South London Main

Engineering Justification Paper (SGN-GD3-EJP-RPX-004)

Final Version 1.0

11th December 2024

Network Strategy SGN

SGN

Your gas. Our network.

Contents

1 Summary Table

1 The following table sets out the key information on the project. The costs are provided in 23/24 price base are inclusive of overheads.

Table 1: Ofgem Project Summary Table

Name of Project	South London Main		
Scheme Reference	SGN-GD3-EJP-RPX-004		
Primary Investment Driver	Asset health		
Project Initiation Year	2027		
Project Close Out Year	2031		
Total Installed Cost Estimate (£m)	£30.02		
Cost Estimate Accuracy (%)	+/-10%		
Project Spend to date (£)	£0.00		
Current Project Stage Gate	Design/Planning Phase		
Reporting Table Ref	BPDT 8.14 BUS		
Outputs included in RIIO-GD2 Business Plan	No		
Spend apportionment £m (23/24 price base)	GD2	GD3	GD4
	£0	£30.02	£0

All expenditure above in 23/24 prices

2 Executive Summary

2 The South London Medium pressure network supplies gas to 1.25 million of SGN's customers, with increasing evidence of deterioration across this asset base. This project proposes the replacement of 15 kilometres of 36-inch Cast iron mains for a cost of £30.02 million.

3 This asset base is currently undergoing at least £1.14m per year of repairs costs and there is increasing evidence of deterioration across this network. These assets are a high priority for replacement due to proximity to homes and businesses, but also to ensure security of supply to as sixth of our customers. In turn this will reduce the strain on our operational teams and allow a refocus on other aspects of operational requirements.

4 We are proposing this project as a stand-alone Price Control Deliverable (PCD), which will be completed across the GD3 period. We plan to replace circa 3km annually at a cost of £5.68m per year. This project has been designed to ensure delivery but also protect the gas supply to our customers.

5 This proposal is supported by cost benefit analysis that shows a net present value for the preferred option at a 16-year assessment point from the start of the model (2043) as £0.89m in the Southern Network.

Table 2: GD3 Project Expenditure Profile in 23/24 Prices

Year	26/27	27/28	28/29	29/30	30/31	Total
Forecasted Cost (£m)	£6.00	£6.00	£6.00	£6.00	£6.00	£30.02
Mains Length (km)	3.0	3.0	3.0	3.0	3.0	15.0

6 This project is not a continuation of GD2 works and is a new separate project.

Table 3: GD2 FD Allowances and Volumes in 23/24 Prices

Year	21/22	22/23	23/24	24/25	25/26	Total
FD Allowance (£m)	No allowances in GD2					

7 As we look to form our plans and develop our strategy for the next price control GD3, we have engaged with support from our Independent Stakeholder Group (ISG) with a wide range of our customers and stakeholders to better understand what their needs are and what they expect from us. We have responded, challenging ourselves to focus on the projects that prioritise safety and resilience, while delivering most value to our customers. This document should be read in conjunction with our GD3 Business plan, section C2 Customer and Stakeholder priorities. This section provides a greater level of detail of our approach to customer and stakeholder engagement.

3 Project Status and Request Summary

8 The South London Medium Pressure (MP) network is composed of c.200 kilometres (km) of Tier 2 and Tier 3 iron pipes. It is a critical section within the gas distribution network that supplies around 1,250,000 customers. The network operates within carriageways in areas of London that multiple Highway Authorities (HA) and Local Councils have a significant interest in, and the engagement with these organisations is crucial in being able to deliver any mains replacement work.

9 Throughout GD1 and GD2, we have been using hotspot analysis and operative insights to replace small stretches of this infrastructure with mains replacement. More latterly, we have also been using CISBOT, which has only recently been approved for the use on MP, to target joint failures on the network.

10 The network was typically constructed as a point-to-point network, it therefore has little redundancy for sections to be removed without affecting supplies. It also means that there is no opportunity to decommission mains without any associated lay.

11 Why are we looking at this asset now and why not later?

- **a.** We continually review mains under our reactive and proactive asset management procedures as set out in our Other Mains EJP. However, this asset is set apart from other networks due to size, importance and the number of customers connected.
- **b.** It is often difficult to work on this asset due to the number of HA and Local Authorities (LA) involved and their stringent requirements due to the sensitives of the locations of the network
- **c.** We know that it is nearly impossible to work on two sections of the same stretch of the system at the same time which means,
- **d.** Replacing the system could take numerous price controls
- **e.** We've seen an increase in the number of network failures, which leads us to understand that our network is in worse condition than previously thought
- **f.** The integrity of this system has recently come into question, with additional focus from HA's, LA's, other stakeholders and the HSE

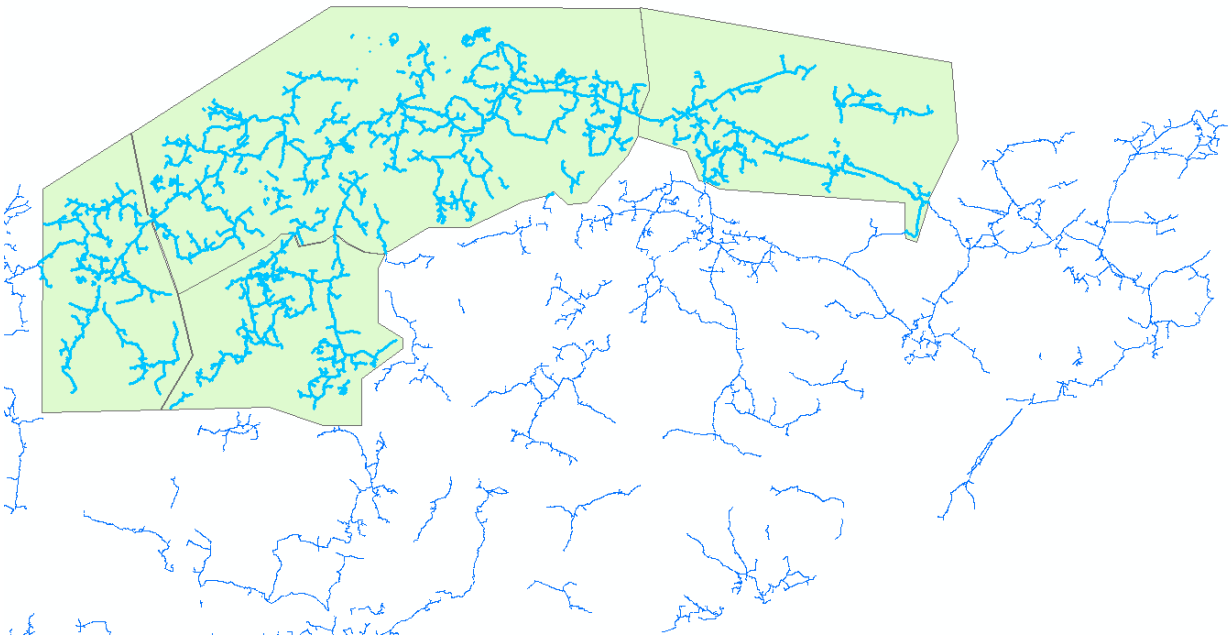
12 This project proposes the replacement of 15km of Tier 3 (>18") iron assets across the network, specifically looking at larger diameter 27", 30" and 36" mains. This stretch of mains is comprised of 124 metallic assets and an additional 2km composed of 24 PE assets, these assets cover from Greenwich to Mitcham Common and has undergone 177 separate repairs since 2013. The predominant material is 36" Cast Iron (circa 85%).

13 The funding requested is to replace the highest risk 15km within this network. The definition of highest risk in this instance are the assets with highest failure rates, and the assets with the highest recorded escapes. By targeting these assets for replacement, we will enhance supply resilience into this critical part of the network.

14 It will be delivered in key phases or sub projects to prevent supply interruption and minimise disruption to our customers. These sub projects have been designed to be localised and allow for flexibility while working within Local Authority restrictions, this is due to the nature of the works being completed which will require road closures, lane rental, parking bay restrictions, these will all be coordinated in advance with local authorities. This is all driven by scale of the works required to replace large diameter assets.

15 Figure 1 below displays not only a geographic distribution of the area being targeted by proposed projects for both GD3 (see SGN Business Plan) and GD4 but also exemplifies the scale of the London MP network (there is also further detail available on scoping in the project scope section). The proposed project represents the beginning of a long-term targeted replacement strategy for this network. The highlighted areas in Figure 1 below represent scoped areas which we will begin targeting in GD3.

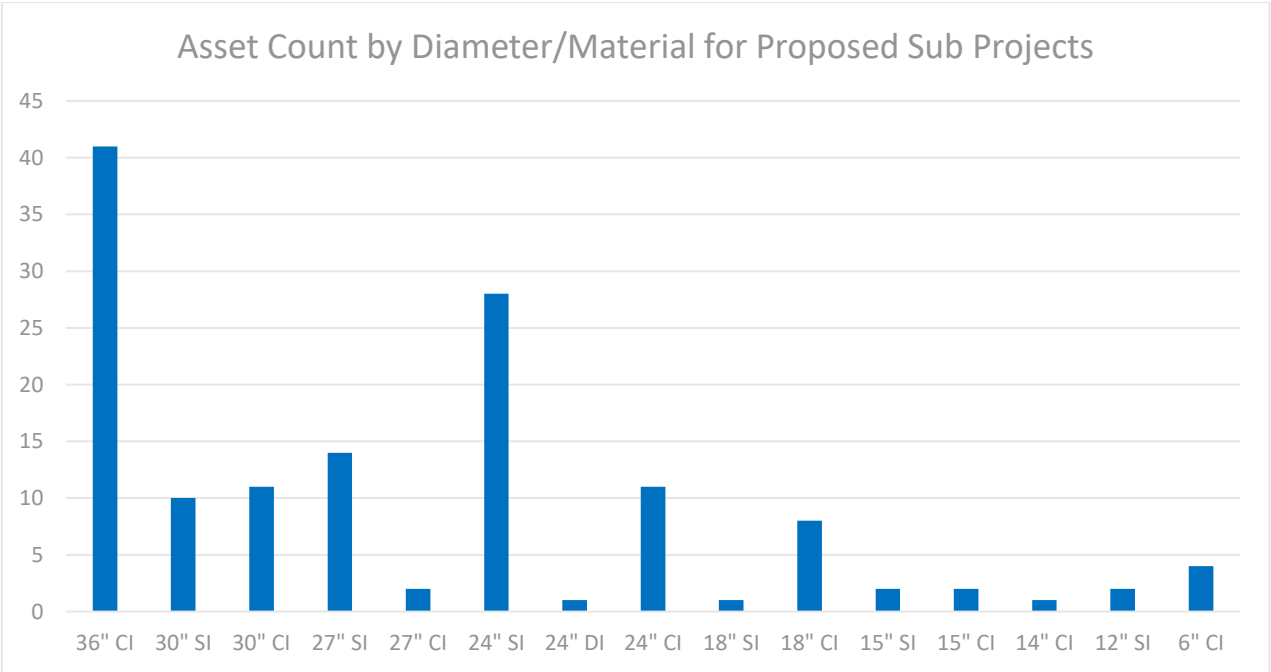
Figure 1: A map of the South London MP network



