

# Final Report

## **Review of climate resilience mainstreaming into regulatory and voluntary standards, national guidance, and other sectoral/industry codes of practice**

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## Contract

This report describes work commissioned by the Met Office. The Met Office's representative for the contract is Zorica Jones.

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## Purpose

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## Executive Summary

This project and its outputs provide a broad understanding of current UK standards and guidelines relevant to climate resilience and set out a vision for the future for climate resilience standards and guidance towards 2030. Working with leading stakeholder organisations we have gained detailed insight into the use of climate resilience standards and guidance, as well as the drivers and barriers related to use. The project has assessed the usability of current standards and guidance, setting out examples of good practice and what makes standards and guidance effective. Looking to the future, it has worked with stakeholders to propose priorities for the improvement of standards and guidance across all UK sectors to 2030.

'Standards' is a catch-all term for documents that distil best practice and are drafted by recognised experts. 'Guidelines' and 'codes of practice' are subsets of standards and tend to provide non-binding recommendations, whereas 'requirements' standards contain mandatory provisions.

Looking broadly across all sectors most likely to be impacted by climate change, the project team set out to identify the routes to influence climate resilience standards and good practice guidance, providing advice on how SPF UKCR can raise awareness amongst those responsible for standards.

An initial literature review found that:

- Standards and guidance in use typically vary by UK nation, administrative area or by sector. This helps standards and guidance to be tailored and specific; though, can result in overlap, inconsistency and, in some cases, confusion.
- Sectors responsible for built infrastructure tend to have more detailed standards, guidance and codes of practice compared with those that are not.
- The ISO 14090: Adaptation to climate change - Principles, requirements and guidelines can be applied across sectors.
- There are very few standards or guidance examples using UKCP18 data, with most based on UKCP09 data if any is used.

Consultation through a questionnaire and targeted interviews identified three areas of feedback, as illustrated below.



### Drivers

Regulatory obligations (inc. Climate Change Act 2008 & Adaptation Reporting Power)  
Funding / business case  
Recent adverse weather events

### Barriers

Experience and understanding of complex science  
Need for single design values vs. projection uncertainty  
Lack of clarity on target (e.g. 2 or 4 deg warming)  
Resources and time  
Lack of organisational adaptive capacity

### Usability

Case studies  
Flow diagrams  
Stronger language ('shall', not 'may' or 'should')  
Clearer language (resilience or adaptation?; language for engineers, planners, non-experts)  
Applicability – sector specific  
Prescriptive

A project workshop held in October 2020, with wide multi-sectoral representation, drew out the following eight highest priority activities in moving towards climate resilience standards, guidance and codes of practice for the next ten years.

Ranking	Priority activity
1	Government departments leadership and facilitation is required (Guidance doesn't always lead to resilience – adaptive capacity needed and tough decisions from Government) / Merging of standards, guidance and policy into a single direction
2	Collaboration leading to interlinked and consistent standards between sectors
3	Defining resilience and what we are being resilient to (e.g. weather events or longer-term change)
4	Mandatory requirements are needed / Avoidance of ambiguity, with no scope for 're-interpretation'
5	Simple communication and guidance for different parts of a process / Clear guidance on process of assessing risk - for lay-person
6	Agreement on the 'level of service' (LoS) to be provided between sectors and Government; sectors / orgs then decide on climate values to achieve this LoS
7	Stress test systems to determine thresholds, then become resilient to these
8	An overarching approach to standards is needed with a process of commonality to reviewing, analysing and interpreting UK climate projections and sectoral standards co-developed with regulators, operators, and govt departments.

Steps to achieve the above priorities were discussed and proposed within the workshop, also identifying, where possible, organisations that could or should be responsible for these steps, timelines over which these happen, and associated dependencies, constraints, opportunities and synergies.

