

Engineering Justification Paper

CPM7996 South East Wedge (Edinburgh)

Appendix B – Asset Health

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2 Introduction

Reinforcement has been identified within the Edinburgh MP system, specifically relating to an anticipated system capacity failure at Danderhall, towards the south-east extremity of the Local MP network. This project is part of a wider programme of reinforcement associated with the RIIO-GD2 Business Plan Appendix for Capacity Management. This is a complex project that comprises of both distribution and transmission reinforcement elements that will be captured in 3.01 and 3.02 tabs of the Business Plan Data Template.

2.1 General Background

The SGN distribution and transmission systems are built to ensure security of supply for all our customers. Our networks operating at pressures above and below 7bar are designed to meet a peak demand level that could be experienced under 1:20 conditions, supporting a safe, secure and reliable service to those customers and meeting requirements outlined within our 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 and, to support this level of growth, SGN has developed a programme of reinforcement across its network.

2.2 Site Specific Background

Development within the Edinburgh IPMP Grid is primarily covered by the City of Edinburgh Local Development Plan (LDP). However, development in Midlothian and East Lothian also impacts directly on the south-eastern extremity of the network.

The City of Edinburgh, Midlothian and East Lothian LDPs and associated documents sets out how and where the requirements of the Strategic Development Plan (SDP) for the Edinburgh and South East Scotland Region can be met.

The driver(s) for reinforcement of the Edinburgh network are several Local Development Plan sites located within the South East Strategic Development Area, commonly known as the South-East Wedge.

3 Equipment Summary

Transmission

T/11 - Edinburgh – Borders Transmission (19bar)

The Edinburgh – Borders Transmission System is a pressure controlled network with an MOP of 19bar, energized by Broxburn National Offtake (via Fairmilehead HP/HP regulators) and Soutra National Offtake. The system supports a number of <7 bar distribution systems including those energised via Straiton TRS, Musselburgh TRS and Dalkeith TRS.

Security

Distribution

Grid 83 - West Edinburgh IP (7bar)

The West Edinburgh IP network operates at 7bar and is supplied from Bol-o-Bere TRS, Turnhouse TRS and Fairmilehead TRS. The three stations are fully integrated via an IP main, predominately 10" ST, which skirts around the west side of the city, feeding a number of DPGs / systems, including Swanston (2.0bar), Balerno (0.41bar), Redford Rd (0.35bar), Edinburgh Park (2.0bar), Glasgow Road (0.31bar), Drumbrae (0.25bar), Sighthill (0.41bar) and Ratho (2.0bar).

Grid 85 – Edinburgh MP (2bar)

The Edinburgh MP network operates at 2bar and is supplied from Granton TRS (2bar), also known as Forth TRS, in the north and Swanston DPG in the south. This is a strategically important system, running across the city and supporting the Local MP network via DPGs at Meadowbank (0.41bar), West Mains Road (0.41bar) and Canaan Lane (0.25bar).

Grid 76.1 – Edinburgh Local MP (0.41bar)

A large part of the city is supplied via the Edinburgh Local MP network which operates at 0.41bar. Granton TRS is the predominate feed, supported by DPGs at Meadowbank, West Mains Road and Sighthill, with a number of lesser DPGs operating in 'top-up' mode.

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 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.

In the case of Edinburgh MP system, significant on-going committed development at existing GT sites, combined with potential development identified within the LDP/HLA and associated documents, will see the network approach capacity in the early part of RIIO-GD2.

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

What is the outcome that we want to achieve?

Maintain SGN’s 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, SGN will monitor system performance to ensure expected system pressures are maintained. This will take the form of regular system performance checks and localised pressures surveys to ensure a successful outcome has been achieved.

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

4.1 Narrative Real-Life Example of Problem

The “South-East Wedge” has been identified for major development, with a significant impact on capacity available within the Edinburgh MP system. The existing network will require significant reinforcement to support these sites.

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 New Mills Balerno (P17141081).

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 30 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 350 new/existing customers.

Security

The developments driving this reinforcement project are listed in Table 1.

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 SGN has deemed the requirement for this reinforcement within the RIIO-GD2 period as 'High' and has therefore included the funding request in both our Base Growth and High Growth scenarios.