Network Composition

16 The predominant material in the mix is Cast Iron, 90% of total length is Cast Iron on the South London MP.

Figure 2: Asset Diameter and Material Mix for Scoped Sub-Projects



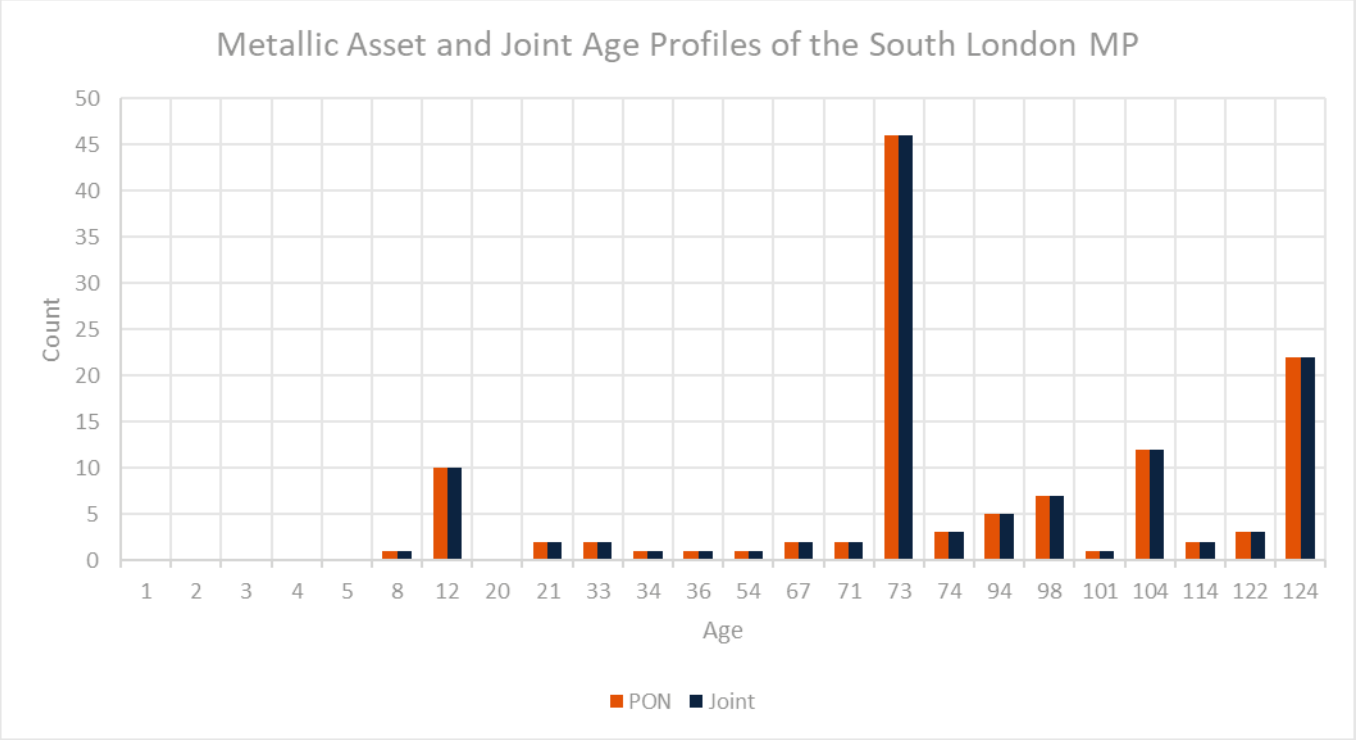
17 Figure 2 above illustrates the diameter mix for the sub project list, what is discernible is the volume of greater than 24-inch assets within these scoped sub projects with the predominant asset type being 36-inch Cast Iron. This project will be primarily targeting these assets, and this aligns with historic failures as evidenced below in the following section.

4 Problem/Opportunity Statement

18 This project seeks to resolve recurring asset health issues on the South London MP main system. There are increasing failures within this network and increased escapes. These increases pose significant risk to customer safety and security of supply.

19 80% of the 148 assets on this network are more than 70 years old with 30% of the asset base being laid in 1951 and this can be seen in figure 3 as assets which are 73 years and older. Of the 148 assets 40 are understood to be over 101 years old, suggesting that 27% of this asset base could be nearing the point of its planned obsoletion. The asset ages are visualised below in Figure 3.

Figure 3: Age profile of the Metallic assets on the South London MP network

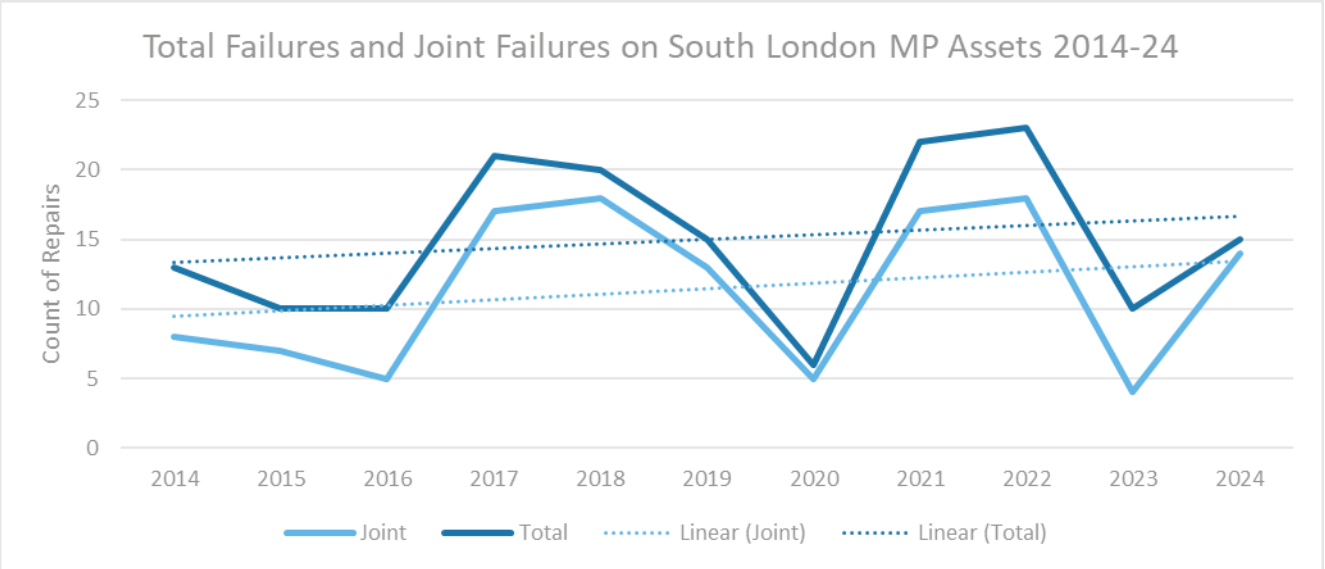


Data taken from SGNs asset repository Maximo

20 Figure 3 above reveals the age distribution of the targeted asset base, and it is evident that most assets and the related joints are at least 73 years old. The link between asset age and joint age is driven by Maximo asset data capture, these assets were laid prior to the introduction of digitisation in the industry and as such the records taken from the asset are applied to the joint records as well.

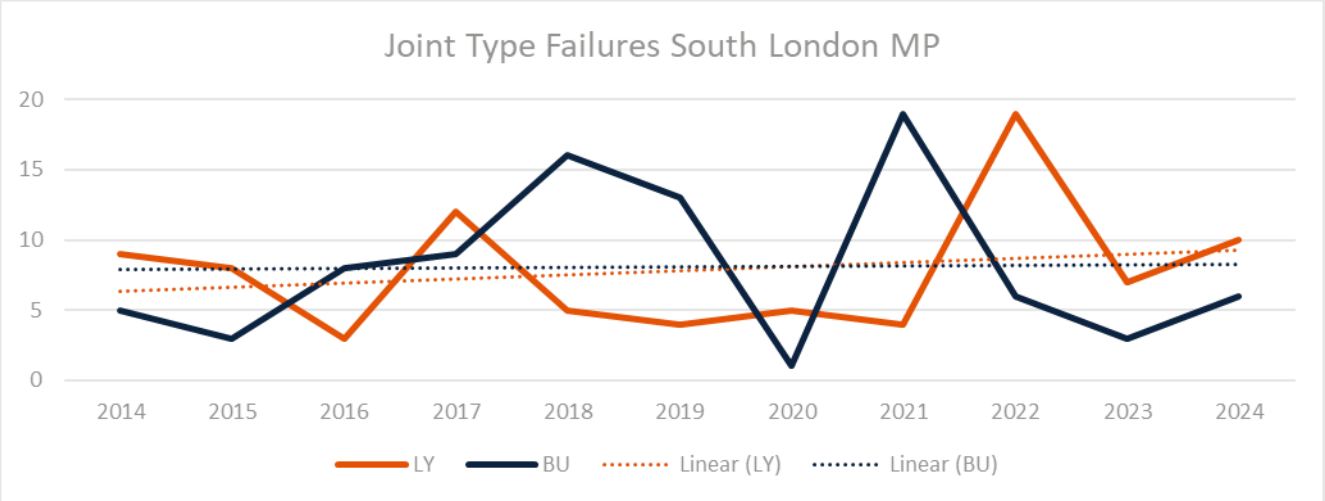
21 Of the 615 total repairs undertaken of this stretch of network 557 of these repairs have been performed on the Cast Iron assets and specifically joints. Figure 5 below evidence that since 2014 there have been 165 failures on the 36-inch Cast Iron assets along this stretch with the predominant failure mode being joints (76% of all failures).

