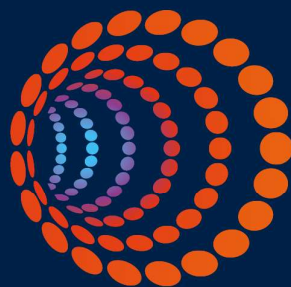


# 3<sup>rd</sup> Round Climate Change Adaptation Report

December 2021



**SGN**

Your gas. Our network.

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## 1. Introduction

SGN is a privately owned Gas Distribution company, operating over 70,000km of gas mains and services in the south and South East regions of England and the whole of Scotland under the banner of SGN. It is the UK's second largest Gas Distribution network (GDN) company and is responsible for delivering gas to its 5.9 million customers safely, reliably, and efficiently.

Our Scotland network distributes gas across all of Scotland to 75% of households, including remote areas through the Scottish Independent Undertakings (SIUs) at Stornoway, Wick, Thurso, Oban and Campbeltown.

Our Southern network stretches from Milton Keynes in the north, to Dover in the east and Lyme Regis in the west, including London boroughs to the south of the River Thames, distributing gas to around 90% of households.

### 1.2 Energy Networks Association

Energy Networks Association (ENA) is the trade association for the energy networks. Its members own and operate the infrastructure which carries electricity and gas into your community, supporting our economy.

SGN has contributed to the collaborative 3<sup>rd</sup> Round Climate Change Adaptation Report by the ENA's Adaptation to Climate Change Task Group<sup>1</sup>. The ENA report provides an update on existing risks, mitigation measures and programmes, as well as looking to identify new risks being realised in order to provide a fuller picture of the potential for climate change impacts to affect networks. More importantly the ENA report consolidates Gas and Electricity network reports to provide an Energy Networks response.

The ENA report was prepared by a task group of gas and electricity distribution and transmission network operator members of ENA and is intended to provide a response to climate change adaptation on behalf of the Energy Networks. It continues the progress made since the second round of reporting and should be read in conjunction with the 2<sup>nd</sup> round reports.

## 2. SGN Adaptation Reporting

### 2.1 Adaptation first round report

SGN has been designated as a 'reporting authority' under the Climate Change Act 2008 and was as such directed to submit a climate change adaptation report in 2011 as part of the Adaptation Reporting Power Round 1 (ARP1). The report included:

- an assessment of the current and predicted impacts of climate change in relation to our functions; and
- a statement of our proposals and policies for adapting to climate change.

Our report detailed the assessment to identify the risks and opportunities posed by climate change, and how we had responded to the identified risks by installing the foundations to integrate climate change adaptation into our organisation.

Climate change risks were identified and appraised at three time intervals: current (i.e. 2011), 2020 and 2050. The UKCP09 climate data was used as the primary source of information for the assessment, supplemented by information from the MET Office and flood maps provided by the Environment Authority (EA) and Scottish Environment Protection Agency (SEPA). The weather events/environmental consequences considered when undertaking the risk assessment were broadly identified as one or more of the following:

- Flooding (including saturated ground conditions);
- Heavy rain;

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<sup>1</sup> Adaptation to Climate Change Task Group, Gas & Electricity Transmissions and Distribution Network Companies, 3<sup>rd</sup> Round Climate Change Adaptation Report (March 2021)

- Snow and ice;
- Cold snap;
- Heatwave;
- Drought;
- Wildfires;
- Coastal or river erosion;
- Storms (damage and/or lightning strikes); and
- High winds.

The findings of the risk assessment in ARP1 identified that as the majority of the gas distribution network is located underground, it is inherently resilient to many of the proposed impacts of climate change and designed to function generally unimpaired during adverse weather. Our assets most at risk are those found above-ground, typically large Pressure Reducing Installations (PRIs), critical sites such as IT Data and Gas Control centres and pipelines at river crossings. In addition, prolonged periods of extreme weather could have a significant impact upon our workforce, particularly our field-based engineers, and impinge upon our ability to conduct 'business as usual'.

In response to the identified risks, the SGN ARP1 report described our approach to imbedding climate change adaptation into our organisation, including making provisions for regular review and evaluation to ensure we followed the appropriate course of action. This process entailed:

- assigning business owners to risks
- developing action plans to address the impacts of climate change
- incorporating adaptation requirements into our policies and procedures, and where necessary, developing new procedures to address climate change impacts
- undertaking periodic reviews of our current understanding of the relationship between climate variables and identified risks
- periodically reviewing climate data provided by UKCIP, EA, SEPA, and other sources, and incorporating new information into risk assessments, action plans and work procedures

## 2.2 Adaptation second round report

SGN submitted a Combined Climate Change Adaptation Reporting, which was a joint second round response with the other gas distribution networks and National Grid<sup>2</sup> in response the Adaptation Reporting Power Round 2 (ARP2) under the Climate Change Act.

The ARP2 report concluded here had been no significant change in the understanding of climate change risks since the first round of Adaptation Reports were submitted in 2010/11. This understanding was based on the UKCP09 data published under the Climate Impacts Programme (UKCIP) that forecast the risks under various scenarios to the end of this century.

Similarly, Environment Agency flood maps that were available and referenced at the time had not been developed any further and so the perceived risk remained the same. However, all the gas networks operators (GDNs) had experienced severe weather events in last few years which have provided ongoing learning and further insight into, and confidence in, the resilience of the gas networks infrastructure.

Further the ARP2 report concluded that long term asset assurance is an essential component of the long-term business strategies of the gas network companies. The adaptation reporting and monitoring process has not only provided confidence in the existing framework and plans but has also contributed to building adaptive capacity as part of a wider framework of business as usual processes. Existing controls were in place for most of the identified risks, but there has been an increased awareness in other areas such as ground movement and riverbank erosion.

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<sup>2</sup> ENA Gas Environment Group, Combined Climate Change Adaptation Reporting, Joint Second Round Response (2015)



## 2.3 Adaptation third round report introduction

This assessment report has been developed in the response to the Climate Change Act (2008) and forms the 3<sup>rd</sup> round of Climate Change Adaptation Reporting (ARP).

## 3. Climate Change Adaptation Risks

In considering adaptation to climate change, we, like the other gas and electricity network companies, use the Met Office UK Climate Projection (UKCP18) tool, and take into account projections to the end of this century as much of the network infrastructure generally has an operational life expectancy of 30-80 years.

The Met Office study based on projections using General Circulation Models and the latest UK Climate projections (UKCP18), indicated:


- Many of the hazards identified are projected to increase due to future climate change, including:
  - the frequency of high temperature days
  - prolonged rainfall events and hourly rainfall extremes
  - sea-level rise
  - risk of wildfire
  - extreme diurnal cycle events.
- The frequency of snow and ice days are expected to decrease.
- Solar storms are not affected by increased greenhouse gases.
- Hazards for which there is not currently strong evidence for a change in frequency include strong wind events, high wave heights, wetter conditions coincident with warmer temperatures and/or strong winds, lightning and to some extent, diurnal temperature cycles.
- Increased risk to interconnected industry sectors resulting in increased risk to our operations, for example, telecommunications and road transport. Telecommunications are already important for automated and remotely controlled equipment, and for communication with personnel in the field. Risk from telecommunications failure has the potential to increase in the future with greater reliance on smart systems (dependent on telecommunications). Road transport is often essential for restoration of supply and access to assets for routine maintenance.
- Societal responses to climate change may also increase the risk on the road network from the electricity network, as electric vehicles become more commonplace.

## 4. Met Office Research

In spring/summer 2020, on behalf of its members, ENA commissioned the Met Office to undertake a review of the UKCP18 data and existing studies in order to understand the changes in potential impact to energy infrastructure assets from climate change. The report from this research has been used to assess the current risks to the energy network, and to guide future mitigation or management actions.

Key weather and climate hazards identified by the ENA and the GDNs shaped the scope of the Met Office study, and included the following:

- Quantitative analysis of the hazards associated with the main projected changes in climate, including:
  - prolonged rainfall leading to flooding
  - extreme high temperatures
  - heavy rainfall/ drought cycles.
- Tailored climate analysis for intense short-duration rainfall and strong winds.
- Qualitative literature review for low priority risks associated with:
  - sea level rise
  - warm and wetter conditions, followed by heavy rainfall and/or wind

- 
- storm surge and wave height
  - warmer and wetter conditions – longer growing/nesting seasons
  - snow and ice
  - wildfire
  - lightning
  - solar storm
  - diurnal temperature cycles.

