Engineering Justification Paper

Climate Change Adaptation

Final Version

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Classification: Highly Confidential

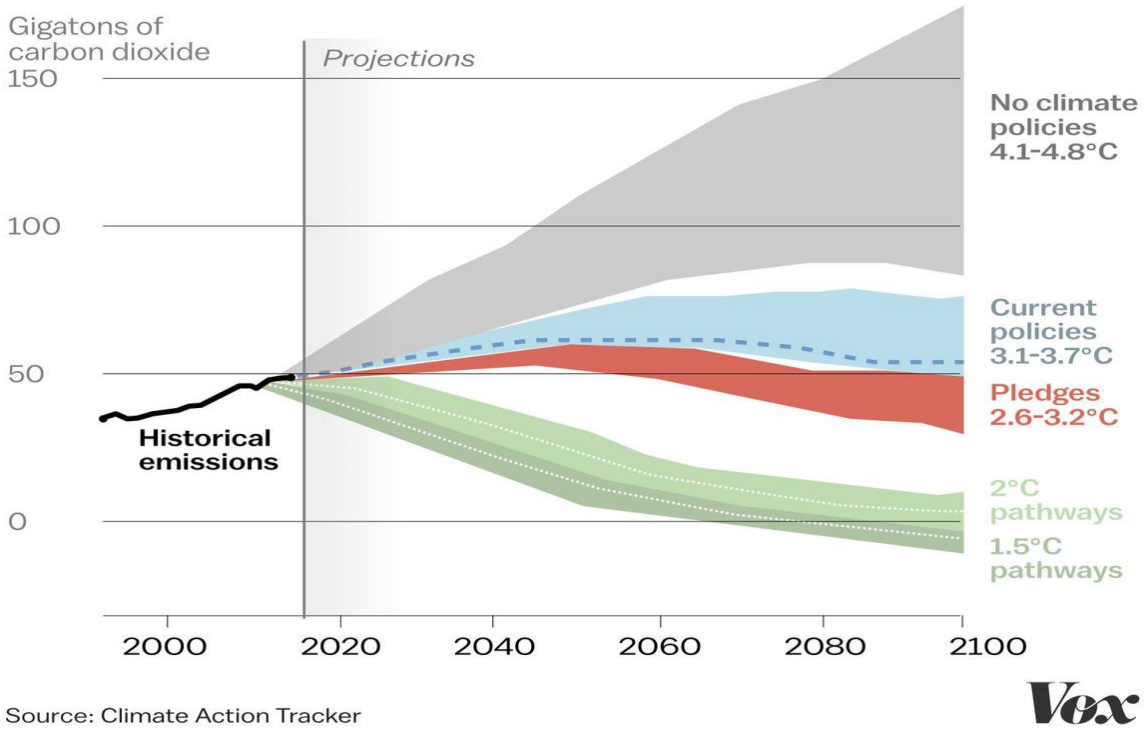
1. Table of Contents

2 Introduction

Based on current levels of UK policies, changing weather patterns and declarations of Climate Change Emergency, we could be looking at an average warming of over 3°C along with increased likelihood of extreme weather events. **Figure 1** below shows potential temperature rise based on current policies. We should be making the necessary changes to our assets and operating procedures to ensure we are well adapted and continue to operate efficiently and safely. Whilst the impacts of climate change are well understood in some departments, others are more uncertain of the impacts and what adaptation measures are required.

This paper focusses on understanding the climate change risks at our occupied sites through surveys to identify where mitigation actions need to be taken. Additionally, this paper highlights the benefits and costs of detailed flood mapping software which would assist our understanding of flood risk at our operational sites. The flood map software would also support the occupied sites and focus effort so surveys can be prioritised for higher risk sites.

Figure 1: Effect of current pledges and policies



2.1 General Background

The highest potential climate change risks for SGN are flooding, coastal and river erosion and extreme temperatures. 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'.

There may be opportunities that arise due to Climate Change, but these will be identified separately.

2.2 Site Specific Background

This paper identifies some of our at-risk sites and assets and proposes we carry out climate change adaption surveys for our occupied sites in order to better understand the risks and what remediation measures are required. These surveys do not focus on operational assets at this stage because the risks are already monitored and mapped to some extent, though there is potential to improve the mapping data available by purchasing Landmark Climate mapping software. The mapping software will identify the higher risk sites and were future surveys may need to be carried out.

3 Equipment Summary

Location of Equipment

Our Assets and sites are located across Southern England and Scotland and are subjected to different risks depending on the site location, age and type of asset.

The analysis by Network is based on SEPA and Environment Agency flood data and has some limitations. The Environment Agency data is very basic and only shows High, medium, low River and Sea flooding combined with no surface water data. The SEPA maps are more detailed but still not the same level of climate forecasts and detail as the Landmark mapping system proposed in this paper. We have proposed the upgrade of the flood mapping system to provide detailed climate and flood data across our network areas.

