Engineering Justification Paper: EJP18

Mains Reinforcements Below 7 Bar

Cadent
Your Gas Network

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1 Summary Table

Name of Project	Mains Reinforcement below 7bar		
Scheme Reference	Mains Reinforcements below 7 bar EJP18		
Primary Investment Driver	Maintaining Capacity		
Project Initiation Year	2026		
Project Close Out Year	2031		
Total Installed Cost Estimate	[Cost Data]		
Cost Estimate Accuracy (%)	+/-5%		
Project Spend to date	[Cost Data]		
Current Project Stage Gate	This is a rolling programme of maintenance		
Reporting Table Ref	5.02 - Reinforcements		
Outputs included in RIIO-2 Business Plan	No		
Spend apportionment (for RIIO-3 plan)	**GD2**	**GD3**	**GD4**
	[Cost Data]	[Cost Data]	[Cost Data]
Proposed Regulatory treatment for RIIO-3 work plan	In base expenditure		

Table 1: Summary Table

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).

Prices are pre-efficiency and are in 2023/24 price base.

2 Executive Summary

Our Mains Reinforcement Programme addresses two primary needs: accommodating increased gas demand due to population growth and industrial expansion and managing network capacity impacts associated with the "insertion" method for mains replacement under the Iron Mains Risk Reduction Program (IMRRP). The programme ensures compliance with our Gas Transporter Licence requirements to provide secure gas supply, even under peak conditions (1 in 20 year events).

In our RIIO-2 business plan we assumed that our reinforcement needs would be 80% of the minimum annual level, but in practice they were significantly higher. As such, our base-case supply demand scenario selected for this EJP, is the 5-year centralised Supply-Demand forecast which is developed with NESO taking actual demand and historic requirements from us into account. For 2030 to 32 this forecast has assumed a reduction in demand in relation to each networks forecasted volumes. For further information on our review of the FES future energy scenarios refer to the Network Asset Management Strategy (NAMS) section 3.1.

These two factors have been considered whilst we assessed a number of options for reinforcement, which included the minimum, average and maximum lengths or reinforcements.

We have determined that maintaining a level of reinforcement consistent with the actual expenditure in RIIO-2 with a 5% annual reduction is appropriate to reflect the anticipated gradual decline in gas demand. This is designed to handle emerging demand while adjusting for future gas network requirements. We have modelled the volume using known delivery volumes per network and have applied unit costs derived from our unit cost workbook to create our proposal.

The programme will enhance network resilience and support economic growth, enabling seamless connections for new customers and maintaining reliable supply during peak demand. It will also ensure continued efficiency of our Iron Mains Risk Reduction Programme (IMRRP) and reduce service disruption to our customers. The average reinforcement level, reduced progressively, balances current and future needs while aligning with our broader sustainability objectives.

The forecasted cost and volume for this investment is shown below in

Table 2. All prices in this paper and pre-efficiency and are in 2023/24 price base.

[Commercially Sensitive Information Redacted]

Table 2: Summary of Preferred Option

3 Introduction

In our RIIO-2 business plan we took a cautious approach to projecting future reinforcement expenditure. We assumed future expenditure would not exceed 80% of the minimum annual historical expenditure. It is a conservative approach to manage uncertainty in demand trends and avoid overestimating funding needs. However, actual expenditure in RIIO-2 exceeded this projection, leading to adjustments in RIIO-3 planning to align with average RIIO-2 levels while incorporating expected future demand reductions.

Recognising this fact, we have assumed the level of RIIO-3 expenditure will be the average level of actual expenditure in RIIO-2. We have therefore derived our forecasted volume using historical trend analysis and extrapolation actual RIIO-2 volumes, combined with commercial rates identified within our unit cost workbook. As such, our base-case supply demand scenario selected for this EJP, is the 5-year centralised Supply-Demand forecast which is developed with NESO taking actual demand and historic requirements from us into account. For 2030 to 32 this forecast has assumed a reduction in demand in relation to each networks forecasted volumes. For further information on our review of the FES future energy scenarios refer to the NAMS, section 3.1.

Whilst we can forecast based on an average number of reinforcements per year, it is difficult to be completely certain as these are customer driven works, and we see variances both in terms of volume and complexities.