The Met Office assessment concluded:

- Many of the hazards identified are projected to increase due to future climate change, including, increased frequency of high temperature days, prolonged rainfall events, hourly rainfall extremes, sea-level rise, extreme sea level events, increased risk of wildfire and increased extreme diurnal cycle events.
- The frequency of snow and ice days are expected to decrease.
- With regards to societal response to climate change, the assessment considered that impacts of the weather hazards on the energy network are likely to come in the form of an altered dependency between weather and both supply and demand, impacting forecast accuracy. And this turn, is expected to increase the impact of the hazards on the sector.

Interconnections between different industry sectors was considered a major source of risk for the energy network, with failures from one sector frequently causing impacts. For example, telecommunications. Telecommunications are already important for automated and remotely controlled equipment, and for communication with personnel in the field. Risk from telecommunications has the potential to increase in the future with greater reliance on smart systems (dependent on telecommunications).

### **Extreme high temperatures**

Figure 1 sourced from the Met Office report shows trends that the climate in the UK is warming. The average hottest day of the year, in the most recent available decade within UKCP18 (2008 - 2017), has been on average 0.1 °C warmer than the 1981 - 2010 average and 0.8 °C warmer than the 1961 - 1990 average hottest day of 26 °C.

The figure also shows a significant temperature gradient across the UK, with northern mountainous regions experiencing maximum summer temperatures over 7 °C cooler than southern and eastern regions.

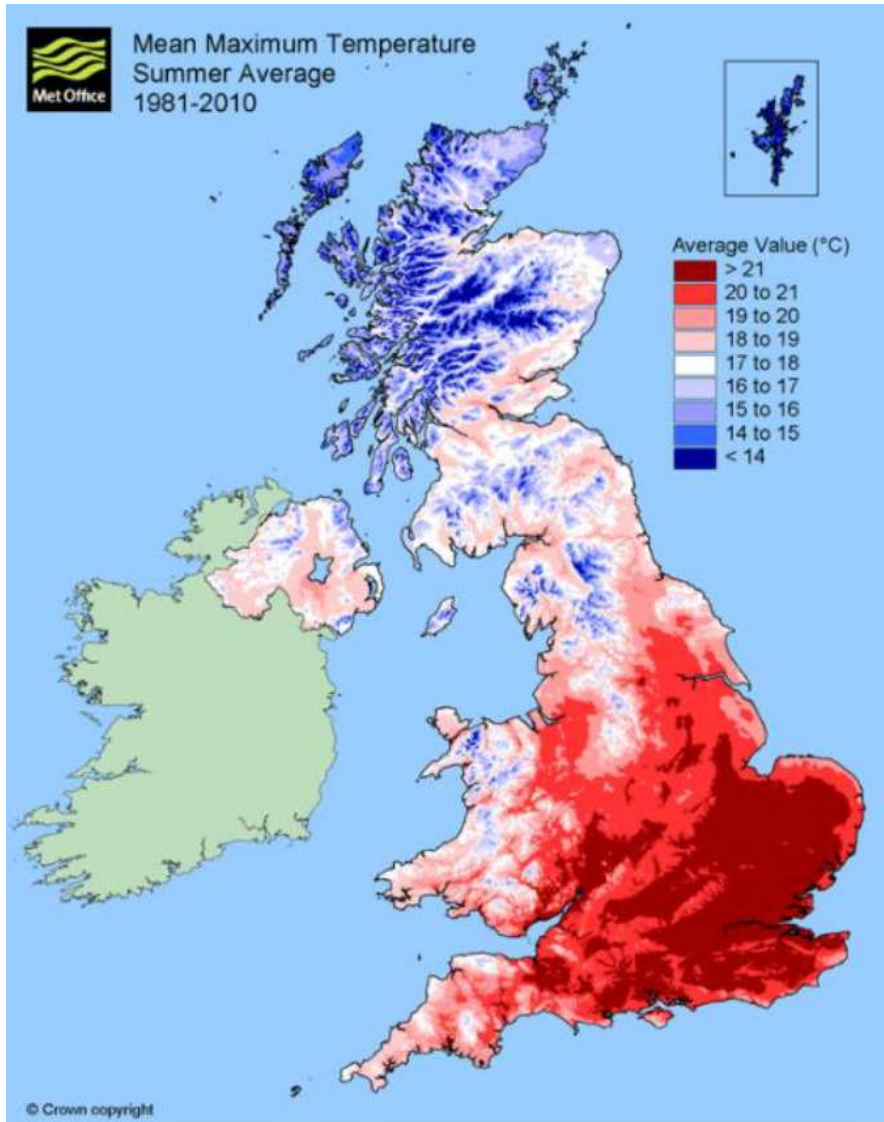


Figure 1: Mean Maximum Daily Summer Temperature in the UK 1981 to 2010 (source: Met Office 2021)

### Rainfall leading to flooding and/or erosion

The study showed that there is significant variation in the amount of rainfall occurring throughout the UK with the driest areas in the SE of the UK and wettest areas in the west and the highlands of the UK. This suggests that our assets at greatest risk are those located in clay soils in the driest areas of the UK such as London and the SE.

The climate data indicates that in the west of England and much of Scotland and Wales more prolonged rainfall will result in the thresholds being exceeded more frequently, and that these precipitation events are expected to be focused in the autumn and winter months. This is of relevance to our network in Scotland.

Further, the data projections suggest significant increases in hourly precipitation extremes in the future. Whilst in the summer the frequency of wet days may decrease, when it does rain average rainfall intensity is greater. This in turn will impact on the frequency and severity of surface water flooding and is considered to represent an 'emerging risk' for us.



## Sea-level rise and extreme sea level events

The data shows that sea level continues to rise with projections indicating up to 1 m increase by 2100. This is also likely to be coupled with increased frequency and/or intensity of storm surges. This is expected to have a direct impact on our assets located close to the coastline, for example, the northeast coast of Scotland and coastal areas along the south coast of England.

## Increased risk of wildfire

Projections of hotter, drier summers as well as increases in summer hot spells suggest fire risk in the UK will increase in future. This is of particular relevance where our assets are located in close proximity to moorland and in areas predicted to have the warming future climates, such as the south east coast of England.

# 5. Risk Assessment

## 5.1 ENA Collaborative Work

An assessment of climate risks to the gas networks was done collectively with the GDNs and is summarised in figure 2.