Occupied sites

Table 1: Overview of occupied sites at most risk in Scotland

	River 1:10	River 1:200	River 1:1000	Coastal 1:10	Coastal 1:200	Coastal 1:1000	Surface 1:10	Surface 1:200	Surface 1:1000
Building	1	2	0	0	0	0	2	4	0
Boundary	3	5	1	2	2	3	11	15	0

Table 2: Overview of occupied sites at most risk in Southern England

	High	Medium	Low	Very Low
Building	1	3	4	1
Boundary	3	4	7	2

Table 3: Occupied Sites Susceptible to flooding (Scotland)

Building at risk of flooding	Risk of flooding within site boundaries
Axis House	Axis House
Coatbridge	Coatbridge
Kilmarnock	Dumfries
Galashiels	Dunfermline
	Galashiels
	Glasgow
	Glenmavis
	Inverness
	Kilmarnock
	Oban
	Paisley
	Provan
	Stornoway
	Thornton
	Wick

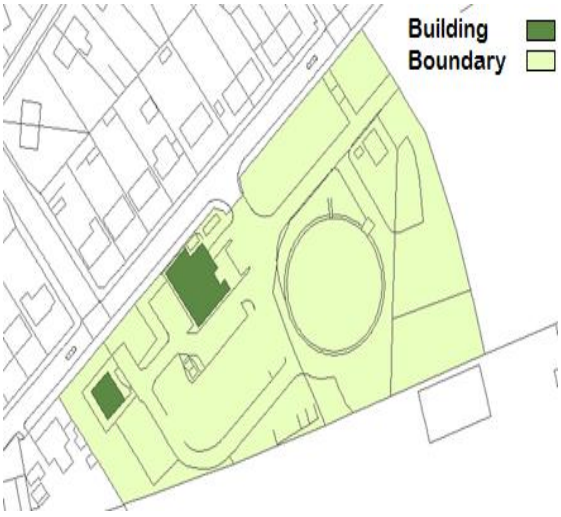


Table 4: Occupied Sites Susceptible to flooding (Southern)

Building at risk of flooding	Risk of flooding within site boundaries
Godstone Road, Whyteleaf	Godstone Road, Whyteleaf
151 Pier Road, Gillingham	151 Pier Road, Gillingham
Walton Park, Walton Road, Portsmouth, Hampshire	Walton Park, Walton Road, Portsmouth, Hampshire
52 Kenavon Drive, Reading	52 Kenavon Drive, Reading
Kennington Holder Station, Kennington, London	Kennington Holder Station, Kennington, London
	Wotton Road, Kingsnorth Industrial Estate, Ashford, Kent
	North Close, Aldershot
	Finmere Road, Eastbourne
	2 Leesons Hill, St Mary Cray, Orpington, Kent
	Bletchley Road, Milton Keynes

Scotland operational sites:

The table below shows data for all equipment within our Scotland Operations plan.

Table 5: Scotland Operational Assets in Flood zones

		Number of equipment in flood zone								
Total equipment In Scotland	Equipment type	River 1:10	River 1:200	River 1:1000	Coastal 1:10	Coastal 1:200	Coastal 1:1000	Surface 1:10	Surface 1:200	Surface 1:1000
1580	DGs	27	114	105	3	80	11	26	17	112
205	DPGs	8	11	18	1	1	2	6	14	18
128	TRSs	4	10	10	0	2	2	3	8	9

Table 6: Southern Operational Assets in Flood zones

Total equipment for Southern	Equipment type	High	Medium	Low	Very Low
4006	DGs	30	106	126	113
296	DPGs	4	7	13	10
137	TRSs	1	5	7	3

4 Problem Statement

The problem we are trying to solve is ensuring our occupied sites are adapted to climate change as far as reasonably practicable, including carrying out a cost benefit analysis for recommendations for each relevant site. Current flood mapping software used to identify risk at operational sites is high level and focusses on flooding alone. An improved climate mapping software package would be beneficial in allowing SGN to identify risks including different levels of climate scenario.

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

We are doing this work because Climate Change is an increasing risk in the UK and worldwide and multiple UK cities have declared Climate Change Emergencies. Risks stemming from Climate change including severe flooding, extreme temperatures and coastal and river erosion can significantly impact our assets and staff in some conditions.

Without the Initial Survey and Risk Assessment to our occupied sites and upgrade to our Flood Mapping Software we will not have the knowledge to assess the impacts of climate change on occupied sites and operational assets. Therefore, we will not know what the best measures are to take in adapting these sites for climate change and will unable to take a proactive approach. Instead this will increase the risk of failures occurring and force us to take a costly reactive approach to the impacts of climate change.

If we do nothing there will be an increased risk of damage to assets, additional maintenance requirements, potential loss of supply, gas escapes and increased response times. Costs for doing nothing are likely to exceed the cost of adaptation measures if extreme weather events continue. For example, Network are suggesting the relocation of a pipeline in Scotland due to increased erosion at a cost of around **£25.77m** as doing nothing would hold an increased risk.

Notable risks: -

- River bed & bank erosion exposing pipelines;
- Flash flooding impacting bridges carrying gas mains;
- Flooding of pressure reduction installations and other sites
- Impacts on our critical supply chain: and
- Contaminant mobilisation and migration
- Staff will be unable to get to offices/depots and operational sites
- Loss of IT and data systems
- Water ingress on low pressure systems

What is the outcome that we want to achieve?

The proposed outcome is that all our operational and occupied sites have been risk assessed and the necessary climate change adaptation measures have been completed. Climate change is already recognised as a key Business risk, but the processes need to be better implemented throughout the business. This would include increased awareness in Operational Business Continuity Plans and increased resilience throughout SGN.

How will we understand if the spend has been successful?

The Spend will be successful once SGN have a clear understanding of the Climate change impact and adaptation required for the occupied sites and operational assets mentioned in Section 3. SGN can then plan the steps required to pro-actively mitigate the risks to these sites.

If successful, the impacts of climate change will have minimal impact on the business as usual operations of the business. This will include robust planning and improved resilience across our operations and estate.

4.1 Narrative Real-Life Example of Problem

Current mapping of flood risks is varied depending on available mapping tools. Scotland flood data is currently more advanced. We have suggested below that an upgrade to an enhanced mapping system would be beneficial.

Scotland and Southern datasets are provided by different organisations and show different levels of detail and information. For SEPA, obtaining access to their shape files was a lengthy process involving data sharing agreements and IT approval. The shapefile is not live data and must be updated when the SEPA maps change.

