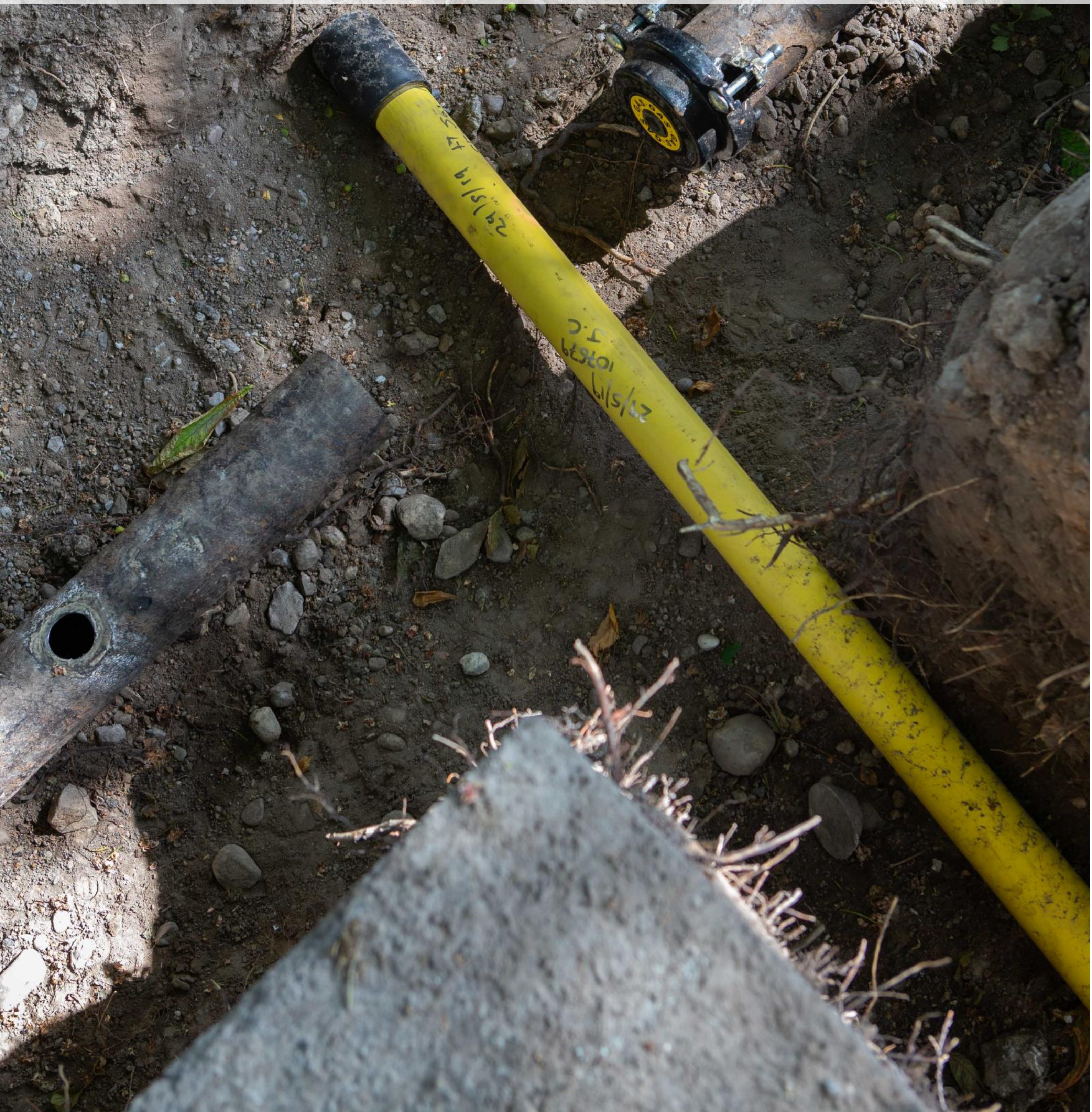
Engineering Justification Paper: EJP05

Services Not Associated with Mains Replacement



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1 Summary Table

Name of Project	Services not associated with mains replacement
Scheme Reference	EJP05
Primary Investment Driver	Asset Health
Project Initiation Year	Start date for proposed RIIO-3 work plan: 2026
Project Close Out Year	Completion date for proposed RIIO-3 work plan: 2031
Total Installed Cost Estimate (£)	[Cost Data Redacted]
Cost Estimate Accuracy (%)	+/-5%
Project Spend to date (£)	Expenditure in RIIO-2 is estimated as [Cost Data Redacted]
Current Project Stage Gate	This is a rolling program of high-volume low-cost work
Reporting Table Ref	CV6.08 Repex services
Outputs included in RIIO-2 Business Plan	Yes
Spend apportionment (RIIO-3 plan)	[Cost Data Redacted]
Proposed Regulatory treatment for RIIO-3 work plan	NARM, with exception of OPEX services which are included in Baseline

Table 1: Summary table (All costs stated in this paper are in the 23/24 price base, unless stated otherwise)

During the RIIO-2 period, we committed to several key deliverables to enhance the safety and reliability of our gas distribution network. Currently, we are behind schedule on the bulk steel replacement initiative and are only achieving about one-third of the forecasted volumes for relay after escape activities. These challenges highlight the need for strategic adjustments to ensure we can meet our obligations in these areas.

We are on track with re-laid service alterations, effectively addressing customer-driven requests and supporting necessary infrastructure modifications. Additionally, while our progress on other services is slightly off track as it was forecasted a [redact] of volume of work from the actual delivered, it remains within a manageable range compared to forecasted figures. Moving forward, it is crucial to address these gaps in delivery, and further insights regarding our commitments and justifications will be provided in Section 10.5, which summarizes the RIIO-2 plan and outlines what was delivered.