Figure 4: Total Repairs and Joint Repairs on the South London MP asset base



22 What can be taken from Figure 4 is that the predominant failure mode across the targeted asset base is joint failures. This is to be expected when reviewing Figure 5 below and that most of the joints in this stretch of network are 73 years or older. Figure 5 below summarises these joint failures in greater detail.

Figure 5: Joint failures since 2014 on the targeted asset base broken into joint types



23 What can be discerned from Figure 5 is that there are two types of joints on the South London MP. These are lead yarn and bolted unanchored joints, both joint types are failing in equal proportions. These failures are driven by the lead yarn joint itself drying out, which occurs due to the change in gas mix from town gas to the dryer natural gas. For bolted joints, the failure can be put down to corrosion as the bolt is made from carbon steel rather than iron and therefore corrodes at a higher rate.

24 Like many other trends being recorded on our distribution assets there has been a gradual upward trend in failures since 2022. In addition to these failures there is limited data on the status of the pipe barrel or pipe walls due to these assets being below ground and in difficult to access locations. There is additional risk if these aspects of the asset cohort are starting to display evidence of deterioration, however this is difficult to check without exposing the asset.

25 Our robust methodology provides confidence that our investment is aligned to address the probability of failure highlighted in this paper.

Failure Rates

26 The NARMs modelled mains failure rates assumed for each failure mode are provided in Appendix D

Availability of the network

27 As stated in Section 2, the network is built as a point-to-point network without redundancy. Whilst the system is integrated, the level of back feed can be limited and therefore must be a consideration when we are planning a replacement job.

28 As the network is a crucial feed to so many customers isolating any section can impact the supply to 10's if not 100' of thousands of customers at a time. With this risk being noted, we have adopted an approach of only working on one location on any given stretch of the system at a time. A stretch being defined as a section of the network between two feeds (IP/MP or HP/MP), e.g. the section that runs between Mitcham Common (IP/MP) and Port Greenwich (IP/MP).

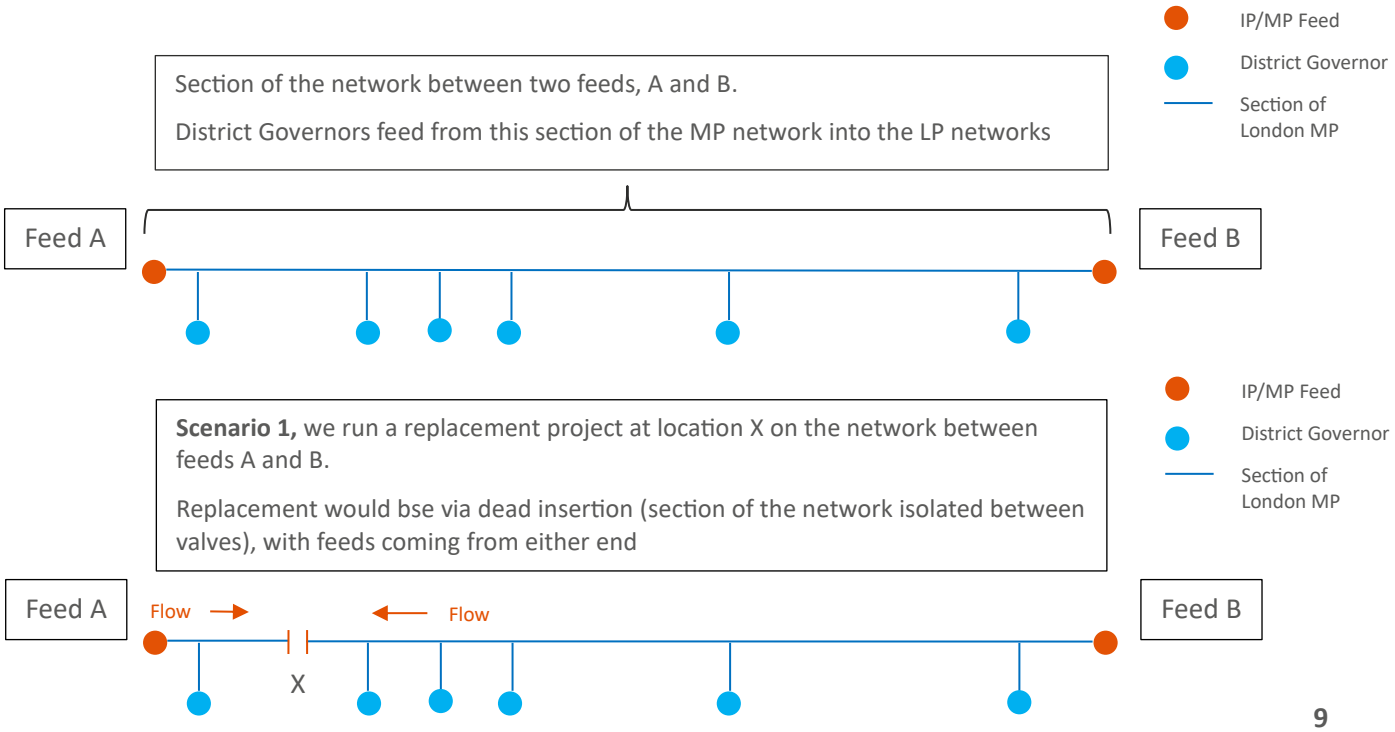
29 There may be opportunities to work on other stretches of the network, but this would depend on the level of back feed available i.e. the capacity of the feed and the number of customers being fed. Additionally, careful consideration must be given to how valve closures are approached and the need to run a rider system around any network outage (to facilitate insertion).

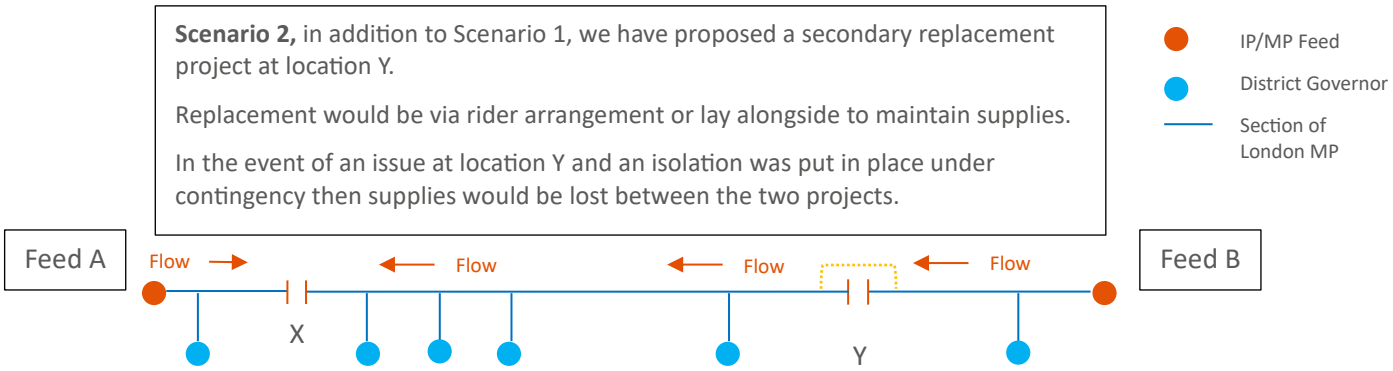
30 To add to the level of complication, all the work on the London MP would come under the SCO4 procedures which dictates the need for a Non-Routine Operation (NRO). Part of the requirement for an NRO is the need for a fully workable contingency in the event of something going wrong. Often the contingency focuses on an unplanned release of gas and, as a way of mitigation, involves the closure of a valve to stop the uncontrolled release of gas.

31 If we were to be working on two areas of the same stretch of network at the same time it's possible that the combination of contingency measures, or at least the presence of another job's contingency being enacted, would isolate significant parts of the network. It's questionable, under that situation, if it would constitute a fit-for-purpose contingency, as it could be argued that it wouldn't be workable. If, in the unlikely event that, it was deemed workable, we have concerns that staff would be unwilling to enact the contingency due to the consequences on customers. This could bring about a dangerous situation where staff had a conflict of interest in a potentially dangerous situation.

32 To illustrate the situation described above, we have prepared figure 6 below.

Figure 6: Ensuring Security of Supply to SGN Customers through effective planning on the South London MP





SGN planning assumptions

33 This figure shows that in a combination of Repex jobs on a single stretch of the system could result in loss of supply to the customers downstream, between the two Repex jobs, if a contingency were invoked. Even if both projects were run with either riders or lay alongside replacement techniques, which notably would be considerably more expensive, any invoked contingency would cease work on both jobs due to the risk posed on the second. Most of these works, undertaken with specific requirements from HA's and LC's and cessation of works would normally mean that permission would be impossible to be obtained again. This, in combination with the fact that investigations following the enactment of an incident would normally mean that would work be paused for months.

Project Scope

34 From the 200km spread across London, we have selected several potential projects. These projects have been built up from local knowledge and data analytics where; repair costs are either difficult or expensive to put in place, stakeholder concerns exist following multiple repairs, there is a concern around integrity of the main flagged due to either the nature of failures or the number of failures, or a history of gas entering buildings following network failure.