For the Environment Agency, the shapefiles were created in 2018 and had combined data for River and Coastal flooding (no Surface water data) and could only give a High/Medium/Low rating with no date ranges.

Current flood data in Scotland resembles that shown below:

Figure 2: Scotland flood map example- site is at risk of a 1 in 200 Surface Flood

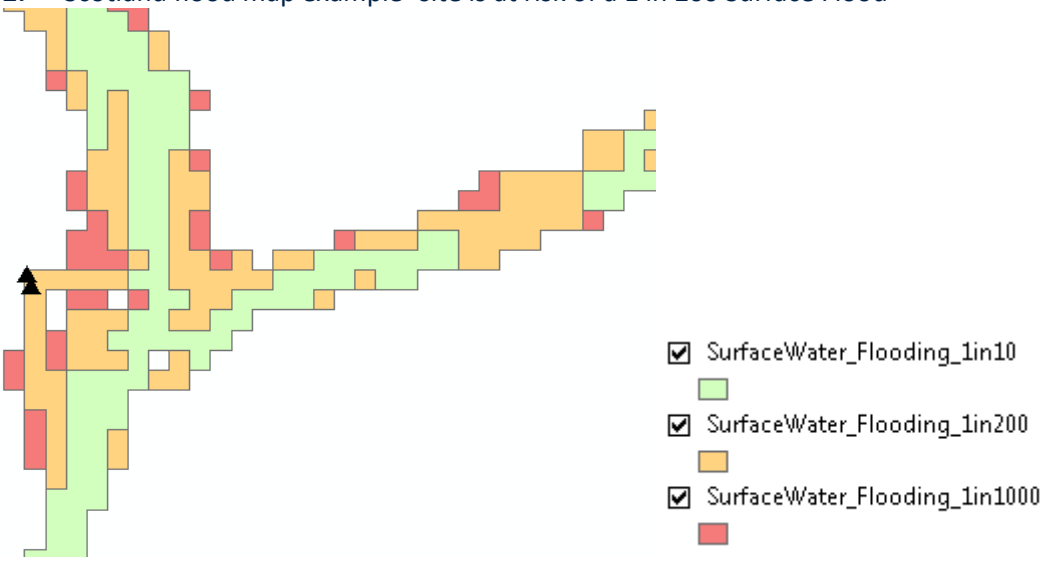
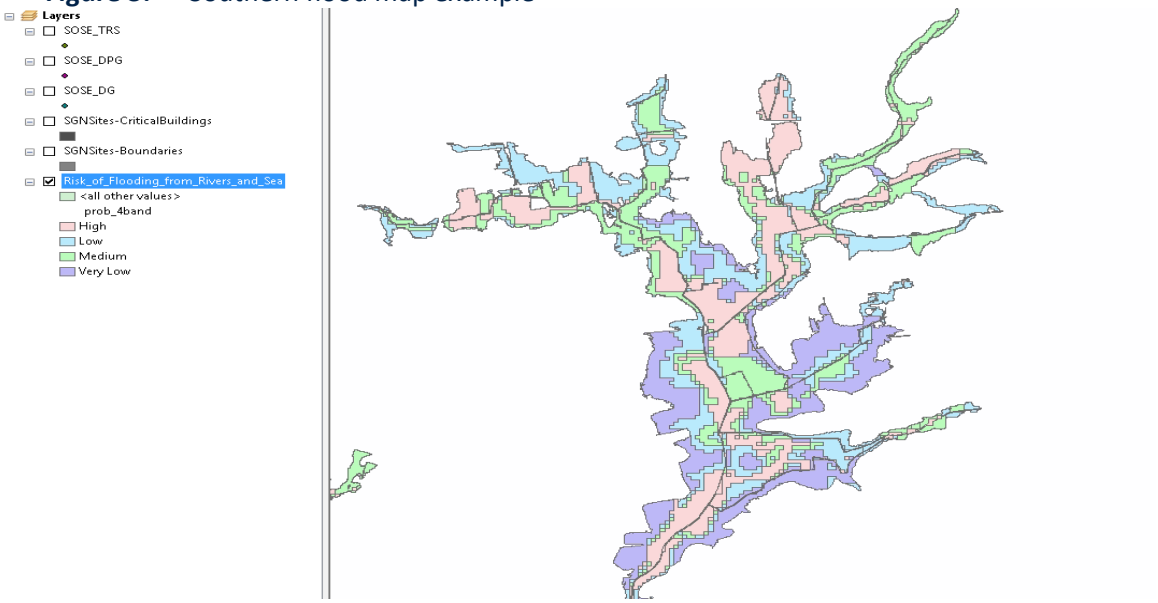
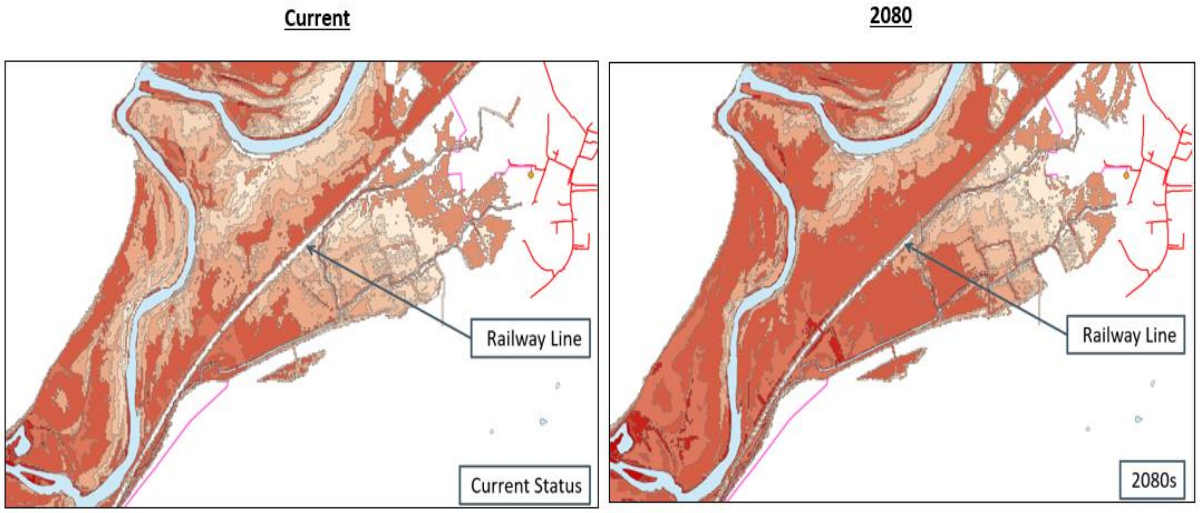