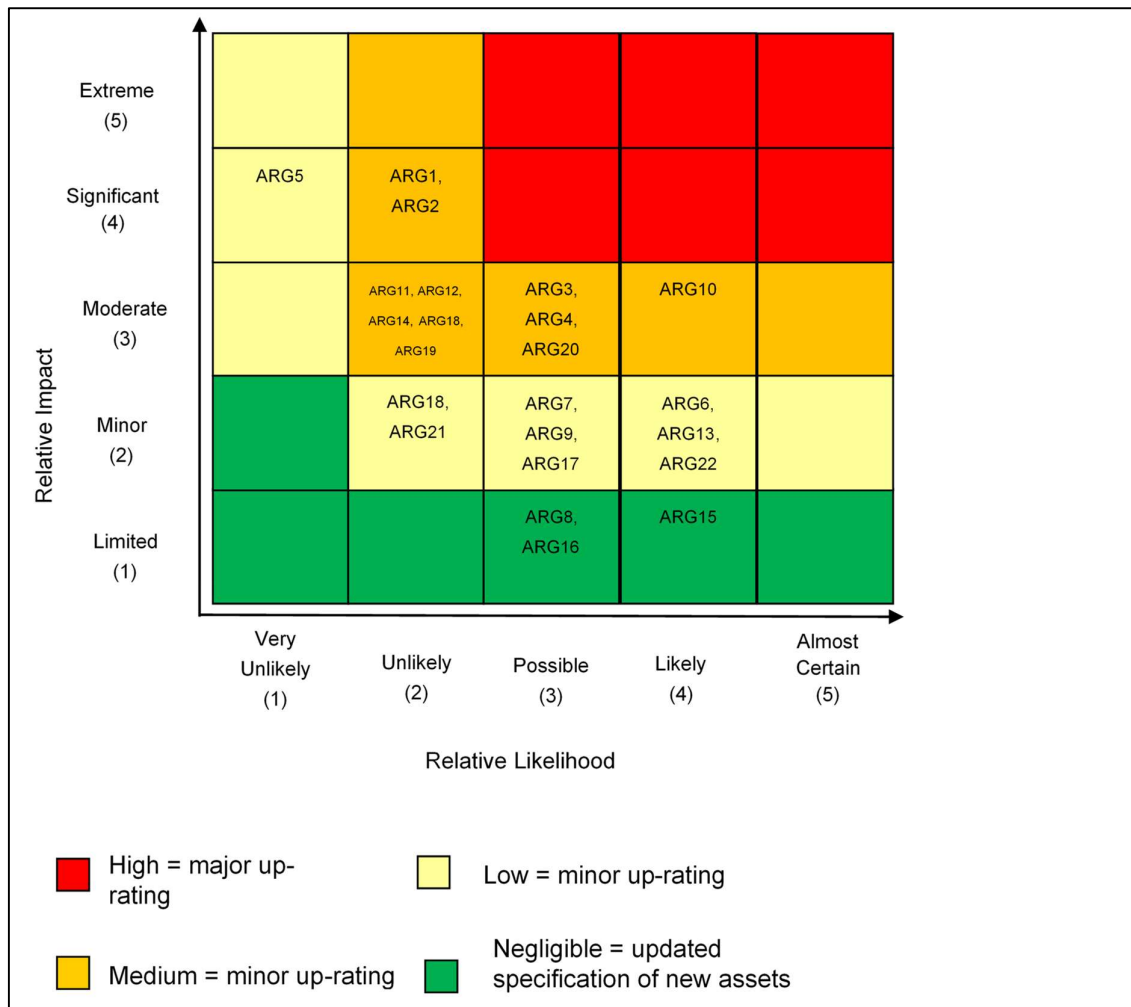


Figure 2: Risk Matrix (source: ENA 2021)

The matrix used to score the risks are included in Appendix A.



## 6. SGN Risk Mitigation and Management

At SGN we seek to mitigate climate change and we support the UK and Scottish Governments targets to achieve net zero by 2050 and 2045, respectively. We also consider that climate change is already happening across both of our networks and there is a risk of failing to assess and manage changes as a result of more extreme weather events, zero carbon legislation and policy changes and technological change. Therefore, we have adopted 'Environment and climate adaptation' as one out of 12 strategic risks within the SGN risk management framework. Strategic oversight of this risk is provided by our Stakeholder, Environment and Customer sub-board Committee.

At regular intervals throughout the year the SGN Risk Committee meets. The purpose of the Committee is to provide visible leadership, to make sure that enterprise risk is understood, assessed and controlled and to embed Enterprise Risk Management through the organisation. The Risk Committee is responsible for:

- reviewing the company's operational risks, controls and current issues to ensure that risk dashboards are suitable and sufficient and provide appropriate updates to the Executive Committee;
- providing effective governance as part of the SGN risk management structure;
- identifying and reviewing internal and external events and analyse the impact on the company and operational risks and control environments;
- identifying, reviewing and agreeing action plans to mitigate risks so far as is reasonable practicable and to monitor their implementation;
- ensuring that the risks inherent in proposed business activities are adequately understood and managed;
- that the organisation operates in accordance with the company's risk management process, policy and procedures;
- maintaining a close relationship with the Executive and to make recommendations for appropriate changes to enterprise risk systems and assessments; and
- requesting group audit and review internal and external audit report findings, actions, recommendations and observations.

### 6.1 SGN Risk Register

Climate risks could adversely affect our business operations because of ineffective adaptation and mitigation management leading to direct physical impacts and damage to our assets, financial impacts with costly remedial actions and reputational impacts including losing our social license to operate. Climate adaptation risks are particularly featured in our Network & Safety risk register. The risk register details in total 43 potential risks pertaining to asset management and physical security, health & safety and environment & climate change. It includes consideration of first line control framework, internal monitoring and assurance activities to manage the inherent risk and deliver a residual risk. A risk matrix made up of likelihood of risk and impact of risk is used to determine a risk scoring.

### 6.2 Lessons Learned from the COVID Pandemic

Adapting to Covid also showed us a different working model that could be adopted in the event of severe climate change disruptions to travel, working from office or depot locations etc. Here we share our lessons learned from the early days of the pandemic.

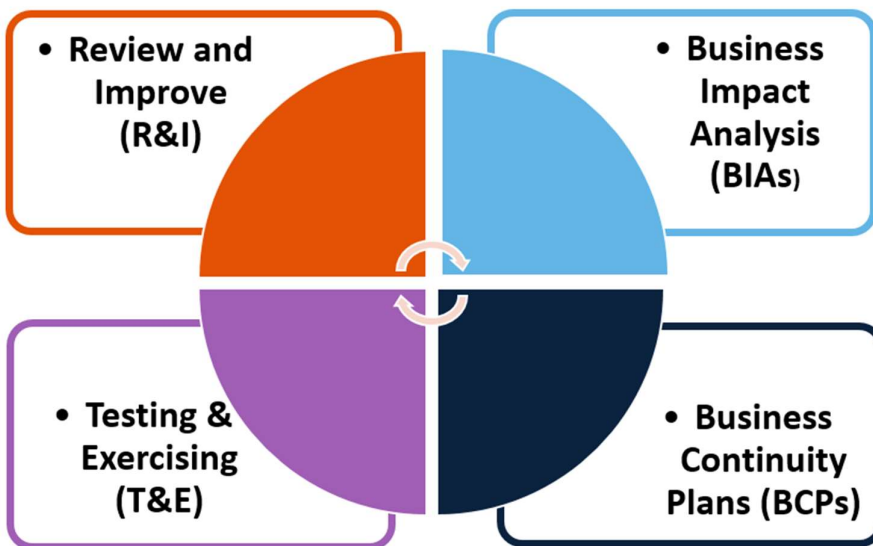
SGN began preparations for responding to the threat of COVID-19 in January 2020, with a working group which met virtually and collated strategic priorities – those services we would prioritise for protection and those that we could postpone or suspend in order to bolster our resilience. As part of these preparations, we began widespread trials of home working which required the procurement of additional IT equipment and training our employees on how to use it. Some of these trials coincided with the government lockdown announcement and some of those employees have only recently moved to a hybrid model due to the success and uptake of remote working. The adoption of MS Teams has replaced many other separate systems and has provided a

collaborative platform for sharing information and co-working across geographical boundaries and reducing the frequency and cost of business travel.

Our core business operations continued throughout the pandemic, with the co-ordination and management of these activities conducted mostly remotely. Some of our activities which we had previously thought could not be interrupted suffered many months of forced disruption. Whilst COVID presented exceptional circumstances that allowed for extraordinary procedures and arrangements to be implemented and exceptions granted, we as a business are not only more resilient but more mindful of the powerful potential of high impact risks as a direct result.

### 6.3 Business Continuity Management

Business Continuity is a collaborative process that involves everyone working together to make sure we can withstand disruption and recover from it quickly. It Business Continuity helps us to identify our critical functions and potential disruptions to these functions. In 2020/21 we created, revised, reviewed and uploaded business continuity plans into Clearview, our continuity software tool. To make sure our BCM plans are as robust as they can be, we test plans and exercise people at least once per year. The business adheres to a BCM Policy & Framework and follows the annual business continuity lifecycle:



In relation to climate adaptation risk, our business continuity management system deals with loss of locality (e.g. an office or a depot) due to extreme weather events and flooding as well as severe travel difficulties which would also impact our operatives when required to travel to site.

### 6.4 Taskforce for Climate Related Financial Disclosures

Taskforce for climate related financial disclosures, or TCFD, was created in 2015 by the Financial Stability Board (FSB) to develop consistent climate-related financial risk disclosures for use by companies, banks, and investors in providing information to stakeholders. The TCFD sets recommendations for climate-related financial disclosures that are consistent, comparable and reliable. These provide decision-useful information to lenders, insurers, and investors.

The TCFD disclosures are focused around four areas:

- Governance
- Strategy

- Risk management
- Metrics and targets.

The UK Government has decided that TCFD should become mandatory and for SGN this means that new disclosure requirements will come into effect in our accounts for the year end 31 March 2024. As a result, we have started to review disclosure requirements and performing a gap analysis to ensure we are ready to comply. SGN has also decided to follow the World Economic Forum framework on ESG (Environment, Social and Governance). This framework, “Measuring stakeholder capitalism”<sup>3</sup>, also includes reference to TCFD.

## 6.4 SGN Approach to Risk Assessment

As stated above (6.1) our risk registers uses a matrix of likelihood and impact to determine an overall risk score. The matrices are included in table 1 and 2 below.