Three over-arching recommendations are made that can be used to inform a ten year (2020-2030) 'road map', enabling the UK to attain a high degree of systemic resilience to the future climate, recognising the value of a cross-cutting policy approach supported by harmonised, coherent standards in all sectors and at all levels of society.

**RECOMMENDATION 1** – Establishment of a Climate Change Adaptation (CCA) Policy Leadership Task Force with a 'task and finish' theme under the responsibility of the Climate Cabinet Committee, supported by UKRI, CCC, Met Office and sector experts. To deliver: a common understanding of resilient levels of service in each sector; a convergence and harmonisation exercise across sectors; a gap analysis to identify where standards are not yet available; development of standards to fill those gaps; identification of capacity gaps at key decision-making levels; a communications strategy and associated communications plans; funding for industry bodies e.g. LCCP, IOAF; an overarching, horizontal governance structure.

**RECOMMENDATION 2** - Task Force to address the additional priorities (minimum standards based on climate science of risk exposure, aligning resilience standards with carbon net zero, sharing good practice across sectors, steer on dealing with projection uncertainty, 'Kite mark' for successful application of guidance, developing allowances where they don't exist [e.g. for overheating for buildings], standardised agreement for reporting).

**RECOMMENDATION 3** - Stress testing to identify critical thresholds that are sector-specific with cross-cutting issues being identified that can apply across sectors. This exercise would ideally take place within two years and then should then be repeated in 5-10 years. It is thought this activity could be instigated by Cabinet Office owing to its Civil Contingencies role.



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## Abbreviations

AHRC	Arts and Humanities Research Council
BEIS	Department for Business, Energy & Industrial Strategy (UK Government)
BSI	British Standards Institution
CCA	Climate Change Adaptation
CCC	Committee on Climate Change
CEN/ Cenelec	The European standards bodies
CCRA	UK Climate Change Risk Assessment
CIBSE	Chartered Institution of Building Services Engineers
DAERA	Department of Agriculture, Environment and Rural Affairs (Northern Ireland)
DEFRA	Department for Environment, Food and Rural Affairs (UK Government)
DfT	Department for Transport (UK Government)
EA	Environment Agency (England)
EPSRC	Engineering and Physical Sciences Research Council
ESRC	Economic and Social Research Council
ETSI	European Telecommunications Standards Institute
IEC	International Electrotechnical Commission
IOAF	Infrastructure Operators Adaptation Forum
ISO	International Standards Organisation
ITU	International Telecommunication Union
LCCP	London Climate Change Partnership
LoS	Level of Service
NAPF	National Adaptation Policy Framework
NERC	Natural Environment Research Council
NIC	National Infrastructure Commission
NRW	Natural Resources Wales
OJEU	Official Journal of the European Union
ORR	Office of Road and Rail
SEPA	Scottish Environment Protection Agency
SPF	Strategic Priority Fund
SUDS	Sustainable Drainage Systems
TCFD	Task Force on Climate-related Financial Disclosures
UKCP	UK Climate Programme (UKCP09, UKCP18 – UK climate projections released in 2009 and 2018)
UKCR	UK Climate Resilience Programme
UKRI	UK Research and Innovation

## 1 Introduction

The United Kingdom (UK) is facing a suite of climate change threats that present unique challenges for the nation and its businesses. To better understand, mitigate, and adapt to these threats, guidance and standards exist in some sectors; some include explicitly the need to consider climate change impacts. There is a multitude of good practice, guidance documents and tools, with some sectors having more mature guidelines concerning dealing with climate change impacts than others. The standards and guidance exist within the context of evolving international (ISO), European (CEN/CENELEC) and UK (British Standards Institute [BSI]) considerations of climate change impacts.

This project and its outputs provide a broad understanding of current UK standards and guidelines relevant to climate resilience and set out a vision for the future for climate resilience standards and guidance towards 2030. Working with leading stakeholder organisations we have gained detailed insight into the use of climate resilience standards and guidance, as well as the drivers and barriers related to use. The project has also assessed the usability of current standards and guidance, setting out examples of good practice and what makes standards and guidance effective. The project has looked to the future, working with stakeholders to propose priorities for the improvement of standards and guidance across all UK sectors for the next ten years.

