

Engineering Justification Paper

CPM6843 Brackley (North & West Oxfordshire IPMP)

Version: Final

Date: December 2019

Classification: Highly Confidential



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2 Introduction

Reinforcement has been identified within North and West Oxfordshire IPMP Grid, specifically relating to anticipated Capacity failure at Brackley. 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

The SGN distribution system is built to ensure security of supply for all our customers. Our networks operating at pressures below 7bar are designed to meet a peak six-minute demand level that could be experienced under 1 in 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 that are likely to impact on SGNs ability to ensure security of supply to all customers, Network Planning will look to establish optimum cost-efficient reinforcement strategies to mitigate that 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.

SGN has 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 SGN with confidence that the sites identified will progress to development, to support this level of growth, SGN has developed a programme of reinforcement across its network.

2.2 Site Specific Background

Brackley is supplied by approx. 7.5km of 315/250mm PE MP mains energised by Charlton Road TRS. Pressure losses incurred over such distance make the feed to Brackley sensitive to increasing demand. Requirement for reinforcement in GD2 is driven by a major development site within Brackley as outlined in the South Northamptonshire District Council Local Development Plan and Housing Land Audit.

3 Equipment Summary

North & West Oxfordshire IPMP system is fed from Oxfordshire HP system via PRIs at Newton Longville 'B', Steeple Claydon 'A', Banbury 'A', Stanton St (220) and Galley Farm (219) to the IP network while Charlbury, Tackley, Cod Bicester, Marsh Gibbon, Winslow, Aynho, Banbury 'B', Rowsham Road (217) feeds to MP networks in the grid. Charlton Road HP-MP TRS energises the Brackley MP system at 1.86 bar via approximately 7.5km of 315/250mm PE MP mains.

Equipment	Tier	Comment
Charlton Road TRS	HP-MP	Outlet pressure 1.86 bar

Table 1 - Brackley MP Equipment Summary

Security

4 Problem Statement

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

New connections to our networks reduce available capacity and when pressures are predicted to fall below minimum acceptable levels it is necessary to reinforce or increase pressures to facilitate increased capacity in the system.

b) What is the outcome that we want to achieve?

Maintain SGN's licence conditions to ensure security of supply, avoid becoming a blocker to development and support the economic prosperity of this area.

c) How will we understand if the spend has been successful?

On completion of the proposed reinforcement, SGN will monitor system performance to ensure expected system pressures are maintained. This will take the form of regular system performance checks and localised pressure surveys to ensure a successful outcome is delivered.

At a customer level, SGN will have delivered a reinforcement that ensures a safe and secure network, meets stakeholder aspiration and ensures developments progress timeously.

4.1 Narrative Real-Life Example of Problem

Brackley has been identified for major development, with a significant impact on capacity available within the Brackley MP system. The existing network will require significant reinforcement to support these sites.

Failure to reinforce this area will result in SGN becoming a blocker to proposed development which, if connected prior to reinforcement, will result in the loss of supply to approximately 4000 customers.

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.

Development Name	Site Usage	Site Status	Confidence
Turweston Road	350	Allocation within the Adopted Local Development Plan, 2018 HLA	Probable (>75% confidence)

Table 2 - Development Summary

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Please see Appendix A 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 SGN have deemed the requirement for this reinforcement within RIIO-GD2 as ‘Probable’ and have therefore included the funding request in both our base growth and high growth scenarios.

Currently there are a number of development areas under construction within the Brackley area, indicating a significant appetite for growth and buoyant market.

4.2 Spend Boundaries

The spend associated with these reinforcement works provides capacity within the Brackley MP system to support projected development during RIIO-GD2.

5 Probability of Failure

As development progresses, the Brackley MP grid is predicted to fail between 85-90% peak demand by winter 2022/23, putting at risk supplies of up to 4000 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 SGN's Safety Case and is a fundament of SGN's Licence to Operate.

Validation ensures that 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 ensures that the models continue to be accurate and fit for purpose.

Network Growth

The Local Development Plans covering and associated documents covering the NW Oxfordshire grid have been reviewed and an assessment made as to the probability of sites contained therein progressing to construction (see Table 2).

The resulting outputs have been applied to the network model, providing confidence that pre-emptive repair of the network (i.e. reinforcement) will be required during RIIO-GD2 to ensure minimum supply pressures are maintained under all demand conditions.

6 Consequence of Failure

Loss of Supply to Customers

Failure to reinforce will put at risk the supply to customers in Brackley. The loss of supply to Brackley would result in the loss of supply of up to 4,000 customers and a failure to meet SGN's licence conditions, attracting adverse publicity and reputational damage.

Among the affected customers would be 3 GP practices, 8 schools, Brackley fire station and Brackley police station.

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.