Table 1 – Likelihood

Definition	Explanation	Probability	Score	Parameters
<b>Almost Certain</b>	Event is expected to occur in most circumstances	>90%	5	Has occurred over 10 times in the past 5 years in this organisation, or circumstances are in motion that will almost certainly cause it to happen.
<b>Likely</b>	Event will probably occur in most circumstances	50-90%	4	Occurred more than 5 times over the last 5 years in this organisation, or in similar organisations, or circumstances are such that it is likely to happen in the next few years.
<b>Possible</b>	Event should occur at some time	30-50%	3	Has occurred in this organisation more than 3 times in the past 5 years, or occurs regularly in similar organisations, or is considered to have reasonable likelihood of occurring in the next few years.
<b>Unlikely</b>	Event could occur at some time	10-30%	2	Has occurred 2/3 times over the last 5 years in this organisation, or in similar organisations.
<b>Rare</b>	Event may occur only in exceptional circumstances	<10%	1	Has occurred, or can reasonably be considered to occur, only once or twice in 100 years.

Table 2 – Impact

<sup>3</sup> Measuring stakeholder capitalism, World Economic Forum, 22 December 2020: <https://www.weforum.org/reports/measuring-stakeholder-capitalism-towards-common-metrics-and-consistent-reporting-of-sustainable-value-creation>

Category	Insignificant	Minor	Moderate	Major	Critical
Capability (over 5 years or 20 years if risk is a long term strategy risk) (physical security, IT, people, information and fraud)	Minor skills impact. Minimal impact on non-core operations. The impact can be dealt with by routine operations.	Some impact on organisation in terms of: delays; systems; quality, but able to be dealt with at operational level.	Impact on the operations resulting in reduced performance such that targets are not met. Overall operations are not threatened, but could be subject to significant review	Breakdown of key activities leading to reduction in performance (e.g. service delays, loss of sensitive information, legislative breaches). An event which, with proper management, can be endured.	Protracted unavailability of critical skills / people / assets / systems. Critical failure preventing core activities from being performed. Survival of the project / activity / organisation is threatened.
Financial (impact over 1 year)	<£5m	£5m or <£15m	£15m or <£50m	£50M or <£100M	£100m or over
Environment	Non-reportable environmental incident with no impact on the surrounding environment, immediate resolution.	Non-reportable environmental incident effecting the local environment, resolution within 48 hours.	Reportable environmental incident resulting from breach of consents/permits, enforcement action possible.	Reportable environmental incident, effects on the surrounding environment last for weeks, enforcement action likely.	Reportable environmental incident, effects on the surrounding environment last for months or years, enforcement action certain.
Safety (people, security of supply and assets)	Little or no impact on people or assets. Immediate resolution possible. HSE interest.	Minor injury or damage to asset leading to shut down of installation. No HSE fine or information requested by HSE.	RIDDOR reportable injury or damage to asset leading to shut down of installation. HSE fine and no Enforcement Action.	Multiple serious injury, single loss of life, occupancy damage or Major asset damage. Security of Supply category B or C. Fine and HSE Enforcement Action.	Multiple loss of life or multiple occupancy damage or total loss of asset. Security of Supply category A1 or A2. Heavy fine & Enforcement Action.
Reputation (Brand)	Local incident, or public statement with no financial loss and inconvenience. Self-improvement required.	Incident, or public statement, that leads to local media and stakeholder interest. Short-term local media concern.	Incident, or public statement, that leads to wider & prolonged media coverage and stakeholder interest & scrutiny by external agencies.	Major inc or public statement, leads to serious injuries/ environment inc or asset failure leading to extensive media coverage. Brand impact.	Fatality or multiple fatalities due to alleged company negligence or poor practice/procedures. Direct blame to SGN and leading to extreme media coverage. Critical damage to Brand.
Regulatory (Ofgem, HSE)	Minor breaches by individual staff members. Remains within the Regulatory Department.	No fine. Investigation instigated or information requested by Ofgem.	Fine and no Enforcement Action due to breach of licence condition, but organisation not threatened.	Heavy fine; Ofgem licence breaches; enforcement action. Major disruption to normal business and significant review by Ofgem.	Heavy fine and enforcement action. Critical failure to meet licence conditions. Survival of the organisation is threatened.
<b>Score</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

Based on the residual risk a scoring is determined, calculated as likelihood times impact.

Our risk scoring is shown in table 1:

<b>Likelihood</b>	Almost Certain 5	5	10	15	20	25
	Likely 4	4	8	12	16	20
	Possible 3	3	6	9	12	15
	Unlikely 2	2	4	6	8	10
	Rare 1	1	2	3	4	5
		Insignificant 1	Minor 2	Moderate 3	Major 4	Critical 5
		<b>Impact</b>				

Table 1: SGN risk scoring matrix

#### 6.4.1 Gap analysis

The collaborative work under with the GDNs and ENA identified 22 potential climate change hazards that may impact SGN operations. These risks are labelled ARG1 to ARG22 and described in the table below.

Following on from the collaborative work through ENA we recognise the need for a more thorough review of climate adaptation risks to our business. We have therefore started an internal review on how ARG1 – ARG22 could impact SGN with a view to make necessary adjustments in our business risk registers and / or other procedures.

Below we share the initial gap analysis which is the result of this review. It also includes actions and consideration which we commit to take into account to improve our internal risk register.

ARP3 Risk, Code and (Score)	Climate Variable	ARP3 Risk description	SGN Risk Code (Score)	GAP Analysis and actions
Lack of climate change management procedure ARG1 (8)	All	Climate change management procedures and actions should be integrated into the organisation's environmental management system (EMS). This ensures a greater understanding of the potential impact of climate change and improves the overall environmental culture within the business.	Network & Safety Risk no. 41 Impact 4, Likelihood 2 (8)	Our EMS aspects register acknowledges climate change risks. We have a procedure in the EMS with a focus on Climate Change. Our risk register considers lack of procedures and tools.  Actions: None
Lack of specific policies and procedures governing risk assessment process on climate change ARG2 (8)	All	Robust climate risk assessment process is required for major investment decisions to ensure climate change is considered at the planning stage prior to the installation of new/replacement gas infrastructure.	Network & Safety Risk no. 41 Impact 4, Likelihood 2 (8)	Our risk register considers lack of procedures and tools. Our template for investment decisions includes environmental considerations. We are in the process of implementing the TCFD (Taskforce for Climate Related Financial Disclosure) framework and this will ensure additional processes as required.  Actions: Continue to implement TCFD reporting.
Risk and action owners not identified at senior leadership team level ARG3 (9)	All	Climate risks need to be afforded the same status as other risks to assets including security, safety, and other environmental impacts, and accountability is required at senior management level with responsibilities included within existing business risk processes	n/a	'Environment and climate adaptation' is one of 12 strategic risks in SGN. Strategic oversight of this risk is provided by our Stakeholder, Environment and Customer sub-board Committee. The risk owner is our Network & Safety Director.  Actions: None
Flood risk of above ground assets (governors and pressure reducing equipment) ARG4 (9)	Precipitation	Risk of physical damage to assets located within flood plains or to assets from extreme and extended rainfall. Ancillary instrumentation and communication equipment being the most vulnerable, given governors and pressure reducing equipment are resilient and capable of operating when submerged in water	Network & Safety Risk no. 4 Impact 4, Likelihood 3 (12)	This is included in our risk registers. We have also carried out analysis that show breakdown of our assets in different flood zones, using EA and SEPA flood mapping and shape files.  Actions: None

ARP3 Risk, Code and (Score)	Climate Variable	ARP3 Risk description	SGN Risk Code (Score)	GAP Analysis and actions
Flood risk of above ground assets (governors and pressure reducing equipment) from catastrophic dam failure  ARG5 (4)	Precipitation	Extreme precipitation can lead to dam overload and failure, posing a risk to assets located in the vicinity of the dam (plant and equipment would not only be impacted by water ingress but are likely to be physically damaged or washed away by the force of water).	n/a	We have analysed the length of mains pipelines, number of district governors, TRS's (transmission reductions stations) and Pressure Reduction Stations within flood reservoirs. This is used to acquire a greater understanding if and where we would have any assets at particular high risk, and the maps and shape files are a useful tool when any upgrades or other works are being planned.  Actions: None
Above ground assets affected by raised temperatures  ARG6 (8)	Temperature	Gas network assets are manufactured to international standards and designed to operate within particular temperature parameters. Increasing temperature impacts all plant and equipment and increases could affect rating and asset performance. Any impacts are therefore not expected to be severe. IT equipment and instrumentation may need additional protection.	n/a	We do not consider this as a general mechanical issue. In the past we have put air conditioning units in to manage temperatures and will continue to do so if required.  Actions: None
Damage to above ground assets from storm events  ARG7 (6)	Wind	Damage to above ground assets from storm events are subject to damage from extreme storms and high winds, and therefore any increase in the frequency and severity of these events will mean a higher risk of infrastructure damage and failure, with communication equipment being the most vulnerable assets.	n/a	We have existing procedures dealing with Site husbandry on sites. In addition, when we are experiencing extreme weather events, we hold back work as required to ensure the safety of our people. For our occupied sites we are acquiring appropriate software to highlight sites/ areas at risk of climate change impacts so that we can plan capital investment to mitigate such risks, be that from storm, flooding or other climate variables.  Actions: No additional actions
Extreme weather impacts from lightning  ARG8 (3)	Temperature	Lightning strikes could cause physical damage leading to operational failure, loss of telecommunications equipment, and be a fire risk to gas venting stacks	n/a	We are actively working on this and ensuring we have sufficient lightning protection system. We are also carrying out Risk Assessments for new sites which takes this into consideration.  Actions: No additional actions