This project sits within the wider UK Climate Resilience (UKCR) Programme, part of the Strategic Priority Fund (SPF) on UK Climate Resilience. This programme aims to draw together fragmented climate research and expertise to deliver robust, multi- and inter-disciplinary climate risk and adaptation solutions research. Led by UKRI and the Met Office the programme has three main objectives:

1. Characterising and quantifying climate-related risks
2. Managing climate-related risks through adaptation
3. Co-producing climate services

This standards project is supporting both objectives 2 and 3 of the UKCR programme.

### 1.1 Acknowledgement

The UK Climate Resilience programme is supported by the UKRI (UK Research and Innovation) Strategic Priorities Fund. The programme is co-delivered by the Met Office and NERC (Natural Environment Research Council) on behalf of UKRI partners AHRC (Arts and Humanities Research Council), EPSRC (Engineering and Physical Sciences Research Council), ESRC (Economic and Social Research Council).



## 1.2 Objectives of the research

This research sought to achieve the following objectives:

- An improved understanding of how climate resilience is mainstreamed into the sectors' standards, guidance, and other codes of practice;
- A new 'standards landscape' to inform a broad range of stakeholders (what standards and guidance exist, how standards and guidance documents are modified and updated, including when the standards can be updated, who is responsible for doing so, and what types and format of information are needed);
- Examples of good and best practice in relation to climate adaptation and standards; and
- Recommendations of future work areas (e.g. research questions, specifications) for future elements of the SPF UKCR programme.

## 1.3 Final report

This report draws together findings from all stages of the project (shown in Figure 3-1). It describes the methodology in brief, the outcomes of the final workshop and recommendations for the future of climate resilience standards and guidance in the UK. Detailed outcomes of the various stages of the project are provided in Appendices A – C.

## 2 Differences between standards, guidance, codes of practice

BSI explains<sup>1</sup> how standards cover a wide range of subjects from construction to nanotechnology, from energy management to health and safety, from cricket balls to goalposts. They can be very specific, such as to a particular type of product, or general such as management practices.

The point of a standard is to provide a reliable basis for people to share the same expectations about a product or service. This helps to:

- facilitate trade
- provide a framework for achieving economies, efficiencies and interoperability
- enhance consumer protection and confidence.

'Standards' is a catch-all term for documents that distil best practice and are drafted by recognised experts. 'Guidelines' and 'codes of practice' are subsets of standards and tend to provide non-binding recommendations, whereas 'requirements' standards contain mandatory provisions. Often, the development process for requirements standards is more rigorous than for guidelines and codes, owing to the need to get e.g. consensus across a range of experts, and the terminology agreed. Terms in standards help distinguish whether clauses are mandatory, are recommendations or providing guidance. When an organization chooses to adopt, or impose a standard it is agreeing to adhere to the nuances of the language in the standard - any term where, for example, 'shall', 'should' or 'may' appear:

'Shall' clauses are requirements – these must be followed;

'Should' clauses are recommendations – those activities that ought to be followed; and,

'May' clauses are 'guidelines' – those activities that are permitted.

Individual Standards may be a mix of requirements, recommendations and guidelines<sup>2</sup>.

### 2.1 Relevant types of standard

CEN/ CENELEC, the European Standards body, describes types of standards as follows<sup>3</sup>:

**Test methods and analysis standards** - these measure characteristics such as temperature and chemical composition. Typically, these are used by verification and assurance organizations and can be used throughout and infrastructure project's construction phase to assure that the materials used meet the required performance specification – concrete composition and strength is an example;

**Organisation standards** – these describe the functions and relationships of a company, as well as elements such as quality management and assurance, maintenance, value analysis, logistics, project or system management, production management, etc. Typically, these are used by larger organizations and corporations, an example being ISO 9001 on quality management.