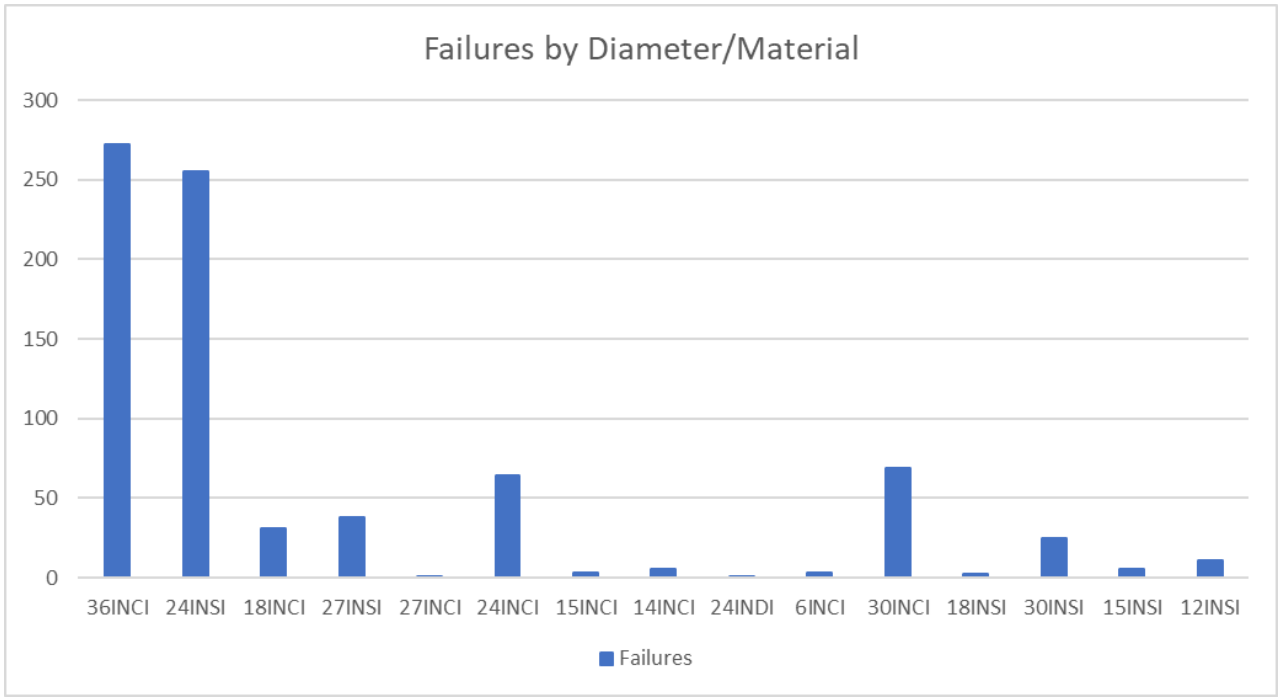
35 The initial scoped length for the project is 26.4km across 14 separate sub-projects. These scoped locations form the basis for targeting the 15km replacement in GD3. These scoped areas are composed of 138 pipes, of which 30% are 36-inch Cast Iron pipes, this is visualised below in Table 4.

Table 4: Scoped Sub-Projects for the South London MP

Scope Name	Length (m)	Fracture Failure	Corrosion Failure	Other Failure	Interference Failure	Unknown Failure	Total Failures Count
Northwood Road	1,535.88	2	1	56	0	0	59
Cypress Road	1,292.66	3	8	123	0	0	134
Kent House Road	2,789.28	0	16	66	2	7	91
Kevington Drive	2,079.92	0	3	51	0	0	54
Collingwood Rd.	1,532.75	5	3	18	2	0	28
Belmont Rise	2,540.20	0	1	29	0	0	30
Littleworth Road	2,058.16	1	12	50	0	4	67
Copsem Lane	2,642.59	0	16	77	0	2	95
Copse Hill	2,373.17	3	6	59	0	2	70
Coombe Road	1,896.62	0	8	21	0	2	31
Nightingale Road	1,570.22	0	2	48	0	1	51
Burnell Road	1,609.87	0	2	20	1	2	25
Kingston Road	1,728.45	3	1	11	1	0	16
Frogmore	761.88	0	5	29	0	0	34
Total	**26,411.65**	**17**	**84**	**658**	**6**	**20**	**785**

36 What is clear from table 4 and figure 6 is that there are the early indications of asset deterioration in this network, this is evidenced by the corrosion values and fracture values across these sub projects. To compound this the predominant asset types across these sub projects is large diameter (>24inch) Cast/Spun iron mains. These scoped assets broken out below in figure 7.

Figure 7: Failures by Asset and Material in Sub projects



37 Figure 7 above highlights the failures by asset cohort (diameter/material) and provides a clear indication the assets which this project will proceed to target.

Project Goals

38 The aim of this project is to actively target the highest risk/failing sections within the proposed sub-projects first. This will provide the dual benefit of reducing failures and the subsequent risk, it will also reduce leakage and our environmental footprint and fortify asset integrity in advance of future gas mixes. Finally, this project will ensure security of supply for 1,250,000 of our customers.

39 This project not only reinforces supply security across this asset cohort it also reduces risk to the respective customers by targeting the highest failing assets. If nothing is done, there is evidence to indicate that there will be a continued upward trend of failures predominantly driven by joint deterioration. In addition to this the health status of the asset beyond joints is currently unknown therefore there is the risk of asset failures beyond joints.

40 Additionally, looking holistically at the London MP network, at the proposed level of replacement it would take 67 years to complete the replacement of the whole network. We already have significant concerns over the condition of this network, which would only be worse in the timeframe noted above. It's also worth remembering that this network, feeding so many customers both domestic and commercial, would be one of the last networks to be decommissioned under any electrification pathway. Unless a workable solution is found for the thousands of small, medium and large businesses that rely on gas for their process the network may never be decommissioned, and conversion may be the only option.

Under what circumstances would the need or option change for this project?

41 Optioneering is driven by long term risk reduction across this asset base. To ensure security of supply traditional mains replacement is the best solution to this issue. However, it is an expensive solution that is particularly invasive and has a high level of impact on the surrounding stakeholders when the works are taking place.

42 In comparison robotic intervention is an alternative for consideration. CISBOT actively targets joint repairs by re-sealing lead yarn joints. However, we have discounted this as an option for the following reasons:

- The joint repair has an unknown lifespan, and we are concerned over the whole life costs as we believe that failures would begin to re-appear before anticipated decommissioning or re-purposing of the network.
- CISBOT costs circa 70% of the replacement cost and still leaves us with a 70+ year old asset which will continue to degrade in the ground. These assets could still show corrosion and fracture failures in the future and pose a very high risk to the surrounding properties.
- CISBOT is not compatible with fittings and bends which negates the rollout to the whole network. It may be possible to conduct a part CISBOT and part conversional replacement programme. However, we have not considered this as it would be almost the same cost to conventionally replace and would still leave us with significant lengths of iron mains to manage into the future.
- CISBOT only effectively repairs lead yarn joints. It does not sufficiently remediate bolted joints, where the primary failure is of the bolt corroding. This is evidenced in figure 5 where we see a high proportion of bolted joint failures.
- As an aside point, CISBOT does not tackle services, but there are few services on the MP network and are typically only used in commercial situations. They could be remediated alongside any CISBOT rollout but would need to be factored into any solution.

What are we going to do with this project?

43 This project is part of a longer-term strategy to target large diameter transporter assets across the South London network. This is driven by ensuring security of supply to our customers while simultaneously de-risking one of the most complex networks in SGN. There will also be a long-term reduction in emissions as part of this programme which is a key contributor to net zero.

Project: Challenges to Delivery

44 There are several challenging aspects to this project, the environmental factors centre on road space availability, while the engineering challenges centre of ensuring there is the capability to maintain supply during these works. These assets are based in the one the most densely populated regions of the UK, as such there will be increased traffic management due to higher traffic volumes and road space will be challenging due to enhanced road space restrictions.

45 These challenges are visualised below for desk-based site walks performed by our teams; these site walks were used to understand the surrounding asset replacement restrictions and proximity to properties for each asset. The following figure exemplifies the challenges to replacement, including proximity to properties, road-space, properties with specific working hour conditions and potential lane rental as well. Figures 8 and 9 below illustrate these challenge and are the location for one of the assets targeted for replacement in the Cypress Road sub-project.

Figure 8: Cypress Road, Croydon, London, SE25 4AU. Location for 36-inch CI MP line as part of MP network

46 The medium pressure asset runs down the centre line of the road in this image this is confirmed using geospatial mapping (see Figure 9 below). What is important to note is that the buildings are less than 20 metres from the asset in some parts and the asset visualised below has failed on 62 separate occasions. This is a priority asset in this project, but also is adjacent to 2 schools and will require a full road closure due to the location in the carriageway.

Figure 9: Asset #115789967 a 36-inch Medium Pressure mains which runs through Cypress Road

47 The asset above is one of 138 assets targeted for replacement within the planned sub-project scope. This asset is 305 metres in length and a 36-inch Cast Iron pipe.

Environmental Factors

48 This is driven by road space availability and working within one of the most densely populated parts of the UK. There are numerous local restrictions, applied by HAs and LAs, that will apply in conjunction with the availability of road space to complete the necessary works as there will be multiple other utility networks in proximity. To minimise disruption the proposed project is designed to be completed in sections to balance these requirements and reduce the impact on customers.

Engineering Factors

49 The proposed project is composed of large diameter mains, these assets require a significant mix of engineering techniques beyond insertion. These include but not are exclusive to:

- Fitting replacements
- Multiple connections to other mains
- Additional network topography for example, governors, pressure points, large diameter commercial connections
- Stopple operations for isolation
- Tier 3 medium pressure which is always conducted as dead-insertion
- Some areas may need lay alongside, which can be affected by adjacent buried plant
- Valve replacement

What are the key milestone dates for project delivery?

50 We anticipate that following successful stakeholder engagement and the ability to work on the road space that these mains reside in, that it will be continuous rollout over the GD3 period. However, there are several key factors to take note of:

- Security of supply means that replacement will need to be undertaken outside of the winter peak demand period.
- Jobs will need to be scheduled over the 5-year period to ensure that only one job takes place at one time due to the issues highlighted above.

- There may be requirements made of us by the HA's and LA's which affect road space availability, and this will require extensive consultation and planning. Likely, this will be the determining factor for working in these locations.

51 These factors are explained below.

Demand, security of supply and time of year

52 These factors are mutually exclusive due to demand profiles being higher in winter and in conjunction to this the network must be fully available during these periods. Therefore, delivery is designed to coincide with the availability of the network to be thrown dead, or by supply being maintained by use of lay alongside or by rider arrangement.

Inter Project Completion and scheduling with stakeholders

53 As stated in the section above we will aim to target as many scoped sections as possible at once without impacting the supply to customers. Completion of the projects will be phased to ensure that all stakeholder concerns are addressed and there may be some interaction with Tier 1 projects with this regard.

Road Space Availability

54 This is driven by road space availability and working within one of the most densely populated parts of the UK with multiple local authorities who determine this availability. There are numerous local restrictions that will apply in conjunction with the availability of road space to complete the necessary works as there will be multiple other utility networks in proximity. To minimise disruption the proposed project is designed to be completed in sections to balance these requirements and reduce the impact on customers.

