

Engineering Justification Paper

CPM7564 Aldermaston (Basingstoke IPMP)

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2 Introduction

We anticipate development to result in a system capacity failure at Aldermaston, thus, reinforcement has been identified within the Aldermaston MP system. This project is part of a wider programme of reinforcement associated with the RIIO-GD2 Business Plan Appendix covering Capacity Management.

2.1 General Background

Our distribution system is built to ensure security of supply for all customers. The networks operating at below 7bar are designed to meet a peak six-minute demand level which could be experienced under 1:20 conditions, supporting a safe, secure and reliable service to those customers and meeting requirements outlined within the Licence Condition, including, but not limited to, Condition 16 contained therein.

Link: [Gas Transporters Licence – Standard Conditions](#)

Where capacity constraints are identified which are likely to impact on our ability to ensure security of supply to all customers, Network Planning will look to establish optimum, cost-efficient reinforcement strategies to mitigate risk. Such constraints may arise as a result of a number of factors, but the most common is increased demand levels, often resulting from new connections.

We have initiated an extensive programme of stakeholder engagement, working closely with Local Authorities, both in Scotland and the South of England, to establish a fully informed and independently sourced picture of planned development.

This engagement has provided us with confidence the sites identified will progress to development and, to support this level of growth, we have developed a programme of reinforcement across its network.

2.2 Site Specific Background

Development within Basingstoke IP/MP Grid, more specifically Aldermaston MP is covered by the West Berkshire District Council Local Plan which presents a strategy for directing growth for the next 10-20 years.

The driver(s) for this reinforcement project are Local Plan sites located within the Aldermaston and Aldermaston Wharf regions.

The West Berkshire Local Plan has allocated sites to develop 1,151 homes in the region of Aldermaston and Aldermaston Wharf. In addition, four sites have been allocated for non-domestic development, totalling 167.7ha. At present none of the domestic or non-domestic sites have planning consent.

The Aldermaston system is extremely sensitive at the tail of the system and would only require between 100-200 new dwellings to trigger a requirement for reinforcement.

3 Equipment Summary

The Aldermaston MP network operates at 1.8bar and is supplied via Aldermaston 'B' DPG. The leg is 100% PE. Four DG's are supplied by the leg, three at the tail and one at the mid-point between the source and the tail.

Security

4 Problem Statement

Why are we doing this work and what happens if we do nothing?

New Connections to our networks reduce available capacity. It is necessary to reinforce or elevate pressures to increase capacity in the system when pressures are predicted to fall below minimum acceptable levels.

In the case of the Aldermaston MP system, significant potential development identified within the Local Plan and associated documents will see the network approach capacity early in RIIO-GD2.

Failure to reinforce the network will restrict the delivery of these developments.

What is the outcome that we want to achieve?

Maintain our Licence Conditions to ensure security of supply and support economic prosperity by not becoming a blocker to development.

How will we understand if the spend has been successful?

On completion of the proposed reinforcement, we will monitor system performance to ensure system pressures are maintained. This will take the form of regular system performance checks and localised pressure surveys to ensure a successful outcome has been achieved.

At a customer level, we will have delivered a reinforcement ensuring a safe and secure network, meets stakeholder aspirations and allows developments to progress timely.

4.1 Narrative Real-Life Example of Problem

The Aldermaston MP system is highly sensitive to minor increases in demand as a result of the significant distance from the source to the tail. As such, development identified in Aldermaston and Aldermaston Wharf regions will drive significant reinforcement in the early part of RIIO-GD2.

A recent example of good planning to meet customer expectation, whilst also ensuring security of supply, occurred following the acceptance of a quotation to supply a new development at Milton Heights, Milton, Abingdon, Oxfordshire (P18143337).

Network analysis confirmed a requirement to reinforce SGN's system in advance of connecting the fully developed site load. However, network analysis also confirmed an interim load/connection of 72 new properties in advance of reinforcement, thereby meeting the GT/Developer's schedule of works.

Reinforcement to supply the full development was subsequently planned and completed in advance of connections beyond the interim load, ensuring security of supply to approximately 500 new/existing customers.