Table 1: Development Summary

Development Name	Site Usage	Site Status	Confidence
Cauldcoats	350 houses	Planning Permission	Highly probable (>90% confidence)
Cauldcoats Phase 2	200 houses	Allocation within the Adopted Local Development Plan	Probable (>75% confidence)
Shawfair	Mixed Dev. Incl. 3343 houses	Partial Planning Permission	Highly probable (>90% confidence)
Newton Farm	480 houses	Allocation within the Adopted Local Development Plan	Probable (>75% confidence)
Newton Farm Phase 2	220 houses	Allocation within the Adopted Local Development Plan	Probable (>75% confidence)
Edmonstone	368 houses	Allocation within the Adopted Local Development Plan	Probable (>75% confidence)
Millerhill Marshalling Yards	commercial land (18ha)	Planning Permission	Highly probable (>90% confidence)
Whitehill Mains	commercial land (13ha)	Allocation within the Adopted Local Development Plan	Probable (>75% confidence)
Sheriffhall	commercial land (11.5ha)	Allocation within the Adopted Local Development Plan	Probable (>75% confidence)

4.2 Spend Boundaries

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

The monies associated with these works ensures security of supply for existing customers and connection of planned development to the network.

Costs contained within this paper have been prepared using average contracted rates at depot level and validated against known costs for similar, completed projects. Firm costs for each option will be identified as part of an on-going Feasibility Study.

Not included within this spend are the costs for subsequent phases of reinforcement required to support demand out-with the RIIO-GD2 period and/or any costs associated with reinforcement of the upstream Edinburgh-Borders Transmission system.

5 Probability of Failure

As development identified for South East Edinburgh progresses, the Edinburgh Local MP Network is predicted to fail at 72% peak demand by winter 2025/26, putting at risk supplies to 75,000 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 winter system performance checks ensure that the models continue to be accurate and fit for purpose.

The latest system performance review confirmed the accuracy of the model against actual pressures recorded on 31st January 2019.

Table 2: System Performance Review – 31st January 2019 (82% peak demand)

System	Site	System Pressure		Yr1 System Pressure	
		(82% Pk hr)		(1 in 20)	
		Recorded Actual	Modelled Predicted	Minimum Acceptable	Modelled Predicted
Edinburgh MP (2.0bar)	West Mains Road DPG	1.64bar	1.53bar	0.76bar	1.02bar
Edinburgh Local MP (0.14bar)	Newton Church Rd. DG	0.26bar	0.28bar	0.14bar	0.14bar

Security

Network Growth

The City of Edinburgh and Midlothian Local Development Plans 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 that pre-emptive repair of the network (i.e. reinforcement) will be required during RIIO-GD2 to ensure SGN meets its Licence Conditions, maintaining minimum supply pressures under all demand conditions.

6 Consequence of Failure

Loss of Supply to Customers

Failure to reinforce will initially put at risk the supply to those customers supplied via the Edinburgh Local MP system. However, as development progresses demand will impact not only on this system but also the upstream Edinburgh 2bar MP grid.

Ultimately this will result in the failure of West Mains Road DPG due to insufficient inlet pressure and the loss of supply to approximately 75,000 existing/new customers and a failure to meet SGN's Licence Conditions, attracting adverse publicity and damage to the company's reputation.

Affected customers will include the Royal Infirmary of Edinburgh and the University of Edinburgh Medical School, as well as a number of high-profile new developments in South East Edinburgh.

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 3: Projected RIIO-GD2 Pressures (2025/26) without Reinforcement

Location	Min Required Pressure (bar)	Min. Modelled Pressure (bar)
Newton Church Road DG	0.14	-0.53

Security

Safety Impact of Failure

Reinforcement of the Edinburgh MP system is necessary to meet the requirements 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.

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 in use for the reinstatement of public highways following the conclusion of these works.

7 Options Considered

Options Summary

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 SGN's Licence Condition.

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

This option has been discounted as asset replacement does not inherently provide additional capacity.

Pre-Emptively Repair

Mains reinforcement and/or Interruption based on model data prior to network failure. Four options have been considered for further investigation, three of which are main-laying solutions

Security

Do Nothing

Not considered practicable as on-going committed development at existing GT sites, combined with potential development identified/programmed within the LDP/HLA and associated documents, will see the Edinburgh Local MP system approach capacity towards the early part of RIIO-GD2.

7.1 First Option Summary: Swanston/West Mains

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

The first option considered for further investigation, **Swanston/West Mains**, involves the construction of approximately 2.91km x 18" ST IP, 2 x DPGs and 1.28km x 630mm PE MP.