55 In addition to the local restrictions there are several additional restrictions which impact this work and the unit costs of delivery. Many of these assets sit in tight busy roads, and with this in mind there is the addition of buried plant to factor into planning. In addition to these large diameter gas mains there are:

- Fresh Water Mains
- Waste Water Network
- Fibre and Telecoms
- Electrical Network

56 The density of these networks impacts not only the unit cost but also replacement techniques, open cut rather than insertion and will also determine the road space required and if we need to apply for road closures.

4.1 Related Projects

57 The following projects have been completed on similar lengths of network since GD1, these projects allow for insights into how this project will be completed in GD3. Key learnings from these projects drive this projects design, delivery and efficiency while also providing extensive insight into the environmental challenges facing delivery success.

Table 5: Related Projects across GD2 and GD3

Price Control	Project	Length (km)	Cost (£m)
GD1	Tooley	3.01	£1.67 (18/19 price base)
GD2	Mitcham Common	4.15	£2.34 (18/19 price base)
GD2	Trafalgar Avenue	2.65	£1.16 (18/19 price base)
GD2	Sandiford Road	1.51	£1.52 (18/19 price base)

4.2 Project Boundaries

58 This project is specifically targeting the replacement of 15km of a 20km stretch of assets, in addition to this there are further additions to this network which will be considered over the long term and price controls proceeding GD3. However, as this body of works is risk driven the order of delivery is not set at this time. The drivers of these decisions are primarily risk reduction, cost benefits, and security of supply.

59 By targeting 15km this project will solely focus on mains replacement activities. Therefore, no additional network architecture will be replaced through these works.

What Are the benefits of this Project?

60 There are several key outcomes that can be clearly highlighted as project benefits. These centre around the long-term benefits to our customers and additional environmental benefits of completing this work. These key benefits are:

- Increased Network Resilience/Security of Supply
- Reduced risk faced by the public/reduced Operational expenditure
- Emission reductions/Preparation for future gas mixes

Increased Network Resilience/Security of Supply

61 Completing the proposed project or 15km will enhance key points in the MP network for London, it will add network resilience especially at critical points through the replacement of strategically located assets. Increased network resilience will ensure our most vulnerable customers will be supplied at key times. In addition to this it guarantees long term supply security and preparation for future gas mixes.

Reduced risk faced by the public/reduced Operational Expenditure

62 As stated in the problem statement many of these assets are starting to fail and/or key components are failing and leading to escapes of gas. This is a direct risk to the public and our customers. By replacing the worst performing assets first, this risk is reduced steadily through the replacement process. In correlation with this replacement there will be a reduction in Operational expenditure costs are asset failures are reduced.

Emission reductions/Preparation for future gas mixes

63 As was identified in the problem statement there are regular failures across the specified asset cohort and these failures ultimately result in gas leakage. As part of this proposed replacement project, we have calculated that by replacing 15km of these mains they will save 11.78tonnes of CO_2e. In addition to this, the enhanced asset resilience increases our preparation for future gas mixes which in turn will reduce dependence on natural gas.

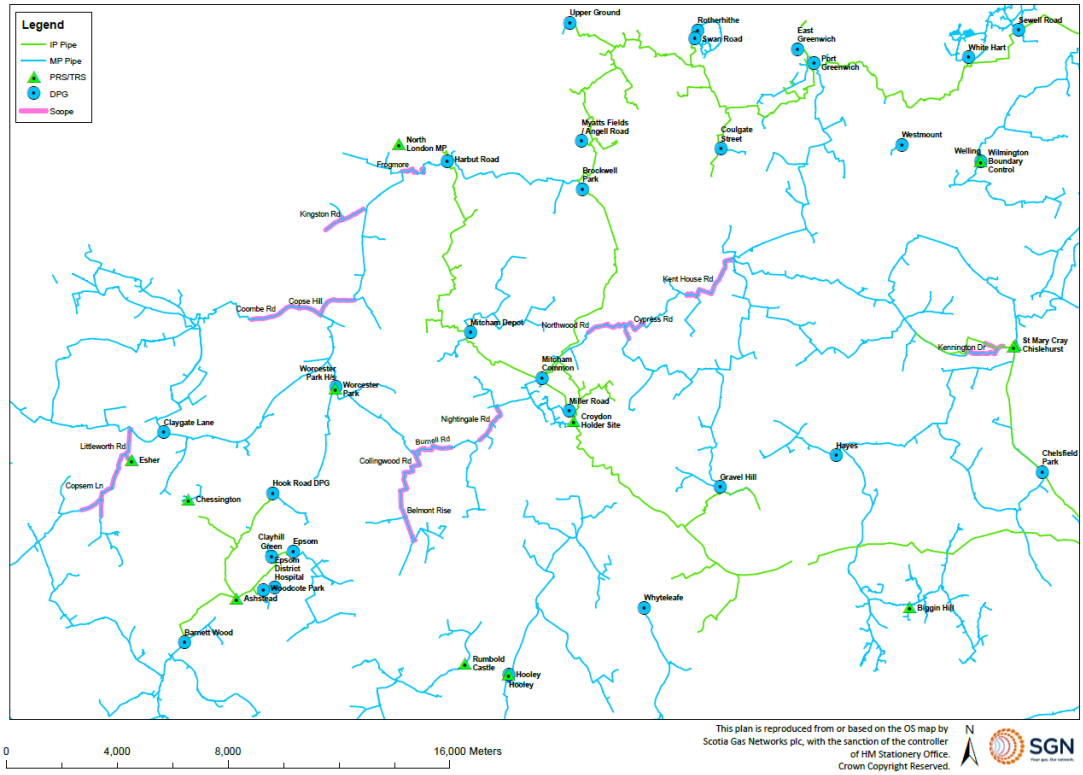
5 Project Definition

64 To summarise the proposed project; it is a major project which is proposing to complete a large diameter mains replacement programme in the South of London. This is a large-scale engineering project which will have long term benefits for our customers. This work will enhance the security of supply and provide resilience within a network which suffers from clear degradation across elements of its asset-base.

5.1 Project Scope Summary

65 The scope of this project is the decommissioning of 15km of Medium Pressure Cast Iron 36" diameter mains, key sections will be replaced will be replaced at the following sections (see figure 10 below) with PE pipe using insertion. These sections have been specifically targeted as they will ensure that there is continued supply to our customers throughout the replacement works. As such these works will be phased to ensure that key sections are replaced separately.

Figure 10: Scoped Sub projects for replacement on the South London MP network



6 Options Considered

66 The options considered have been initially determined by balancing the maximising of replacement against environmental drivers, the pressure tier of the network, and the aim to ensure long term network resilience. The options have then been determined through delivery variables and the understanding that this is part of a longer-term delivery project which will deliver throughout GD3 and, with a separate scope of works, into GD4 and beyond. We also consider what would happen if nothing was done. These options must also balance efficiency, while also aiming to minimise the impact on our customers, as such the options considered are:

- 1. Proactive programme (15km - Preferred Option)
- 2. Larger proactive programme (20km – Do More)
- 3. Smaller proactive programme (10km – Do Less)
- 4. Reactive workload (Do Minimum)
- 5. Do nothing
- 6. Do Minimum and Defer to GD4

67 The above options will be assessed using the following criteria:

- Technical
- Cost estimate basis
- Project benefits
- Delivery capacity and timescales
- Key assumptions

68 We have spent time to cost up options where we feel there will be value added to the decision-making process. Where options are less likely to be pursued, we have chosen to present higher level costs, without the breakdown.

69 Prior to reviewing the options available, the determination of traditional replacement vs robotic intervention must be discussed as to understand the driving factors behind our decision-making process. Throughout GD1 and GD2 we have deployed robotic intervention across its Southern network. Through this deployment several issues have been diagnosed through long term asset monitoring, this is discussed below in more detail.

Traditional Replacement

70 The benefits of traditional replacement are driven by the lay of PE assets which reduce the associated leakage and failures, PE assets also add long term material resilience into the network and able to support future gas mixes. This method provides long term safety and resilience to the network.

Robotic Intervention

71 As evidenced earlier in this document, there are multiple limitations to deploying CISBOT in our network and specifically to a project like this. As such, when considering the safety drivers for this project in conjunction with the inferred network configuration, CISBOT must be ruled out as an effective option for this projects optioneering. Therefore, traditional replacement is the proposed method in the following options considered section.

6.1 Proactive programme (15km - Preferred Option)

72 Our preferred option consists of targeting 15km from the proposed sub projects and will prioritise the projects with the highest failure rates first. These projects are predominantly composed of 36-inch Cast Iron mains as highlighted in the Figure 7 above. This is our preferred option due to the deliverability of this option, 15km will allow for project progression while not detracting from other key gas infrastructure programmes and projects.

73 This will still be subject to HA and LA approval which will allow us to work in the road space that these mains reside.

Technical

74 The preferred option will be built around replacing 36-inch cast iron pipes which supply medium pressure gas into the LP distribution network. In addition to targeting 36-inch mains, we would also target the logically contiguous mains that will bring about sensible sized projects where the driver for replacement still exists. These assets have the highest failure rates and as such by targeting these assets first the failure rate will be abated.

Cost estimate basis

75 Cost estimates have been derived from experience delivering projects of this nature over GD1 and GD2 and using our efficiently arranged schedule of rates agreed as part of our Major Works contracts.

76 This has combined with desk-based road space assessments of the sub project sites. This assessment has included a virtual site walk for each sub project and incorporated additional challenges including street works, road closures and material costs. These costs also include the provisional network design and included the implementation of stopples, connections, valves and replacement pipe size. From this assessment we will know if we are able to insert the old main, need to lay alongside or lift and lay in some extreme situations.

Project Benefits

77 There are 4 key benefits with our preferred option, these benefits are below:

- Improved safety to our customers
- Reduced emissions through leakage
- Increased security of supply through the reduction of network failures
- It is within a stretch-deliverable plan that won't affect our delivery rates already agreed

78 The above benefits will be addressed in sequence. Through targeting the highest failing assets first there is a combination of reducing the risk to the public while simultaneously reducing CO2e emissions from these assets. By replacing failing Cast iron mains with pe there will be significant risk reduction across the worst condition assets.

79 In addition to the risk and emission reduction, there will be improved security of supply to our customers. This is because by removing degrading assets from the network ensures that there will not be a supply interruption from asset failures. By replacing the iron pipes with pe there is the additional benefit of enhancing the network readiness for future gas mixes.