Security

The developments driving this reinforcement are listed in Table 1 below:

Table 1: Development Summary

| Development Name | Site Usage | Site Status | Confidence |
|--------------------------------|----------------------------------|---------------------|-------------------------------------|
| Basingstoke ALD5 | 60 Houses | No Planning Consent | Good prospects (>50% confidence) |
| Land Fronting Bath Rd (A) | Mixed Dev. (Incl. 135 Houses) | No Planning Consent | Good prospects (>50% confidence) |
| Land Fronting Bath Road (B) | Mixed Dev. (Incl. 84 Houses) | No Planning Consent | Good prospects (>50% confidence) |
| Land at Padworth Lane | Mixed Dev. (Incl. 325 Houses) | No Planning Consent | Good prospects (>50% confidence) |
| Land at Foresters Farm | 60 Houses | No Planning Consent | Good prospects (>50% confidence) |
| Aldermaston Park | 285 Houses | No Planning Consent | Good prospects (>50% confidence) |
| Former Youngs Garden Centre | 92 Houses | No Planning Consent | Good prospects (>50% confidence) |

Please see Appendix B of this document which gives further details of the criteria applied when determining the attributable 'confidence' level of the above sites progressing to development.

Through this determination we have deemed the requirement for this reinforcement within the RIIO-GD2 period as 'Low' and is therefore included the funding request in our Base Growth and High Growth scenarios.

4.2 Spend Boundaries

The spend associated with these reinforcement works provide capacity within the Aldermaston MP system to support the project development during RIIO-GD2.

The monies associated with these works ensure security of supply for existing customers and connection of planned development to the network. Costs have been prepared using average contracted rates at depot level and validated against known costs for similar, completed projects.

5 Probability of Failure

As development for Aldermaston progresses, the Aldermaston MP Network is predicted to fail under all demand conditions by winter 2025/26 as the industrial sites alone put the network out of capacity, putting at risk supplies to 1800 new and existing customers.

5.1 Probability of Failure Data Assurance

Model Validation

To ensure the accuracy of the Network Analysis models, validation is carried out in line with the published requirement under Section 17 of our Safety Case and is a fundament of our Licence to Operate.

Validation ensures the current models are an accurate representation of the actual gas transportation system and can be used to predict network behaviour under a variety of conditions, including the 1 in 20 design condition.

In addition to the Validation Programme, a robust model maintenance process and annual system performance checks ensure the models continue to be accurate and fit for purpose.

Network Growth

The West Berkshire District Council Local Plan and associated documents have been reviewed and an assessment made as to the probability of sites contained therein progressing to construction (see Table 1).

The resulting outputs have been applied to the network model, providing confidence the pre-emptive repair of the network (i.e. reinforcement) will be required during RIIO-GD2 to ensure we meet our Licence Conditions, maintaining minimum supply pressure under all demand conditions.

6 Consequence of Failure

Loss of Supply to Customers

Failure to reinforce will put at risk the supply to those customers supplied via the Aldermaston MP system.

Insufficient pressure will result in the loss of supply to approximately 1800 new and existing customers within Aldermaston and a failure to meet our Licence Conditions, attracting adverse publicity and damage to the company's reputation.

Affected customers will include the Aldermaston Church of England Primary School.

Financially, after the first 24 hours, affected householders will be compensated for time without gas. Domestic customers will receive £41 for each 24-hour period without gas, small businesses will receive £69 for each 24-hour period without gas.

Table 2: Projected Pressures (2025/26) without Reinforcement

| Location | Min. Required Pressure (bar) | Min. Modelled Pressure (bar) |
|------------------|------------------------------|------------------------------|
| Watson Close DPG | 0.345 | -9.515 |

Security

Safety Impact of Failure

Reinforcement of the Basingstoke IPMP system is necessary to meet the requirements of our Licence Condition.

In this instance, no immediate issues were experienced as the initial network connections were made during a period of low demand. However, as demand increased over the winter period insufficient capacity resulted in the loss of supply to 299 properties both direct fed and within an IGT area.

Environmental Impact

A system failure on this scale will result in a major recovery exercise. Environmental impacts will include increased travel to site by our employees, leading to an increase in greenhouse gas emissions and disruption to the public.