For this reason, we have used our RIIO-2 historic work volumes and costs to forecast a likely future volume and investment need for chargeable and non-chargeable reinforcement for RIIO-3. As agreed with Ofgem through our engagement sessions, we have not attempted to justify this investment using a CBA, because this work is driven by legislation and is external driven so cannot be predicted with any certainty.

4 Equipment Summary

There is a total of 127,155km of mains distribution network across our four networks. Table 3, below, provides a summarised breakdown of mains material type by network as submitted through the RRP (Regulatory Reporting Process) process in 2023/24. Please see supporting evidence Annex A in file EJP18-SE-Reinforcements below 7 bar for further details.

Material	EE (km)	Lon (km)	NW (km)	WM (km)
Iron	6,320	4,165	4,739	4,055
Steel	2,906	884	1,274	1,488
PE	40,562	15,395	27,298	18,016
Other	2	-	50	0
Total	49,791	20,445	33,361	23,559

Table 3: Distribution Mains Population

In RIIO-2 we took a cautious approach to projecting future reinforcement expenditure, we assumed future expenditure would not exceed 80% of the minimum annual historic expenditure. In practice, our expenditure has been significantly greater than this level. Recognising this fact, we have assumed the level of RIIO-3 expenditure will be consistent with RIIO-2. This is shown in

Table 2 in section 2.

[Commercially Sensitive Information Redacted]

Table 4. RIIO-2 Summary Cost and Volume

It is difficult to predict the specific location, length of mains and pressure tier that will need to be reinforced during RIIO-3 because the work is driven by changes in domestic and industrial customer demand and the specific location and volume of new connections on the network (noting that there are wide ranges in forecasts for new properties). Pipe diameter assumptions have been made based on historical averages for similar reinforcement works, with specific diameter ranges considered for costings. For more details on our costing methodology please see section 8.4.7.

This investment is not triggered by asset health, but by obligations as part of our Gas Transporter Licence conditions, as described in section 5. Therefore, we are not able to declare a condition score at the start and end of RIIO-3. Reinforcement of network for changing demand conditions is a continuous process, therefore the investment in this paper is specific to the RIIO-3 period only.

5 Problem/Opportunity Statement

Our Gas Transporter Licence conditions (Standard special conditions A9 and A17) require us to ensure proportionate and timely investment in infrastructure to support our commitment to provide a reliable service to customers and enable economic growth.

Investment in reinforcing the distribution network to accommodate local growth in gas demand will help ensure that our customers do not suffer any supply interruptions, particularly during periods of peak demand.

We are also constrained in the way we are able to respond to supply-demand deficits through changing our operating strategies. Our mains and services are subject to Pipeline Safety Regulations, Regulation 11, which mandates that pipelines are operated within pre-defined Safe Operating Limits.

5.1 Investment drivers

As part of our gas transporter licence conditions, we are required to provide a reliable service to our customers, ensuring that our network is resilient and able to cope with extreme events (including 1 in 20 year events). Reinforcements of the networks are required to continue to meet customer gas demand requirements where we have an increase in growth or where network changes impact capacity. There are two main reasons that drive investment in reinforcement:

- Reinforcement to meet demand growth (consisting of new gas demand growth or new connections),
- Reinforcement to enable insertion, reducing overall delivery costs and environmental impact of our mains replacement activity (network capacity reduction due to mains insertion technique used in mains replacement).

There is evidence to show that reinforcement activity in RIIO-3 will need to continue because of the following drivers, however there is a high level of uncertainty on when and exactly where the reinforcement will be required:

- Increased peak winter demand
- Continued growth in housing
- Continued growth in local power generation
- Our target mains renewal insertion rate

Peak Winter Demand: For load-related capacity the regulatory framework for our business clearly defines a '1 in 20 peak day' demand obligation we must provide for all customers, new and old. This standard must be delivered through the energy transition. Failure to maintain this standard would result in lower pressure or full loss of supply to customers during periods of high demand – impacting heating and cooking needs, as well as industrial and commercial activity.

Even though we forecast aggregate peak day capacity being fulfilled by an ongoing reliance on existing assets, we must invest to remove highly localised constraints where these cannot be resolved by the use of commercial alternatives. Such constraints are inevitable, and driven by changes in customers' profiles, localised redevelopment and urban spread occurring across our towns and cities.

The winter of 2017/18 was particularly cold, leading to a high gas demand which ultimately led to the loss of supply to 1,600 customers. A combination of events led to this supply interruption but, gas demand and network performance played a significant role. This event changed our view of the "worst case" design case for modelling network reinforcement needs.

