Due to the condition of our network and stretching cost and performance targets, we undertake a large volume of operational and response interventions such as proactive leak find and fix, monitoring, valve maintenance and cross-connections. This activity increases our opex expenditure, relative to other companies, and reduces our ability to undertake the renewals rate achieve by other companies.

To ensure the resilience of our assets we undertake a combination of interventions compromising regular maintenance and replacement alongside operating expenditure to sustain a level of network performance that is acceptable to our customers. In the context of a deteriorated and failing network, we are constrained by the stretching package and have had to trade off our base allowances within AMP to address other risks and needs within the business whilst maintaining performance.

Between 2011-12 and 2021-22 we have delivered an average annual renewals rate of 0.27% - lower than the industry average due to nature of stress and poor performing network. This rate has been delivered through a combination of base and enhancement expenditure. In the next section, we set out the rate of renewals we have historically delivered through our base expenditure.

Our historical renewal rate funded through base

We consider that the renewal we have been able to deliver through our base expenditure is the most appropriate and balanced approach to determining the implicit allowance.

We provide an overview of the approach we have used to determine the volume of renewals undertaken through base versus enhancement expenditure, this approach is used to determine the volume of mains replacement that is implicit in Ofwat's base cost models.

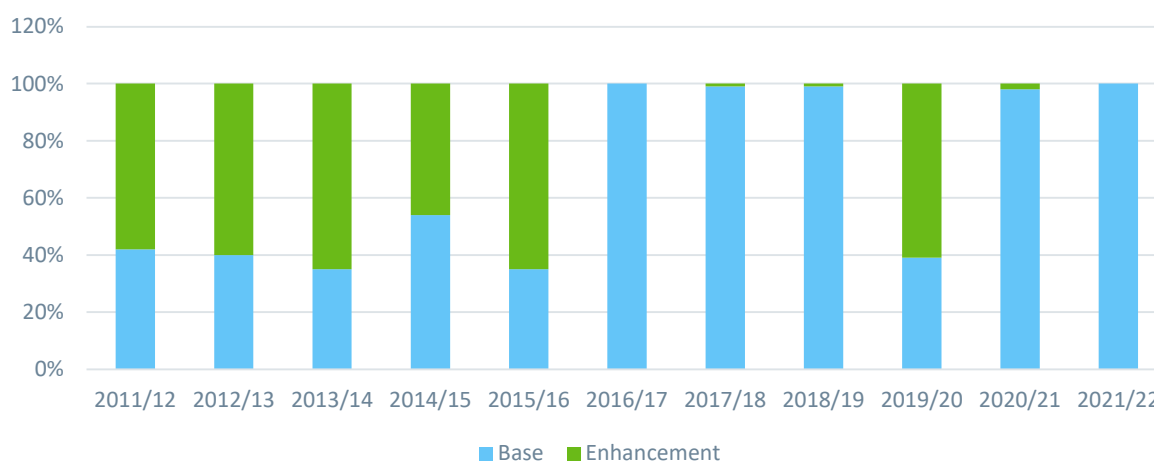
Our approach to determining the volume of mains replacement in base and enhancement

We allocate our mains replacement activity into base and enhancement using our historical expenditure (2011/12 to 2021/22) on mains replacement (MR) and Victorian Mains Replacement (VMR) programmes.

Our MR expenditure is split between base and enhancement expenditure. The VMR programmes relates to the expenditure carried over from AMP4 to AMP5 and some of the base costs include some historical enhancement costs that were accounted for as base. We identify that VMR enhancement expenditure constitutes 26.6% of total expenditure across all years.

The figure below summarises the annual percent split between base and enhancement expenditure for total mains replacement. These percent proportions are used to apportion our total lengths of main renewed that were funded by base and enhancement.