Figure 3: Southern flood map example



Investing in a more detailed flood mapping system such as Landmark would be beneficial. This would provide fluvial and pluvial in-depth data including climatic projections. Example extracts shown below:

Figure 4: Landmark mapping example showing climate scenarios in different years



4.2 Spend Boundaries

The spend for this project will assess the initial occupied sites which are at highest risk of climate change. Through the uncertainty mechanism we will then look at prioritising adaptation measures based on risk. Operational asset sites have not been included in the spend here outside of the proposed mapping system upgrade. Operational assets at particular risk of climate change have been identified within departmental appendixes.

The proposed spend focusses on Climate Change Adaption Surveys for the selected occupied sites. This will involve some site inspections, some desktop studies and review of climate data and flood maps. The costs we are bidding for initially are for carrying out the surveys and for installing Landmark mapping.

We then intend to bid for a 'use it or lose it' sum in order to carry out the key recommended adaptation measures. The size of this pot is unknown until the surveys have been completed to give us a better picture but based on the consultant's recommendations, we have suggested a pot of **£9.826m.**

Costs for suggested network projects in GD2 that are directly related to Climate Change Adaption have been included in the Section 8 narrative but detailed costings will be submitted in the Network GD2 papers.

5 Probability of Failure

Data on the probability of failure is not known at this stage. Carrying out more detailed surveys for the selected sites will allow us to ascertain this. Although we don't know the probability of Failure, we have overviewed some of the failure modes that climate change could bring, including:

1. Flooding- One of the most common aspects of climate change. Already occurring with increasing frequency across the UK. Highly likely this will be a risk we have to deal with over GD2, and it may affect access to site among other consequences listed in Section 6.
2. Structural Damage- Erosion, heat extremes and flooding may lead to structural damage in some areas. This is not currently deemed a high risk for occupied sites but is a risk for pipelines. The risks will be better understood after completing the surveys.
3. Subsidence- As per structural damage.
4. Reduced Accessibility to site- This is a potential medium risk as it may occur from any of the situations above, amongst others. This may lead to BCM (Business Continuity Management) as detailed in section 6.

With regards to the current flood mapping systems themselves they are reliant on the data providers updating their systems to take account of the most up to date climate projections i.e. UK CP18. Until the systems are updated with November 2018 climate projections (UKCP18) the data will be outdated. Using the most up to date data is vital in accurately assessing the risks on our sites. The lack of detail on the EA maps also causes difficulties for risk assessment.

5.1 Probability of Failure Data Assurance

No current failure data is known so assurance is not possible at this time as the uncertainty level is high.

6 Consequence of Failure

Detailed consequences are not known until the surveys have been completed. Potential high-level consequences are shown below:

Loss of Supply to Customers

- Loss of IT, Dispatch and Security systems if Walton Park is flooded (this site is currently at risk of flooding). This would have large knock on effects across the business.
- Loss of supplies will occur if operatives cannot access jobs at operational sites such as pressure reduction stations due to extreme weather or flooding
- Interdependencies with other industries- e.g. if a local electricity sub-station floods there may be a loss of electricity supply to site reliance on back
- Water ingress on low pressure systems
- Any of the Failure modes mentioned in Section 5 could affect the Gas Control Centre. This would mean that we lose control of network pressure monitoring and unable to respond to certain demand scenarios.
- Reputational damage

Safety Impact of Failure

- Gas escape or loss of supply if pipelines are damaged due increased river/coastal erosion
- Loss of access to occupied sites leading to Business Continuity Management (BCM)
- Loss of access to operational sites leading to BCM

Environmental Impact

- Flooding of operational sites, offices and access roads/travel routes
- Overheating of buildings/equipment and engineers
- Increased erosion and flooding
- Increased storm damage
- Migration of soil or water contaminants due to increased flooding and erosion

Depending on the extent of climate change, consequences of failure may spread across multiple or all areas of the business.

7 Options Considered

The following options have been considered:

- Replace on Failure
- Repair on Failure
- Pre-emptively replace
- Pre-emptively repair
- Do nothing

We don't yet have a good understanding of the risks and vulnerabilities of SGN buildings and three of the 5 options imply that we wait and 'see what happens' in the face of climate change science and our own experience of more extreme events. Doing nothing or only responding after a serious event would mean dealing with the impacts, effects and costs of damage to our assets and the wider consequences to our customers as a function of the loss of business continuity.

The preferred two options of 'Pre-emptively repair or replace' mean that we react positively, initially by building the evidence base around our vulnerabilities now and in the future, the risks and potential costs of doing nothing and the options and costs of adaptation action. We will then be able to react to the evidence in a well-considered and informed way.

Replace on Failure

This option would indicate that we choose to wait until failure from natural disaster before we replace the site and undertake the Climate Change Survey and Risk Assessment. Likewise, with the Flood Mapping Tool, we wait until Failure on operational assets due to flooding before we Replace the mapping software.