This investment case does not satisfy the criteria for late competition or early competition and pursuing these activities would not be in the interests of the customer. We recognise the benefits that competition can bring to customers through efficiency and innovation. We continue to challenge ourselves as a business to ensure that we are harnessing competitive forces where they can provide these benefits. For specific detail on how we have assessed competition, please see Chapter 6 of the Workforce and Supply Chain Strategy (Appendix 17).

2 Executive Summary

This investment case covers service pipe replacement activities that we undertake which is not associated with mains replacement. We invest in these assets on an ongoing basis to ensure security of supply to customers and to manage the safety risk associated with domestic and non-domestic service pipe. We have an absolute duty (Pipelines Safety Regulations, 1996[1]) to ensure that pipes are maintained in an efficient state, in efficient working order and in good repair. We also have a duty under the Gas Act to maintain connections to customers. This work is therefore mandatory.

We undertake interventions on services not associated with mains replacement, for the following reasons:

- Bulk Steel Service Relay: We carry out limited proactive service replacement volume in areas where our data indicate high failure rate trends
- Service Relay After Escape (RAE)
- Service Alterations: This is a customer-driven activity associated with home improvements which require us to move our pipework (e.g. extensions)
- Smart metering Relay: services relayed or altered to support supplier to deploy smart metering; these are chargeable to Suppliers unless there is a condition issue with the service or termination (e.g. legacy Emergency Control Valve)
- Other Services Relays: This category covers several drivers including shallow or exposed services, relay services with damage but not leaking, built over services and where there is inadequate capacity to ensure adequate pressure to the customers property

Volumes and costs were derived from RIIO-2 actuals, with analysis of trends and forecasts used to estimate appropriate figures. All costs mentioned in this document are post-efficiency.