In infrastructure project-cycle terms, organizational standards would tend to be applied at or before the early stages of a project to assure project 'sponsors' or organizations that the functions and relationships exist so that e.g. assured quality outputs are achieved. Some organizations might be certified to a standard and the application of such a standard becomes a routine activity regardless of project needs – ISO 9001 would be a typical example, as would

1 <https://www.bsigroup.com/en-GB/standards/Information-about-standards/what-is-a-standard/>

2 ISO 14090 Adaptation to climate change – Principles, requirements and guidelines

3 Eurocodes, available at: <http://eurocodes.jrc.ec.europa.eu/showpage.php?id=1>

ISO 55001 on asset management, which requires processes that link an organization's high-level aims to activities 'on the ground';

**Specification standards** – these define characteristics of a product (product standards), or a service (service activities standards) and their performance thresholds such as fitness for use, interface and interoperability, health and safety, environmental protection, etc. Typically, these are used in infrastructure projects at the design stage to perform the structural design calculations (e.g. safety, loadings, resistance to loadings), and to select and specify the desired materials' performance (e.g. concrete strength, paint coatings, fixings).

During the service life of the infrastructure project, specifications will set maintenance and operational requirements – aspects such as when to inspect, repair and renew components and how to manage train movements, signalling, and despatch in stations. Maintenance standards often are part of the organization's asset management plans, so linking into ISO 55001 where adopted.

## 2.2 Harmonized standards

Some European Standards are 'harmonised'. A harmonised standard is a European Standard developed by a recognised European Standards Organisation: CEN, CENELEC, or ETSI (European Telecommunications Standards Institute). It is created following a request from the European Commission to one of these organisations. Manufacturers, other economic operators, or conformity assessment bodies can use harmonised standards to demonstrate that products, services, or processes comply with relevant EU legislation, such as the Construction Products Directive.

The references to harmonised standards must be published in the Official Journal of the European Union (OJEU). This is to provide access to the latest lists of references of harmonised standards and other European standards. This means that by using these standards, compliance with relevant EU legislation is realised; in formal terms, a 'presumption of conformity with the essential requirements in the law'.

## 2.3 How standards are developed

There are at least two ways that standards can be developed – those required within a sector, industry or company, and those produced by a standards body such as national (e.g. NEN, DIN), regional (e.g. CEN and CENELEC) or international standard bodies (e.g. ISO, International Electrotechnical Commission [IEC], International Telecommunication Union [ITU]). The three European Standardization Organizations, CEN, CENELEC and ETSI are officially recognized as competent in the area of voluntary technical standardization by EU Regulation (1025/2012) that settles the legal framework for standardization.

Sectors, industries or companies will have their own development process which might involve internal steering groups, expert advisors, a drafting, vetting and a publication process. Examples of such standards include the UK Energy Networks' Association's ETR 138<sup>4</sup> "Resilience to Flooding of Grid and Primary Substations" and Network Rail's NR/L3/CIV/020 "Design of Bridges".

Standards produced by a standards body respond to a market need. The ISO process<sup>5</sup> is summarised here, other bodies such as CEN/CENELEC and BSI use similar processes:

- ISO standards respond to a need in the market, from e.g. a request from industry or other stakeholders. Typically, an interested group communicates the need for a standard to ISO via its national standards body

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<sup>4</sup> <http://www.ena-eng.org/ENA-Docs/EADocs.asp?WCI=DocumentDetail&DocumentID=8021>

<sup>5</sup> <https://www.iso.org/developing-standards.html>

- These standards are developed by groups of experts from all over the world, that are part of larger groups called technical committees. These experts negotiate all aspects of the standard, including its scope, key definitions and content
- Technical committees are made up of experts from the relevant industry, but also from consumer associations, academia, NGOs and government
- Developing ISO standards is a consensus-based approach and comments from all stakeholders are taken into account