The basis for the cost estimate/unit cost

Costs for this option, amounting to £5.951M, 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 committed/planned development identified for construction during RIIO-GD2. Reinforcement of the Local MP system can be phased to meet development.

Delivery timescales

This project has been scheduled to commence in 2022/23. The final phase of the Edinburgh Local MP (0.41bar) reinforcement is not anticipated to be required before 2024/25.

Key assumptions made

Land purchase within the City of Edinburgh can often be expensive and difficult to secure. It has been assumed that a suitable site can be secured for a new DPG within the Greenbank/Braidburn area of the city.

Any other items that differentiate the option from the others considered

Reinforcement of the Local MP system at West Mains Road will result in a redistribution of demand across the MP network. This will necessitate reinforcement of the Edinburgh MP (2bar) system to support the additional downstream flow on the Edinburgh Local MP (0.41bar) system at West Mains Road DPG.

This option delivers a robust reinforcement solution whilst also providing a resilience benefit to both the Edinburgh 2bar and Local MP systems, providing the greatest resilience benefit to the city centre but leaves a single feed to the elongated leg south to Danderhall, including the feed to the Royal Infirmary of Edinburgh.

7.2 Second Option Summary: Danderhall/Musselburgh

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

The second option considered for further investigation, **Danderhall/Musselburgh**, involves the construction of 1 x TRS, 2.2km x 12" ST IP, 2 x DPGs and 4.71km x 500mm/630mm PE MP.

The basis for the cost estimate/unit cost

Costs for this option, amounting to £8.602M, 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 committed/planned development identified for construction during RIIO-GD2.

Delivery timescales

This project has been scheduled to commence in 2022/23 and is expected to be completed in the same financial year.

Key assumptions made

General locations for the proposed TRS and DPGs have been identified. It has been assumed that suitable parcels of land can be secured at these locations.

Significant physical obstacles to be overcome include crossings of the A1/A720 carriageways and the Borders/East Coast railways.

Musselburgh TRS is situated on a flood plain, this solution allows for the abandonment of this station, removing risk to this site and reducing future costs for any remedial works at this location. For this option it has been assumed that replacement of Musselburgh TRS will occur during RIIO-GD2.

The existing LTS inlet to Musselburgh is also the LTS system "low point" in this area and is sensitive to any additional load. Relocation of Musselburgh TRS to Danderhall/Shawfair removes this potential restriction and any unforeseen reinforcement of the Musselburgh LTS leg.

Any other items that differentiate the option from the others considered

This option seeks to develop a solution that provides a wider benefit to the existing and extended network, giving consideration to both the LTS and Below 7bar networks.

The construction of a new 500mm MP main from Danderhall to Musselburgh provides a trunk main in support of significant development identified for this area.

This solution creates a robust 0.41bar system in the immediate locality of the proposed South East Edinburgh developments.

Resilience at Danderhall is improved by the creation of a two-way feed. However, a slightly reduced resilience benefit exists for the city centre compared to the Swanston/West Mains solution.

Reinforcement of the Edinburgh MP (2bar) system is not required.

Phasing of these works is not an option for this solution.

7.3 Third Option Summary: Danderhall DPG (0.41bar)

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

The second option considered for further investigation, **Danderhall DPG (0.41bar)**, involves the construction of 1 x TRS, 2.2km x 12" ST IP, 1 x DPG and 0.08km x 630mm PE MP.

The basis for the cost estimate/unit cost

Costs for this option, amounting to £5.029M, 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 committed/planned development identified for construction during RIIO-GD2.

Delivery timescales

This project has been scheduled to commence in 2022/23 and is expected to be completed in the same financial year.

Key assumptions made

General locations for the proposed TRS and DPG have been identified. It has been assumed that suitable parcels of land can be secured at these locations.

Significant physical obstacles to be overcome include a crossing of the City of Edinburgh Bypass (A720).

Musselburgh TRS will not be replaced and will remain in situ at the current location throughout RIIO-GD2. Reinforcement of the LTS inlet to Musselburgh TRS will not be required during the RIIO-GD2 period.

Any other items that differentiate the option from the others considered

This option creates a robust 0.41bar system in the immediate locality of the proposed South East Edinburgh developments.

As with the Danderhall/Musselburgh solution, resilience at Danderhall is improved by means of a two-way feed. However, a slightly reduced resilience benefit exists for the city centre compared to the Swanston/West Mains solution.