[Commercially Sensitive Information Redacted]

Table 2: Summary of investment case for services not associated with mains replacement

1 Introduction

[1]Pipeline Safety Regulations 1996 -Regulations mandating the safe operation of gas pipelines:

We are investing in services to address the risks posed by ageing and deteriorating services which supply domestic and non-domestic customers. These assets face a higher likelihood of failure, leading to increased operational downtime and higher repair costs. Asset failures not only impact network operations and supply security but also incur substantial operational expenditures (OPEX). To prevent these risks, our proactive replacement strategy, including the bulk steel replacement initiative, aims to enhance network reliability, reduce unplanned outages, and ensure safety compliance while managing long-term financial impacts.

This document provides the investment case methodology for service interventions not replaced as part of our mains replacement programme, in the EJP08-Mains IMRRP (Including Associated below=2" Steel) and in EJP09-Cost Beneficial Mains Replacement.

The scope includes both domestic and non-domestic services, covering the pipe from the meter at the property to the connection with the gas main.

Services operating below 2 bar and less than 32mm are not digitised in our core systems, meaning we do not have precise information on the condition, age, or material for the majority of services in our network. However, we understand geographic general trends regarding the volume density of services, indicative mix of materials, and asset ages across our footprint. Consequently, we cannot utilise our Asset Integration Management (AIM) deterioration model to optimise our service-relay programme.

We have considered the areas of investment detailed in the table below together, as they share the same asset base, are drawn from similar data, and are affected by similar factors.

Areas of investment	Description of work-type	Investment Methodology
Bulk Steel Service Relays	Safety-driven, proactive service renewal targeting areas with high frequencies of service pipe gas escapes, based on historical data on previous escapes	We proactively relay steel services where we have identified areas with high failure rates of steel services relative to the service density in the area. We are forecasting a flat volume of work based upon the RIIO-2 outturn, assuming there will be reducing volumes of Bulk Steel Service Relays, but an increasing volume of Steel Tails replacement to address
Service Relay After Escape	Replacement of domestic steel service pipes following gas escape due to corrosion. PE services are cut out and replaced, while steel services are replaced due to the likelihood of corrosion at multiple points	Reactive replacement of corroded pipes is performed to prevent future failures, leveraging efficient asset management practices. We have forecasted a volume based upon known service density and failure rates, correcting for changes from mains replacement activities
Service Alterations	Customer-driven service alterations due to building work that require the relocation of our assets. Costs for relocation are charged to the customer, while pipe replacement is covered by us	Customer triggered reactive work type. Forecast work volumes and costs are estimated based on historic volumes

Areas of investment	Description of work-type	Investment Methodology
Smart Metering	Suppliers are obligated to install smart meters. This work is required to alter existing services for that purpose. The work is chargeable to suppliers unless there is an issue with the termination of the service	Supplier triggered workload. We are not providing a forecast for this workload due to low historic volumes
Other Services	Various drivers, including shallow/exposed pipes, damaged but non-leaking pipes, build-over issues, and inadequate capacity due to customer appliance upgrades	Reactive interventions are determined by specific situations like shallow pipes, damage, or capacity issues

Table 3: Investment Areas Covered in this EJP & Investment methodology used

In this paper, we address services not associated with mains, acknowledging challenges due to limitations in digitised data for these services. As mitigation we have made several key assumptions based on existing data from mains and related services:

- We assume that the age profile of services not associated with mains follows a similar distribution to that of mains, allowing us to estimate the likelihood of deterioration over time. This assumption is based on the understanding that both sets of assets were likely installed during similar periods and under similar conditions.
- We assume that environmental factors, such as soil conditions and external stresses, affecting the services not associated with mains are consistent with those impacting mains. This allows us to extrapolate environmental risk factors, although we acknowledge that localised variations may exist.
- We assume that operational and maintenance practices for decentralised utility systems have mirrored those applied to mains infrastructure, enabling us to use historical data from mains services as a proxy for failure rates and maintenance needs for these decentralised systems.

While our modelling can identify risks of failure for these services, we and the industry in general are constrained by the limited amount of service asset data available. Thus, we have adopted a pragmatic approach to predicting a reasonable forward workload for service relays. The programme of work remains largely reactive and has not been justified using a Cost-Benefit Analysis (CBA). We aim to guide our engineering decisions with historic trends of reactive intervention upon failure as a basis for estimating service life.