## 2.4 Choice vs. Mandated

Organisations that develop their own standards normally require adherence to them by, for example, internal and external teams, projects or programmes. Standards produced by standards bodies – such as ISOs or European Standards – can be subject to choice. These ‘voluntary standards’ may become mandatory as a result of its use, reference, or adoption by a regulatory authority, or when invoked in legislation, contracts, purchase orders, or other commercial instruments<sup>6</sup>. Clients, investors and other organizations can choose to require adherence to standards as part of a contractual agreement. Technical guides produced by sectors, industries or companies can sometimes be relied upon as examples of good practice in court cases.

While European Standards are ‘voluntary’, the ‘Structural Eurocodes’<sup>7</sup>, used for construction projects, are mandated for public works in the European Union under the Public Procurement Directive<sup>8</sup>.

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6 <https://www.cen.eu/work/areas/construction/eurocodes/Pages/default.aspx>

7 <http://eurocodes.jrc.ec.europa.eu/doc/publicprocurementdirective.pdf>

8 <http://eurocodes.jrc.ec.europa.eu/showpage.php?id=1>

### 3 Research methodology

#### 3.1 Overall methodology

The project set out to generate a clear mapping of climate standards and standardised industry-wide tools related to UK climate resilience. Looking broadly across all sectors most likely to be impacted by climate change, it has set out to identify the routes to influence climate resilience standards and good practice guidance, providing advice on how SPF UKCR can raise awareness amongst those responsible for standards.

To achieve these aims, the JBA project team completed a series of project stages outlined in Figure 3-1, and further detailed in this section.



**Figure 3-1 Project stages**

Consultation activities have provided qualitative and quantitative evidence of sectors' drivers, barriers and usability of climate standards, guidance and codes of practice, and opportunities. Consultation has allowed us to make recommendations for a strategic direction for the future development of climate resilience standards, guidance and tools.

#### 3.2 Inception stage

The inception stage established the sectors for investigation in the project. Sectors were proposed, discussed and agreed upon based on primary risks within the Climate Change Risk Assessment (CCRA2). The final set of sectors for analysis is shown in Table 3-1. Flood and coastal risk is given the highest priority in the CCRA and is an area where there has been considerable focus for making allowances for climate change in engineering design and planning. Its impacts on urban environments and buildings are significant. The inclusion of Health and well-being from high temperatures with the Transport infrastructure sector was regarded as significant. The Finance sector could be impacted by all the CCRA risk areas, though in different ways and to different levels of severity.

**Table 3-1 Matrix of CCRA risks and sectors selected for analysis**

CCRA risk	Urban environments	Buildings	Agriculture / forestry	Health	Natural environment	Transport Infrastructure	Water utilities	Finance
Flooding & coastal								
Health & well-being from high temperatures								
Water supply (for public, agriculture, energy generation, industry)								
Natural capital (ecosystems, soils, biodiversity)								
Food production (UK &								
Pests / diseases / invasive species								



### 3.3 Literature review

A systematic review of 57 peer-reviewed and grey literature was conducted to complete the literature review. It examined regulatory and voluntary standards, national guidance and other sectoral/industry codes of practice in the UK and international approaches. This literature review drew out good and best practice, identified where climate resilience (or adaptation) was an explicit objective and determined how appropriate relevant guidance and requirements were for its intended audiences.

This literature review was guided by the central research question of 'What are the climate standards and standardised industry-wide tools related to UK climate resilience?'. It is available in Appendix A.

### 3.4 Questionnaire

The purpose of the questionnaire was to build upon the findings of the literature review, drawing out further reference documents, standards, and practices in the scoped areas. It also provided further quantitative and qualitative review of the gap analysis and provide richness to the stakeholder mapping for further distribution of the questionnaire, interviews, and workshop.

