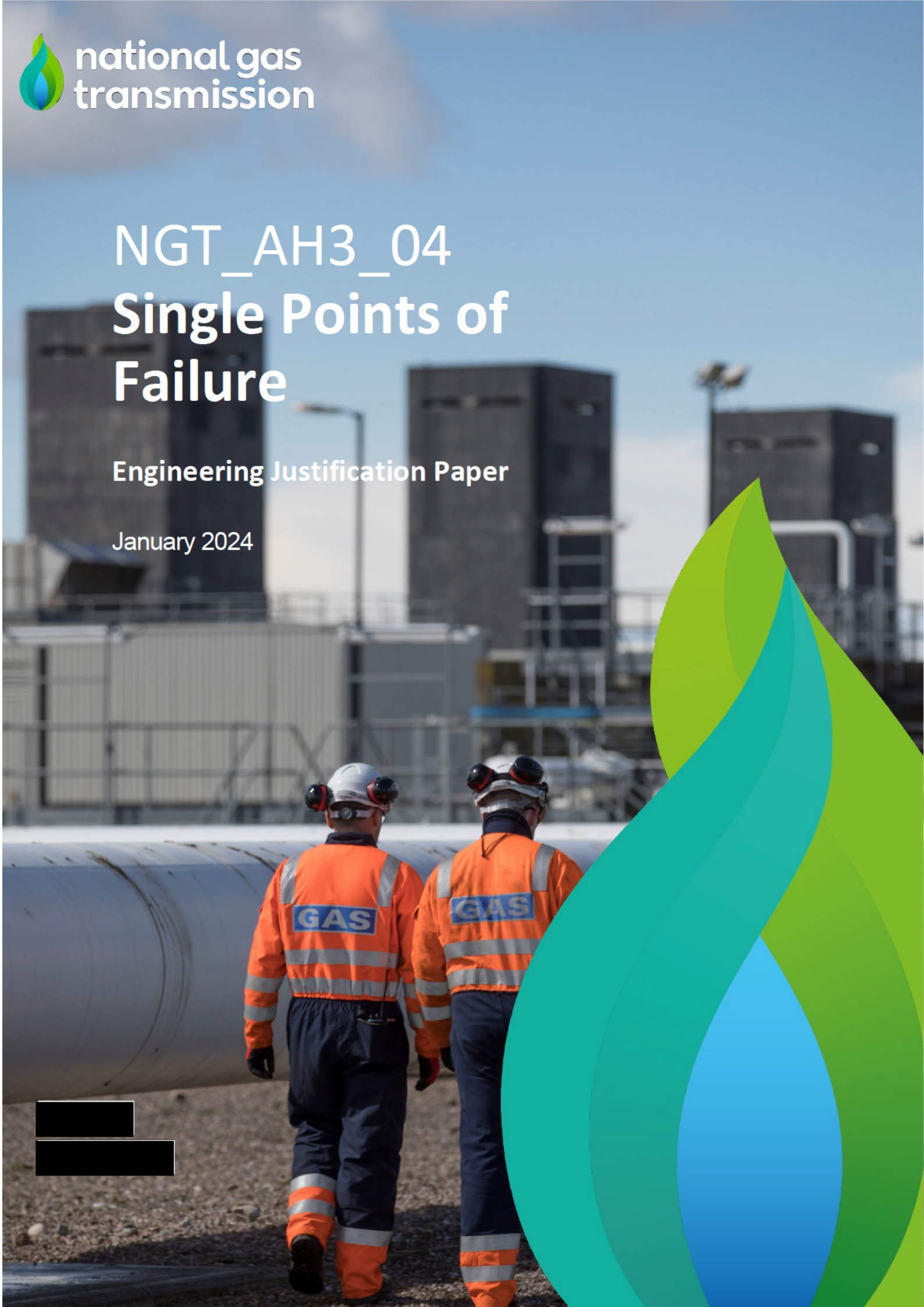
national gas transmission

NGT_AH3_04 Single Points of Failure

Engineering Justification Paper

January 2024



[redacted]

Engineering Justification Paper - Asset Health

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Name of Scheme/Programme	*Single Points of Failure Feasibility Assessment*
Primary Investment Driver	*Network Resilience*
Scheme reference/ mechanism or category	*NG_AH3_04*
Output references/type	*Risk Mitigation Study and a Pipeline Routing Study*
Cost	£380,149.21
Delivery Year	*RIIO2*
Reporting Table	*Project Costs: Table 3 Feasibility Assessment Direct Costs*
Outputs included in RIIO T1 Business Plan	*No*

Executive Summary

A significant portion of the pipeline that underpins the national transmission system (NTS) was commissioned in the 1960's with no new pipelines having been installed since 2007. Since then, the landscape of the gas industry has experienced the dismantling of the distribution network's gas storage capability, significant growth in demand, a shift to universal firm and increasing compensation rates which has heightened the level of risk held by single points of failure on the NTS.

These pipelines are crucially important to the UK's energy infrastructure and its ability to maintain security of supply. If the UK were to experience a cold winter the impact would be far reaching with GDN's assuming a minimum of 8 weeks to reconnect 250k consumers. The consequential impact would lead to consumer fatality risk, significant compensation charges, power generation impacts, social costs, repair costs and environmental and reputational damage.