2 Equipment Summary

2.1 Overview of the assets

Our gas distribution network comprises over 11 million service pipes that supply gas to domestic, industrial, and commercial customers, as well as multiple occupancy buildings. These service pipes form a critical part of the infrastructure, connecting the distribution mains to customers' meters. As the final link between the main distribution network and end users, service pipes ensure safe and reliable gas delivery.

As previously stated, services operating below 2 bar and less than 32mm are not digitised in our core systems. However, we understand geographic general trends regarding the volume density of services, indicative mix of materials, and asset ages across our footprint. This is how we are able to determine volumes of work throughout this paper. The restriction in asset data does, however, mean that the asset health score is not presently available for this asset class.

The distribution of service pipes across our four main regions—Eastern (EE), North London (LN), North West (NW), and West Midlands (WM)—is detailed in the table below, with a total of over 11 million services:

Network	EE	NL	NW	WM
Number of services ('000s)	4,048	2,288	2,703	1,975

Table 4: Service Asset Base as per RRP 2023-24

Historically, service pipes were predominantly made of steel, which remained the standard until the mid-1970s. With advancements in material science and engineering, PE has since become the material of choice for service pipes due to its durability and resistance to corrosion. Today, all new service pipes are laid using PE, except in situations where pipes are above ground or other specific engineering constraints require an alternative material.

This transition to PE has significantly improved the reliability and longevity of the network, ensuring that our infrastructure is resilient and capable of meeting the demands of modern as supply.

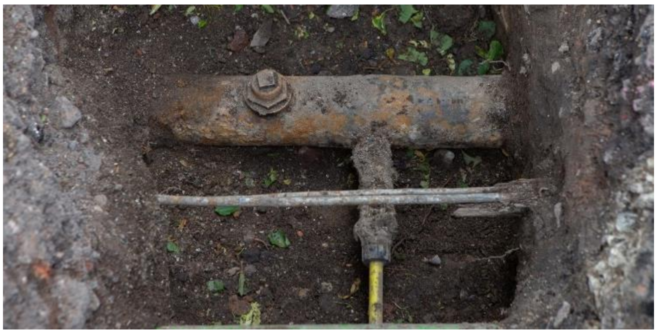

Figure 1: Yellow PE service tee off Steel mains

Our network's service population now primarily consists of PE pipes, extending from main distribution pipes to customer meters. This transition to PE has significantly improved the network's resilience, durability, and safety. In the late 1980s, a policy shift led to a decline in the use of "steel tails" in installations, with PE pipes becoming the standard. By the end of the 1980s, it was anticipated that PE pipes would extend up to the Emergency Control Valve (ECV), facilitated by advancements in PE house-entry fittings that eliminated the need for steel sections. By 1990, the use of fully PE systems became standard, enhancing the gas network's durability and safety due to PE's superior corrosion resistance compared to steel.

The table below outlines the approximate distribution of the 11 million service pipes across our four primary regions, segmented by material type:

Network	EE	Lon	NW	WM
PE (‘000s)	3,749	2,077	2,466	1,766
Steel (‘000s)	268	199	215	195
Mixed (PE + Steel Tail) (‘000s)	31	13	22	14

Table 5: Service Asset Base by Material Type as per RRP 2023-24

The predominance of PE across the network reflects the significant transition from traditional steel services. Nevertheless, a portion of the service population still comprises steel or mixed material installations (PE with steel tails), which represent a smaller but important segment of the network.

For services of all material types, the internal diameters typically range from ¾” to 1½”, providing sufficient capacity for most domestic and commercial applications. Larger services, which are more commonly found in industrial and commercial settings, exceed 2” in diameter. These larger services are prioritized for replacement based on mains-replacement criteria and, as such, fall outside the scope of this particular investment case.