Increased Insertion: Insertion is generally the most efficient method of replacing mains, reinforcing the network to allow insertion can create overall savings in delivery. This technique, when compared to other options, reduces the amount of excavation work required, which, in turn, reduces costs and disruption to members of the public. Insertion does, however, reduce the capacity of the network – the newly inserted pipe being smaller in diameter and therefore can transport less gas. Analysis of our insertion rates over RIIO-2 indicate that current reinforcement volumes to allow for insertions will suffice to meet our mains replacement ambitions. For more information on our Tier 1 Mains replacement programme see EJP08-Mains IMRRP (Including Associated below=2" Steel).

5.2 Required outcome and measuring success

[Commercially Sensitive Information Redacted]

5.3 Narrative real-life example of problem

[Commercially Sensitive Information Redacted]

Figure 1: Pressure Modelling the Reinforcement

[Commercially Sensitive Information Redacted]

5.4 Project Boundaries

[Commercially Sensitive Information Redacted]

6 Probability of Failure

[Commercially Sensitive Information Redacted]

6.1 Probability of Failure Data Assurance

[Commercially Sensitive Information Redacted]

7 Consequence of Failure

[Commercially Sensitive Information Redacted]

8 Options Considered

[Commercially Sensitive Information Redacted]

8.1 How we have structured this section

[Commercially Sensitive Information Redacted]

8.2 Types of intervention

Table 5 below explains the intervention types that we have considered.

[Commercially Sensitive Information Redacted]

Table 5: Intervention types

8.3 Timing choices

[Commercially Sensitive Information Redacted]

8.4 Options

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 6: Volume options considered

8.4.1 Option 0 – Baseline

[Commercially Sensitive Information Redacted]

8.4.2 Option 1 – Do Minimal

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Figure 2: Option 1 – Do minimal lengths: general reinforcements

[Commercially Sensitive Information Redacted]

Figure 3: Option 1 – Do minimal lengths: specific reinforcements

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 7: Volume of options considered option 1 (km)

[Commercially Sensitive Information Redacted]

Table 8: Cost profiles for Option 1 (£m)

[Commercially Sensitive Information Redacted]

8.4.3 Option 2 – Do Average

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Figure 4: Option 2 – Do average lengths: general reinforcements[1]

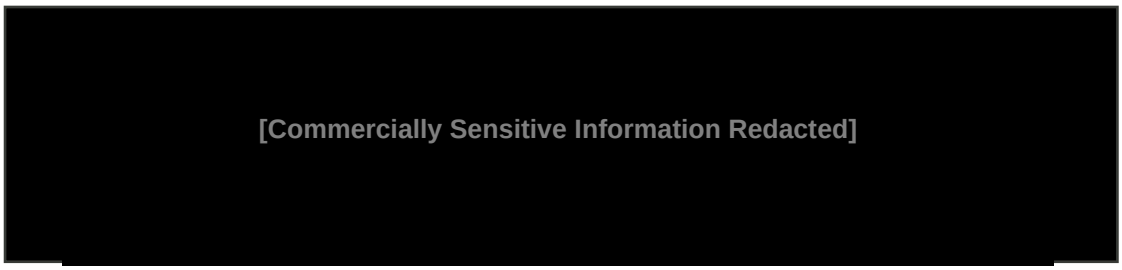

Figure 5: Option 2 – Do average lengths: specific reinforcements

[Commercially Sensitive Information Redacted]

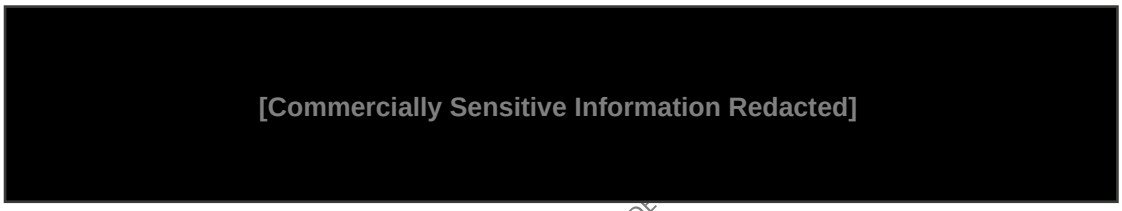

Table 9: Volume of options considered option 2 (Km)