In response to the UK Governments Energy Security Plan, National Gas Transmission (NGT) have mobilised a programme of work to address their immediate concerns on resilience including the forementioned supply and demand risk (areas of the network where only a single transmission asset exists). This programme of work commenced with the Network Resilience Summit held in May 2023, attended by Ofgem, DESNZ, NGT and the ESO and since then NGT has facilitated a number of work groups with Ofgem and DESNZ to explore the areas of concern related to gas transmission network infrastructure resilience.

It was at these sessions where NGT highlighted the absence of an industry standard for high impact events [redacted] As a result of the evidence provided at the sessions, DESNZ have confirmed they will be leading a review using existing Critical National Infrastructure (CNI) frameworks to assess the approach to managing the risk of single points of asset failure on the network.

In order to support the Government led review NGT also garnered support from Ofgem and DESNZ to submit a request for funding for a feasibility assessment via the Asset Health Price Control Reopener Uncertainty Mechanism in January 2024.

This submission covers NGT's request for £380,149 to complete a feasibility assessment on [redacted] sections of pipeline that NGT have found to be carrying the most significant risk [redacted]

The feasibility assessment will include a risk mitigation study and a pipeline routing study, to be completed by June 2024, which will allow NGT to form an understanding of how we can improve the level of resilience of gas supplies across the gas transmission network.

NGT's review of the risk mitigation and pipeline routing study will be completed by September 2024 and a report will be provided to Ofgem detailing the findings. Any required investment will be submitted as part of NGT's T3 business plan in December 2024.

Introduction

The UK and other countries have increased their attention on energy resilience. This has been driven by recent global events, such as the curtailment of Russian gas flow into continental Europe, which are having a profound and long-lasting impact on how energy security is perceived and delivered. Events that have previously been considered credible but low probability have materialised and brought into focus the need to be able to manage these events across the UK's energy infrastructure.

A resilient network is crucial to managing the impacts of significant events to ensure the network can efficiently transport gas supplies to meet the required demand. In recent years the way in which the network is used by customers has changed significantly and the volatility seen is increasing. As a result of this the UK Government have outlined a number of key commitments within the Energy Security Plan, their Powering up Britain Publication, to enable the UK's energy Security.

In response to the UK Governments Energy Security Plan, NGT have mobilised a programme of work to address their immediate concerns on resilience including a focus on supply and demand risk (areas of the network where only a single transmission asset exists). This programme of work commenced with the Network Resilience Summit held in May 2023, attended by Ofgem, DESNZ, NGT and the ESO, and since then NGT has facilitated a number of work groups with Ofgem and DESNZ to explore the areas of concern related to gas transmission network infrastructure resilience.

The output of the work groups led to the Government confirming they will be leading a review using existing CNI frameworks to assess the approach to managing the risk of single points of asset failure on the network [redacted] The objective of this review would be for government to define the level of impact that is deemed an acceptable risk on pipelines where a single point of failure is present and to stipulate an enhanced risk management policy for those locations.

In addition to the Government led review NGT also garnered support from Ofgem and DESNZ to submit a request for funding for a feasibility assessment via the Asset Health Price Control Reopener Uncertainty Mechanism in January 2024.

NGT, using its asset management modelling coupled with sessions with the gas distribution networks (GDN's), have identified [redacted] sections of demand pipeline and [redacted] section of supply pipeline that present the most significant levels of risk to downstream connections, [redacted]

This submission covers NGT's request for funding to complete a feasibility assessment on [redacted] sections of pipeline. The feasibility assessment will include a risk mitigation study and a pipeline routing study which will allow NGT to form an understanding of how we can improve the level of resilience of gas supplies across the gas transmission network and obtain additional data to better inform any potential future investment decisions.

[1] In line with Ofgem's compensation repayment policy Compensation for energy supply issues | Ofgem

Problem Statement

A significant portion of the pipeline that underpins the NTS was commissioned in the 1960's with no new pipelines been installed since 2007. Since then, the landscape of the gas industry has experienced the dismantling of the distribution network's gas storage capability, significant growth in demand, a shift to universal firm and increasing compensation rates which has heightened the level of risk held by single points of failure on the NTS.

These pipelines are crucially important to the UK's energy infrastructure and its ability to maintain security of supply. If the UK were to experience a cold winter the impact would be far reaching with GDN's assuming a minimum of 8 weeks to reconnect 250k consumers. The consequential impact would lead to consumer fatality risk, significant compensation charges, power generation impacts, social costs, repair costs and environmental and reputational damage.

In addition to the outlined risks there would also be potential for significant regional impacts to electricity supply. In order to manage a scenario where gas distribution networks are unable to sufficiently 'flow swap'[2] from the affected area, the supply to the largest gas users would have to be isolated. These are likely to be large gas-fired power stations which produce electricity to the National Electricity Transmission System or large industrial consumers.

Current Risks to Pipelines

The current hazards are documented in T/PL/PSR/7 - The Major Accident Prevention Document (MAPD) for UK Transmission and are as follows.