Here it is the summary of volume of work for RIIO-2 and the costs associated with the volume of work for the different services:

[Commercially Sensitive Information Redacted]

Table 6: Summary of volume and costs in RIIO-2

3 Problem Statement

Our approach to addressing asset health issues, particularly in areas prone to high failure rates, aligns with the broader strategic objectives outlined in the Network Asset Management Strategy (NAMs). By targeting service pipes most susceptible to deterioration, we are adhering to the proactive asset stewardship model and risk-based investment principles described in the NAMS, ensuring both regulatory compliance and safety for our customers.

The key driver for investment in these service assets is the need to mitigate the risk of asset deterioration and failure. As pipes age, particularly older steel and mixed-material services, the likelihood of gas leaks increases, leading to potential safety hazards. Gas leaks near or under buildings present a significant threat, endangering occupants and possibly resulting in non-compliance with several critical safety regulations.

We have a legal duty to maintain a safe network in accordance with the Pipelines Safety Regulations (1996) and the Gas Safety (Management) Regulations (1996), [2]as well as the requirements outlined in the Gas Act. These regulations, along with the Gas Industry Network Code, mandate the responsible operation and management of gas pipelines to ensure public safety, specifically emphasising the need to maintain connections to customers. Any breach, such as gas leaks in proximity to or within buildings, not only represents a significant safety risk but may also violate the Health and Safety at Work Act 1974[3], exposing the business to regulatory penalties and reputational damage.

This presents a clear opportunity for targeted investment aimed at addressing the ageing segments of the service pipe population. By replacing deteriorating steel and mixed-material pipes with modern PE alternatives, we can significantly reduce the risk of gas leaks, ensuring continued compliance with safety standards and enhancing the overall resilience of the gas distribution network.

3.1 What happens if we do nothing

If we fail to address the deterioration of the service pipes in our gas distribution network, having considered only the population of metallic and mixed (PE and steel), the consequences could be severe, leading to heightened risks in several key areas:

- Safety: As service pipes degrade, the risk of failure increases. This could lead to gas escaping from the pipes, with the potential for gas to accumulate within buildings. If gas builds up to dangerous levels, it may cause explosions, putting lives and property at risk. Without proactive replacement of deteriorating pipes and reactive replacement of pipes which have deteriorated, there would be an inevitable rise in gas escapes and an increase in the frequency of catastrophic incidents

- Environmental Impact: Every gas leak contributes directly to higher carbon emissions, as natural gas—primarily composed of methane—is a potent greenhouse gas. Leaking gas from our service network would undermine efforts to reduce emissions, negatively impacting our environmental goals and contributing to climate change

- Regulatory Compliance: We are legally obligated to ensure that our network is maintained in an efficient state, in efficient working order, and in good repair as outlined in the Pipelines Safety Regulations (1996) and the Gas Safety (Management) Regulations (1996). Any gas leak or service failure could result in breaches of these regulations, as well as violations of the Health and Safety at Work Act 1974. Continued inaction not only jeopardizes public safety but could also lead to legal penalties and regulatory sanctions

- Security of Supply: Failure of service pipes due to neglect could result in significant interruptions to gas supply for domestic, industrial, and commercial customers. These interruptions not only erode trust in our ability to deliver reliable energy services but also pose a violation of the Gas Act, which establishes our absolute duty to maintain connections to customers. The Gas Industry Network Code specifies that, for customers with domestic size meters, the service pipe capacity must match the badged capacity of the meter. Extended outages could have wider socio-economic impacts on businesses and households alike

- Financial Costs: Each gas escape from the network incurs significant costs. These costs include emergency response, repairing damaged pipes, and restoring any supplies that were lost or turned off during the leak. Over time, these operational costs will accumulate, creating a significant financial burden for the business. Additionally, if these incidents become more frequent, the rising costs of reactive replacement could far exceed the investment required for preventive replacement of at-risk pipes