ARP3 Risk, Code and (Score)	Climate Variable	ARP3 Risk description	SGN Risk Code (Score)	GAP Analysis and actions
Asset impact from snow/ice falls and accumulation ARG9 (6)	Precipitation	While the risk to above ground assets is expected to gradually decrease due to less frequent snow events, there's potential for physical damage from excessive snow or ice falls, for example increased loading on building roofs	n/a	We do not consider this a big issue for our network assets, there is no or little risk to damage because of snow/ ice falls. It is much more of an issue from an accessing sites perspective and as such dealt with in relevant BCM Plans.  Actions: None
Risk to underground pipelines from river erosion ARG10 (12)	Precipitation	Pipelines can be exposed and are then susceptible to physical damage (scouring and erosion of pipeline coatings). More frequent flooding and increased river and watercourse flows will increase this level of risk.	Network & Safety Risk 4 Impact 4, Likelihood 3 (12)	This risk is included in our existing risk register. Please also refer to the case study on River Tay in section 6.5  Actions: None
Ground contamination and transport of materials from flooding of contaminated sites ARG11 (6)	Precipitation	Flooding of contaminated sites may lead to faster and greater transportation of materials in groundwater (especially relevant to sites located within floodplains). This can lead to increased inspection and remediation costs to mitigate any damage. There is also a risk of resulting regulatory and enforcement action.	Network & Safety Risk 43 Impact 4, Likelihood 2 (8)	This risk is included in our exiting risk register.  Actions: None
Ground movement due to drought conditions and dry ground ARG12 (6)	Temperature	Ground movement caused by drying and shrinkage will exert tensile forces on underground assets, especially to more vulnerable joints and connections, with cast iron mains presenting the highest risk. This could lead to mechanical damage and the potential fracture of pipelines leading to a serious risk of gas release or explosion.	n/a	The gas mains replacement programme and growth in PE pipe installation are reducing risks from ground movement arising from drought conditions.  Actions: None
Vulnerability of critical IT systems managed by third parties from extreme weather events ARG13 (8)	Temperature & precipitation	This represents an interdependency with other service providers, and there is a risk of the loss of critical IT systems and functionality. Any loss of capacity could lead to the need for manual intervention and reduced network control	IT Risk 6 Impact 3, Likelihood 3 (9) IT Risk 3 Impact 3, Likelihood 3 (9)	Climate change/ extreme weather events are included in our IT risk registers, referencing IT supply chain and IT resilience.

ARP3 Risk, Code and (Score)	Climate Variable	ARP3 Risk description	SGN Risk Code (Score)	GAP Analysis and actions
Asset damage if no wildfire risk assessment or remediation measures ARG14 (6)	Wildfire	Wildfire is a consequential risk of increased temperatures and reduced precipitation and, whilst difficult to forecast, pose a significant risk to above ground assets where they are located in susceptible areas. These include open heathland, grassland or forested areas and may be in remote locations. The risk of underground pipeline damage is increased in the absence of vegetation clearance within 3m of site boundaries.	n/a	Around all above ground installations there are hard surfaced areas and sites are being managed from a vegetation perspective. Currently the risk of wildfires to our assets are not specifically considered in our risk registers and there is a question what we could do to mitigate. This could be discussed with peers in the industry.  Actions: To bring up for discussion at the ENA Climate Change Resilience Group
Vegetation growth ARG15 (4)	Temperature & precipitation	Increases in both temperature and precipitation will lead to increased vegetation growth. Above ground assets will be impacted by any increased growth of trees adjacent to operational equipment. This will lead to increased levels of maintenance and reduced access issues. Similar issues may be encountered with the accelerated growth of plants or invasive species.	n/a	We have existing procedures around site husbandry to deal with vegetation.  Actions: None
Wildlife impacts ARG16 (3)	All	The effects of climate change could lead to impacts on wildlife due to changes in environments, habitats, and behaviours. This could lead to restricted access to assets from changed nesting habits, prolonged nesting seasons, changes to species migration, subsidence from digging etc	43 Impact 4, Likelihood 2 (8)	This is considered in our risk register. We also have procedures and provide guidance to deal with nesting birds and similar wildlife impacts.  Actions: None
Supply chain impacts ARG17 (6)	All	Risk to supply chain provision for both equipment and services in the event of extreme weather events. The adoption of new technology and equipment will assist in the ability of the workforce to work remotely and continue to manage network assets.	n/a	With regards to services from our supply chain, this is considered as part of our Business Continuity Management Plans. We recognise there is a risk of supply chain impacts due to climate change (and we have experienced such impacts recently with delays to deliveries due to the catastrophic floods in Germany this summer) and have yet to develop an adaptation response.



ARP3 Risk, Code and (Score)	Climate Variable	ARP3 Risk description	SGN Risk Code (Score)	GAP Analysis and actions
BCM plans affected due to severe travel difficulties resulting from extreme weather events ARG18 (4)	Precipitation	Business Continuity Management plans could be affected due to extreme weather events. There may be an impact on organisational capability and staff resources and the continued operation and maintenance of the networks	n/a	Risk to travel and associated operational difficulties due to weather events are covered in our BCM Plans. The COVID pandemic has tested the arrangements and systems in place which have proven to be effective.  Actions: None
Knock on effect on GDN operations from variable electricity supply due to impact on DNOs ARG19 (6)	All	One of the potential interdependencies within the sector is the knock-on effect on gas network operations from a variable electricity supply. Any initial climate impact on the electricity networks may result in electricity supply interruptions leading to an impact on asset operations and gas supplies to customers	n/a	This risk requires a utility response and collaboration and has as such been noted as an interdependency in this report and the ENA industry adaptation reporting.  Actions: Collaboration with gas and electricity transmission and distribution companies are established through the ENA Climate Change Resilience Group.
Tidal Flooding of above ground assets ARG20 (9)	Sea level rise	Regardless of the source the impact of flooding on above ground assets is the same. There is a risk of physical damage to assets, although governors and pressure reducing equipment are resilient and capable of operating when submerged in water. This will be exacerbated if flood defences are ineffective and/or plant relocation is not possible.	Network & Safety Risk no. 4 Impact 4, Likelihood 3 (12)	The risk of flooding to assets are considered in our risk registers. We have surveyed our assets using Coastal Flood Boundary Datasets from EA and DEFRA, and SEPA flood risk maps for Scotland.  Actions: None
Saline contamination and increased corrosion rate of above and below ground assets from sea water ARG21 (4)	Sea level rise	There is a risk of gradual chemical damage to pipelines from increased tidal flooding, which will affect asset integrity and could lead to water ingress and gas release. Ingress of saline groundwater may also impact the buoyancy of pipes and cause structural issues.	n/a	There is a possibility that our distribution network could be impacted but we have yet to undertake any analysis to quantify this.  Actions: Keep a watching brief on potential issues.