SGN have designed all of our reinforcement solutions to meet 1 in 20 demand conditions. The SGN distribution system is built to ensure security of supply for all our customers. Our networks operating at pressures below 7bar are designed to meet a peak six-minute demand level that could be experienced under 1 in 20 conditions, supporting a safe, secure and reliable service to those customers and meeting requirements outlined within our Licence Conditions.

Safety Impact of Failure

Reinforcement of the Brackley MP system is required to meet the obligations of our Licence Condition.

In this instance, a failure to reinforce will result in a system failure during peak winter conditions. The resulting loss of supply may have serious health and safety implications for vulnerable customers who rely on gas for essential heating and cooking facilities.

System failure and the resulting loss of supply may have serious implications for vulnerable customers who rely on gas for heating and cooking facilities.

Environmental Impact

A system failure on this scale will result in a major recovery exercise. Environmental impacts will include increased travel to site by SGN operatives, 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 used for the reinstatement of public highways following the conclusion of these works.

Location	Minimum Required Pressure	Lowest Predicted Pressure
Radstone Fields CSEP	360 mbar	-5 mbar

Table 3 – Projected Pressure without Reinforcement in 2025/26

Security

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 as it is impracticable to replace the Aldershot IPMP system.

Repair on Failure

Mains reinforcement after the network has failed. This option has been discounted due to non-compliance with SGN’s licence condition.

Pre-emptively Replace

Replace the network before the network fails. This option has been discounted as it is impracticable to replace the Aldershot IPMP system.

Pre-emptively Repair

Mains reinforcement based on model data prior to network failure, three options considered for further investigation: *(see Sections 6.1, 6.2 and 6.3 for details)*

Do Nothing

This option has been discounted as it would breach SGN’s licence conditions, driving pressure below minimum operating pressure at Brackley.

7.2 First Option Summary – Reinforcement of MP feed from Charlton Road TRS

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

Mains reinforcement of existing MP feed from Charlton Road TRS to Brackley, removing capacity issue by significantly reducing pressure loss across the reinforcement route. Involves construction of 2.05km x 315mm PE MP Reinforcement.

The basis for cost estimate/unit cost

Cost estimate for the reinforcement is based on average contracted rates supplied by depot, validated against known costs for similar, completed projects.

The perceived benefits of the option

MP reinforcement will accommodate known forecast growth within RIIO-GD2 (2021-2026).

Delivery timescales

MP reinforcement is required to be delivered before winter 2022/23 to avoid anticipated capacity issues.

Key assumptions made

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

Any other items that differentiate the option from the others considered

The length of this reinforcement is significantly shorter than the second option considered. This solution can be implemented with minimal disruption to the public. This reinforcement is the final part of a multi-phase strategy, allowing for optimisation in the event of any changes to development as outlined in the LDP at the driver site in Brackley.

Security

7.3 Second Option Summary – Reinforce MP Feed from Radclive DPG

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

Mains reinforcement of MP system between Radclive DPG and Brackley, removing capacity issue by significantly reducing pressure loss across the reinforcement route. Involves construction of 8.6km x 250mm PE MP Reinforcement.

The basis for cost estimate/unit cost

Cost estimate for the reinforcement is based on average contracted rates supplied by depot, validated against known costs for similar, completed projects.

The perceived benefits of the option

MP reinforcement will accommodate known forecast growth within RIIO-GD2 (2021-2026).

Delivery timescales

MP reinforcement is required to be delivered before winter 2022/23 to avoid anticipated capacity issues.

Key assumptions made

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

Any other items that differentiate the option from the others considered

This reinforcement benefits the overall health of the wider integrated South IPMP network to a greater extent than the targeted solution option one. This is a significantly longer reinforcement and would cause greater disruption to the public than option one.

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, SGN has the option to offer a tender for interruptible contracts to customers to offset the need to invest for capacity.

Interruptible consumers receive discounted transportation charges for the flexibility they provide to the system for demand side management at times of high demand.

Within the NW Oxfordshire Network there are some sites that meet the criteria for an interruptible supply. Interruption at all of these sites may only offer a short delay in the requirement for reinforcement and has therefore been discounted. Based on experience to date this would be unlikely to be achieved but the opportunity will be explored in greater detail closer to the time.

7.5 Options Technical Summary Table

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Design Life (years)	Total (£m)
1/ Reinforce feed from Charlton Rd TRS	2022/23	2022/23	2.05km x 315mm PE MP	10	0.91
2/ Reinforce feed from Radcliffe DPG	2022/23	2022/23	8.6km x 250mm PE MP	10	4.01

Table 4 – Options Technical Summary Table

7.6 Options Cost Summary Table

Option	Volume of Interventions	Cost Breakdown (£M)	Total (£m)
1/ Reinforce feed from Charlton Rd TRS	2.05km x 315mm PE MP	0.91	0.91
2/ Reinforce feed from Radcliffe DPG	8.6km x 250mm PE MP	4.01	4.01

Table 5 - Options Cost Summary Table

8 Business Case Outline and Discussion

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

A full review of the relevant Local Development 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 a failure to meet minimum required pressures by winter 2022/23, putting at risk supplies to 4000 customers.