If Climate impacts occur at a specific site, such as extreme flooding and damage, the site can be relocated or protected. The costs for this are likely to be very high as it will involve remedial works for repair as well as a new project requirement for site relocation or protection, which will take a long time to plan and install.

Repair on Failure

If climate impacts occur and lead to damage, we will repair the damage and take no further action to proactively reduce the risk of failure happening again. Repairs could be timely and a high cost, depending on the type of failure i.e. major structural damage. The flood mapping system may be updated if it failed, though a short-term failure of the mapping system would not have a large impact on our adaptation response. This is because the mapping system does not provide live data, the risks are a snapshot at a certain period of time and do not need to be repeated regularly.

Pre-emptively replace

Replace assets or sites that are at high risk from climate change, this will be high cost but less risky and potentially lower cost than replacing on failure.

In order to pre-emptively replace we will need better climate projection data. Pre-emptively Repair

There will be limited pre-emptive repairs that could be completed due to the nature of flood and erosion risks being unpredictable. The Climate Change Adaptation and flood surveys may highlight repair recommendations to reduce impact which could be considered on a site by site basis.

Do Nothing

Doing nothing may lead to extreme consequences such as those described in Section 4 and 6 above. Delaying the surveys to GD3 or beyond would infer climate change is not already a risk. We need to act now to understand the risk and prioritise the recommended mitigation measures.

7.1 First Option Summary- Pre-emptive replace/repair

This is the preferred option and would reduce the level of risk to site operations. The other options have not been considered acceptable due to the high level of uncertainty triggered by the current climate 'emergency'.

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

The technical detail is not known at this stage until the climate change adaptation surveys have been completed and key actions/ sites identified.

The basis for the cost estimate/unit cost

The cost estimates have been based on speaking to Climate Change Consultants from ARUP.

The perceived benefits of the option

The benefits of this option are that by being proactive we will better understand the risks our sites face and can prioritise adaption measures for the most at-risk sites.

Upgrading to use Landmark mapping which is regularly validated following UK flood events and regularly updated for latest river flow, rainfall, land use and climate change predictions. This will allow us to assess the impacts shown below:

- Fluvial, Pluvial and Tidal flood data
- Tide lines
- Sea level rise inundation zones
- Insight into potential impact on transport, bridges and river banks

We will use landmark data and climate and flood site surveys to inform our decision on which remedial adaptation measures to complete. Common adaptation measures for an occupied site are detailed below. Costs are highly dependent on building size and type so have not been included at this stage:

- Solar Shading- to prevent overheating
- Flood proof building components
- Green roofs and edge zones
- Increased drainage to reduce surface runoff
- Natural ventilation

Delivery timescales

Over GD2 we intend to assess the climate risks of our occupied sites and implement adaptation measures at our most risk sites. Our further adaptation programme is likely to be required in GD3 as the climate continues to change.

Key assumptions made

Assumptions were made that the adaptation measures and costs cannot be quantified until after the surveys have been carried out, this is due to the high level of uncertainty.

Any other items that differentiate the option from the others considered

It was deemed that the other options are not acceptable, this is the only feasible pro-active approach that we can make to our sites, assets and flood mapping systems. Climate change is happening, and we need to act now if we are to continue to operate successfully and help prevent the Earth moving to critical tipping points and runaway global warming. There would be potential after remediated works are complete that we could apply for certification against the new Climate Change Adaptation Standard ISO 14090.

7.2 Second Option Summary- Do Nothing

This is the alternative option to pre-emptive replacement, but this is not preferred. This 'Do nothing' option would increase the level of risk to sites and business as usual operations. This option would expose us to the risks of the current climate emergency without any detailed understanding of what mitigation is required.

The technical detail of the option i.e. capacity, system rating, availability etc.
The technical detail is not known at this stage until the climate change adaptation surveys have been completed and key actions/ sites identified.

The basis for the cost estimate/unit cost
The cost estimates for Do Nothing are likely to be high but are unclear without further survey work. As an example, a third party organisation we work with, Climate Ready Clyde, submitted a funding application for adaptation measures for a small area of Glasgow at £1.1 billion. This demonstrates the scale of the challenge. This cost is based on a number of detailed studies of Climate change impact and financial cost in the Glasgow City Region.

The perceived benefits of the option
The benefits of this option are that there is no initial outlay cost, instead, costs are likely to occur as various climate impacts happen.

Delivery timescales
N/A- No action proposed under this approach though it is likely we would be forced to take action in the future as climate change impacts increase.

Key assumptions made
Assumptions were made that adaptation measures and costs cannot be quantified until surveys have been carried out, this is due to the high level of uncertainty.

Any other items that differentiate the option from the others considered
It was deemed that this option is not acceptable if we are to maintain a positive company reputation and continue to carry out business as usual operations.

7.3 Options Technical Summary Table

Table 7: Option Summary

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment / Investment Design Life	Total Cost £m
Option 1- Pre-emptively replace/repair	2021	2026	Medium	Various	10.349
Option 2- Do Nothing	N/A	N/A	Unknown	N/A	Unknown

7.4 Options Cost Summary Table

There are some tasks that need to be done regardless of how many buildings are to be assessed. We've provided a budget cost for this.

There are also tasks that are building specific, like the actual survey. We've provided a 'per building' cost for this as discussed, so we can include as many or as few buildings as you would like surveyed.

The building specific work includes a desk study, site survey (by two people), interview with building manager and risk assessment, with summary report per building.

Budget cost for this is **£4,000** per building, including an allowance for travel to the building but not including VAT. Smaller sites are likely to have a lower cost but we have assumed **£4,000** per site at this stage.

