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Updated Supplementary Evidence

NGET_A10.05

Extreme Weather

As a part of the Draft Determination Response NGET_NGETQ5

nationalgrid

Contents

1. Introduction

Following engagement with Ofgem, it was confirmed that of the £59.8m requested in Investment Decision Pack NGET_A10.05_Extreme Weather (Extreme Weather IDP), partial funding of £24.6m has been allowed as per the table below.

We do not agree with Ofgem's draft determination as we must implement the guidance in Energy Networks' Associations Engineering Technical Report 138 (ETR138) to protect our network against surface water flooding by the end of the RIIO-T2 period, as required by BEIS. Failure to invest in flood defences at the right level at the right time could result in devastating consequences for our customers and stakeholders, and the end consumer.

The intention of proposing the Extreme Weather investment as a Price Control Deliverable was that we would be held to account in the RIIO-T2 period to deliver [redacted] sites for £49.8m and therefore should detailed site assessments demonstrate that less than [redacted] sites need protection, the money would be returned, reducing the risk to consumers.

Ofgem's draft determination leaves us with a funding gap to meet the current requirements of ETR138 and does not reference any regulatory mechanism to enable us to request the shortfall. If Ofgem is not minded to award the full funding, we propose that the scope of the MSIP re-opener should be extended to include all funding that may be required for Extreme Weather to meet the current requirements of ETR138.

Should Extreme Weather be included within the MSIP re-opener, we do not support there being a materiality threshold applied to this category, as this expenditure stems from government mandated requirements, whilst the value is unlikely to trigger the materiality threshold. The re-opener window timing of January 2024 is also too late in the price control period.

The following paragraphs provide further context and detail on the approach outlined in the Extreme Weather IDP. The additional detail included in Section 3.3 demonstrates that we are following a tried and tested approach that is robust and transparent. We have also outlined an alternative approach in Section 3.3.2 based on Table 6.16.1 "criticality substations" from our annual RRP submission that further demonstrates the required level of investment. No detailed site assessments had been carried out when the Extreme Weather IDP and SQ151 were submitted. However, detailed design has now been completed for [redacted] sites and initial cost estimates are available for [redacted] of these (see Section 3.3.2, Figure 8).

	Extreme Weather IDP	Draft Determination	Revised proposal
Flooding	£49.8m	£16.6m	£47.2m
Erosion	£8m	£8m	£8m
Climate Change Research	£2m	zero	Zero
Reopener	Yes – but only to cover further updates to ETR138	Yes – but only to cover further updates to ETR138	Yes – to cover *all* funding required to deliver ETR138
Total	**£59.8m**	**£24.6m**	**£55.2m**

2. Business Plan Context

The Electricity Safety, Quality & Continuity Regulations[1] (ESQCR) 3 (1) (b) state that "Generators, distributors and meter operators shall ensure that their equipment is so constructed, installed, protected (both electrically and mechanically), used and maintained as to prevent danger, interference with or interruption of supply, so far as is reasonably practicable". However, ESQCR does not provide specific guidance on the acceptable level of flood risk. The Energy Networks Association's Engineering Technical Report 138 (ETR138) seeks to address this gap and provides a common approach to assessing flood risk and installing appropriate mitigation. ETR138 states that:

"As a general principle Network Owners will target the completion of agreed protection to grid and primary substations as follows:

Transmission sites

- *Flooding from rivers and the sea – by the end of RIIO-T1 in 2021*
- *Flooding from surface water – by the end of RIIO-T1 in 2021"*

Recognising that this guidance was published in 2016, when funding had already been agreed for the T1 period, we must mitigate against the risk of pluvial flooding by the end of the RIIO-T2 period, as required by BEIS.

This requirement is echoed by our stakeholders. Our Business Plan is underpinned by the largest public engagement exercise we have ever conducted. Through this exercise:

- ☐ Our stakeholders asked us to maintain levels of reliability at an affordable cost;
- ☐ We adopted a tougher T2 target for Energy Not Supplied (ENS) weighing more heavily on recent performance; and
- ☐ We committed to maintaining a consistent level of network reliability between T1 and T2.