On site, the use of fossil fuels to power plant and equipment required in the restoration of supplies will further increase greenhouse gas emissions, as will subsequent travel/plant in use for the reinstatement of public highways following the conclusion of these works.

7 Options Considered

7.1 Options

In accordance with the guidelines set out in the Ofgem guidance document '*Engineering Justification Paper Frameworks for RIIO-GD2 and RIIO-GT2*' – Appendix B (Section 7), the following options have been considered:

Replace on Failure

Wait until the network fails then replace the system. This option has been discounted due to non-compliance with our Licence Condition.

Repair on Failure

Mains reinforcement after the network has failed. This option has been discounted due to non-compliance with our Licence Condition.

Pre-emptively Replace

Replace the system prior to network failure. This option has been discounted as it is impracticable to replace the Aldermaston MP system.

Pre-emptively Repair

Mains reinforcement based on model data prior to network failure. Two options have been considered for further investigation, both are main laying solutions.

Security

Do Nothing

Not considered practicable as potential development identified/programmed within the local plan and associated documents will see the Aldermaston MP system approach capacity early in RIIO-GD2.

7.2 First Option Summary: Church Road

The technical detail of the option i.e. capacity, system rating, availability etc.

The first option considered for further investigation, **Church Road**, involves the construction of approximately 2.4km x 180mm PE MP mains in two locations to reinforce the existing 90mmPE MP main

The basis for the cost estimate/unit cost

Costs for this option, amounting to £1.621m, have been prepared using average contracted rates at depot level and validated against known costs for similar, completed projects.

The perceived benefits of the option

The proposed works provide capacity for the development identified within the Local Plan which is scheduled for construction during RIIO-GD2.

Delivery timescales

This project is scheduled to commence in 2022/23 and is expected to be phased over 3 years, to be completed in 2024/25.

Key assumptions made

It is assumed the known potential demand growth within RIIO-GD2, and beyond, will require the same level of gas supply as is currently experienced.

This option, by following the existing main route and avoiding the main A road through Aldermaston, will have a lesser impact on the public.

Any other items that differentiate the option from the others considered

This option provides the best overall value as it is possible to phase based on the delivery of development.

In addition, by following the existing main route and avoiding the main A road through Aldermaston, this option will have a lesser impact on the public.

7.3 Second Option Summary: A340

The technical detail of the option i.e. capacity, system rating, availability etc.

The second option considered for further investigation, **A340**, involves the construction of approximately and new DPG, 1.86km x 180mm PE MP and 0.02km x 180mmPE IP mains to reinforce the existing network.

The basis for the cost estimate/unit cost

Costs for this option, amounting to £1.603m, have been prepared using average contracted rates at depot level and validated against known costs for similar, completed projects.

The perceived benefits of the option

The proposed works provide capacity for the development identified within the Local Plan which is scheduled for construction during RIIO-GD2.

Delivery timescales

This project is scheduled to commence in 2022/23 and is expected to be phased over 3 years, to be completed in 2024/25.

Key assumptions made

It is assumed the known potential demand growth within RIIO-GD2, and beyond, will require the same level of gas supply as is currently experienced.

Any other items that differentiate the option from the others considered

This option provides a robust solution, however the lack of flexibility due to phasing not being possible, creates a large upfront cost.

Additionally, this option follows the A340, a major road, and therefore will cause significant disruption to the public.

7.4 Third Option Summary: Interruption

In addition to the above, consideration was given to interruption.

As part of Interruption Reform, also known as the Mod 90 process, we have the option to offer a tender for interruptible contracts to customers to offset the need to invest for capacity.

There are no sites within the Aldermaston MP Network which are eligible for an interruptible supply, this option has been discounted.