Table 8: Cost Summary

Option	**Individual Cost Breakdown £k**	**Total Cost £m**
Upfront Opex allowance		
Climate Change Adaption Surveys for occupied sites	4	0.176
Flood Surveys for occupied sites	2.5	0.110
Landmark mapping tool	N/A	0.237
Proposed Capex "use it or lose it" allowance		
Climate Change Adaption Remedial Actions (Use it or lose it)	N/A	9.826
Total £m:		**10.349**

8 Business Case Outline and Discussion

The probability and consequences of failure will increase as climate change impacts increase and the global average temperature rises. The preferred option for pre-emptive repair/replace will minimise that risk. The recommended measures will be based on the surveys and will give us a better indication of cost. The key drivers for this are Environmental and Social but there will be some long-term financial benefit for being proactive instead of reactive.

In the Appendix of this EJP, climate change impacts and adaptation measures from other key business areas have been included for reference. These are captured fully within departmental Appendix's and within their EJPs and BPDT. Business areas reviewed are:

- Transmission
- Distribution
- Operations
- SIU

8.1 Key Business Case Drivers Description

Table 9: Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	Pre-emptive repair/ replace Assess and Implement Adaptation measures	Environmental and social- doing nothing could lead to significantly increasing risks. There would be potential after remediated works are complete that we could apply for certification against the new Climate Change Adaptation Standard ISO 14090.
2	Do Nothing	No initial financial outlay or workload for investigating or carrying out remediation works.

No low, medium or high ambitions have been submitted for Climate Change Adaption as we have no choice but to adapt if we want to minimise disruption across the business. The vast majority of the costs are in the remedial measures which is part of the 'use it or lose it' pot. If the full recommended amount of **£10.349m** is not approved, then we will prioritise remedial work based on risk and bid for further funding in GD3 if required. This pre-emptive option would allow us to better understand the risks and where mitigation actions are needed. It would also demonstrate positive environmental action to our customers and shareholders.

In contrast, a 'do nothing' approach would expose us to a variety of unknown financial, reputational and environmental risks.

8.2 Business Case Summary

Due to the high uncertainty of this project and the requirement of the use it or lose it uncertainty mechanism we have been unable to carry out a Cost Benefit analysis or associated Business Case Matrix. This is because the cost and risk cannot be quantified without the initial surveys.

9 Preferred Option Scope and Project Plan

9.1 Preferred option

The preferred option is pre-emptively replacing and repairing assets and sites based on knowledge or risks and recommended remedial actions. These risks will be better understood after completing the surveys and using Landmark mapping.

There would be potential after remediated works are complete that we could apply for certification against the new Climate Change Adaptation Standard ISO 14090.

9.2 Asset Health Spend Profile

If approved some of the survey costs could be moved forward to start in 2020/21 but it has been assumed at this time that no additional funds will be available until GD2.

The gross costs including efficiencies requested for climate change adaptation works in RIIO-GD2 is **£10.349m.**

The breakdown of costs per activity is provided in the table below.

Table 10: Asset spend profile

Activity	Pre GD2	2021/22	2022/23	2023/24	2024/25	2025/26
Climate Change Adaption Surveys for occupied sites	0	0.176	0	0	0	0
Flood Surveys for occupied sites	0	0.110	0	0	0	0
Landmark mapping tool	0	0.237	0	0	0	0
Climate Change Adaption Remedials *(Use it or Lose it)*	0	0	2.475	2.463	2.450	2.438
TOTAL	**0**	**0.523**	**2.475**	**2.463**	**2.450**	**2.438**

9.3 Investment Risk Discussion

Currently there is limited awareness on Climate Change Adaption requirements across our occupied Property. For this reason, we intend to carry out Climate Change Adaptation surveys at our occupied sites using an external consultant. This will include desktop study, site survey, interviews, risk assessment and summary report for the site. Basic flood data will be reviewed during these surveys but if a site is deemed to be at risk a detailed (Stage 3) Flood risk assessment may be required. We have included the costs for a detailed flood risk assessment for each site, but this may not be required for every location.

It is highly uncertain what the cost of the survey recommendations will be, as it is highly dependent on-site location, size and type among other factors. After speaking to an Adaptation Consultant, they recommended a 'Use it or Lose it' uncertainty mechanism of **£9.826m** for adaptation remedial actions across the estate in GD2.

Though we have a better understanding on the climate change impacts including flooding and erosion, the mapping systems are not highly detailed. We propose upgrading to Landmark mapping which is a far more detailed tool which assess fluvial, pluvial, total and erosion impacts among other areas. Landmark mapping is regularly updated to include latest river flow, rainfall, land use and climate change projections so will also support us in Climate Change Adaptation Reporting to DEFRA.

9.4 Uncertainty Mechanism

As discussed above, following discussion with our consultants, we are proposing a bespoke 'use it or lose it' uncertainty mechanism. Our justification for this is as follows:

What is the issue/risk that the proposed mechanism addresses?

The uncertainty around climate change is highly volatile and it is largely dependent on the global action to what extent we will be affected by climate change across both our licenced areas. The risk is industry- wide but effects will be felt very differently in different regions e.g. depending on distance from water, ground type etc.

Where does the ownership of risk lie in relation to the uncertainty?
Ownership of the risks to adapt to climate change lie with SGN as it is our responsibility both to mitigate our emissions and to adapt to future climatic extremes as far as reasonably practicable. If we fail to adapt, we could experience more emergency situations or not be able to access our sites, among other issues described in earlier sections.

We will minimise the risk to the customer by using the mechanism, as this will allow us to only use funding where it is feasible to implement projects.

Through the stakeholder engagement activities undertaken around the Environmental Action Plan, it is believed that the level of risk (funding requirement) we are exposing the customer to is proportional to the potential advantage that could be gained through the proposed works.