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

8.1 Key Business Case Drivers Description

Pre-emptively Repair – Option 1

This is the recommended option, providing capacity for development identified for construction by the South Northamptonshire District Council Local Plan and associated documents, during the period 2021/22 to 2026. The route of the reinforcement follows the existing 250mm PE.

This is the third of a 3-phase reinforcement strategy which can be phased in line with the Turweston Road development driving the reinforcement, providing some flexibility in the scheduling and splitting costs over multiple years instead of just one.

Pressure loss will be substantially reduced by the reinforcement over the 250mm PE main leading to Brackley, where the development is expected to connect to the network.

Pre-emptively Repair – Option 2

This option aims to maximise network health by delivering a more robust and resilient network configuration when compared with option one. However, with a cost much higher than the total of the 3-phase reinforcement strategy of which option one is a part, and the increased disruption to the public due to a substantial increase in lay length, this option has not been considered as good value to the customer and has been discarded.

Option No.	Name of Option	Key Value Driver
1	Reinforce feed from Charlton Rd TRS	Provides available capacity for future growth within Brackley. Part of a phased reinforcement strategy that can be adjusted in line with driver development. Focused solution with minimal disruption to the public compared with option two.
2	Reinforce feed from Radcliffe DPG	Provides available capacity for future growth within Brackley. A more robust/resilient solution than Option one in terms of overall network health, this option incurs much greater cost and disruption to the public.

Table 6 - Summary of Key Value Drivers

8.2 Business Case Summary

	Move Cliffsend CGS to Windsor Road, Cliffsend.	Move Cliffsend CGS to Cliffsend Roundabout.
Capex (£m)	0.91	4.01
Design Life	10 Years	10 Years
Positive Benefit (Pros)	Maintains SGN license Obligations to maintain Security of Supply whilst accommodating notified growth up to 2031. Minimal length of main-laying minimizes disruption to the public. Part of a phased strategy that can be adjusted in line with development at driver site.	Maintains SGN license Obligations to maintain Security of Supply whilst accommodating notified growth up to 2031. More robust in terms of overall network health.
Negative Impact (Cons)	Focused solution, no significant benefit to network out with target area.	High cost solution with increased disruption to the public.

Table 7 - Business Case Summary

9 Preferred Option Scope and Project Plan

9.1 Preferred option

PRE-EMPTIVELY REPAIR – Option 1 – 2.05km x 315mm PE MP reinforcement

9.2 Asset Health Spend Profile

Reinforcement cost - £0.91m, scheduled to be completed 2022/23. Included as part of the overall Reinforcement costs in the table below. The project is expected to take no longer than 12 months.

All costs inclusive of Overheads and Efficiencies

Pre GD2	21/22	22/23	23/24	24/25	25/26	Post GD2
0.0	0.0	0.91	0.0	0.0	0.0	0.0

Table 8 - Summary of Schedule of Spend

9.3 Investment Risk Discussion

Gas demand growth has been based around current Local Plan projections for new housing within RIIO-GD2 (2021-26) with reinforcement design providing for future capacity needs beyond 2026 to the limit of the Local Plan in 2031.

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. SGN have proposed volume driver funding mechanism to de-risk underspend/overspend for these works and further details of our proposal could 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 Governments targets, SGN's long term target is to achieve Net Zero emissions by 2045. This means a decarbonisation of the energy network and supporting the transition to an environmentally sustainable low-carbon energy system. Indeed, SGN recognise that there have been preliminary government targets set facilitating a move toward a renewable or low carbon heat solutions by the end of RIIO-GD2. As such, throughout RIIO-GD2 we will continue to closely monitor this emerging heat strategy with a view to refining any potential impact on current growth forecasts.

10 List of Acronyms

Acronym	Backronym (spelled out acronym)	Definition / explanation
Pressure Tiers <ul style="list-style-type: none"> ○ IP ○ MP ○ LP 	<ul style="list-style-type: none"> ○ Intermediate Pressure ○ Medium Pressure ○ Low Pressure 	<ul style="list-style-type: none"> ○ Intermediate Pressure i.e. 2 – 7bar ○ Medium Pressure i.e. up to 2bar ○ Low Pressure i.e. up to 75mb
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.
LTS	Local Transmission System	The higher-pressure tier supplying the Below 7bar network.
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.

Appendix A - Sites Driving Reinforcement

The following Table sets out the manner in which identified potential load growth has been categorized 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’. 9. The site would require significant additional infrastructure, e.g. additional roads, schools. 		