The questionnaire was developed based on the results of the literature review and had a majority of closed questions to ensure a quantitative analysis could be completed and the respondents were able to quickly complete the questionnaire. It was separated into 'your sector you identify with' section and 'your organisation' section allowing for clarity between responses. Open questions supplemented the closed questions to provide any qualitative data.

The questionnaire was distributed by a web-based survey, Microsoft Forms, and only the JBA research team had access to the questionnaire responses. The responses were anonymous, unless the responder expressed an interest in attending the project workshop.

The questions and summary of responses is presented in Appendix B.

### 3.5 Interviews

To inform this research, 24 interviewees from 21 organisations were interviewed during June and July. Interviews provide people with an opportunity to speak freely about their thoughts and for follow-up questions to be posed. The interview questions followed responses from the questionnaire, so that questions could be posed that explored some of the questionnaire answers that were given. To widen the number of interviews and the sectors covered, some interviews were made of individuals who did not complete the questionnaire. For these individuals, the interview scripts were adapted accordingly.

Interviews were completed with a wide range of stakeholders, covering 12 sectors and 21 organisations.

The interviews conducted were 'semi-structured' in that they followed a prescribed set of questions, but also allowed for the interviewers to ask follow-up questions and discuss aspects raised that may have been sector- or organisation-specific. This approach allowed the interviews to be flexible and adaptable to each individual participant and the conversations could follow each participant's experience and expertise. A broad interview guide was developed which outlined the key questions and topics to cover with each participant.

The questions are presented in Appendix C.



### 3.6 Workshop

The workshop was used to test our Interim Report finding and enable the Met Office, through engaging with sector expertise to confirm a strategic direction for the future development of standards, guidance and tools.

The workshop was held over two days in an online environment using Microsoft Teams software, employing Microsoft Forms to allow participants to carry out evaluations and provide feedback during the workshop.

During the breakout sessions participants were posed the following questions:

1. What aspects of good practice are important for you / your sector and why? (Day 1)
2. What are the two highest priorities for standards and guidance in the next ten years? (Day 1)
3. What is your preferred approach for achieving these priorities? (Day 2)

The workshop was attended by representatives of the organisations shown in Table 3-2. There were 22 workshop participants.

**Table 3-2 Workshop sectoral representation**

Organisation	Sector
Defra	Environment
Environment Agency	
Forestry Commission	
Ministry of Defence	Infrastructure
City of London	Infrastructure / built environment
Royal Town Planning Institute	Built environment
Highways England	Transport
Transport for London	
Network Rail	
Yorkshire Water	Water
ClimateWise	Finance / insurance
London Climate Change Partnership	Cross-sectoral
Tarian Inspection Services (environmental ISO compliance)	
Committee on Climate Change	
Met Office	

## 4 Literature Review and Consultation outcomes

### 4.1 Literature review key learning points

The 57 publicly available published documents reviewed provided an understanding of how climate resilience is integrated into regulatory and voluntary standards, national guidance, and other sectoral / industry codes of practice. The key learning points are below.

- A key standard on climate resilience is ISO 14090: Adaptation to climate change - Principles, requirements and guidelines. This international standard can be applied across sectors.
- Reference to UKCP18 is largely confined to flood risk guidance, though evidence that UKCP09 has been used to inform documents is significantly more widespread. There are plans identified from the literature review for urban environment, agriculture/forestry, natural environment, transport infrastructure and water utilities sectors documents to be informed by UKCP18.
- Standards and guidance in use typically vary by UK nation, administrative area or by sector (e.g. flood risk guidance for applying climate change allowances are the same for England and Wales, but differ in Scotland and Northern Ireland). This helps standards and guidance to be tailored and specific; though, can result in overlap, inconsistency and, in some cases, confusion. This can be seen as a dichotomy: sector- or organisation-specific standards and guidance have advantages and disadvantages, as do consistent, 'one size fits all' standards and guidance.
- There appears to be a clear divide between sectors responsible for built infrastructure and those that are not. This may be a result of health and safety requirements associated with built infrastructure and the severity of climate impacts on people; however, it is clear there is a gap for additional guidance and standards in some sectors. An example of this is in the health sector.