Furthermore, the National Infrastructure Commission (NIC) published Anticipate, React, Recover: Resilient Infrastructure Systems[2] in May 2020, which outlines a framework for resilience. Our proposals are designed to ensure that we can maintain a network that is resilient to weather related risks now and into the future, and are in line with the recommendations in the NIC report, an extract of which is included in Figure 1.

Figure 1: Extract from Anticipate, React, Recover: Resilient Infrastructure Systems

To deliver resilient infrastructure, a framework for resilience is required that:

- better anticipates future shocks and stresses by facing up to uncomfortable truths
- improves actions to resist, absorb and recover from shocks and stresses by testing for vulnerabilities and addressing them
- values resilience properly
- drives adaptation before it is too late.

Much of what is needed is already in place, but improvements can still be made:

- government should publish a full set of resilience standards every five years, following advice from regulators, alongside an assessment of any changes needed to deliver them
- infrastructure operators should carry out regular and proportionate stress tests, overseen by regulators, to ensure their systems and services can meet government's resilience standards, and take actions to address any vulnerabilities
- infrastructure operators should develop and maintain long term resilience strategies, and regulators should ensure their determinations in future price reviews are consistent with meeting resilience standards in the short and long term.

[1] https://www.legislation.gov.uk/uksi/2002/2665/contents/made

[2] https://www.nic.org.uk/wp-content/uploads/Anticipate-React-Recover-28-May-2020.pdf

The approach outlined in Section 3.3 achieves the required balance between maintaining a network that is resilient to future weather-related shocks and delivering value for the end consumer, in-line with our stakeholders' expectations.

3. Flooding

3.1. Context and Approach

The floods of summer 2007 saw the largest loss of essential services since World War II. Neepsend substation was shut down with loss of power to 40,000 people and Walham substation, which supplies 500,000 people, was only saved from shut down thanks to a coordinated effort to erect temporary defences between National Grid, the Emergency Services, the Armed Forces and the Environment Agency (EA). Sir Michael Pitt was charged with leading a review into the events of 2007, which culminated in the publication of The Pitt Review[3] in June 2008. The Energy Networks' Association (ENA) further developed the findings of The Pitt Review and published Engineering Technical Report 138 (ETR138) in October 2009. ETR138 was developed in partnership with BEIS, Ofgem, TOs and DNOs and provides guidance on how to improve the resilience of electricity substations to flooding to a level that is acceptable to customers, Ofgem and Government. It provides a systematic approach using a risk-based methodology and takes account of a cost/benefit assessment for each site. ETR138 was last updated in 2018 to incorporate additional information on surface water (pluvial) flooding; our RIIO-T2 investment plan is designed to meet the requirements of the updated Technical Report.

The approach outlines several key activities, including:

- Conducting Flood Risk Assessments for each substation;
- Identification of the Flooding Impact for each site and individual assets;
- Establishing if a site will be protected by a National flood protection scheme;
- Where necessary, identifying the most appropriate flood protection system for each site.

ETR138 states that Grid substations should be resilient against the level of flooding that may occur within a 1/1000 year event for pluvial, fluvial and coastal flooding. National Grid's Flood Mitigation Policy and Flood Defences Technical Standard incorporate the guidance from ETR138 to target a 1/1000 year resilience level for all new and existing substations, with the addition of a suitable allowance for climate change (as defined in UKCP09) and 300mm of freeboard to account for data errors (specified in ETR138). On rare occasions, engineering constraints and cost/benefit analysis may lead to a lower resilience level being more appropriate, for example at [redacted] substation, where we are installing a 2.4m high perimeter protection to achieve a 1/700 year resilience level.