[2] Gas Safety Management Regulations 1996 – regulations mandating the safe management of gas flow through a network and a duty to minimise the risk of a gas supply emergency

[3] HSE – Health and Safety Executive – Guidance on safety regulations for gas services

- Customer Disruption: A failing service has significant implications for customers, as it directly leads to supply interruptions and often impacts multiple households or businesses. These disruptions are among the most intrusive activities undertaken in maintaining the gas network. While unavoidable, managing these failures in a controlled and well-planned manner is crucial for minimizing their impact. This approach ensures that interventions deliver the best value for the customer by prioritizing efficiency, reducing downtime, and addressing safety concerns swiftly. Proactive planning and effective response strategies allow us to maintain service reliability while supporting broader safety and regulatory compliance objectives. By adopting these measures, we can minimize inconvenience and build trust through consistent and dependable service delivery

Inaction would allow these risks to escalate, undermining safety, environmental, regulatory, and financial objectives, and exposing the business to growing operational challenges. Management of these service assets is therefore essential to avoid these negative outcomes.

3.2 Key outcomes and understanding success

Successful investment in RIIO-3 will aim to hold asset health stable or improve it throughout the period, ensuring no compliance failures, minimising supply interruptions, and reducing fault rates. Our asset data indicates that metallic service pipes are particularly prone to failure, especially due to corrosion and inadequate capacity in areas with high gas demand, resulting in gas escapes and potential supply interruptions. Through our proactive replacement programs—including bulk steel service relays in high-risk areas and reactive measures triggered by gas escapes or performance issues—we expect to sustain or improve the health of this asset group.

This approach reflects our commitment to maintaining safety and compliance with the Pipelines Safety Regulations (1996) and Gas Safety (Management) Regulations (1996), ensuring our network operates safely without contributing to emissions through unplanned gas escapes. By focusing on both proactive and reactive interventions, we aim to minimize the need for reactive remediation, pre-emptively replacing assets at risk of failure. This strategy will ensure the security of supply and reliability of the gas distribution network, reducing the risk of environmental impacts and managing long-term operational costs effectively.

3.3 Narrative real-life example of problem

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Figure 2: Incidents (explosions) Caused by Mains and Services Through Time (All GDNs)

[Commercailly Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Figure 3: [redacted]

[Commercially Sensitive Information Redacted]

3.4 Project boundaries

[Commercially Sensitive Information Redacted]

4 Probability of Failure

[Commercially Sensitive Information Redacted]

4.1 Failure modes

[Commercially Sensitive Information Redacted]

4.2 Failure rates of services following a gas-escape.

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Figure 4: Failures of service-pipes (identified through a gas-escape)

[Commercially Sensitive Information Redacted]

Figure 5: Failure rate per steel service-pipe, due to gas-escape.

4.3 Failure rates for service alterations and other customer requests

[Commercailly Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

4.3.1 Service alteration relays

[Comme [redacted]

[Commercially Sensitive Information Redacted]

Figure 7: Service relays / alterations – from RRP table 6.09 (row 190 to 208)

[Commercially Sensitive Information Redacted]

Figure 8: Failure rates for Relay Service Alterations

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4.3.2 Other service relays: Metallic

[Commercially Sensitive Information Redacted]

Figure 9: Total number of other-service relays (metallic pipes) - (RRP table 6.09)

[Commercially Sensitive Information Redacted]

Figure 10: Other Service Re-laid (Metallic) per Network (normalised by number of steel services) - (RRP tables 6.09 and 8.03)

[Commercially Sensitive Information Redacted]

4.3.3 Other service relays: non-metallic

[Commercially Sensitive Information Redacted]

Figure 11: Other service relays for non-metallic pipe - from RRP table 6.09 (row 190 to 208)

[Commercially Sensitive Information Redacted]

Figure 12: Other Service Re-laid (Non-Metallic) per Network, normalised by PE service population.