### 4.2 Consultation key learning points

The 29 questionnaire responses and 24 interviewees provided further qualitative and quantitative findings building upon the results of the literature review. The key learning points from this consultation are below.

- Findings from consultation can be grouped into aspects of drivers, barriers and usability. These aspects can form a basis from which to explore the future needs for climate resilience standards, guidance and codes of practice across the UK.
- Language and style are very important to ensure standards, guidance, or codes of practice can be followed easily. Simple language should be used, written to be easily understood by the user, with case studies and examples where the reader can follow it exactly.
- There is a need to understand where people are within the journey of climate resilience (i.e. education, organisational uptake, senior management commitment) before asking them to comply with climate standards, guidance or codes of practice
- Some sectors indicated that good standards or guidance can still be ineffective because they can be 'sidestepped' – for example, developers can avoid climate resilient drainage solutions despite guidance being available.

- Climate resilience means something different to different organisations and individuals<sup>9</sup>. There is a need for systemic view that considers the utility and take-up of standards in support of policy, where policy mandates climate resilience and does not provide the means to hinder or cancel the effectiveness of what the standard requires. This points to a need for a consistent method to determine the level of climate resilience required within each sector or organisation so they are aware to what level of climate resilience they should be adapting.
- Firm direction from both the Government and regulators is needed. This firm direction will aid in ensuring there is a standard of climate resilience proportionate to needs and the various sectors and organisations join up thinking. For example, if ports are adapted to a 1 in 100 year flood event, but the road infrastructure or utilities are only protected to a 1 in 50 year flood event, the ports will still be vulnerable. Government and regulators can aid in the joined-up thinking. This aligns with the National Infrastructure Commission (NIC) calling for a Framework for Resilience to be set up and for Government to publish a full set of resilience standards every 5 years.

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<sup>9</sup> The definition of climate resilience was the subject of a recent UKCR webinar by Professor Kate Lonsdale, available at: <https://www.ukclimateresilience.org/news-events/webinar-creating-climate-resilience-in-the-uk-what-does-this-mean-and-how-might-we-achieve-it/>

## Headline learning points

Themes that emerged from the consultation phase have been captured in Figure 4-1.

The headline findings have been organised into three over-arching themes: drivers, barriers and usability. These terms are expanded on below.

**Drivers** – the reason for using climate resilience standards, guidance or codes of practice – what is motivating or requiring organisations to use or develop these

**Barriers** – aspects that prevent or hinder the use of climate resilience standards, guidance or codes of practice – important to inform how future S/G/CoP could develop / be improved

**Usability** – the reasons that make S/G/CoP useful, easy to apply, and encourage compliance



**Figure 4-1 Organisation of summary feedback from consultation**

## 5 Workshop Outcomes

### 5.1 Output summary

The priority activities (effectively participant recommendations) drawn out from responses in breakout groups on Day 1 of the workshop are summarised below. There were 22 workshop participants representing 15 organisations.

#### Government role / direction

- A. Government leadership<sup>10</sup> (Guidance doesn't always lead to resilience – adaptive capacity needed and tough decisions from Government) / Merging of standards, guidance and policy into a single direction
- B. Defining resilience and what we are being resilient to (e.g. weather events or longer-term change)
- C. Setting minimum standards based on climate science of risk exposure that matches life of assets and timetable for achieving this / Determining the targets of resilience for each sector
- D. Agreement on the 'level of service' (LoS) to be provided between individual sectors and the related Government department; sectors / organisations then decide on climate values to achieve this LoS