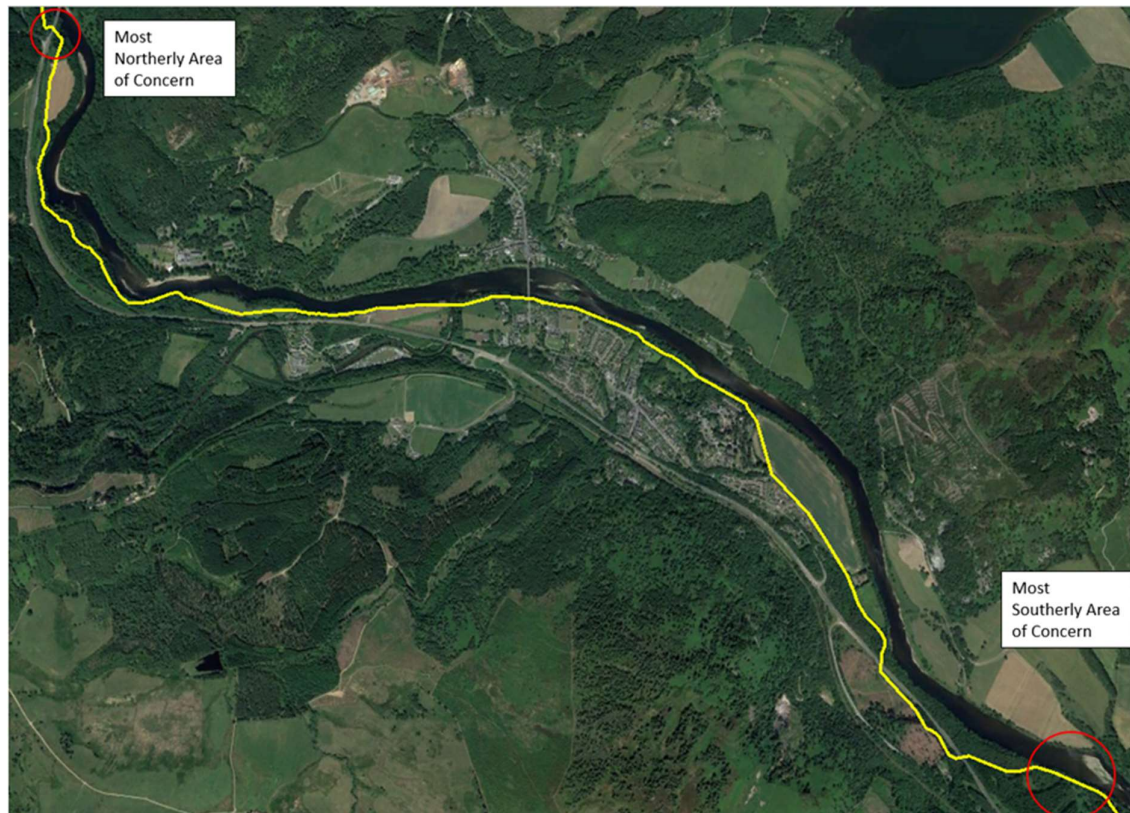
ARP3 Risk, Code and (Score)	Climate Variable	ARP3 Risk description	SGN Risk Code (Score)	GAP Analysis and actions
Ground water flooding of below ground assets leading to water ingress to pipes  ARG22 (8)	Precipitation	Despite the inherent resilience of pipelines, more frequent and prolonged flooding will increase the risk of physical damage and the likelihood of water ingress leading to operational and supply issues.	n/a	We are already experiencing and dealing with the consequences of ground water flooding. Could be an opportunity to discuss with peers in the industry what mitigating actions they might be taking to reduce the impacts.  Action: To bring up for discussion at the ENA Climate Change Resilience Group.

## 6.5 Case Study – Pipeline Replacement near River Tay

This case study of the planned works near River Tay is an example of how we are being proactive when it comes to the assessment of climate risk.

In the current price control (RIIO-GD2) we have successfully secured capital investment for the replacement of the pipeline local to Dunkeld, between Perth and Kinross. The replacement is required to address sections of the pipeline where the River Tay is compromising the pipeline's integrity.

The proposal is to carry out a diversion of the pipeline local to Dunkeld to address ongoing issues with integrity as caused by its proximity to the River Tay. The area of concern can be seen in figure 3 below. The ongoing erosion caused by the river is compromising the lateral and bedding support of the pipeline. This has been worsened by the frequency of flood events that have occurred in recent years.



*Figure 3: Map of the 7.1km of pipeline where there are proximity issues local to Dunkeld. The manner in which the pipeline closely follows the path of the river is apparent.*

Flow rate through the river can fluctuate significantly based on weather conditions, particularly rainfall. This can be observed from figure 4 below. This demonstrates that every year there is at least one event with flowrate over 500 m<sup>3</sup>/s with the worst years recently recording an event with flowrate over 1,500 m<sup>3</sup>/s.



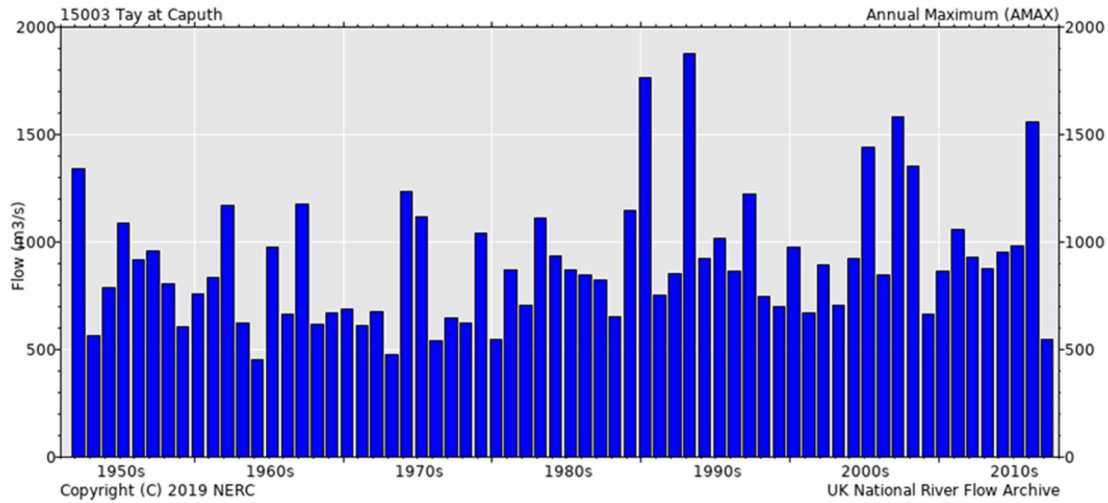


Figure 4: Graph of Peak Flow Rate within each given Water Year.

These high flows cause accelerated erosion of the riverbank and changes the morphology of the river in a way that is often difficult to predict. The continued threat from climate change is affecting the rainfall within the UK. As temperatures rise, evidence indicates that this causes greater extremes in events of high rainfall. Since the Meteorological Office records began in 1910, there have been 17 record-breaking rainfall months or season; nine of these have occurred since the year 2000. As this trend continues, it is fair to say that the probability of rapid erosion events caused by flooding will increase. The increase in risk is significant as water volume and velocity both contribute to the river's energy.

In the winter of 2015/16 there was severe flooding of the banks adjacent to the River Tay. This is visible on figure 4 as the peak above 1,500 m<sup>3</sup>/s on the far right of the graph. A visit was conducted in January 2016 to survey the severity of the flooding. Figure 3 illustrates how high the water level was above the pipeline.