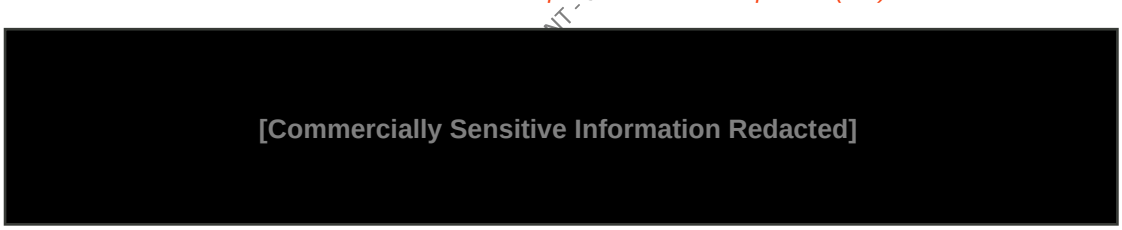

Table 10: Cost profiles for Option 2 (£m)

[Commercially Sensitive Information Redacted]

8.4.4 Option 3 – Do Maximum

[Commercially Sensitive Information Redacted]

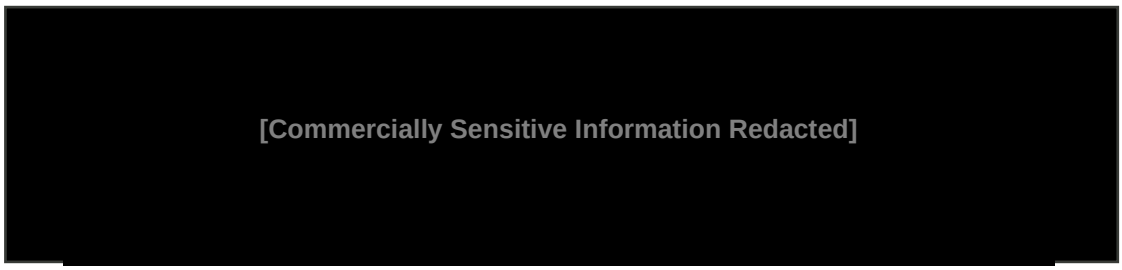

Figure 6: Option 3 - Do maximum lengths: general reinforcements

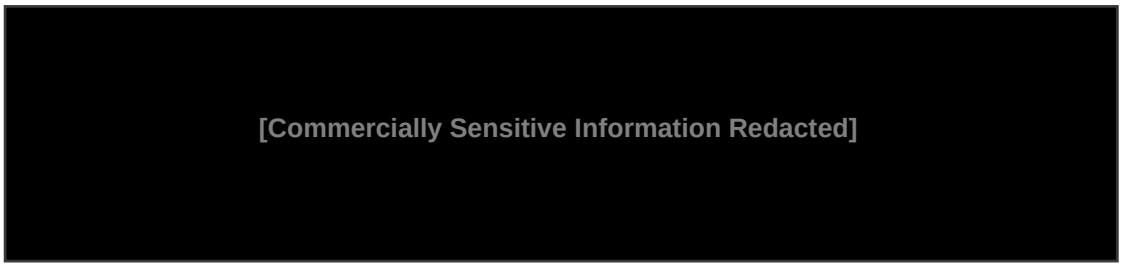

Figure 7: Option 3 - Do maximum lengths: specific reinforcements

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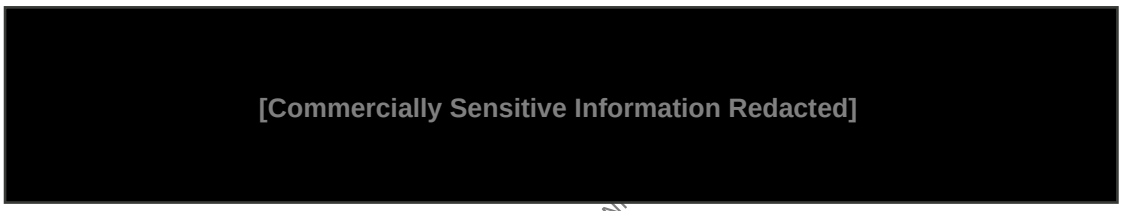

Table 11: Volume of options considered option 3 (Km)