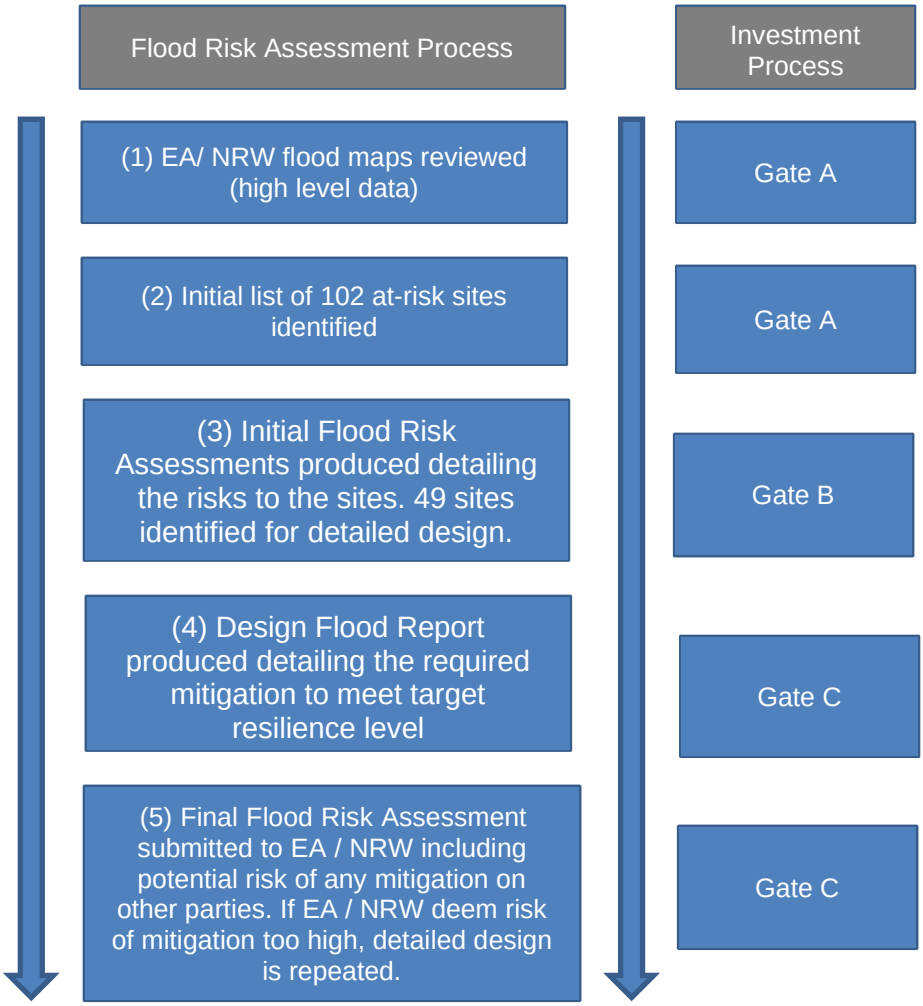
3.2. RIIO-T1

Within our RIIO-T1 proposals, 102 sites were initially identified at risk of fluvial and coastal flooding using EA and Natural Resources Wales (NRW) mapping data, which defines the risk level (1/100, 1/200 and 1/1000 year event) for each area. Our proposals did not include pluvial flood mitigation as accurate data was not available at the time. However, all sites that have been protected against fluvial and coastal flooding are automatically protected against pluvial flooding. The EA / NRW maps identify the risk on a large scale (usually 1:10,000) and are therefore not completely representative of the risk to a local area and don't usually include predicted flooding depths. ETR138 states that the provision of robust flood depth data is essential for the proper assessment of flood risk to substations and the identification of appropriate protection. It therefore recommends employing specialist contractors to carry out modelling of flood depths across a substation site to identify areas at risk of flooding and understand the level of

3 https://webarchive.nationalarchives.gov.uk/20100812084907/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf

protection required. National Grid followed this recommendation and appointed external contractors to carry out Flood Risk Assessments for the 102 sites identified at risk, which culminated in 49 sites requiring protection. The high-level process is summarised in Figure 2.

Figure 2: High-level summary of flood risk assessment process



As it wasn't possible to carry out detailed modelling on all 102 sites prior to the start of the RIIO-T1 period, we completed a desktop assessment using risk bandings that led to an estimate of 45-55 sites requiring mitigation. This is the same process that was followed in TPCR-4. An example of these bandings is shown in Figure 3 (section 3.3). Our current plan is to install mitigation at 49 sites, which is within the estimate of 45-55 sites, demonstrating the effectiveness of the process.