7.5 Options Technical Summary Table

Table 3: Summary of RIIO-GD2 Costs

| Option | First Year of Spend | Final Year of Spend | Volume of Interventions | Design Life (years) | Total (£m) |
|----------------|---------------------|---------------------|-------------------------|---------------------|------------|
| 1/ Church Road | 2022/23 | 2024/25 | 2.14km x 180mm PE MP | 10 | 1.621 |
| | | | 0.26km x 180mm PE MP | | |
| | | | 0.8km x 180mm PE MP | | |
| | | | 0.46km x 180mmPE MP | | |
| | | | 0.4km x 180mmPE MP | | |
| 2/ A340 | 2022/23 | 2024/25 | 1.86km x 180 PE MP | 10 | 1.603 |
| | | | 0.26km x 180mm PE MP | | |
| | | | 0.8km x 180mm PE MP | | |
| | | | 0.46km x 180mmPE MP | | |
| | | | New DPG | | |
| | | | 0.02km x 180mm PE IP | | |

7.6 Options Cost Summary Table

Table 4: Summary of RIIO-GD2 Costs

| Option No. | Volume of Interventions | Cost Breakdown (£m) | Total (£m) |
|----------------|-------------------------|----------------------------|------------|
| 1/ Church Road | 2.14km x 180mm PE MP | Commercial Confidentiality | 1.621 |
| | 0.26km x 180mm PE MP | | |
| | 0.8km x 180mm PE MP | | |
| | 0.46km x 180mmPE MP | | |
| | 0.4km x 180mmPE MP | | |
| 2/ A340 | 1.86km x 180 PE MP | Commercial Confidentiality | 1.603 |
| | 0.26km x 180mm PE MP | | |
| | 0.8km x 180mm PE MP | | |
| | 0.46km x 180mmPE MP | | |
| | New DPG | | |
| | 0.02km x 180mm PE IP | | |

8 Business Case Outline and Discussion

Validation of the network analysis model, a robust model maintenance process and system performance checks have confirmed the accuracy of the Aldermaston MP model for use in network analysis.

A full review of the relevant Local Plans and associated documents, followed by close engagement with stakeholders, has provided confidence in the level of development expected during RIIO-GD2.

The development outputs have been applied to the validated network model which predicts the system will fail under all demand conditions by winter 2025/26 as the industrial site alone puts the system out of capacity, putting at risk supplies to 1800 new and existing customers.

To mitigate this risk and meet Licence Conditions it will be necessary to pre-emptively reinforce the network during the RIIO-GD2 period.

For the purposes of this report, costs associated with the identified options have been collated using average contracted rates at depot level and validated against known costs for similar, completed projects.

8.1 Key Business Case Drivers Description

Pre-emptively Repair: Option 1, Church Road

Project costs for this solution can be expected to be significant, involving substantial lengths of main laying through the town centre.

Reinforcement of the Aldermaston MP network can be phased in line with the development driving reinforcement through this option, providing some flexibility in the scheduling of this strategy.

This option delivers a robust reinforcement solution whilst also providing a resilience benefit to the Aldermaston MP system.

Pre-emptively Repair: Option 2, A340

Project costs for this solution can be expected to be significant involving substantial lengths of main laying, additionally involving a new DPG station. Installing a new DPG would require land purchase, therefore further increasing costs.

This option provides a second supply to the sensitive Aldermaston MP system, closer to the tail, thus providing a further resilience benefit.

Table 5: Summary of Key Value Drivers

| Option No. | Desc. of Option | Key Value Driver |
|------------|-----------------|---|
| 1 | Church Road | Opportunity to phase, minimally disruptive. |
| 2 | A340 | No phasing opportunity, highly disruptive. |

8.2 Business Case Summary

This project is driven by our Licence Conditions to ensure security of supply.

Table 6: Business Case Matrix

| | Church Road | A340 |
|--------------------------------|--|---|
| Cost (£m) | 1.621 | 1.603 |
| Positive Benefit (Pros) | A robust reinforcement solution. Reduced disruption to public. Opportunity to phase works. | A robust reinforcement solution. The least cost solution. Provides an additional IP supply to the sensitive Aldermaston MP system. |
| Negative Impact (Cons) | Aldermaston MP remains a single supply system. | New DPG location wholly dependent on securing land easements. Engineering Difficulty – Mains lay along busy A road. In following this route there is no opportunity to phase these works. |

Costs inclusive of Overheads and Efficiencies

9 Preferred Option Scope and Project Plan

9.1 Preferred option

Pre-Emptively Repair - Option 1, Church Road: 4.06km x 180mmPE MP reinforcement.