- External interference
- Corrosion (both internal and external)
- Construction/material defects
- Loss of ground support/Ground movement
- Over pressurisation
- Stress corrosion cracking
- Weld defects

In the previous five years NGT have recorded [redacted] emergency pipeline isolations (appendix 1) as a result of [redacted]

[2] Flow Swap-The ability to redirect gas flows to another network point when a bottleneck occurs while transporting gas e.g., in the event of a disaster, technical problem, or maintenance.

Current Activities to Mitigate Risks to Pipelines

The current activities and associated frequencies documented in table 1 are compliant with IGEM/TD/1 Edition 6 which covers the design construction, inspection, testing, operation, and maintenance of steel pipelines. What this does not provide is a view of the mitigation levels achieved by the activity/frequency scenario and whether there is an alternative scenario that would either reduce or fully mitigate the risk presented by the sections of pipeline included in this submission. This approach is standard policy for all pipelines irrespective of the downstream risks.

Table 1-Existing Pipeline Management Activities

	Activity	Frequency
Regular	Ariel Surveys	Every 2 Weeks
	Full Walking Surveys	Every 4 Years
	Marker Posts	Fixed
	Condition Monitoring	Operator Scheduling
	Preventive Maintenance	Operator Scheduling
	Procedure Reviews	Operator Scheduling
	Operator Training	Operator Scheduling
Risk Based	Corrosion Monitoring	Risk Based Approach
	Damage Detection	
	Coating Surveys	
	Corrosion Surveys	
	Leakage Surveys	
	Internal Inspection	

Consequence of Failure Assumptions

Consequence of Failure (COF) values for individual sections and sites are calculated in the Loss of Supply (LOS) Consequence Model which is based on the published NGGT NARMs methodology. This model works on calculating the failures at a site from a failure which leads to loss of gas supply. The current model includes some improvements from the Ofgem Audit review that will be published in the next periodic methodology update. These improvements are:

1) The valuation of fatalities from Gas Supply loss. This is based on the HSE Issue of [redacted], assuming that 90% of people will self-isolate and reconnect.

2) The increase in daily compensation for domestic consumers from [redacted], which is used in the T2 Methodology, to [redacted], which is the real value that GDNs are expected to pay[3].

3) The separation of business consumers from domestic consumers for distribution offtake consequences. This was based on the ratio of domestic to industrial meters in the UK, based on a 2021 BEIS report.

The model itself is based on a 1 in 20 Supply Demand Scenario from FES. This is then linked to a network map. For individual sites various aspects of the use of gas and the compensation for failure to supply are evaluated, including the value of flow through sites against entry and exit capacity, compensation expected by domestic consumers and industrial customers. Individually, all sites and pipelines will have a value for consequence of failure for loss of supply for the site/pipeline only.

There is then a connectivity model, which is a logical map of the sites, flow, and connections between sites on the network. This describes how well-connected sites are and describes which other sites are lost if there is a loss of supply event at one site or pipeline. If a site is well connected with more than 2 independent pathways in it can be thought of as part of the "mesh" of connected sites where the event effects the site and the site only. For sites that are on a spur/dead leg, where there is only one pathway back to the mesh, then every site on the way back to the mesh will have the COF of its own value and any dependent sites. Where it links into the mesh will also have that consequence of the entire spur.

[redacted]

In Figure 2, a real-world example, [redacted] is an offtake that is clearly outside the mesh. It has no downstream dependencies, so its consequence is only the value of itself. For the pipe that links [redacted], the value of the pipe is itself, plus the value of the dependent offtake. Working back towards the mesh, [redacted] would also have the value included in its COF value, as would [redacted].

[3] https://www.sgn.co.uk/help-and-advice/customer-service/guaranteed-standards/compensation, Loss of gas supply - Witham, Chelmsford | Cadent (cadentgas.com)

Oppositely, [redacted] is within the mesh, so a failure at [redacted] would only affect [redacted] as there is another route to all other sites. i.e. [redacted] is affected but Gas can still get to [redacted]. This means [redacted] COF value is just the value of [redacted].

A longer explanation for how the model works can be found in section 6 of the NGGT NARMs Consequence of Failure Document[4], while further information about how the calculations work and what is valued can be found in section 6 of the NGGT NARMs Service Risk Framework[5].

Submission Content

Sections of Pipeline In-Scope of Assessment

As part of the Network Resilience Programme NGT held a work group with DESNZ and Ofgem on the 11th October 2023 to address their concerns in regard to the risk presented by single points of failure on the NTS. It was at this session where NGT highlighted the absence of an industry standard for high impact events that can result from a single asset failure which is in contrast to government policy regarding physical and cyber network security threats.