Materiality of issue
The issue of climate change could have far reaching costs, for example one pipeline diversion due to increased river erosion from the River Tay in Dunkeld is predicted to cost **£25.77m** in GD2 (*See Appendix021- Transmission Integrity and Compliance-Section 1.4*). This gives an idea of potential costs across our whole network. The 'use it or lose it' **£9.826m** figure we have suggested is focussed on occupied sites as the risk here is less clear than the operational sites. This amount was suggested by a Climate Change Adaptation Consultant from ARUP.

Frequency and probability of issue over the price control period
During GD2, climate change impacts are expected to be felt more strongly and frequently and this has already been recognised globally. In the UK the number of cities declaring Climate Change Emergencies has risen rapidly (https://www.climateemergency.uk/blog/list-of-councils/).

What is the proposed mechanism?
We are proposing a use it or lose it mechanism, providing funding of **£9.826m** to carry out the necessary remedial actions following CCA and flood surveys that will be carried out in years 1 & 2 of the GD2 price control period. Investing in an improved climate mapping tool which will assist in understanding flood risks and erosion risks at our operational sites will also reduce uncertainty. Following these surveys and investigation with the mapping tool we will be better placed to select the most at-risk sites and implement appropriate adaptation measures. We will seek approval from Ofgem for any proposed expenditure and any unused portion of the 'use it or lose it' funding will be return to consumers.

What are the justifications for the mechanism?
The mechanism will allow us to better understand what sites are at risk and prioritise where we need to invest to protect our assets and occupied sites in order to maintain our standards of service and minimise the cost to the consumer.

What are the drawbacks of the proposed mechanism?
The drawbacks of this method are the uncertainty is high and costs may be significantly higher or lower than forecast. The initial surveys will give us the best chance of understanding the risks and planning our adaptation measures in detail. This method was also recommended by our consultant.

Can the drawbacks be reduced?
The drawbacks of high uncertainty are inherent with climate change risks, there is little way to predict how it will affect our sites without surveying them further. The proposed mechanism reduces risk to the consumer by returning any unused portion of the proposed funding to them.

Explanation of how on balance, the mechanism delivers value for money while protecting the ability to finance efficient delivery.

The benefits outweigh the drawbacks because completing the surveys and prioritising adaptation measures will put us in the best position to deal with the effects of climate change efficiently and cost effectively**.**

Treatment in Business Plan Data Templates (BPDTs)

The project described has been included in **3.05 (Other Capex)** BPDT.

Appendix A - Approach to Risk Assessment

Project boundary
This project is focussed on physical risks that are capable of directly affecting SGN buildings. They include extreme weather events, gradual sea-level rise, and changing weather patterns.

We also recognise there is a range of 'transition risks', which result from a shift to a lower-carbon economy and using new, non-fossil-fuel sources of energy. These include regulatory changes, economic shifts, and the changing availability and price of resources. Transition risks are being considered elsewhere within SGN. Physical and transition risks for buildings and the risk assessment process are summarised below.

Approach to evidence-based risk assessment

Overview:
We plan to work closely with a consultant with expertise in climate change risk assessments and who can bring experience and lesson learned from other similar studies for other organisations. Together we have developed a five-stage approach to developing an evidence base of vulnerabilities, risks, adaptation measures and costs. The stages are shown in overview in the diagram below and the tasks within each stage described in more detail.

Stage 1 – Inception
We will start the project with an inception meeting to introduce the core project team and:

- Establish a clear understanding of the project and SGN's outcomes
- Review the detailed tasks, the project timeline and key milestones
- Discuss challenges or opportunities for engagement across the SGN estate
- Discuss and agree greenhouse gas (GHG) emission scenarios and timeline for climate projections
- Agree communication protocols and follow-up with our building managers to let them know about the project and what to expect.

Stage 2 – Review existing knowledge
The tasks in this stage will gather and review existing knowledge and will prepare tools and questionnaires ready for next stages.

We will:

- Work with our specialist consultant to review lessons learned from their work, such as for Marks & Spencer's estate across the UK, other risk assessments for building portfolios and the C40 Cities' climate hazards taxonomy.
- Review UKCP18 climate projections and agree the emissions scenarios and climate projections we want to use in the project. This is subject to review and testing, but could be something like:
- Summer mean precipitation for the low emissions scenario (RCP2.6) and 10th percentile.
- Winter mean precipitation for the high emissions scenario (RCP8.5) and 90th percentile.
- Summer maximum temperature for the high emissions scenario (RCP8.5) and 90th percentile.
- Winter minimum temperature for the low emissions scenario (RCP2.6) and the 10th percentile.
- Develop an SGN (spreadsheet based) specific climate adaptation tool– based on at risk elements of buildings and physical risks from extreme weather events and changing weather patterns. This will help us maintain consistency in the way we review each of our assets. The tool could be extended to include other climate related risks.
- Develop an electronic questionnaire for distribution to SGN building managers and a range of SGN staff to understand the key design and operation characteristics and the local historical and current impacts on their buildings. This first-hand experience of historic extreme weather events

and the impacts on SGN buildings and staff will be important in building the evidence base of vulnerabilities and impacts.