Delivery Timescales

80 We are currently providing a linear delivery for this project of 3 kilometres per annum. However, this will become more phased as subprojects are planned accordingly. This is to ensure that there is limited impact to network supply in case of a failure elsewhere in the network. It must be noted that with the limited approach taken it will take 60-70 years to replace the network at the rate targeted, this may fall short of arresting deterioration and may need to step up in following price control periods.

Key assumptions

81 The following assumptions drive the decision making for this option:

- The remainder of the work scoped in the sub projects will be completed in GD4 as part of a continuation and multi-price control programme of works.
- The road space is available through engagement with HA's and LA's, which is still on progress
- Sufficiently skilled resource is available for these works which has been agreed with our contract partners
- The 15km preferred option would target sub projects with mains only and does not include any additional network architecture

6.2 Larger proactive programme (20km – Do More)

82 Our do more option would consist of targeting 20km from the proposed sub projects and will prioritise the projects with the highest failure rates first. These projects are predominantly composed of 36-inch Cast Iron mains as highlighted in the Figure 7 above.

83 We have discounted this option due to deliverability challenges, with our contracting partners being unable to resource this work in the short term. Whilst we could explore options to bring on additional resources, we know that this comes at a cost, and we believe it would be a disproportionate spend. However, we do acknowledge that over future price controls, once the current IMRRP is complete, that resource will be more able to focus on non-Tier 1 mains including the London MP network.

Technical

84 The do more option would still prioritise the 36-inch cast iron pipes which supply medium pressure gas into the LP distribution network, but this option would allow to target more of the sub projects and as such there would be a broader range of target diameters to be replaced. These assets have the highest failure rates and as such by targeting these assets first the failure rate will be reduced significantly, but there would be enhanced network resilience with this option.

Cost estimate basis

85 As stated in the previous option, cost estimates have been derived from experience delivering projects of this nature over GD1 and GD2 and using our efficiently arranged schedule of rates agreed as part of our Major Works contracts.

86 This has combined with desk-based road space assessments of the sub project sites. This assessment has included a virtual site walk for each sub project and incorporated additional challenges including street works, road closures and material costs. These costs also include the provisional network design and included the implementation of stopples, connections, valves and replacement pipe size. From this assessment we will know if we are able to insert the old main, need to lay alongside or lift and lay in some extreme situations.

Project Benefits

87 There are 3 key benefits with our Do more option, and these benefits reflect those of the preferred option, these benefits are below:

- Improved safety to our customers
- Reduced emissions
- Increased security of supply

88 The above benefits will be addressed in sequence. Through targeting the highest failing assets first there is a combination of reducing the risk to the public while simultaneously reducing CO2e emissions from these assets. By replacing failing Cast iron mains with pe there will be significant risk reduction across the worst condition assets.

89 In addition to the risk and emission reduction, there will be improved security of supply to our customers. This is because by removing degrading assets from the network ensures that there will not be a supply interruption from asset failures. By replacing the iron pipes with pe there is the additional benefit of enhancing the network readiness for future gas mixes.

90 The do more option is in essence an enhancement of the preferred option, however, with increased workload the cost would also increase significantly. This increase will water down the benefits of the project when analysed through a CBA.

91 We have seen from our re-resourcing work for Tier 1 contractors across GD2 that new entrants are coming in with a 30% premium over the established contractor base. With the option to defer and build this additional work, i.e. the 5km, into future price controls we believe that option 1 is still represents the best overall package of works based on current information.

92 We have chosen not to test this option through a CBA as we have a low level of confidence over any uplift applied and it would be based only on our experience from Tier 1 in GD2.

Delivery Timescales

93 We are currently providing a linear delivery for this project of circa 4 kilometres per annum. However, this will become more phased as subprojects are planned accordingly. This is to ensure that there is limited impact to network supply to the 1.25 million customers downstream of these assets in the event of an unplanned loss of supply elsewhere in the network.

Key assumptions

94 The following assumptions drive the decision making for this option:

- The remainder of the work scoped in the sub projects will be completed in GD4.
- The road space is available
- Sufficiently skilled resource is available for these works
- The do more option would incorporate additional network architecture which would require additional costing

6.3 Smaller proactive programme (10km – Do Less)

95 Our do less option would consist of targeting 10km from the proposed sub projects and will prioritise the projects with the highest failure rates first. These projects are predominantly composed of 36-inch Cast Iron mains as highlighted in the Figure 7 above. We have discounted this option due to the length not representing our ambition and with the capacity to do more we feel we should.

96 The approach of doing what we can to arrest deterioration, and not let the network degrade any further, was broadly supported by our customer and stakeholder engagement and our ISG. When originally discussed with the ISG they challenged us to do more in this space as they saw it as a crucial network with high levels of customer interaction and focus.

97 As such, we do not believe that a smaller programme is supported by our engagement, and we have rejected this option on that basis.

Technical

98 The do less option would only prioritise 36-inch cast iron pipes which supply medium pressure gas into the LP distribution network. These assets have the highest failure rates and as such by targeting these assets first the failure rate will be reduced significantly, but there would be enhanced network resilience with this option. However, by choosing this option there would be assets within the sub projects which would present a prolonged risk to our customers, for example the 30inch Cast iron assets (see Figure 7).

Cost estimate basis

99 Cost estimates have been derived from experience delivering projects of this nature over GD1 and GD2 and using our efficiently arranged schedule of rates agreed as part of our Major Works contracts.

100 This has combined with desk-based road space assessments of the sub project sites. This assessment has included a virtual site walk for each sub project and incorporated additional challenges including street works, road closures and material costs. These costs also include the provisional network design and included the implementation of stopples, connections, valves and replacement pipe size. From this assessment we will know if we are able to insert the old main, need to lay alongside or lift and lay in some extreme situations.

Project Benefits

101 There are 3 key benefits with our do less option, and these benefits reflect those of the preferred option, these benefits are below:

- Improved safety to our customers
- Reduced emissions
- Increased security of supply

102 The above benefits will be addressed in sequence. Through targeting the highest failing assets first there is a combination of reducing the risk to the public while simultaneously reducing CO2e emissions from these assets. By replacing failing Cast iron mains with pe there will be significant risk reduction across the worst condition assets.

103 In addition to the risk and emission reduction, there will be improved security of supply to our customers. This is because by removing degrading assets from the network ensures that there will not be a supply interruption from asset failures. By replacing the iron pipes with pe there is the additional benefit of enhancing the network readiness for future gas mixes.

104 The do less option is in essence a reduction of the preferred option, however, with reduced workload the benefits would be less significant as those of the preferred option.

Delivery Timescales

105 We are currently providing a linear delivery for this project of circa 2 kilometres per annum. However, this will become more phased as subprojects are planned accordingly. This is to ensure that there is limited impact to network supply in case of a failure elsewhere in the network. It must be noted that with the limited approach taken it will take 60-70 years to replace the network at the rate targeted, this may fall short of arresting deterioration and may need to step up in following price control periods.

Key assumptions

106 The following assumptions drive the decision making for this option:

- The remainder of the work scoped in the sub projects will be completed in GD4.
- The road space is available
- Sufficiently skilled resource is available for these works
- The do less option would not incorporate additional network architecture and target mains replacement only

6.4 Reactive workload (Do Minimum)

107 This option is discounted as it will lead to an unnecessary increase in the degradation of the network, which will see an increase in failures and cost from operational expenditure. The increase in failures will correspond to an increase in risk to the public alongside an increased risk of supply interruptions to our customers through continued asset failures.

108 It does allow us to continue to work on a reactive basis, which has been forecasted from the delivered projects in GD1 and GD2. However, the level of ambition is less than has been seen in the do-less option which has already been discounted by our customer and stakeholder engagement and won't have the support of the ISG. On this basis the do minimum option is discounted, it is effectively from an asset management perspective doing nothing.

6.5 Do nothing

109 This option cannot be considered as it is not compliant with pipeline safety regulations, as we would have evidence of network failures and, therefore in some instances, mains that are not in a fit state of repair. This would be in direct contravention to Regulation 13 of the PSR[1].

110 By undertaking reactive mains replacement, we ensure that we are compliant with regulation 13. Stopping this work would leave mains in operation that are not fit to remain in use. The HSE has made it clear to all networks that they see our reactive workload as a mandated workload.