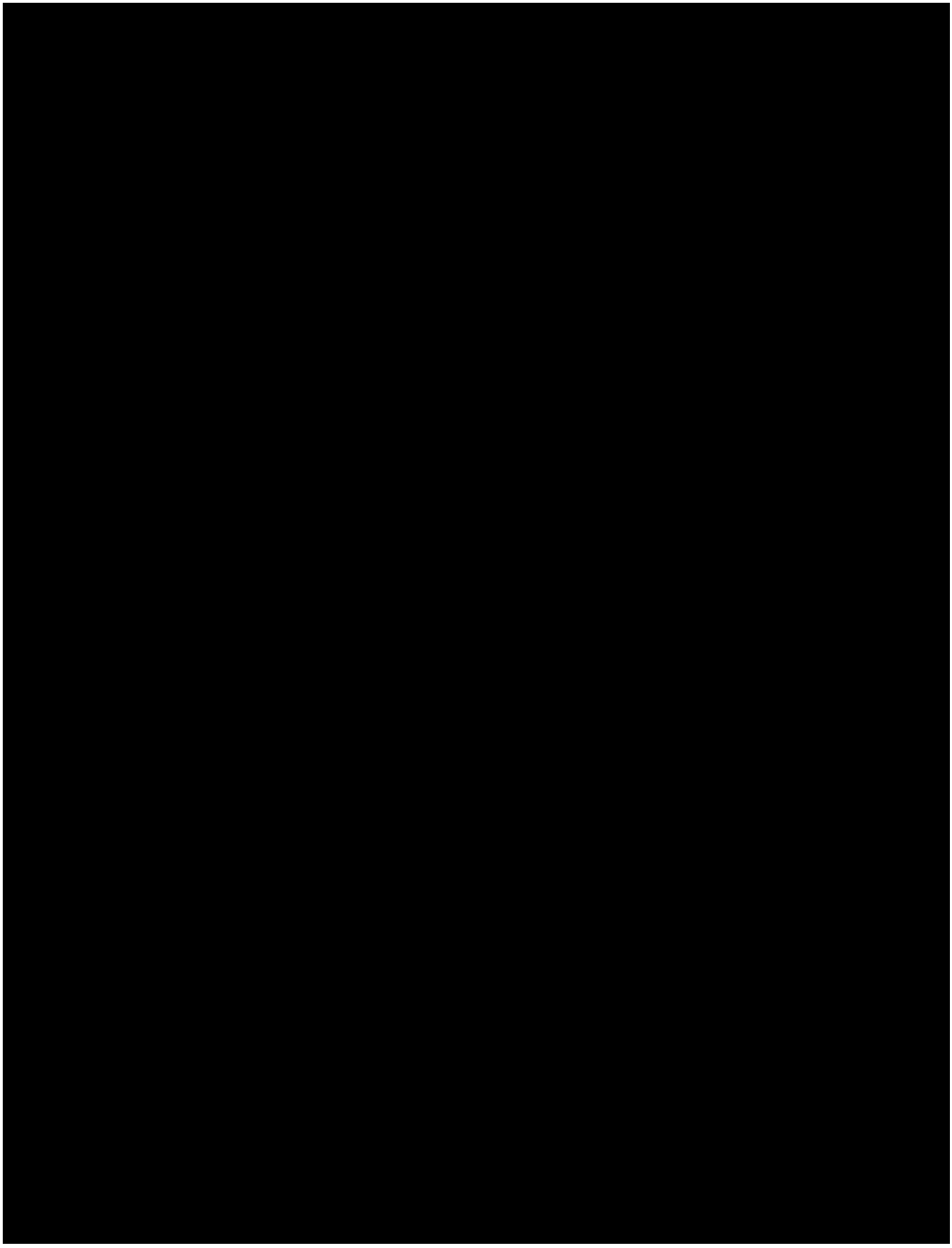
As a result of the evidence provided at the Network Resilience work group DESNZ have confirmed they will be leading a review using existing CNI frameworks to assess the approach to managing the risk [redacted]