9.2 Asset Health Spend Profile

Table 7: Summary of Schedule of Spend

| Asset Health Spend Profile (£m) | | | | | | |
|---------------------------------|---------|---------|---------|---------|---------|----------|
| Pre GD2 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | Post GD2 |
| 0 | 0 | 0.885 | 0.325 | 0.411 | 0 | 0 |

Costs inclusive of Overheads and Efficiencies

9.3 Investment Risk Discussion

The requirement for reinforcement of the Aldermaston MP system is demand driven, primarily, by development identified within the West Berkshire District Council Local Plan and associated documents. Through this determination we have identified reinforcement required within RIIO-GD2.

Risk exists when the planned development does not materialise or proceeds more slowly than anticipated. As reinforcement will not be required until the midpoint of RIIO-GD2, the progress of development will be modified to suit.

We have prepared costs using average contracted rates at depot level and have validated them against known costs for similar, completed projects. Nevertheless, whilst all reasonable steps have been taken to ensure accuracy of costs outlined in this paper, it is recognised external variables may change and subsequently impact on actual costs at the time of construction. Examples of such could include unforeseen increases in contractor rates driven by a surplus of market demand for labour or cost increases for materials.

Factors such as market driven demand linked to the economy, the UK's potential exit from the European Union, emerging decarbonisation strategies and industry innovation can potentially impact on the scope of works outlined in this paper. We have proposed a volume driver funding mechanism to de-risk underspend/overspend for these works. Further details of this proposal can be found in Section 6.2 in the RIIO-GD2 Business Plan Appendix for Capacity Management.

As stated in our Environmental Action Plan, and in line with current UK Government targets, our long-term target is to achieve net-zero emissions by 2045. This means decarbonisation of the energy network and supporting the transition to an environmentally sustainable low-carbon energy system. Indeed, we recognise there have been preliminary government targets set to facilitate a move toward renewable or low carbon heat solutions by the end of RIIO-GD2. As such, throughout the RIIO-GD2 we will continue to closely monitor this emerging heat strategy with a view to refining any potential impact on current growth forecasts.

Appendix A - Development Trajectory Summary

Domestic

| Town | Site Name | LA Ref | Sum of GD1 Total | Sum of GD2 Total | Sum of GD3 Total | Sum of Total |
|--------------------|-----------------------------|--------|------------------|------------------|------------------|--------------|
| Aldermaston | Aldermason Park | ALD1 | 140 | 145 | 0 | 285 |
| | Basingstoke Road | ALD5 | 0 | 60 | 0 | 60 |
| | Former Youngs Garden Centre | ALD3 | 0 | 0 | 92 | 92 |
| | Land at Foresters Farm | ALD4 | 0 | 60 | 0 | 60 |
| | Land at Padworth Lane | PAD3 | 0 | 325 | 0 | 325 |
| | Land Fronting Bath Road (A) | BEEN1 | 0 | 135 | 0 | 135 |
| | Land Fronting Bath Road (B) | PAD1 | 0 | 84 | 0 | 84 |
| Grand Total | | | 140 | 809 | 92 | 1041 |

Non-Domestic

| Town | Site Name | LA Ref | Sum of GD1 Total | Sum of GD2 Total | Sum of GD3 Total | Sum of Total |
|--------------------|-----------------------------------|--------|------------------|------------------|------------------|--------------|
| Aldermaston | Land Fronting Bath Road (A) | BEEN1 | 0 | 19 | 0 | 19 |
| | Land Fronting Bath Road (B) | PAD1 | 0 | 12 | 0 | 12 |
| | Land off Benyon Road, Easter Park | ALD6 | 0 | 49 | 0 | 49 |
| Aldermaston Wharf | Land at Padworth Lane | PAD3 | 0 | 89 | 0 | 89 |
| Grand Total | | | 0 | 168 | 0 | 168 |

Further assurance regarding the above tables will be made available by West Berkshire District Council in Summer 2019. As previously mentioned: *the report reflects the potential developments provided through stakeholder engagement at the time. We will seek out updated information when it becomes available. This may or may not change the strategy of this project.*