[Commercially Sensitive Information Redacted]

4.4 Probability of Failure Data Assurance

[Commercially Sensitive Information Redacted]

5 Consequence of Failure

5.1 Potential Consequences

[Commercially Sensitive Information Redacted]

5.1.1 Supply interruptions

[Commercially Sensitive Information Redacted]

Figure 13: Number of Service Interruption Events in RIIO-2 as per RRP table 9.03

5.1.2 Gas in buildings (GIBs)

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Figure 14: Number of "Gas in Buildings" in RIIO-2 as per RRP (relating to services)

5.1.3 Environmental and Financial Impact of Services Failures

[Commercially Sensitive Information Redacted]

Table 7: Sources of societal benefits

5.2 Future Energy Scenarios

[Commercially Sensitive Information Redacted]

6 Options Considered

6.1 How we have structured this section

[Commercially Sensitive Information Redacted]

6.2 Modes of intervention

[Comme [redacted]

[Commercially Sensitive Information Redacted]

Table 8: Overview of the intervention modes

6.2.1 Remediation of service-pipe after a gas escape

[Commercially Sensitive Information Redacted]

Table 9: Service after gas escape intervention

6.2.2 Remediation of service pipe following some other performance issue

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 10: Other services intervention mode

6.2.3 Re-laid Service Alterations

[Commercially Sensitive Information Redacted]

Table 11: Service alterations intervention mode

6.3 Timing choices

[Commercially Sensitive Information Redacted]

6.4 Options

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 12: Intervention modes and timing choices justification

6.5 Unit Costs for each service relay

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 13: Cost per Service, post-efficiency, 2023/24 price base.

7 Business Case Outline and Discussion

7.1 Key Business Case Drivers Description

[Commercially Sensitive Information Redacted]

7.2 Business Case Summary

[Commercially Sensitive Information Redacted]

8 Preferred Option Scope and Project Plan

8.1 Preferred Option

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 14: RIIO-3 preferred option

8.2 Asset Health Spend Profile

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 15: Proposed Total Services Expenditure in RIIO-3 by Driver

[Commercially Sensitive Information Redacted]

Table 16: Proposed Services Work Volumes by Network in RIIO-3

[Commercially Sensitive Information Redacted]

Table 17: Proposed Services Expenditure by Network in RIIO-3 (£m)

[Commercially Sensitive Information Redacted]

Figure 15: Forecast Non-Mains Service Replacement Investment (£m)

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 18: Proposed Total Services Expenditure in RIIO-3, Post Efficiency

8.3 Investment Risk Discussion

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 19: Risk Register

8.4 Key Business Risks and Opportunities

[Commercially Sensitive Information Redacted]

8.5 Outputs included in RIIO-2 Plans

[Commercially Sensitive Information Redacted]

Table 20. Summary of the forecast volume and costs for RIIO-2

9 Regulatory Treatment

[Commercially Sensitive Information Redacted]

10 Glossary

Abbreviation/term	Meaning
NARMs	Network Asset Risk Management - a methodology for quantifying the risks and consequences of asset failures
GIB	Gas in Buildings - incidents where gas escapes into buildings, posing safety hazards
PE	Polyethylene - a material used for gas service pipes due to its durability and resistance to corrosion
RIIO	Revenue = Incentives + Innovation + Outputs - a regulatory framework used in the UK gas and electricity sectors
HSE	Health and Safety Executive - the UK government agency responsible for enforcing workplace health and safety regulations
PSR	Pipelines Safety Regulations - regulations mandating the safe operation and maintenance
AIM	Asset Integration Management - a system for managing and optimizing asset performance and replacement needs
TIM	Totex Incentive Mechanism - a regulatory mechanism for managing capital and operational expenditures
TNC	Technical Needs Case – Services Not Associated with Mains Replacement:
RRP	Regulatory Reporting Pack - A set of documents submitted to regulators detailing operational performance and financial information
BSSR	Bulk Steel Service Relay - A proactive approach to replacing high-risk steel service pipes in identified areas

Table 21: Glossary Table