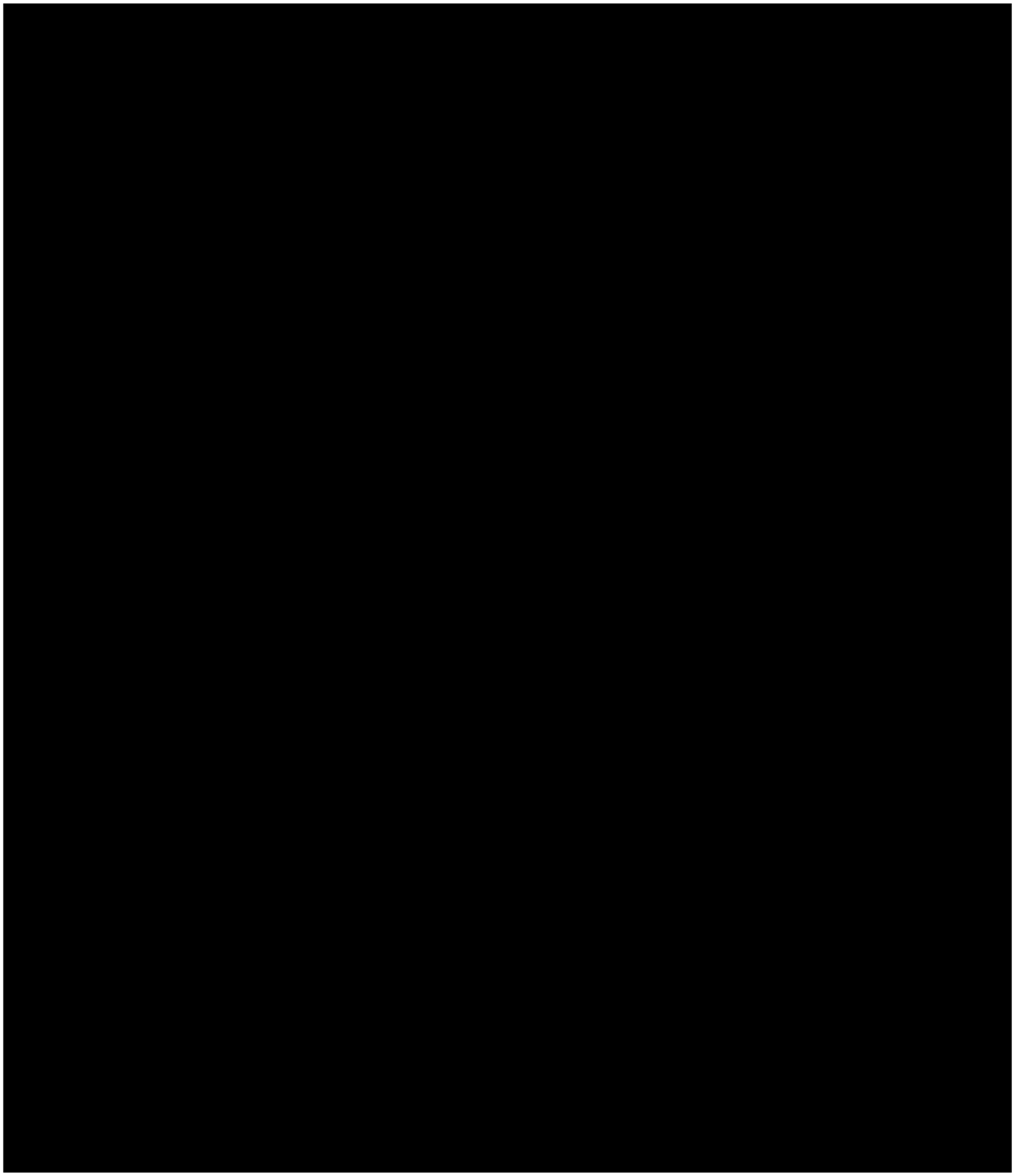
In the interim NGT have identified [redacted] sections of pipeline that are carrying the most significant risk [redacted]

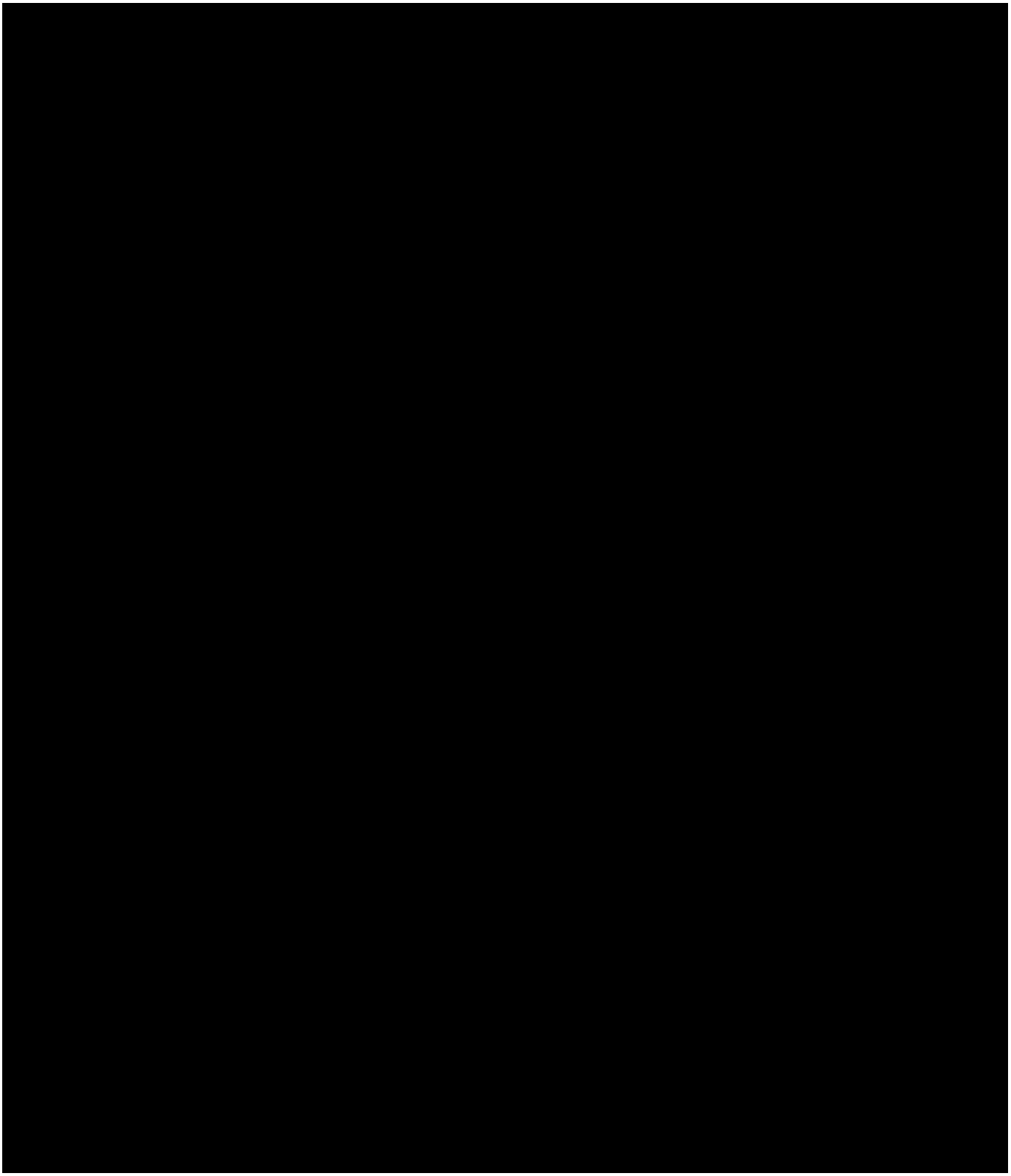
There is [redacted] anomaly to this criteria, [redacted]