Figure 14: Base and enhancement split for MR and VMR programmes



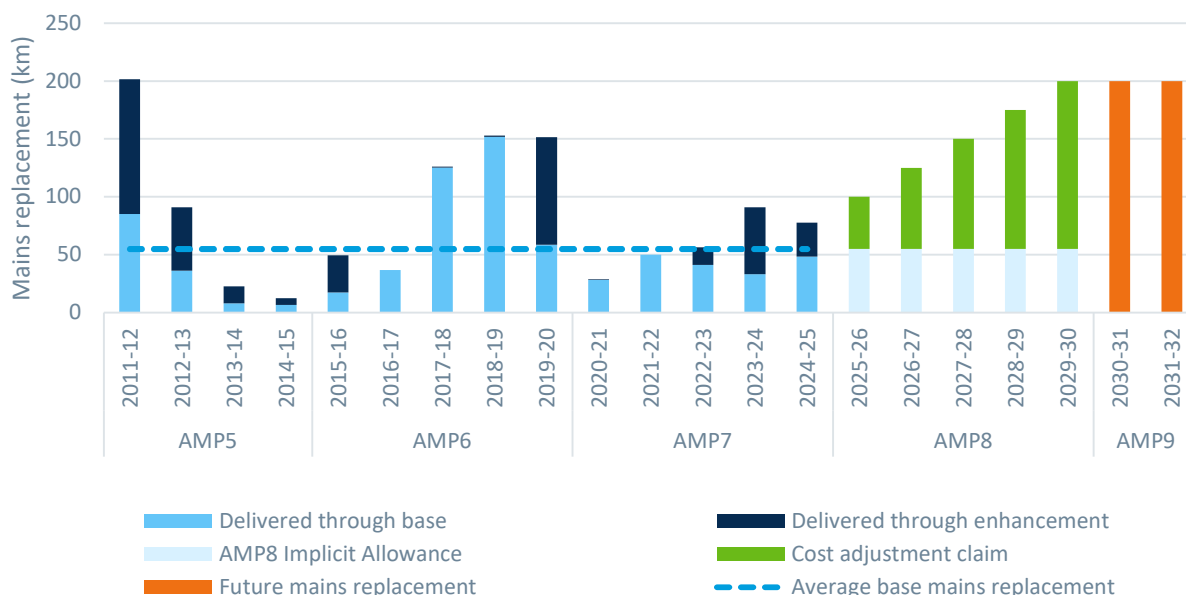
As can be seen, there was significant enhancement expenditure during AMP4 and AMP5 as explained above. Additionally, there was significant expenditure through enhancement during 2019/20. This was due to a replacement programme focussed on addressing water quality as opposed to asset health.

Our assumption on what base funds (replacing 55km of mains per year)

In our AMP8 and beyond forecast, we assume that the base costs models will fund around 55km per year. The estimate of the 55km per year is based on the average of lengths of main renewed in the last 11 years (2011/12 to 2021/22) that was allocated to base costs based on apportionment exercise explained above. The activity related to enhancement is the difference between our forecasts of total replacement activity and base.

Figure 15: Mains replacement activity breakdown, AMP5 to AMP9below displays the profile of mains replacement activity between 2011/12 and 2031/32.

Figure 15: Mains replacement activity breakdown, AMP5 to AMP9



The historical lengths of main renewed are taken from our APR data.

To preserve technically competent and productive mains replacement gangs that we have embedded with our supply chain during AMP7, we are forecasting an additional circa £40m of mains replacement activity in 2024/25. This is despite significantly overspending AMP7 base allowances. However, we consider that this additional investment will be necessary to hit the ground running in Year 1 of AMP8.

4.2 We require an additional £584m during AMP8 to deliver the incremental mains replacement activity

In this section we set out our calculation for the cost adjustment required for mains replacement at PR24. The approach we adopt is based on the evaluation of the cost incremental mains replacement activity, over and above the implicit mains replacement activity which we identified in the previous section.

Our proposed delivery of 750km during AMP8 represent a rate of 0.47% per annum. Of this, we estimate that 475km of replacement activity is to funded through this cost adjustments claim. For completeness, this cost adjustment claim is non-symmetrical as we are claiming only for the additional renewal activity not funded within Ofwat’s base cost models.

Efficient unit rates – London and Thames Valley

A key assumption required for our assessment is where the work will take occur. The work in our region costs more than in other regions, as recognised by Ofwat’s density functions in its base cost models. For this incremental activity, it is right that the rate applied is specific for our region.