6.6 Do Minimum and Defer to GD4

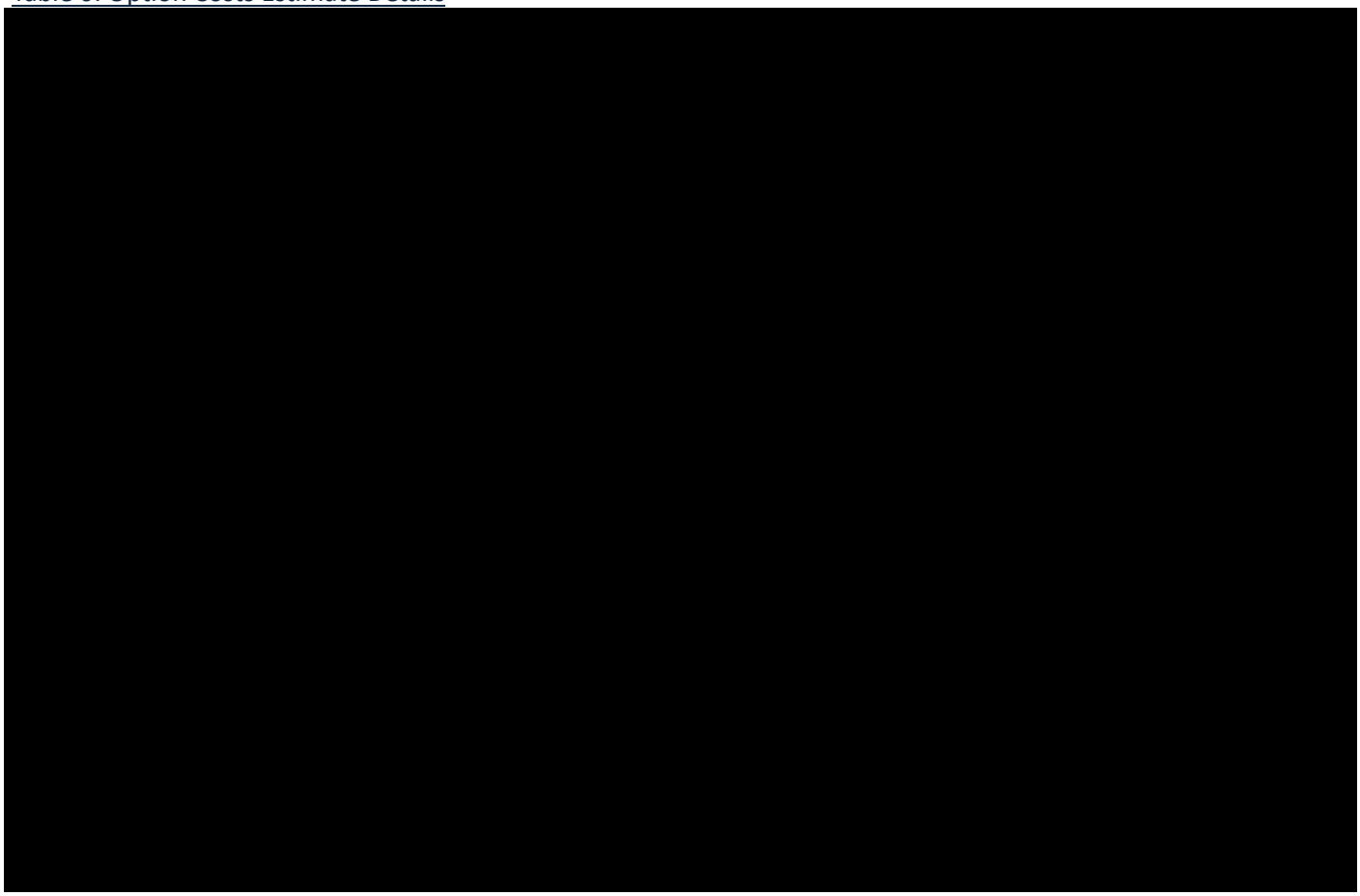
111 This option is discounted as it will lead to further asset deterioration, subsequent failures on these assets, and an increased risk to customers through the continued increase in operational expenditure. In line with an increase in asset failures there is a steadily increased risk of supply interruptions to our customers through continued asset degradation. Therefore, this option cannot be considered due the perceived issues generated by doing nothing in the short term.

112 It must be noted that with the limited approach taken it will take 60-70 years to replace the network at the rate targeted, this may fall short of arresting deterioration and may need to step up in following price control periods.

6.7 Options Cost Estimate Details

113 Options cost estimate details for this proposed project are shown in table 6 below. Note these are early-stage estimates.

Table 6: Option Costs Estimate Details



[1] Pipeline Safety Regulations (PSR) (1996).

114 The above costings are only applicable to work that we have agreed with our delivery partners, beyond this workload we would need to re-tender additional resources. From our experience undertaking this for our Tier 1 programme in GD2, new entrants come with a 30% premium over our existing well established contracting workforce. Often this is due to perceived risk entering a new industry, but also reflects the time taken to establish new systems including, but not limited to, training and ensuring competence of staff.

6.8 Options Technical Summary Table

115 We have presented six options considered to solve the problem described in section 4. Table 7 below is a simple comparison of these options, detailing start date, design life and total project cost (£m) in 23/24 prices.

116 Note the do-nothing option cannot be considered as it does not comply with Pipeline Safety Regulations and the HSE Enforcement Policy2.

Table 7: Options Technical Summary Table

Option	Start Date (year)	Commissioning date	Design life	Operating Costs	Total install cost (£m)	Cost estimate accuracy %
1. Proactive programme (15km - Preferred Option)	26/27	Programme over 5 years	+40 years	N/A	£30.02	10%
2. Larger proactive programme (20km – Do More)	26/27	Programme over 5 years	+40 years	N/A	£43.00 (includes 30% premium)	15%
3. Smaller proactive programme (10km – Do Less)	26/27	Programme over 5 years	+40 years	N/A	£20.55	10%
4. Reactive workload (Do Minimum)	26/27	Reactive replacement on requirement	N/A	N/A	£15.44	10%
5. Do nothing	N/A	N/A	N/A	N/A	N/A	N/A
6. Do Minimum and Defer to GD4	26/27	Minimum Replacement	+40 years	N/A	£15.44	10%

[2] Health and Safety Executive Enforcement Policy Statement (2015)

7 Business Case Outline and Discussion

7.1 Key Business Case Drivers Description

117 The South London MP project is driven predominantly by safety, this is in part due to asset health but also the proximity of the at-risk assets to properties. In addition to this the central positioning of these assets which are critical in the network and strategically important to customer supplies. Finally, the extended costs of reducing operational expenditure on these assets is beneficial to our customers as an effective cost reduction.

118 Prior to discussing these drivers in greater detail, a holistic view of this project within the wider GD3 programme should be ascertained to provide context to our decision making. Deliverability has been central to decision making for GD3 Repex projects. Therefore, it's relevance here is also key to understanding our decision-making processes.

Deliverability

119 GD3 represents a unique challenge to SGN, it is the last full price control for the Tier 1 replacement programme with the IMRRP concluding in 2032. As such the Tier 1 iron programme is a critical delivery driver for the GD3 programme of works and diverting labour and resources away from this programme's delivery is a significant risk. However, the delivery of safety driven compliance projects is also essential to our network maintenance and hence the importance of this project. Therefore, finding a balance to ensuring we are reducing risk through projects like this proposed project and ensuring there is no detraction from primary programmes is at the centre of determining the best option for us.

120 To this end, we have pitched our South London MP programme at a delivery point that is a stretch to our already established and growing Major Works contracts, but not so far as to affect the price point that we have agreed to. Beyond our preferred programme of 15km we know that the contracts would struggle to resource the work, and we would need to re-tender a new contract and would expect to bring in a new supplier for labour.

Safety

121 The aim of this project is to target the assets with the highest failures first, these assets are not only seeing consistent failures but are situated within proximity to residential areas. Often, as is the case for the project in Wrythe Lane[3] which was delivered in GD2 where we saw multiple GiB's from the main, we see repeated problems with mains once they have failures. This drives the necessity to target these assets in GD3 to actively reduce this risk, particularly when they have associated GiB's. As stated in the project plan, we will target the worst condition assets as a priority to reduce this risk.

Opex Reduction

122 As can be seen in the failure data there are recurring issues with failures across the proposed sub-projects. These failures in turn come with an attached operational cost, which also includes additional costs like reinstatement, street works etc not including the additional expenses incurred by asset location (discussed previously in paper). Costs for repairing these types of main are very high which is driven by; deep excavation (due to the size of the main), they are often located in difficult to access areas which need complex traffic management systems and are often with surrounding buried plant. This is a strong feature of the payback seen within our Cost Benefit Analysis (CBA) which relies heavily on the benefits gleaned from avoided costly repairs. By completing the proposed project these assets will not only undergo a significant reduction in failures, but they will also see a significant reduction in associated operational expenditure.

[3] Wrythe lane was visited by the Ofgem Engineering team in June 2024, further detail is contained within the Network Asset Management Strategy document.

Network Resilience

123 As stated in the introduction the London Medium pressure networks supplies gas to 1.25 million of our customers, and as stated in the evidence pack this asset base is showing initial signs of deterioration, but individual sections can be targeted for replacement without interrupting the supply. However, if two of the subproject areas with higher deterioration were to fail the supply of gas to 10's if not 100's thousands of customers are at risk. This project has been specifically designed to ensure continuous supply, and by replacing the targeted assets across GD3 and into GD4 as a programme of works, there is enhanced supply resilience within this section of the network due to the 'removal' of the iron mains.

7.2 CBA Outputs

124 Outputs from the CBAs for options considered in this EJP are shown in tables 8 and 9 below.

Table 8: CBA Output Summary (Southern Network)

Option Name	Included in this CBA? (Y/N)	Preferred Option (Y/N)	NPV (2043 PV, £m)	Company view
Do minimum	Y	N	N/A	Although this option mitigates some of the issues highlighted within the project scope, it does not fully rectify the aims of the project.
Preferred Option	Y	Y	0.89	This option provides a balanced solution to targeting risk while also reducing operational costs as well. By targeting 15km of the worst condition assets there will be a combined risk reduction and improved security of supply.
Do Less	Y	N	0.31	Like the Do Minimum option, this option will mitigate some of the issues highlighted within the EJP but will leave a significant section of deteriorating iron within the network. Rather than preventing failures by replacing all high diameter assets. this option would target the highest failing assets. This option does not mitigate or remove the risk the preferred option does.
Do minimum and defer to GD4	Y	N	-2.42	Although this option mitigates some of the issues highlighted within the project scope, it does not fully rectify the aims of the project until GD4.
Do nothing	N	N	N/A	This is option is unacceptable to SGN, it will lead to an increase in failures steadily over time and increases risk across this asset base.
Do More (20km)	N	N	N/A	This option is not considered for GD3 as it is not deliverable within the timescale, and it would impact other programmes of work.

Table 9: CBA Output – Sensitivity Analysis (Southern Network

NPV (2043 PV, £m)	Low CO2 Cost	Central CO2 Cost	High CO2 Cost
Capex - Low	-0.42	2.26	4.93
Capex - Central	-1.78	0.89	3.57
Capex - High	-3.15	-0.48	2.20

7.3 Business Case Summary

125 The following table has a breakdown for phase 1 of the proposed projects, the costs are in 23/24 prices and cover the initial GD3 phase of the project.

Table 10: Business Case Summary

Option	Commissioning Date	Installed Costs (£m)	Accuracy %	Operating Life
1. Preferred Option	26/27-30/31	£30.02	+/- 10%	> 40 years
2. Do More	26/27-30/31	£43.00	+/- 15%	> 40 years
3. Do Less	26/27-30/31	£20.55	+/- 10%	> 40 years
4. Do Minimum	26/27-30/31	£15.44	+/- 10%	> 40 years
5. Do Nothing	N/A	N/A	N/A	N/A
6. Do Minimum/Defer	GD4	N/A	N/A	N/A

8 Preferred Option Scope and Project Plan

8.1 Preferred Option

126 The preferred option proposes to replace 15km of high-risk mains across the proposed sub projects. The preferred option will cost £30.02 million and will remove the highest risk assets across these sub projects. The preferred option is highlighted in the options and options summaries, but this section reiterates our plan for this project across the GD3 price control.