The initial step taken to identify the sections of pipeline that present the most significant risk was to identify all single points of failure on the NTS of which there are [redacted] (shown in appendix 2). The next step was to understand whether the identified offtakes are at risk 365 days of the year or only at periods of high demand, this was done using the [redacted] and through engagement sessions with DN operators. Once this view was established it was overlayed with the Network Asset Risk Metrics (NARMs) modelling to highlight the annual demand at risk, the number of customers dependent on the offtake and the consequence of failure for each of these offtakes to derive at the [redacted] sections of pipeline NGT consider to be carrying an unacceptable level of risk.

[4]NGGT NARMs Consequence of Failure Document: A4 simple report 1-col no divider Nov 2019 (nationalgas.com)
[5]NGGT NARMs Service Risk Framework:A4 simple report 1-col no divider Nov 2019 (nationalgas.com)







Feasibility Assessment Overview

This submission is focused on providing a view of how we can improve the level of resilience of gas supplies across the gas transmission network and obtain additional data to better inform future decisions on network and energy resilience. The feasibility assessment will include a risk mitigation and pipeline routing study on all [redacted] sections of pipeline. The output of the feasibility assessment will

be the completion of CBA's for the sections of pipeline and any investment required will be submitted in the T3 business plan.

Our current method to assess high impact / low probability events assumes a standard pipeline failure rate based on historic trends formed from a large dataset of high-pressure pipeline operations. This is generic and not explicitly aligned to individual pipelines with varying characteristics. Our intended approach will assess the individual pipeline risks and consider what additional mitigating activity could take place to minimise these risks where possible. This will bring the realistic view of risk to the forefront and demonstrate (if possible) how risk could be reduced at the lowest overall cost. The routing studies present the best-case option (and likely highest cost) to fully mitigate the single point of failure risk and will demonstrate the backstop for full mitigation. Together these assessments will provide the full range of information to move forward with clarity, either we collectively accept the risk, or we agree to mitigate – an outcome that we cannot currently inform in full with generic models and risk information.

Risk Mitigation Study

In order to identify a supplier who would be awarded the risk mitigation study in the event of investment approval, NGT submitted an invitation to tender to their framework suppliers. A scope of work document was provided to [redacted] as a result of the invitation to tender accompanied by a 60-minute session (per supplier) to discuss the scope in further detail. Upon receiving a proposal from all [redacted] suppliers they were assessed against their ability to meet the scope, technical delivery capability and cost with [redacted] coming out as the preferred supplier.

The risk mitigation study will look to review and assess all applicable hazards and the likelihood score for each hazard based on current status before, determining a list of bespoke activities for each section of pipeline that could provide potential mitigation of current risks. Once the list of bespoke activities has been finalised the level of mitigation the activities would enable will be quantified and indicative costs for implementing those actions will be provided. The full proposal for this study can be viewed in appendix 3.

Pipeline Routing Study

[redacted] The result provided by [redacted] highlighted the same corridor that NGT had determined to be most suitable and was able to produce the result with a 93% reduction on time compared to traditional methods and a 65%+ reduction on traceable costs compared to traditional methods.

It is due to the reduction in cost and time, along with [redacted] already possessing a significant portion of the data required to undertake the study that NGT would contract this supplier to carry out the pipeline routing study on the [redacted] sections of pipeline included in this submission, in the event of investment approval.

The pipeline routing study will deliver a view of the alternative pipeline routing options for the [redacted] sections of pipeline included in this feasibility assessment. Through the use of GIS and additional data

[redacted]

sets provided by NGT [redacted] solution will examine millions of pipeline routing options in detail against engineering, environmental, socioeconomic, and cost criteria providing a view of the results through an interactive platform. An example of this is provided in figure 3.

This will enable NGT to rigorously explore the trade-offs between different routing options using objective metrics to demonstrate a much wider range of options, a level of detail we would not otherwise be able to achieve within the timescales of this assessment. The full proposal for this study can be viewed in appendix 4.