We have developed a bottom-up assessment of the activity planned for AMP8, which we summarise in the appendix and will set out more comprehensively in our PR24 business plan. In summary, the level of required activity is roughly even between London and Thames Valley over the period, but we assume that the unit rates are different between the two regions.

The table below summarises the relevant unit rates for AMP8 in 22/23 price assuming we achieve a 6.8% efficiency gain on those used for the conditional allowance. We weigh these equally for the mix of work we are planning.

Table 9: Unit rates for London and Thames Valley Mains Replacement activity

Unit rate London (£)	Unit Rate Thames Valley (£)
1,459	999

Estimating our implicit allowance

The table below displays our funding requirements for mains replacement, splitting out the implicit and cost adjustment claim. The total funding required for AMP stands at £921m, of which we assume the base costs models would provide an implicit allowance of £337m. Therefore, the value of our claim is £584m related to the 475km of mains replacement to be funded through enhancement over AMP8.

Table 10: Summary of funding needs

Period	Renewal activity (km)	Unit Rate (£m)	Funding required (£m)
Total	750	1,229	921.6
Funded through base	275	1,229	337.2
CAC Need	475	1,229	584.4

Materiality of our claim

The Ofwat methodology applies a materiality test to cost adjustment claims; a claim must be at least 1% of the water network plus price control totex in the AMP to pass and be eligible for consideration. We have not yet finalised our water network plus business plan submission, however, we are currently using a working totex assumption to calculate materiality. We estimate that the materiality of the claim is circa 10%.

5. Customer protection

This cost adjustment claim will enable us to renew 750km of our distribution mains. In this section, we set out our proposed customer protection for the investment, which is to utilise a PCD. We set out our intention here and will provide further detail with our full PR24 proposals in our business plan.

5.1 We intend to adopt a PCD for incremental mains replacement activity

For this cost adjustment claim, we propose a PCD of 'km of distribution mains replaced'. This commitment aligns with our intention to proactively replace the distribution mains that have been identified, enabling us to address our asset deficit and improve performance.

We propose that this PCD specifically refers to the mitigations of distribution mains replacement solutions only. Numerous other activities exist to mitigate the trunk main network risks which are critical to the overall level of risk – proactive leak find and fix, monitoring, valve maintenance, cross connections etc. We are not proposing these measures are included in this customer protection measure as they do not reduce the level of asset deficit in our network.

We intend to provide more detail on our PCDs in our PR24 business plan, as well as the related performance commitment benefits of this claim. As we forecast our leakage and mains repairs we will explicitly account for the benefit associated with this mains replacement programme.

5.2 How the PCD will work

Table 11: Scheme delivery expectations of distribution mains replacement PCD Table 11 sets out the scheme delivery expectations and definition of the PCD.

Table 11: Scheme delivery expectations of distribution mains replacement PCD

Scheme delivery expectations	
Description	This PCD refers to the total length of incremental mains replacement attributable to the investment agreed with Ofwat and delivered as part of this cost adjustment claim.
Output measurement and reporting	Total distribution mains replacement is defined as the output (in km) delivered from the mains replacement schemes. The distribution mains replacement level is expressed as the number of kilometres to one decimal. We will report total distribution mains replacement each year. This value less the amount determined in base, that is 55km, is the PCD measurable activity. This should be compared to the forecast for deliverables as set out in table 14.
Conditions on scheme	This PCD specifically refers to the mitigations of replacement solutions only. Operational/response interventions such as proactive leak find and fix, monitoring, valve maintenance, cross connections are not included.

Assurance	We will confirm our assurance approach with our business plan.
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Table 12 sets out the forecast deliverables, measured as the cumulative length of distribution mains. At the end of AMP8, we will have delivered 475km of incremental distribution mains replacement over the 275km identified in base.

Table 12: Forecast deliverables

Deliverable	Unit	Forecast deliverables				
		2025/26	2026/27	2027/28	2028-29	2029/30
Cumulative length of distribution main	km	45	70	95	120	145