8.2 Project Spend Profile

127 An estimated project spend profile for the proposed works is shown in table 11 below. These delivery costs are shown as flatlined at this stage, but we expect this phasing to change when detailed project planning commences.

Table 11: Spend Profile

Year	26/27	27/28	28/29	29/30	30/31	Total
Spend (£m)	£6.00	£6.00	£6.00	£6.00	£6.00	£30.02

8.3 Efficient Cost

128 The preferred option has been costed using average unit costs from similar large diameter projects delivered in GD2. However, there are several sections which require discussion regarding delivery in GD3.

129 These areas are:

- Market Costs
- Delivery-Contractor Availability
- Efficient Costing

Market Costs

130 There is a cost risk uncertainty of upward pressures like what we have seen in recent historic events that we have not built in. We are expecting that any increases over and above the rate of inflation (CPIH) will be covered by an appropriate indexing mechanism to pick up real price effects over and above inflation. With that mechanism in place allowances will adjust appropriately year on year.

131 The bulk of material we use is PE and fittings. We plan our works in advance, so understanding diameters and service fittings allows us to give early sight to material providers as to the mix of materials we will need. We eliminate contract risk for our material contractors if we can give an up-front view of the types of diameter pipes and fitting, we are going to need as part of our forward planning. We have a choice of material suppliers, which mitigates the risk of a single source provider and gives us much more flexibility in our supply chain.

Delivery-Contractor Availability

132 The fact we must go back out to the market for GD3 creates uncertainty as it gives our contractors an opportunity to update their prices from previous contracts. However, with an already established Major Works contract in place, we do not expect any significant challenges. At the point of contract renewal, rate reviews will be conducted which also incorporates assessment of innovation and new methods that have been introduced. However, with the detailed unit cost analysis it provides some confidence that our pricing strategy covers any potential changes in this market.

133 Across both networks there has been a significant resource investment, with multiple front-line teams completing their training since the beginning of GD2. This includes our Major works contractor who have resourced to meet a delivery point by the end of the price control period. However, it must be noted that it takes considerable time to gain the relevant experience to work on larger diameter assets. Therefore, our strategy needs to be one of long-term growth and stability to ensure that costs are kept under control in the interests of customers.

8.4 Project Plan

134 Table 12 below shows the indicative workload phasing plan for this project for GD3. A more formal project plan will be developed once our stakeholder engagement has concluded, as currently we do not have a confirmed number of deliverable projects. Each project has been designed and costed, so the usual planning approach can be somewhat expedited once agreement with LA's and HA's is granted.

135 We expect that our engagement will conclude before the start of GD3 and we will be able to schedule jobs from that point onwards. Please note that extended lead times are not anticipated to be applicable to this programme.

Table 12: Workload Phasing Plan

Workload (km)	*26/27*	*27/28*	*28/29*	*29/30*	*30/31*	*Total*
Mains	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*15.0*

Note: The delivery volumes shown in the table above are flatlined at this stage, but we expect this phasing to change when detailed project planning and stakeholder engagement concludes.

8.5 Key Business Risks and Opportunities

136 The key risks to the delivery of this project are detailed in the risk register in Appendix C.

8.6 Outputs included in RIIO-GD2 Plans

137 Delivery of some MP mains in south London would have been included in our output as measured by NARMs. However, the proposal in this EJP is the first time we have presented a dedicated programme covering the London MP network.

Appendix A - Acronyms

Acronym	Meaning
PSR	Pipeline Safety Regulations
HSE	Health and Safety Executive
OFGEM	Office of Gas and Electrical Markets
GiB	Gas in Building
CI	Cast Iron
SI	Spun Iron
DI	Ductile Iron
REPEX	Replacement Expenditure
OPEX	Operational Expenditure
CAPEX	Capital Expenditure
IMRRP	Iron Mains Risk Removal Programme
SGN	Scotia Gas Networks
PRE	Public Reported Escape
MRPS	Mains Risk Prioritisation System
Km	Kilometres

Appendix B – References

Pipeline Safety Regulations (PSR) (1996).

Health and Safety Executive Enforcement Policy Statement (2015)

Appendix C – Risk Register

Table 13: Risk Register

Risk Description	Impact	Likelihood	Mitigation/Controls	Comments
PE pipe supplier ceases trading	REPEX Timing REPEX Expenditure	<=20%	We have also designed our Contracts to drive not only value for the customer but to promote contractor sustainability. Two independent pipe manufacturers are approved and would request an increase in manufacturing should the need arise.	Loss of pipe or material supplies in our supply chain would significantly delay the programme.
Contracting company ceases trading	REPEX Timing	>20% & <=40%	Southern Network employs multiple smaller contractors therefore a single loss could be absorbed. In our experience both national and regional contractors can deliver the same quality, but national contractors utilise sub-contractors which introduces risk and is dependent upon the quality of sub-contractor management. Our current contracting strategy mitigates this risk. Increase cashflow and release retentions.	Our framework strategy combined with geographical lots allows depots to distribute workloads across more than 1 contractor to ensure not only that targets are achieved but that cost tension is maintained. Monthly, quarterly and annual performance review meetings allow our operational and commercial teams to monitor performance, safety and cost which provides early warning of a contractor in difficulties The guaranteed volumes provide commitment for the term of the contract.
Potential change in HSE approach for IMRRP in GD3	REPEX Expenditure	100%	Agree reopener mechanism with Ofgem to increase or reduce funding as required.	The HSE are reviewing the programme. The expected change in the approach Ofgem could take to the IMRRP programme would cause a misalignment with our procurement strategy. Our GD3

				procurement strategy assumes that GD3 will follow the existing approach, and any variation may delay GD3year 1 delivery if another path has to be followed
Unexpected change in legislation	Leakage/ Shrinkage Volumes Fatalities / Non-fatalities	<=20%	Agree reopener mechanism with Ofgem to increase or reduce funding as required.	The unexpected cessation of the IMRRP would potentially leave at risk pipe contained within the network. Safety is our number one priority; therefore we would continue to carryout reactive repairs to our pipes to ensure safety of our customers. Replacement of these pipes would be considered only when a CBA allows this.
Ambitious programmes introduced from other utilities	REPEX Timing REPEX Expenditure	>75%	Engage with supply chain early in the process to secure services in a competitive manner. Progress with Contractor attraction initiatives and be clear on planning activities early in the process. Source relevant data and evidence to ascertain the potential levels of increase in unit costs to secure the skilled and competent resource.	Ambitious infrastructure programmes being introduced across Water, Electricity, Fibre and other sectors likely to increase through 2025 and beyond. We need to retain and attract the right resource to deliver against our targets. It is important to be clear on workloads and investments required on a longer-term basis with supply chain and Contractors. It is expected there would an indirect impact on SGN's supply chain costs. We will look to source relevant data to ascertain the actual levels of increase in the defined period and

				draw on skilled resource.
Highway Authority change to perimetry	REPEX Timing REPEX Expenditure	>20% & <=40%	Engage with stakeholders to understand street work requirements on an individual basis. Agree reopener mechanism with Ofgem to increase funding as required.	Expansion of Permit to Operate Schemes across Highway Authorities in England. Likely increase in Reinstatement Warranty from 2 /3 years in England & Wales to 5 years and from 2/3 years in Scotland to 6 years Increased requests for shortened periods or smaller siteworks restricting the lengths of lay per operation (<50m)
Highway Authority change to lane rental	REPEX Expenditure	>20% & <=40%	Engage with stakeholders to understand street work requirements on an individual basis. Agree reopener mechanism with Ofgem to increase funding as required.	Lane rental costs have the potential to be increased to promote work in twilight hours
Major reinstator contract ceases trading	REPEX Expenditure	<=20%	Southern Network employs multiple smaller contractors therefore a single loss could be absorbed	Failure to reinstate excavations will lead to FPN's and the inability to move forward with projects
Shortage of reinstatement materials	REPEX Expenditure	<=20%	Review methods of lay, engage with stakeholders and look for alternative mean of reinstatement	Failure to reinstate excavations will lead to FPN's and the inability to move forward with projects
City low emission zones	CAPEX Expenditure REPEX Expenditure	<=20%	Investigate new technology of electromechanical plant. Engage with stakeholders to understand street work requirements on an individual basis. Agree reopener mechanism with Ofgem to increase funding as required.	Diesel plant and equipment not permitted for use in city areas

Major civil construction programme in [South / Scotland]	REPEX Expenditure REPEX timing	>80% & <=100%,	Monitor large scale planned projects and market rates of pay	Given the significant nationwide expenditure on other major particularly heavy engineering projects over the relevant period of RIIO-GD3 it is likely there would an indirect impact on SGN's supply chain costs. We will look to source relevant data to ascertain the actual levels of increase in the defined period and draw on skilled resource.
Impact of major events	REPEX Timing	<=20%	Engage with stakeholders to understand future planning arrangements	e.g. London Olympics. Glasgow commonwealth games. Disruption to existing work sites and delay in starting new projects
Skills and labour shortage	REPEX Expenditure REPEX timing	>60% & <=80%	Offer visibility of work and support contractor in recruitment, training and retention. Continuing vetting of contractor with the potential to increase cashflow and release retentions to obtain contractor stability	Sufficient number of competent/interested contractors and resources per geography to enable a fully competitive tender Sufficient number of competent resources per geography to enable delivery Ageing labour resource pool with more resources leaving the Utility Contracting than entering. GDN's going to market for GD2 requirements around the same timeframe. Work visibility and location may result in higher costs to deliver the works.

Cost pressures	REPEX Expenditure	>40% & <=60%	Ensure an appropriate index is in place to accurately track increasing cost pressures over and above the CPI inflation rate. There is nothing presently in place to track costs in specialised industries such as gas transmission and distribution.	Cost increases will be in excess of inflation and/or determination of costs with Ofgem Carbon issues – pollution free zones / diesel vehicles / congestion charging etc. and impact on regulations / notices / council restrictions Increased operating costs for supply chain via Living Wage requirements and increased Pension Costs to Employers

Appendix D – NARMs modelled failures

Table 14: NARMs modelled mains failure rates (no. per km per year x10^{-6})

Network	Capacity	Corrosion	Fracture	Interference	Joint
SO	1.74	0.00	0.00	0.00	633.69

The modelled failure rates are forecast values for financial year 2026/27. These are forecast using the NARM methodology deterioration rates.