3.3. RIIO-T2

The following paragraphs provide further detail on the approach outlined in the Extreme Weather IDP. This approach applies the guidance in ETR138 to meet our stakeholders' expectations and achieve the required balance between ensuring our network is resilient to weather-related shocks and delivering value for the end consumer.

Following the same flood risk assessment process outlined in section 3.2, [redacted] sites have been identified at risk of pluvial flooding using the latest EA / NRW flood maps. These sites are discrete from the 49 sites that are being protected in T1. The EA / NRW maps identify the risk at a large scale and are therefore not completely representative of the risk to a local area.

We have reviewed the EA / NRW flood map data for the [redacted] sites, in conjunction with the Flood Risk Assessments (where available), satellite images and existing site knowledge, and have carried out a

desktop exercise to make an initial assessment of the risk of pluvial flooding. [redacted] sites are shown in Figure 3 as an example. A summary of this desktop assessment is shown in Figure 4.

Figure 3: Example of initial assessment of pluvial flooding risk

Figure 4: Summary of initial desktop assessment

Sites identified as unlikely to require mitigation			
Sites identified as likely to require mitigation			
Expected number of sites requiring mitigation following detailed assessment			

The initial assessment of each site will need to be verified by a site visit or local knowledge and mitigation will only be installed where it's deemed necessary. For example, a site visit could confirm that although the site is at risk of pluvial flooding, the individual assets are not, e.g. if the site is on a slope with all key equipment on higher ground.

3.3.1. Programme of Works

ETR138 states that "*As a general principle Network Owners will target the completion of agreed protection to grid and primary substations as follows:*

Transmission sites

- *Flooding from rivers and the sea – by the end of RIIO-T1 in 2021*
- *Flooding from surface water – by the end of RIIO-T1 in 2021"*

Recognising that this guidance was published in 2016, when funding had already been agreed for the T1 period, we must mitigate against the risk of pluvial flooding by the end of the RIIO-T2 period, as required by BEIS. In order to meet BEIS's expected timescales, we have planned a rolling programme of works from now until the end of the T2 period, which is summarised in Figure 6.

Figure 6: Rolling programme of works

This allows us to carry out the Flood Risk Assessment (if not already available) and subsequent detailed design for one tranche of sites, whilst simultaneously tendering and awarding work for another tranche of sites. If all site assessments were completed at the beginning of the RIIO-T2 period, there is a risk that EA / NRW data would be updated before work began, leading to over- or under-investment. Following a rolling programme also gives us the opportunity to realise efficiencies by coordinating with other site works. For example, flood mitigation at [redacted] substation has been deferred to coordinate with the [redacted] connection, with an expected saving of £800k.

To date, [redacted] sites have been visited by our specialist contractors; [redacted] sites were deemed to not require mitigation at present, and detailed assessment has been carried out for the remaining [redacted] sites. This drop-out rate is in line with our expectations, as shown in Figure 7. Where sites drop-out of the plan, they will be replaced with other sites with an expectation that detailed design will be completed for an average of [redacted] sites each year. Visits to a further [redacted] sites have taken place / are planned to take place in July, August and September.

A summary of the required mitigations is included in the document below. The initial view of potential mitigations, which were included in SQ151, is included for comparison.

Figure 7: Expected outturn

	Total number of T2 sites	Year 1 sites
Initial sample	[redacted]	[redacted]
Outturn (#)	[redacted]	[redacted]
Outturn (%)	**55%**	**60%**

3.3.2. Costs

In our December submission we applied the following bandings to estimate the total cost of our programme of works:

- [redacted] to [redacted] sites requiring full site protection at a cost of £1m to £3m, which gives a range of £4m to £18m total spend
- Up to [redacted] requiring localised protection sites at [redacted] £31.5m (some will be nearer £0.5m and some will be under £0.1m)

These bandings are based on an exercise where we took an initial view of the range of potential solutions required e.g. full site protection, single building protection, raising of a kiosk etc. This initial view was based on the EA / NRW flood maps, Flood Risk Assessments (where available), satellite images and existing knowledge of the sites. A low and high case cost was applied to each type of mitigation based on average costs of works of a similar scale delivered during RIIO-T1. This then produced a low and high case of total costs, with £49.8m representing the average. The full range of costs is shown in Figure 8.