Appendix B - Categorisation of Potential Load Growth

The following Table sets out the manner in which identified potential load growth has been categorised and applied, leading to customer driven reinforcement, when looking to establish the optimum investment strategy for our networks.

| DEFINITION TABLE | | | | |
|-----------------------------------|---|--|-------------|-------------|
| Confidence | Definition | Factors to be considered | Base Growth | High Growth |
| Highly probable (>90% confidence) | Connection expected in RIIO-GD2 for all sites | <ol style="list-style-type: none"> 1. Quotation accepted but not yet on stream 2. Building is in progress. 3. Detailed planning permission granted. 4. Economic conditions indicate that sites for consumers of a particular type are likely to be developed, e.g. <ol style="list-style-type: none"> a. Domestic sites where there is a high demand for housing and there is a shortage of land available. b. Interest has been shown in having a connection made to a non-domestic site and economic factors suggest development will go ahead. | ✓ | ✓ |
| Probable (>75% confidence) | Connection Likely in RIIO-GD2 for majority of sites | <ol style="list-style-type: none"> 1. Outline planning consent has been granted. 2. Recent development has been carried out in the area. 3. The land is a prime site for development, but no connection enquires have yet been received. 4. Adopted Local Plan Site | ✓ | ✓ |
| Good prospects (>50% confidence) | Connection expected for some sites in RIIO-GD2 | <ol style="list-style-type: none"> 1. Proposed Local Plan Site 2. No indication of planning permission being granted for the site. 3. The site is outside existing gas supply areas. 4. The site would involve physical problems in delivering a gas supply. 5. The site would require substantial additional infrastructure, e.g. additional roads, schools. 6. Site marked “reserve” in Local Plan. 7. Site is known to be contaminated ground. 8. Site has “protection” orders served over it – e.g. SSSI. | | ✓ |
| Poor prospects (<50% confidence) | Significant time or investment required to progress | <ol style="list-style-type: none"> 1. Does not meet the above planning criteria. 2. Site has been deemed as ‘speculative’. 3. The site would require significant additional infrastructure, e.g. additional roads, schools. | | |

Appendix C - List of Acronyms

| Acronym | Backronym (spelled out acronym) | Definition / explanation |
|---|--|---|
| Pressure Tiers ○ IP ○ MP ○ LP | ○ Intermediate Pressure ○ Medium Pressure ○ Low Pressure | ○ Intermediate Pressure i.e. 2 – 7bar ○ Medium Pressure i.e. up to 2bar ○ Low Pressure i.e. up to 75mb |
| CSEP | Connected System Exit Point | A connection point for one of more Individual System Exit Points, most usually supplying a GT Network (see GT below). |
| DG | District Governor | Pressure regulator primarily used for reducing pressures from IP and MP tiers to LP. |
| DPG | Distribution Pressure Governor | Pressure regulator primarily used for reducing pressures from IP tier to MP. |
| GT | Independent Gas Transporter | GT networks are directly connected to the Gas Distribution Network (GDN) via a Connected System Entry Point or indirectly to the GDN via another IGT. |
| HDPE | High Density Polyethylene | Pipe material for use in 7bar rated systems. |
| HLA | Housing Land Audit | Local Authority planning document. |
| LDP | Local Development Plan | Local Authority planning document. |
| PE | Polyethylene | Pipe material. |
| RIIO-GD1 | Revenue=Incentives + Innovation + Outputs – Gas Distribution 1 | 8-Year price control period (2013-2021) |
| RIIO-GD2 | Revenue=Incentives + Innovation + Outputs – Gas Distribution 2 | Proposed 5-Year price control period (2021-2026) |
| SHP | SHP File Format | SHP is a file extension for a Shapefile shape format used in geographical information systems (GIS) software. |
| ST | Steel | Pipe material. |
| TRS | Transmission Reduction Station | Pressure regulator primarily used for reducing pressures from Local Transmission System tier to IP/MP. |
| 1:20 | 1:20 Demand Conditions | Designing a network to operate whilst experiencing demand conditions historically only seen every 20 years, during severe weather events. |