Project Costs

Table 2 shows the CAPEX costs to complete the feasibility assessment, and these have been determined as a result of direct quotes from [redacted]. NGT's OPEX costs (breakdown available in appendix 5) have been calculated based on an assumption of the resource required to support the delivery of the assessment and to review the output upon completion. The supplier quotes can be found in appendix 3 and 4.

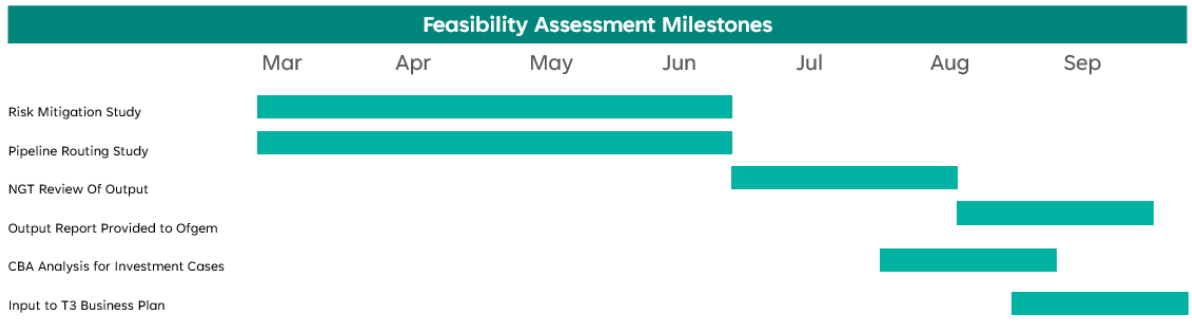
Table 3-Feasibility Assessment Direct Costs

[redacted]

Project Milestones

The risk mitigation, pipeline routing study to be completed by June 2024. National gas transmission's review of output and development of cost benefit analysis to complete by September 2024. Any required investment to be submitted as part of the T3 business plan in December 2024. A report detailing the output of the 3 studies included in the feasibility assessment will be provided to Ofgem in September 2024.