Reinforcement of the Edinburgh MP (2bar) system is not required.

Phasing of these works is not an option for this solution.

7.4 Fourth 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 Edinburgh IPMP Network there are 36 sites that meet the criteria for an interruptible supply. Interruption at all these sites will not remove the requirement for reinforcement during RIIO-GD2.

7.5 Options Technical Summary Table

Table 4: Options Technical Summary Table

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Design Life (years)	Total (£M)
1/ Swanston/West Mains	2022/23	2024/25	2.91km x 18" ST IP	10	5.951
			2 x IP-MP DPGs		
			1.28km x 630mm PE MP		
			Decommission Main		
			Additional Costs		
2/ Danderhall-Musselburgh	2022/23	2022/23	0.1km x 12" LTS main	10	8.602
			1 x TRS		
			2.21km x 12" ST IP		
			1 x IP-MP DPG		
			1 X MP-MP DPG		
			0.11km x 630mm PE MP		
			4.60km x 500mm PE MP		
			Additional Costs		
TRS Decommission					
3/ Danderhall DPG (0.41bar)	2022/23	2022/23	0.1km x 12" LTS main	10	5.029
			1 x TRS		
			2.21km x 12" ST IP		
			1 x IP-MP DPG		
			0.08km x 630mm PE MP		
			Additional Costs		

7.6 Options Cost Summary Table

Table 5: Options Cost Summary Table (split to show costs for transmission and distribution elements)

Option	Volume of Interventions	>7bar Cost Breakdown (£M)	<7bar Cost Breakdown (£M)	Total (£M)
1/ Swanston/West Mains	2.91km x 18" ST IP	n/a		5.951
	IP-MP DPG (1)	n/a		
	IP-MP DPG (2)	n/a		
	1.28km x 630mm PE MP	n/a		
	Decommission Main	n/a		
	Additional Costs	n/a		
2/ Danderhall-Musselburgh	0.1km x 12" LTS main		n/a	8.602
	TRS		n/a	
	2.21km x 12" ST IP	n/a		
	IP-MP DPG	n/a		
	MP-MP DPG	n/a		
	0.11km x 630mm PE MP	n/a		
	4.60km x 500mm PE MP	n/a		
	Additional Costs	n/a		
TRS Decommission		n/a		
3/ Danderhall DPG (0.41bar)	0.1km x 12" LTS main		n/a	5.029
	TRS		n/a	
	2.21km x 12" ST IP	n/a		
	IP-MP DPG	n/a		
	0.08km x 630mm PE MP	n/a		
	Additional Costs	n/a		

Commercial Confidentiality

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 Edinburgh IPMP 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 at 72% peak demand by winter 2025/26, putting at risk supplies to 75,000 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. A Feasibility Study to confirm projected costs is currently in progress, carried out by Jacobs at a cost Commercial Confidentiality.

8.1 Key Business Case Drivers Description

Pre-emptively Repair: Option 1, Swanston/West Mains

This option delivers a robust reinforcement solution whilst also providing a resilience benefit to both the Edinburgh 2bar and Local MP systems.

A more expensive solution than Option 3, Danderhall DPG (0.41bar), however, an opportunity exists to phase reinforcement of the Edinburgh Local MP (0.41bar) system in line with projected development.

Pre-emptively Repair: Option 2, Danderhall/Musselburgh

This option seeks to develop a solution that provides a wider benefit to the existing and extended network, giving consideration to both the LTS and Below 7bar networks.

This solution is the most expensive of those identified and is only viable where significant costs can be off-set by savings generated elsewhere i.e. replacement of Musselburgh TRS and/or reinforcement of the associated LTS inlet main. As this is not currently the case, this solution has been discounted.

Pre-emptively Repair: Option 3, Danderhall DPG (0.41bar)

This solution is a variation on Option 2 that focuses solely on reinforcement of the Edinburgh Local MP without extending the existing network to Musselburgh. In this instance, a single IP-MP DPG will be installed at Danderhall to reinforce the Edinburgh Local MP system.

This option creates a robust 0.41bar system in the immediate locality of the proposed South East Edinburgh developments, whilst still providing an element of system resilience benefit. No further reinforcement of the Edinburgh MP system is required.

Of the options considered, this is the least cost solution.