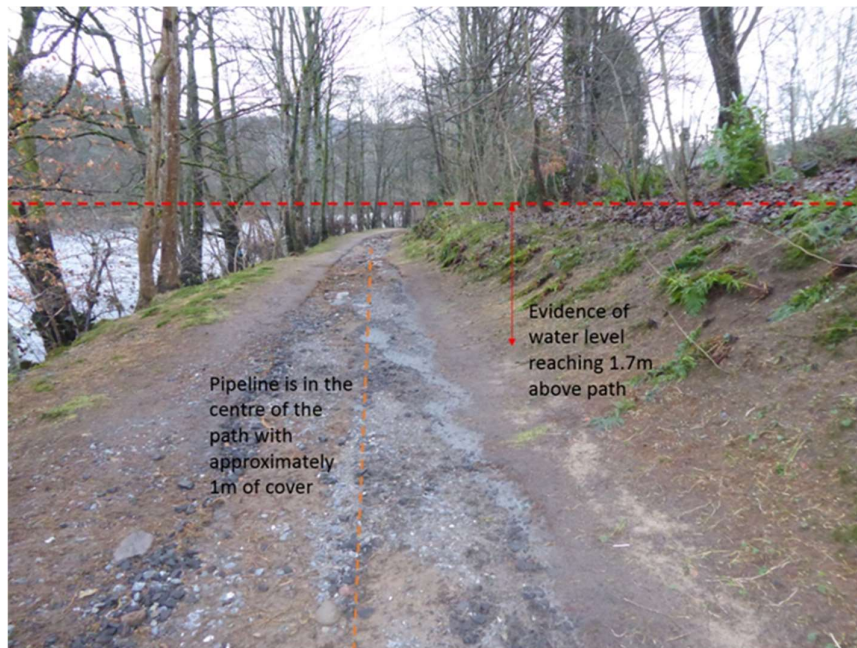
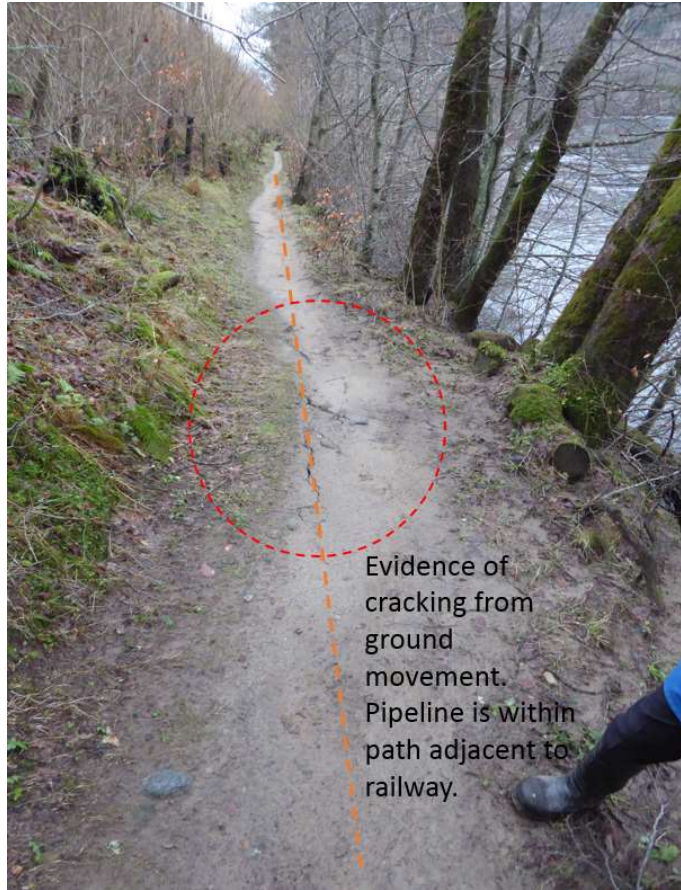


Figure 5: The leaves that have been carried up the bank leave evidence of how high the water level was above the path. The energy discharged into the river bank by these flood events seriously compromise the integrity of the bedding and lateral support of the pipeline.



*Figure6: Pipeline in restricted space between railway and river. Evidence of cracking and ground movement was caused by the flooding.*

Once exposed and without proper bedding and lateral support, the pipeline will experience additional stresses, elevating the risk of buckling and subsequent rupture. In addition, an exposed pipeline is no longer cathodically protected and is therefore subject to far increased corrosion rates following the deterioration of its external coating.

In our investment paper, the following risks are highlighted as consequences should the pipeline fail:

- Gas escape with the risk of having to close nearby key transport routes
- Security of supply and associated impact on vulnerable customers if gas supply was lost
- Safety related consequences.
  - Injury due a dangerous release of stored energy following a pipeline rupture
  - Risk of asphyxiation from a high-volume escape
  - The potential for ignition of the escape and the likelihood of this causing a forest fire.
  - Risk of burns and smoke inhalation from the fire
- Environmental impacts with River Tay being Site of Special Scientific Interest and a Special Area of Conservation. In addition, the specific area at Dunkeld is a 'National Scenic Area' where development is restricted to protect areas in Scotland that have exceptional scenery.
- Reputational risk to SGN.





## 7. Interdependencies

There are clear interdependencies between gas and electricity distribution networks. Examples are highlighted in the ENA ARP 3 report<sup>4</sup>.

The main inter-sectoral dependencies that we consider relevant to SGN can be summarised as follows:

- Knock-on effect of increased electricity demand on the gas supply and demand. For example, increasing temperatures may lead to increasing use of air-conditioning systems, and this in turn will result in increasing electricity demand. Where this is supported by gas fired generation, the resulting drawdown of gas reserves may impact domestic supplies as pressures are reduced to meet demand.
- Effective maintenance and operation of the gas network is high dependent on telecommunications, and with systems becoming “smarter”, the interdependencies are more crucial. Typical climate changes expected to affect telecommunications include strong winds, flooding, high temperatures (causing line sagging), snow and ice, lightning and solar storm. While not all these hazards have direct impacts on the gas distribution network, any outages in telecommunications are expected to disrupt gas supply.  
For example, while Storm Arwen did not directly impact our gas infrastructure, the loss of electricity supply had a knock-on impact on our operations.
- Climate change hazards such as extreme high temperatures (tarmac melting/rails buckling), flooding, strong winds, sea-level rise, storm surge, longer growing seasons, snow and ice are expected to result in road and rail travel disruptions. In turn these disruptions are likely to impact gas distribution through disruptions in maintenance schedules, staff access to sites and gas infrastructure and supply of materials.
- Hazards affecting ports, such as sea-level rise, strong winds and storm surges may lead to disruption and delays in supply of goods and materials that are required to maintain the gas network.

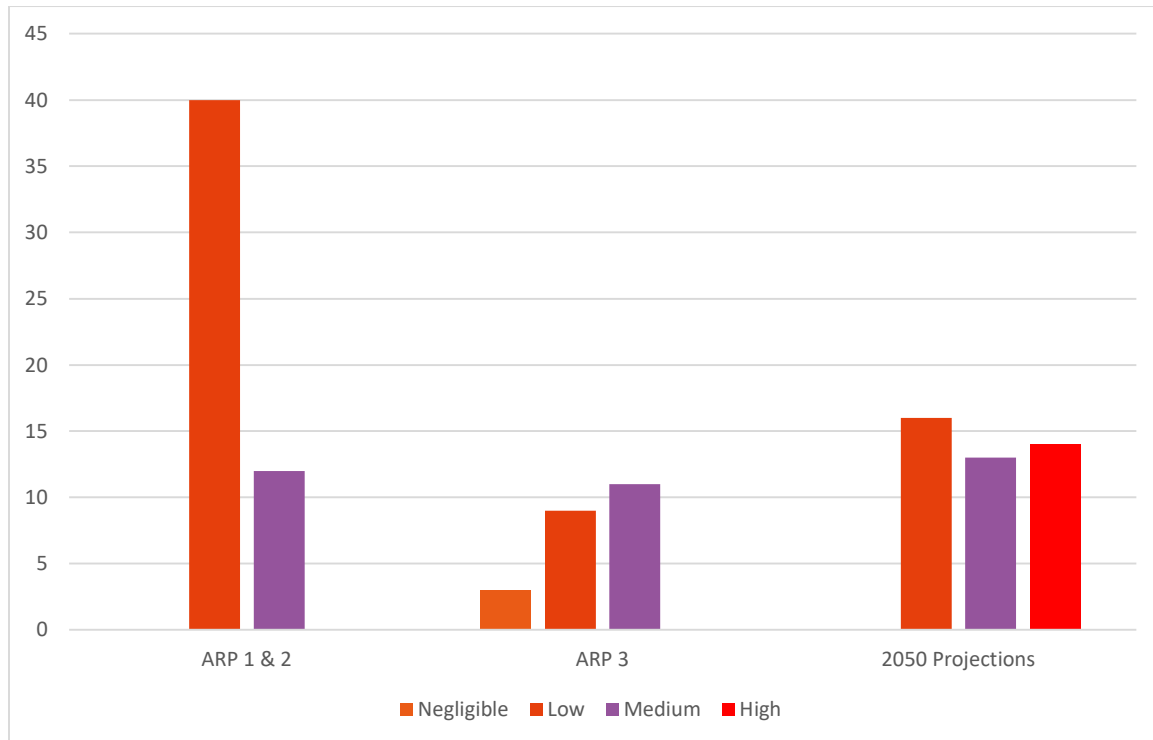
## 8. 2050 Risk Score Narrative

In general, the gas infrastructure has an inherent resilience as the majority of infrastructure is under ground. However, as the Met Office research shows many of the hazards identified are projected to increase due to future climate change, it is also expected that risk scores overall will increase presenting more “severe” and “major” scores and fewer “moderate” or “minor”.

The graph below shows the changes in the number and magnitude of the risks between the reporting periods and projected for 2050.

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<sup>4</sup> ENA, Adaptation to Climate Change Task Group. Gas and Electricity Transmission and Distribution Network Companies. 3rd Round Climate Change Adaptation Report (March 2021).