Stage 3 – Identify hazards

The tasks in stage 3 are designed to develop the evidence base of the climate change related hazards for SGN's buildings. The tasks will be completed for each building, drawing on the outputs from task 2 and applying them to each building:

- Desk study of building to assess localised risks, such as flooding from rivers, the sea and surface water, using EA / SEPA flood maps.
- Issue questionnaire to building managers and staff
- Carry out non-intrusive survey of buildings, using climate adaptation tool to identify hazards in a consistent manner.
- Interview building manager using responses to questionnaires, to gather anecdotal evidence of impacts of extreme weather

Stage 4 - Risk assessment

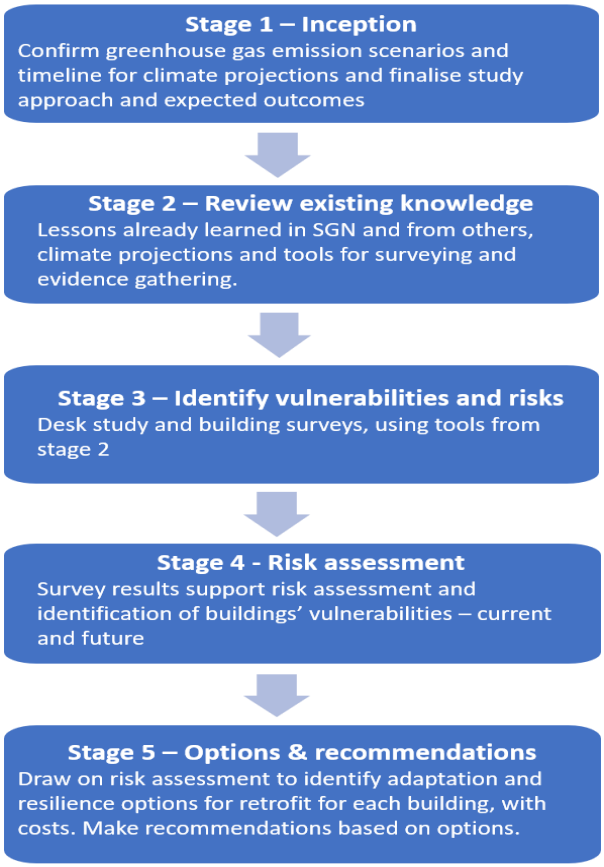
This stage brings together the survey results with the climate projections to identify the vulnerabilities of each building:

- Use survey results to carry out risk assessment and identify current and future vulnerabilities, based on future climate projections for agreed emissions scenarios and timeline
- Bring together survey and risk assessment report for each building

Stage 5 – Options & Recommendations

The work from the previous stages is brought together now to inform the overall options for SGN's response to the climate related risks facing our estate. The tasks include:

- Identifying practical adaptation and resilience responses to the risks facing each building, such as solar shading, improved insulation, solar blinds, upgrading cooling equipment, improving local flood protection.
- Develop budget costs for retrofit measures
- Project workshop to review the range of risks facing our buildings, together with the types of measures required to build resilience
- Identify opportunities for developing programmes of retrofit to benefit from the potential efficiencies of scale.
- Review the range of retrofit measures against the options for action (from do nothing to pre-emptive repair) and in the context of SGN's wider risk matrix for its operations with respect to the risks associated with buildings not being operational.
- This will allow some initial cost benefit of analysis of the costs of developing resilience versus the costs of damage caused by buildings being forced to close owing to extreme weather impacts.
- Develop final report and presentation of findings and recommendations for feeding into the business case for change.



Future work

Once we have an evidence base of the climate risks for our buildings, we may seek to enhance our climate risk assessment toolkit and approach to go beyond physical risks and start to consider the transition risks in more detail. By using some form of climate risk dashboard, we can develop a management tool that maps our estate, the climate risks of each building, the adaptation work being done or completed and the changing level of risk and vulnerability we face at each location.

Appendix B - Extract from Departmental Plans

Operations
Potential gap of embedding Climate Change adaption into procedures. Current focus is strongly on winter preparedness.

Beast from the East: Case Study Extract:

Winters within GD1 have been milder than the seasonal norm, however they have included some extreme weather events, such as the Beast from The East in 2018. Such events can create a short-term surge in reported PREs, and as such we must plan our resources to handle the increase whilst maintaining our performance standards.

During the "Beast from the East" extreme weather event at the end of February and beginning of March 2018 the Winter Plan was fully in effect. Due to the travel disruption and associated workload spike all available resources were called on to deliver standards of service and prioritise uncontrolled and controlled gas escapes. Workload shedding was invoked to the point that repair work was postponed with site check frequencies increased to ensure the ongoing safety of the network.

To assist with the workload, all competent persons throughout SGN, regardless of job role or directorate, were called upon to manage the workload and ensure that our high safety standards were maintained, thus invoking our emergency winter contingency arrangements.

In addition to standard emergency workload we also received increased numbers of reports of "no gas" from customers and endeavour to prioritise vulnerable customers during such extreme weather events.

SIU
Our contingency plans are mainly for the supply side. At the minute we have our main LNG supply site at the Isle of Grain, but we have a plan in place that we can revert to if this site cannot supply us with LNG for whatever reason. Sea level rise is actually a concern for this site as they are located on the Hoo peninsula, which is very flat, and close to sea level, so would be quite susceptible to flooding. Our contingency is to ship our road tankers by roro ferry, and ISO tanks by container ship, over to Belgium to our contingency terminal to load LNG.

With regard to our site deliveries - Due to the locations of these sites, it would be very difficult to plan for the whole range of scenarios that could cause a severe delay on the way to the site. Our first and most effective contingency is to keep the sites as full as possible at all times. In the past we have experienced various delays due to environmental factors, these include rockslides blocking the Campbeltown and Oban roads, heavy snow blocking the Northern route, and flooding causing severe delays on both the road and rail routes. We have to be extremely careful with road closures and diversions, as most secondary routes in the remote areas of Scotland are not suitable for 44 tonne 60 ft long vehicles, so most times it is safer for us to sit and wait for the main road to reopen.

Using the ISO tanks that we have in the fleet at the minute and replacing older road tankers with new high capacity ISO tanks has given us a lot more options in terms of resilience. If one of our supply routes was blocked, and if it looked like it was going to be blocked for a significant period of time, we have the option of transporting our tanks by chartering a small ship or barge from the central belt to each town and arranging