Table 6: Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	Swanston/West Mains	Alternative to Option 3, phasing possible with this solution
2	Danderhall/Musselburgh	Benefits to wider network but the most expensive solution
3	Danderhall DPG (0.41bar)	Least cost solution

8.2 Business Case Summary

This project is driven by SGN's Licence Conditions to ensure security of supply and to support economic prosperity through mitigating the risk of becoming a blocker to development.

Table 7: Business Case Matrix

	Swanston/West Mains	Danderhall/Musselburgh	Danderhall DPG (0.41bar)
Cost (£M)	5.951	8.602	5.029
Positive Benefit (Pros)	<p>Delivers a robust reinforcement solution.</p> <p>Reinforcement of Local MP can be phased to meet development.</p> <p>Enhanced resilience for Edinburgh City Centre.</p>	<p>Delivers a robust reinforcement solution.</p> <p>Supports abandonment of Musselburgh TRS.</p> <p>Supports LTS Network by redistributing demand away from system low point at Musselburgh.</p> <p>Provides a single trunk main through S.E. Wedge, supporting new development and infrastructure.</p> <p>Resilience at Danderhall is improved by the creation of a two-way feed.</p> <p>Reinforcement of the Edinburgh MP (2bar) system is not required.</p>	<p>Delivers a robust reinforcement solution.</p> <p>The least cost option.</p> <p>Resilience at Danderhall is improved by the creation of a two-way feed.</p> <p>Reinforcement of the Edinburgh MP (2bar) system is not required.</p>
Negative Impact (Cons)	<p>Requires reinforcement of both 2bar & Local MP systems.</p> <p>No resilience benefit for the single leg to Danderhall, including the S.E. Wedge development and existing Royal Infirmary.</p> <p>A city centre route.</p> <p>Potential land purchase difficulties.</p>	<p>The costliest option, only viable in support of >7bar works.</p> <p>Engineering Difficulty – major physical obstacles to overcome en-route.</p> <p>Phasing is not an option with this solution.</p> <p>Reduced resilience benefit for city centre, compared with the Swanston/West Mains solution (Option 1).</p> <p>Land purchase/easements required.</p>	<p>Engineering Difficulty – major physical obstacles to overcome en-route.</p> <p>Phasing is not an option with this solution.</p> <p>Reduced resilience benefit for city centre, compared with the Swanston/West Mains solution (Option 1).</p> <p>Land purchase/easements required.</p>

Costs inclusive of Overheads and Efficiencies

9 Preferred Option Scope and Project Plan

9.1 Preferred option

Pre-Emptively Repair - Option 3, Danderhall DPG (0.41bar): 0.10km x 12" LTS main, 1 x new TRS, 2.21km x 12" ST/400mm HDPE IP, 1 x new DPG, 0.08km x 630mm PE MP.

9.2 Asset Health Spend Profile

Table 8: Summary of Schedule of Spend

Asset Health Spend Profile (£M)							
	Pre GD2	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
Transmission	0	0	2.770	0	0	0	0
Distribution	0	0	2.259	0	0	0	0

Costs inclusive of Overheads and Efficiencies

Reinforcement costs to be split between distribution and transmission reinforcement allowance and feed into tab 3.01 and 3.02 of Business Plan Data Template.

9.3 Investment Risk Discussion

The requirement for reinforcement of the Edinburgh MP system is demand driven, primarily committed/potential development in and around the "South-East Wedge" for which the City of Edinburgh and Midlothian LDPs and associated documents sets out a clear programme for development. However, a risk does exist that the planned development does not materialise.

In addition to a full review of the relevant LDPs, SGN has held several meetings with land owners, developers and GTs who have provided every indication that the proposed developments at S.E. Wedge will proceed to construction, with gas playing a major role in the energy mix for these sites.

Furthermore, the latest systems performance review (Jan. 2019) confirms the network to be close to capacity under 1 in 20 conditions, supporting the case for reinforcement.

Through this determination SGN has identified this requirement for reinforcement within the RIIO-GD2 period.