Figure 8: Range of costs for RIIO-T2

	Number of sites		Costs per site		Total costs		Average
	Low	High	Low	High	Low	High	
Full site protection	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	**£17.0m**
Individual asset protection	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	**£28.0m**
Minimal remediation	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	**£4.8m**
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	**£49.8m**

*Scenario assumes a high number of low cost cases or a low number of high cost cases

At present, estimated costs are available for the first [redacted] sites. These costs are based on the drawings that have been produced as part of detailed design, however, this work has not gone out to tender yet and therefore costs are subject to change. Costs could also increase if unexpected issues are encountered once work begins e.g. if soil contamination is discovered.

[redacted] The estimated costs are shown in Figure 9 and a comparison of these estimates to the bandings included in the December submission is shown in Figure 10. [redacted]

Figure 9: Estimated costs for sites visited to date

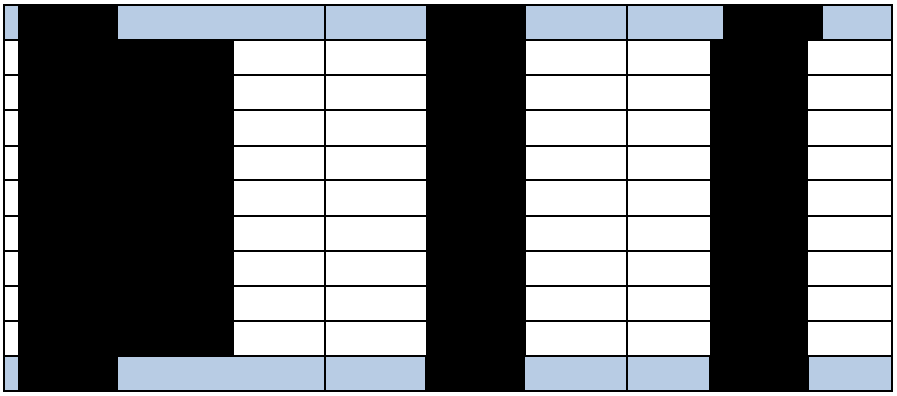


Figure 10: Comparison of estimated costs

Level of protection	Average cost in December submission	Average cost of initial estimate
Full site protection	[redacted]	[redacted]
Localised protection	[redacted]	[redacted]

Although the estimated costs for the initial [redacted] sites are higher than the bandings included in the December submission, we expect these to average out across the T2 period.
Recognising that cost estimates are only available for [redacted] sites to date, we have applied another approach to demonstrate the required level of funding for pluvial flood mitigation. This approach is based on Table 6.16.1 "criticality substations" from our annual RRP submission. The following methodology has been applied:

- Detailed drawings and cost estimates are available for [redacted] of the [redacted] sites that have been identified at risk of pluvial flooding
- The remaining [redacted] sites that have been identified at risk of pluvial flooding have been crossed checked against Table 6.16.1
- [redacted] sites have been identified as supplying customer demand
- We have assumed [redacted] of these sites will require full site protection, in line with Figures 8 and 9 in Section 3.3.2 of this paper.
- We have assumed that the remaining [redacted] sites will require individual asset protection and have applied the average estimated cost of localised protection from Figure 9 in Section 3.3.2.
- We have assumed minimum investment at a further [redacted] sites, recognising that this level of investment is more efficient than remediation costs following a flood.