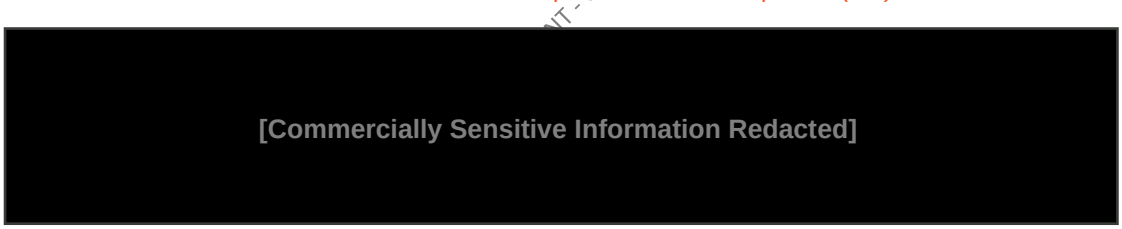

Table 12: Cost profiles for Option 3 (£m)

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8.4.5 Option 4 – Do Reducing Average

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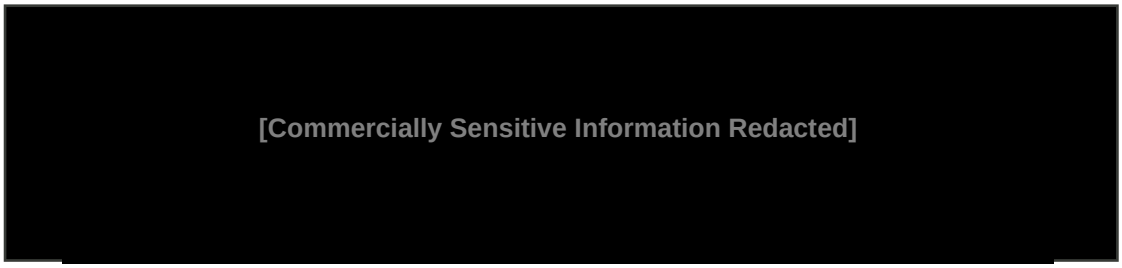

Figure 8: Option 4 - Do Reducing Average: general reinforcements[2]

[Commercially Sensitive Information Redacted]

Figure 9: Option 4 - Do Reducing Average: specific reinforcements

[Commercially Sensitive Information Redacted]

Table 13: Volume of options considered option 4 (Km)

[Commercially Sensitive Information Redacted]

Table 14: Cost profiles for Option 4 (£m)

8.4.6 Options Technical Summary Table (General and Specific Reinforcement)

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 15: Technical Summary Table

[Commercially Sensitive Information Redacted]

8.4.7 Unit Costs

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 16: Reinforcement unit cost rates applicable to RIIO-3

[Commercially Sensitive Information Redacted]

8.5 Reinforcement Driven by Insertion

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 17: RIIO-2 Volume and Cost of Reinforcement to support insertion

9 Business Case Outline and Discussion

9.1 Key Business Case Drivers Description

[Commercially Sensitive Information Redacted]

9.2 Business Case Summary

[Commercially Sensitive Information Redacted]

9.2.1 General and Specific Reinforcements

[Commercially Sensitive Information Redacted]

9.2.2 Insertion-reinforcements

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 18: Insertion Reinforcement Costs (£m)

10 Preferred Option Scope and Project Plan

10.1 Preferred Option

[Commercially Sensitive Information Redact]

[Commercially Sensitive Information Redacted]

Table 19: Volume of Km of general reinforcement

[Commercially Sensitive Information Redacted]

Table 20: Volume of Km of Reinforcement to support insertion

10.2 Reinforcement Forecast Spend Profile

[Commercially Sensitive Information Redacted]

Table 21: Total forecast cost for Reinforcement and Insertion

10.3 Investment Risk Discussion

[Commercially Sensitive Information Redacted]

[Commercially Sensitive Information Redacted]

Table 22: Business Risks

10.4 Project Plan

[Commercially Sensitive Information Redacted]

10.5 Key Business Risks and Opportunities

[Commercially Sensitive Information Redacted]

10.6 Outputs included in RIIO-2 Plans

[Commercially Sensitive Information Redacted]

11 Regulatory Treatment

[Commercially Sensitive Information Redacted]

12 Glossary

Abbreviation/term	Meaning
IMRRP	Iron Mains Risk Reduction Programme
RRP	Regulatory Reporting Process
AIM	Asset Investment Manager
CBA	Cost Benefit Analysis

Table 23: Glossary Table