Table 3- Gantt Chart of Project Milestones

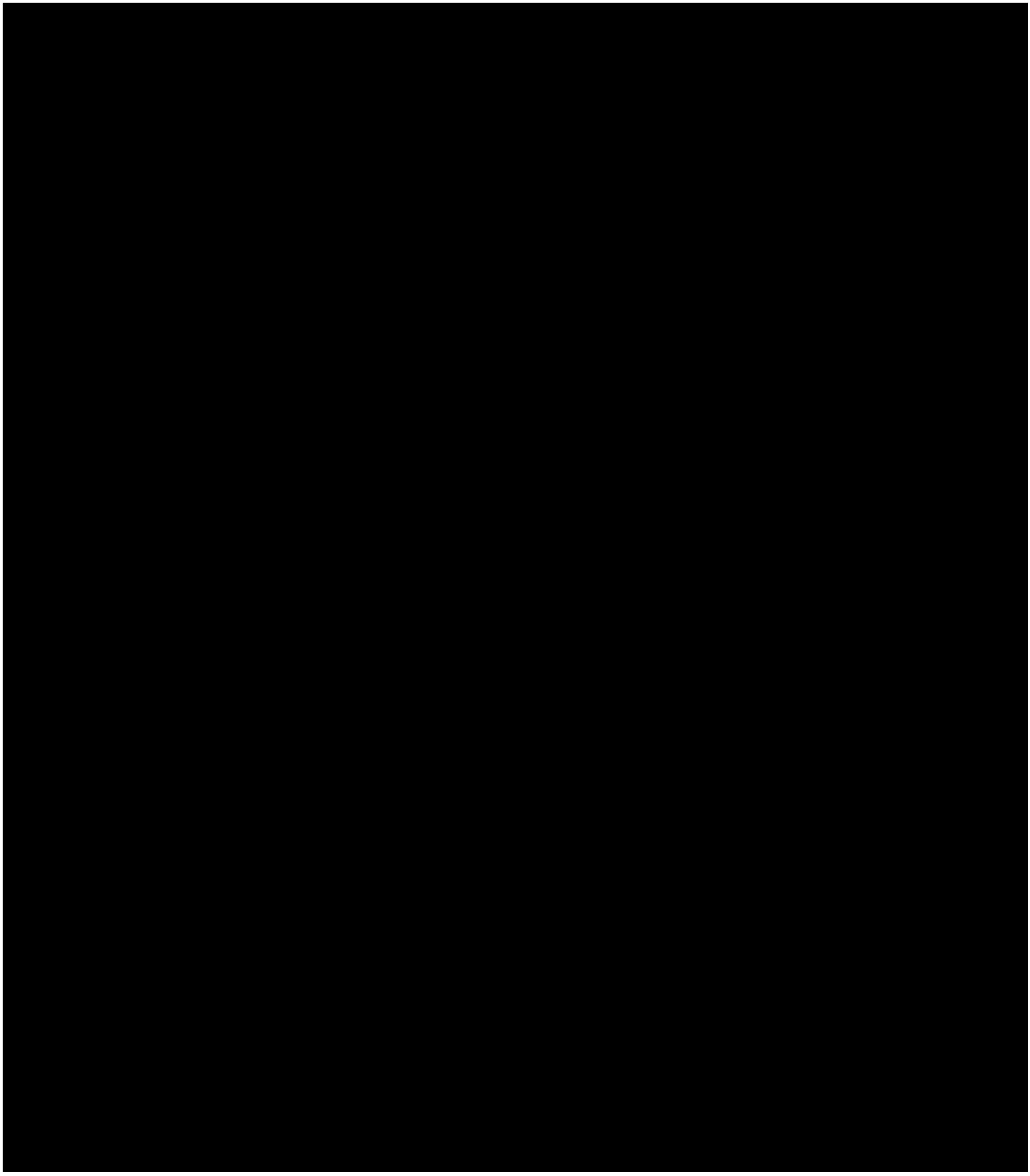


Project Spend Boundaries

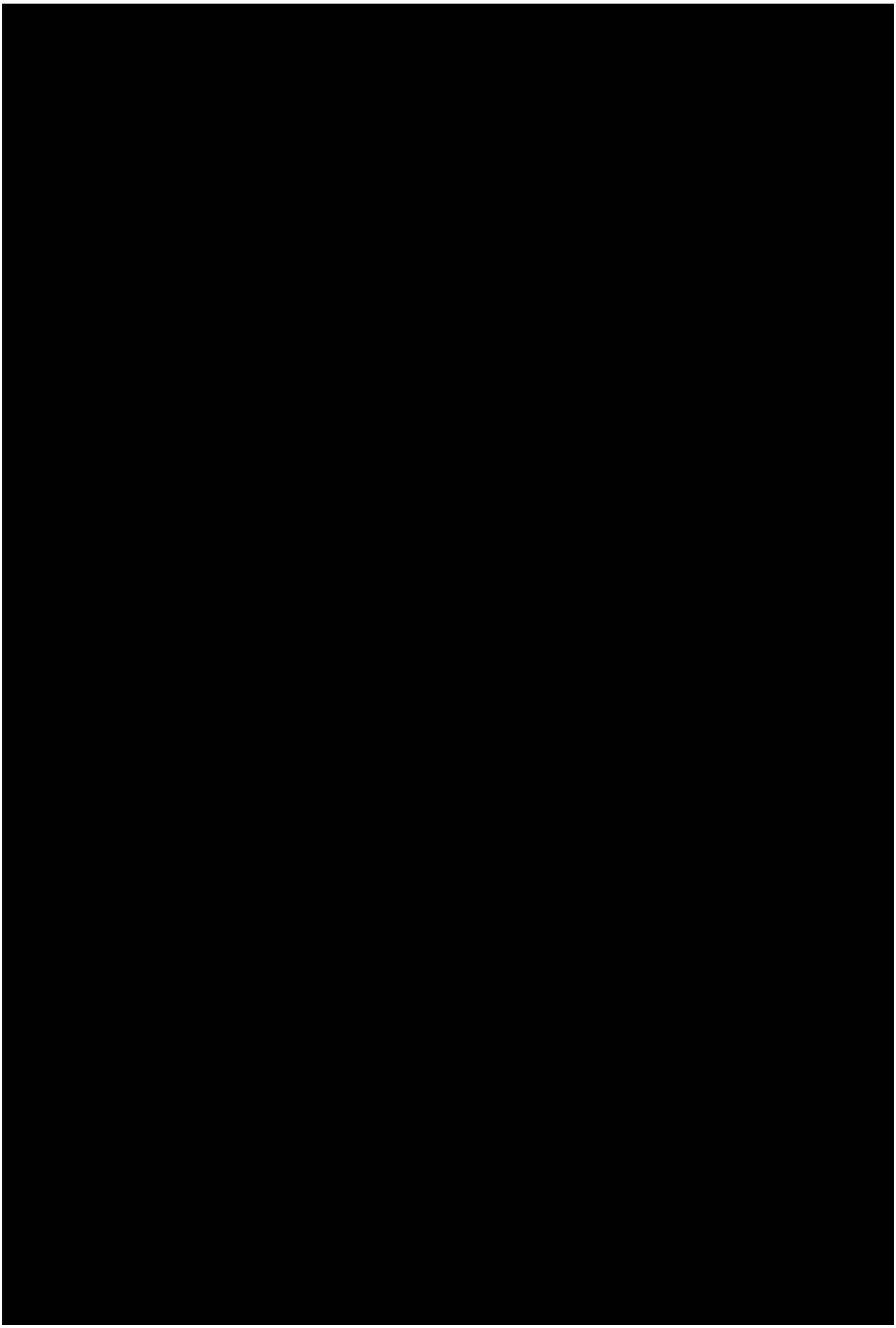
The boundaries of the spend proposed by this justification paper will only cover the cost of completing the risk mitigation study, the pipeline routing study, and the OPEX costs incurred by NGT to support the completion of these studies.

Appendix

Appendix 1: [redacted]



Appendix 2: [redacted]



[redacted]

Appendix 3: [redacted]

[redacted]

Appendix 4: [redacted]

[redacted]

Appendix 5: National Gas OPEX Costs Calculation