Level of protection	Number of sites	Actual cost estimate (Total)		Number of sites	Assumed average cost	Total
Individual asset protection	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Minimal remediation	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Sub-Total	[redacted]	**£7.18m**		[redacted]	**-**	**£39.98**
Total Sites						[redacted]
Total Cost						**£47.16m**

3.3.3. Opportunities

Updates to the EA / NRW's flood data modelling create a 'moving target' to the flood mitigation solution. Any further national flooding reviews and governmental requirements triggering a review of ETR138 could impact on our flood protection plans. Our rolling programme of works allows us to mitigate this risk by reviewing the latest data and requirements each year and allocating spend to where it is needed most, therefore minimising the risk of under- or over-investment. For example, Flood Risk Assessments demonstrated that for 11 of the 102 sites identified at risk of flooding in T1, the flooding risk would not actually materialise until 2050 and beyond. This means that if we invested in our typical 'hard' flood defence assets of steel, concrete and pumps, which typically have lifespans of 30 to 80 years, they could be at least 50% through their life by the time they were required and therefore investing now would not be in the consumers' best interests. [redacted] saving approximately £7m - £11m in asset depreciation. Deferring these sites afforded the opportunity to invest in 11 other sites where data showed that the flood risk would materialise in the short to medium term.

Our rolling programme of works also enables us to coordinate with other site development and maintenance works, where the opportunity arises. This can reduce project management costs and increase efficiency during the construction phase. It also makes efficient use of the available SAP resources, which are in high demand.

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3.3.4. Risks

Failure to invest in flood defences at the right level at the right time could result in devastating consequences for our customers and stakeholders, and the end consumer. If funding is insufficient to enact the guidance in ETR138 in line with BEIS's requirements we will carry a number of risks, including:

- Reduced reliability for our customers and therefore the end consumer
- Loss of system flexibility to support DNO's during a flood
- Increased risk of damage to sites and resultant clean-up costs
- Loss of flexibility to reprioritise sites throughout the T2 period to ensure defences are installed where they are needed most
- Loss of flexibility to make efficient use of SAP resources and reduce project management costs by aligning plan with other site development works

4. In Conclusion

We must protect our network against surface water flooding by the end of the RIIO-T2 period and implement the guidance in ETR138, as required by BEIS. Failure to invest in flood defences at the right level at the right time could result in devastating consequences for our customers and stakeholders, and the end consumer. Ofgem's draft determination leaves us with a funding gap and it is unclear how we request the remaining funding to meet the current requirements of ETR138.

We have provided further context and detail on the approach outlined in the Extreme Weather IDP demonstrating that we are following a tried and tested approach that is robust and transparent. We have also outlined an alternative approach based on our critical substations that further demonstrates the required level of investment. Detailed assessments are now available for [redacted] sites, of which cost estimates are available for[redacted], which demonstrate the range of different mitigations required.

If Ofgem is not minded to award the full funding, we propose that the scope of the MSIP should be extended to include all funding that may be required for Extreme Weather, with no materiality threshold, to meet the current requirements of ETR138.

The table below summarises our position.

	Extreme Weather IDP	Draft Determination	Revised proposal
Flooding	£49.8m	£16.6m	£47.2m
Erosion	£8m	£8m	£8m
Climate Change Research	£2m	zero	zero
Reopener	Yes – but only to cover further updates to ETR138	Yes – but only to cover further updates to ETR138	Yes – to cover *all* funding required to deliver ETR138
Total	**£59.8m**	**£24.6m**	**£55.2m**

Appendix 1 - BPDT References and Revised Spend Profile

RIIO-T2 Business Plan Data Template
National Grid Electricity Transmission
Workbook C: Non Load
Version 1.9 - Submitted on 09 Dec 2019
Sheet: C2.24 Legal & Safety
Prices Base: 2018/19

Pluvial

Flood Mitigation Schemes

The table below is an extract from BPDT C2.24 Legal & Safety

		RIIO T2					RIIO >T2						Total		
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	>2031	RIIO T1	RIIO T2	RIIO >T2
Flood Mitigation Schemes		£m	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m
Substation		-	-	-	-	-	-	-	-	-	-	-	14.296	-	-
Substation		-	-	-	-	-	-	-	-	-	-	-	43.278	-	-
Substation		-	-	-	-	-	-	-	-	-	-	-	61.384	-	-
Flooding Non-Site Specific Costs		4.300	8.760	14.280	16.150	16.330	1.542	-	-	-	-	-	5.444	59.820	1.542

Revised Spend Profile (£m)

2022	2023	2024	2025	2026	Total
8.28	13.248	13.8	11.04	8.832	55.2