SGN has prepared costs using average contracted rates at depot level and has 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 that 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 sharp 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. SGN has outlined funding mechanism strategies to de-risk underspend/overspend for these works 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 Scottish 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 the RIIO-GD2 period. As such, throughout the RIIO-GD2 period 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		Demand (dwellings)			
Site	LA Ref	GD1 Total	2021- 23		Total
			Total	>2023 Total	
Albion Road	LDP HSG 12 / HLA 3965	205	0	0	205
Broomhills	LDP HSG 21 / HLA 5248	150	100	383	633
Brunstane	LDP HSG 29 / HLA 5711	175	200	955	1330
Brunswick Road	HLA 5551A/B	164	0	0	164
Burdiehouse Phase 2	LDP HSG 22 / HLA 5249	144	67	0	211
Calder Road	HLA 4917A/B	164	156	0	320
Cammo	LDP HSG 20 / HLA 5247	175	200	225	600
Cauldcoats	Hs0	160	110	80	350
Cauldcoats Phase 2	Hs0 SC	0	0	200	200
Central Leith Waterfront	LDP EW 1B / 4893	0	0	2680	2680
City Park	LDP HSG 9 / HLA 4812	203	0	0	203
Craighall Road (Napier Univ)	HLA 5280	125	20	0	145
Curriemuirend	LDP HSG / 31 / HLA 5256	50	70	45	165
Duddingston Park South	HLA 5289	186	0	0	186
Eastern General Hospital Phase 2	LDP HSG 13 / HLA 4509.2	155	0	0	155
Eastern General Hospital Phase 3	LDP HSG 13 / HLA 4509.3	76	0	0	76
Edinburgh Park / South Gyle	LDP DEL5 / HLA 5245	100	100	175	375
	LDP DEL5 / HLA 5245.1	200	0	0	200
Ellens Glen Road	LDP HSG 28 / HLA 5710	75	100	65	240
Fountainbridge	LDP CC3 / HLA 4338	120	120	160	400
	LDP CC3 / HLA 4338.2	191	0	0	191
	LDP CC3 / HLA 4900	263	100	90	453
Garden District	N/A	200	400	5400	6000
Gilmerton Station Road	LDP HSG 24 / HLA 5251	220	200	205	625
Granton Harbour	LDP EW 2C / 3744.2	133	0	155	288
	LDP EW 2C / 3744A	100	100	855	1055
	LDP EW 2C / 3744B	0	0	426	426
Granton Park Avenue	LDP EW 2B / 3733A.1	14	41	40	95
Greendykes	LDP HSG 17 / HLA 3754	75	100	656	831
Harvesters Way	HLA 5450	183	0	0	183
International Business Gateway	EMP 6 / 5244	180	120	50	350
Liberton Gardens	HLA 5463A/B	272	25	0	297
Lindsay Road	LDP EW 1A / 3424.7	111	0	0	111
Market	HLA 3544A	114	0	0	114
Maybury	LDP HSG 19 / HLA 5246	175	250	1425	1850
Moredunvale Road	LDP HSG 30 / HLA 5257	50	85	50	185
New Craighall Road	HLA 5254.1	126	0	0	126
New Greendykes	LDP HSG 18 / HLA 3753	320	100	106	526
New Street	LDP CC2	134	30	0	164

Newcraighall East	LDP HSG 27 / HLA 5254	75	50	29	154
Newcraighall North	LDP HSG 26 / HLA 5253	208	12	0	220
Newmills Road	LDP HSG 37 / HLA 5716	152	58	0	210
Newton Farm	Hs1	90	90	300	480
Newton Farm Phase 2	Hs1 SC	0	0	220	220
Niddrie Mains	LDP HSG 3 / HLA 3756	85	60	339	484
North Danderhall	h44	75	90	25	190
North of Lang Loan	LDP HSG 39 / HLA 5717	110	110	0	220
North Shore	LDP EW 2D / 3733B	0	0	850	850
Pennywell Road	5159	75	100	115	290
	HLA 4996.1	193	0	0	193
	HLA 4996.3	177	0	0	177
	HLA 4996.4	68	0	0	68
	HLA 5540A/B/C & HLA 5561	225	0	0	225
Portobello High Street	5561	225	0	0	225
Quartermile	LDP CC4 / HLA 3957	1110	0	0	1110
Ravelrig Road	LDP HSG 38 / HLA 5716	120	0	0	120
Salamander Place	LDP EW 1C / 4894	0	0	719	719
	LDP EW 1C / 4894.1	220	100	461	781
SE Wedge - Edmonstone	LDP HSG 40 / HLA 5704	150	120	98	368
SE Wedge - Edmonstone Extension	N/A	0	0	773	773
SE Wedge - Old Dalkeith Rd		110	0	0	110
Shawfair	SLP H43	125	203	3015	3343
Shrub Place	LDP HSG 11 / HLA 4773	344	30	0	374
South Danderhall	h45	300	0	0	300
South Gyle Wynd	LDP HSG 6 / 4898	203	0	0	203
St. James Centre	HLA 4793	143	0	0	143
Telford College (North)	LDP HSG 8 / HLA 4508	329	0	0	329
The Drum	LDP HSG 25 / HLA 5252	125	50	0	175
The Wisp	LDP HSG 41 / HLA 5718	72	0	0	72
Thistle Foundation (Greendykes)	LDP HSG 16 / HLA 3755	149	0	0	149
Upper Strand Phase 2	LDP EW 2B / 3733A.5	64	0	0	64
Waterfront WEL - Central Dev Area	LDP EW 2B / 3733A	150	100	1354	1604
West Bowling Green Street	HLA 5370	80	34	0	114
West Coates	HLA 4502	125	78	0	203
West Harbour Road	LDP EW 2B / 3733A.6	0	0	42	42
West Shore Road - Forth Quarter	LDP EW 2A / 3105A	100	100	150	350
	LDP EW 2A / 3105B	0	0	691	691
Western Harbour	LDP EW 1A / 3424.8	96	0	0	96
Western Harbour - Newhaven Place	LDP EW 1A / 3424.2	102	0	0	102
	LDP EW 1A / 3424.9	138	0	0	138
Western Harbour - Platinum Point	LDP EW 1A / 3424.1	226	0	226	452
Western Harbour - Taylor Woodrow	LDP EW 1A / 3424.4	308	0	0	308
Western Harbour - The Element	LDP EW 1A / 3424.3	275	0	0	275
Western Harbour (*1)	LDP EW 1A / 3424	0	100	1055	1155