As the energy sectors moves towards a net zero economy and bearing the UK Government’s target of net zero by 2050 in mind, it is increasingly difficult to assess the climate change adaptation risk as there are too many variables that could affect the magnitude of climate change impacts. It would have very little value to try and quantify any risks further at the moment in time. Business as usual is not an option and we can only speculate what the future of gas infrastructure will look like.

SGN will however continue to monitor the impacts of net zero strategies, review climate change impacts and develop and implement mitigation and management strategies for as long as they are supported by the regulatory mechanism and as they become business as usual activities.


## 9. Conclusions and Actions

Since our joint submission for the Climate Change Adaptation Reporting<sup>5</sup> in 2015 we are continuing to engage in various activities to ensure we keep providing a safe and resilient network to our customers.

- The gap analysis and associated actions as detailed above will be used to improve the internal risk management and risk assessments.
- We have conducted the Met Office research through the ENA climate adaptation group which has informed this report and provided valuable information on the impacts on energy infrastructure. This research is further referenced in section 4.
- SGN has been a member of Climate Ready Clyde<sup>6</sup> since 2018. Since February 2021 we have a colleague on the Board. Through the cross-sector initiative we have taken the lead for utilities adaptation and

<sup>5</sup> ENA Gas Environment Group, Combined Climate Change Adaptation Reporting, Joint Second Round Response (2015)

<sup>6</sup> Climate Ready Clyde is a cross-sector initiative funded by fifteen member organizations and supported by the Scottish Government to create a shared vision, strategy and action plan for an adapting Glasgow City Region.  
<http://climatereadyclde.org.uk/>



am in the process of creating a utilities adaptation working group for Scotland. The aim will be to present the outcomes of the Climate Ready Clyde project, share best practices on climate adaption and create an incident management workshop. Clime Ready Clyde has developed a Climate risk assessment toolkit which we will review with a look to adapt within SGN if suitable.

- We are procuring Landmark mapping<sup>7</sup> which will provide us with environmental data, including but not limited to flood risk and ecology. This will be incorporated with existing GIS systems in SGN initially to map and assess the climate risk for occupational sites and for buildings. However, we will also use this mapping to ensure we maintain a safe and resilient network.
- Our Business continuity management (BCM) plans have been revised across the business in 2020/21. This includes consideration of what to do in the event of loss of workplace, which could for example be made unavailable due to flooding. In 2021 the department specific BCM plans will be tested in real life scenarios.
- We are an active participant in the newly formed ENA group on climate change resilience. This is an example of industry collaboration between electricity and gas transmission and distribution companies which builds on the successful collaboration in producing the ENA ARP3 report. This group will look at adaptation to climate change impacts including sharing of knowledge and good practice.
- The UK Government has announced that disclosures in line with Taskforce for climate related financial disclosures (TCFD) will become mandatory across the economy by 2025. In light of this and as part of adapting a wider Environment, Social and Governance (ESG) framework, we will continue to review and assess our climate related risks to ensure we uphold a safe and resilient network.

## 10. Assumptions

Our approach to this adaptation third round report has reliance on the Met Office research and UKCP18 data, as referenced in section 4, and the collaborative work and discussions held with the ENA's Adaptation to Climate Change Task Group, referenced in section 1.2.

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<sup>7</sup>

## Appendix A - ENA collaborative Risk Matrix

Horizons: 2025, 2050, 2080		Impact				
		Limited (1)	Minor (2)	Moderate (3)	Significant (4)	Extreme (5)
Likelihood	Almost Certain (5)	5 / moderate	10 / major	15 / major	20 / severe	25 / severe
	Likely (4)	4 / moderate	8 / moderate	12 / major	16 / major	20 / severe
	Possible (3)	3 / minor	6 / moderate	9 / moderate	12 / major	15 / major
	Unlikely (2)	2 / minor	4 / moderate	6 / moderate	8 / moderate	10 / major
	Very Unlikely (1)	1 / minor	2 / minor	3 / minor	4 / moderate	5 / moderate

### Impact (Gas)

Rating	Definition
<b>Extreme/Catastrophic</b>	<p>Regional area affected with people off supply or significant asset failure which exceeds ability for network intervention or reinforcement.</p> <p>Financial: Cost dependent on GT/GDN impact (&gt;£50M, typically &gt;£20M)                      Safety: Multiple fatality/HSE Enforcement Notice                      Reputation: External impact on international stakeholders, company accused of poor practice or negligence, direct blame to company leading to extensive media coverage, significant business and company value impact, loss of licence                      Environment: Reportable incident, serious and lasting environmental damage or loss (&gt;10 years recovery), enforcement action and fine certain                      Asset/Security of Supply: Total loss of asset, major conurbation and high customer numbers off supply for lengthy period of time (major conurbation off supply &gt;24 hours), national transmission system disruption</p>
<b>Significant/Major</b>	<p>County or city area affected with people off supply or significant asset failure which requires significant network intervention or reinforcement.</p>

	<p>Financial: Cost dependent on GT/GDN impact (<math>\leq</math> £50M, typically £10-20M)</p> <p>Safety: Fatality/Life changing injury/HSE Enforcement Notice</p> <p>Reputation: External impact on national stakeholders, extensive media coverage, business and company value impact, repeated regulatory intervention, potential loss of licence</p> <p>Environment: Reportable incident, significant environmental damage or loss (5-10 year recovery), enforcement action expected</p> <p>Asset/Security of Supply: Significant asset damage or failure, geographical area off supply, major outage on distribution networks</p>
<b>Moderate</b>	<p>Significant increase in costs of response and network strengthening</p> <p>Financial: Cost dependent on GT/GDN impact (<math>\leq</math> £30M, typically £1-10M)</p> <p>Safety: Major injury e.g. RIDDOR reportable</p> <p>Reputation: External impact on stakeholders, adverse media coverage, negative customer impact, regulatory intervention, minor company value impact</p> <p>Environment: Reportable environmental incident resulting from breach of consent or permit, medium damage and loss to environment (up to 5 years recovery), potential enforcement action/letter of concern</p> <p>Asset/Security of Supply: Asset damage of failure, significant numbers of tariff customers off supply for considerable time</p>
<b>Minor</b>	<p>Cost of network maintenance requirements and impact on business now of concern</p> <p>Financial: Cost dependent on GT/GDN impact (<math>\leq</math> £10M, typically £500K - £1M)</p> <p>Safety: Lost time injury/HSE Letter of Concern</p> <p>Reputation: Internal impact within business and stakeholders, industry press and local media interest supported by regulator, some business criticism</p> <p>Environment: Minor, potentially reportable incident affecting local environment (&lt; one year), quick resolution</p> <p>Asset/Security of Supply issues: Minor asset damage or failure leading to localised loss of supply for a short period of time, firm contract customer supply affected</p>

<b>Insignificant/Minimal</b>	<p>Limited impact - can be managed within “business as usual” processes</p> <p>Financial: Cost dependent on GT/GDN impact (≤ £5M, typically &lt; £500K)</p> <p>Safety: Minor injury/medical treatment/near miss/negligible</p> <p>Reputation: Internal issue from local event, negligible inconvenience, minimal local media coverage</p> <p>Environment: Non-reportable incident with negligible environmental impact or damage, immediately resolved</p> <p>Asset/Security of Supply: Limited impact on assets and supplies, limited disruption to interruptible supplies</p>
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**Likelihood (Gas)**

Rating	definition
<b>Almost certain</b>	<p>The risk is expected to be realised and may already be under active management as an event. No controls in place to reduce likelihood of risk being realised.</p> <p>Guideline: &gt;90% or at least once a year frequency.</p>
<b>Likely</b>	<p>More likely and probably will occur, mitigations not fully effective, control weaknesses are known but being managed.</p> <p>Guideline: 60-90% or 1 in 5 years frequency.</p>
<b>Possible</b>	<p>Equally likely as unlikely, mitigations are in place, control measures are under active management.</p> <p>Guideline: 30-60% or 1 in 10 years frequency.</p>
<b>Unlikely</b>	<p>Events are rare and unlikely but could occur, required mitigations in place, controls are effective.</p> <p>Guideline: 10-30% or 1 in 15 years frequency.</p>
<b>Very Unlikely</b>	<p>No known event or extremely rare or remote chance of occurring, controls are fully effective to reduce likelihood of risk being realised.</p> <p>Guideline: &lt;10% or 1 in 20 years or greater frequency.</p>