Western Harbour View (AB Leith Ltd)	LDP EW 1A / 3424.6	175	83	0	258
Western Harbour View (Barratt East Scotland)	LDP EW 1A / 3424.5	105	0	0	105
Grand Total		12465	4362	24888	41715

Non-Dom		Demand (scmh)			
Site	LA Ref	GD1 Total	2021-23		>2023
			Total	Total	
Edinburgh BioQuarter Phase 2	BUS 1B ECLP	0	6616	0	6616
Edinburgh Park	BUS 2 ECLP	198			198
	BUS 2b ECLP				
	BUS 2c ECLP				
Fountainbridge	CA3 ELP	100	0	0	100
Garden District	(blank)				0
Gogarburn	ECON 9 RWELP	282	0	0	282
Granton Waterfront	WAC2 ECLP	733	0	0	733
International Business Gateway	LDP Emp 6	1000	0	0	1000
Leith Eastern Industrial Area	BUS 3 ECLP	0	0	331	331
Millerhill Marshalling Yard	E25	0	0	168	168
Morrison Street	SITE 8 ECLP	250	0	0	250
Newcraighall (land south of)	Site 1 ECLP	0	188	0	188
Niddrie Junction	Site 2 ECLP	0	0	108	108
Northern and Eastern Docks	EW 1e	0	0	2500	2500
Riccarton Research Park Extension	ED7 RWELP	812	0	1286	2098
Shawfair	E27, E25 (part) & Ec1	0	0	2547	2547
Sheriffhall South	E32	0	0	186	186
St. James Quarter	CA1 ECLP	1732	0	0	1732
Turnhouse Road	ED5 RWELP	151	0	0	151
Western Harbour	WAC1a ECLP	0	0	727	727
Whitehill Mains	E26	0	0	307	307
Grand Total		5258	6804	8160	20222

The sites listed in Section 1.2 as the primary drivers for this reinforcement are highlighted above.

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 - Summary of Towns

Edinburgh (Population 459,366)

Edinburgh is Scotland's capital city. It is a city with a long history dominated by the changing roles of Scotland politically and commercially. It is the political centre with the Scottish Parliament and associated government functions. The economy has a service orientation with a significant finance and banking sector, a tourist sector (including the Edinburgh Festival), a large creative industries sector and education and scientific research. It is known as the Athens of the North and is a UNESCO World Heritage site.

This type of city-sized town is extremely mixed in terms of demographics. There are particularly wide ranges of people, housing and activities. The number of older couples with no children is higher than average in this group. There is a mix of professional and non-professional jobs, and part-time and self-employment are both important for a significant proportion of residents. Socioeconomic status is higher than in other kinds of city-sized town and there is a mix of professionals and nonprofessionals, those with higher and lower educational attainment.

Source:

[Scotland's Towns Partnership](#)

Appendix D - 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.