#### Approaches to resilience

- E. An overarching approach to standards is needed with a process of commonality to reviewing, analysing and interpreting UK climate projections and sectoral standards co-developed with regulators, operators, and govt departments.
- F. Stress test systems to determine thresholds, then become resilient to these
- G. Collaboration leading to interlinked and consistent standards between sectors
- H. Align resilience standards with carbon net zero standards (i.e. clear goal in each) / Mitigation not isolated from adaptation
- I. Share good (and bad) practice from different sectors

#### Requirements

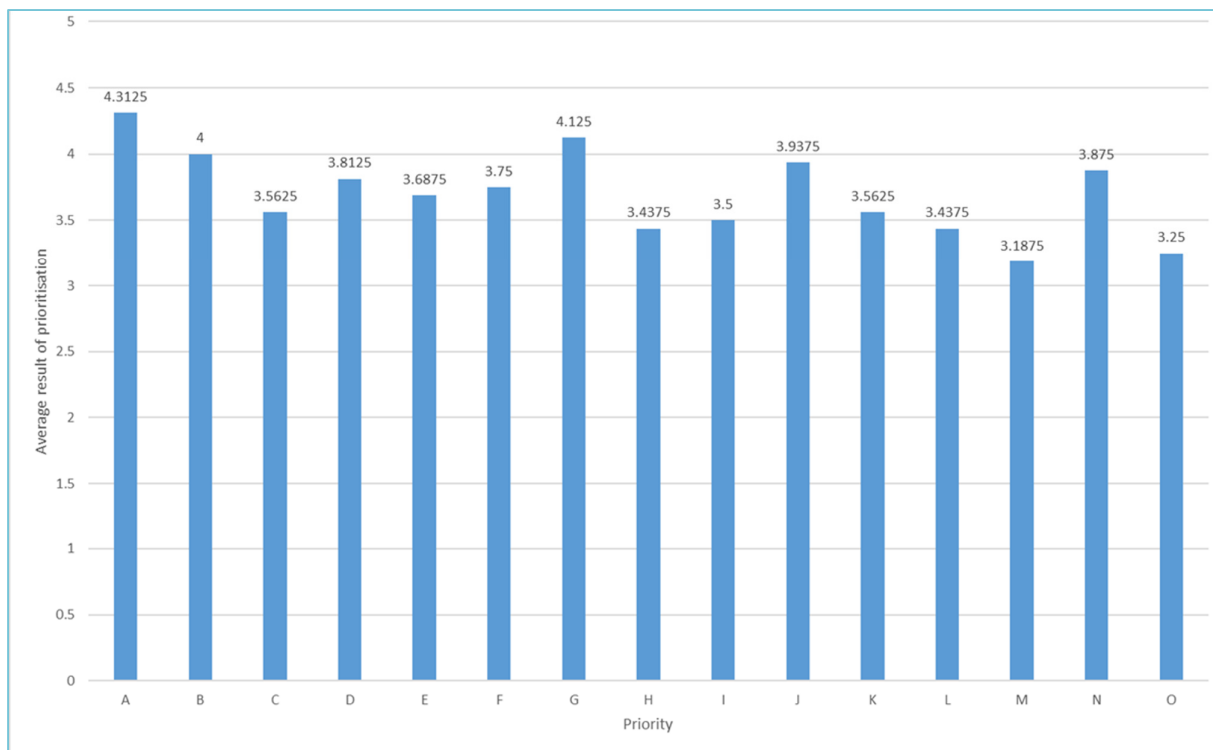
- J. Mandatory requirements are needed / Avoidance of ambiguity with no scope for 're-interpretation'
- K. Clearer steer on dealing with projection uncertainty / Guidance on which RCPs should be used for different cases
- L. 'Kite mark' for successful application of guidance / Quality assurance
- M. Climate change allowances needed where they don't exist, e.g. for overheating for buildings
- N. Simple communication and guidance for different parts of a process / Clear guidance on process of assessing risk - for lay-person
- O. Standardised agreement needed on reporting

On Day 2 of the workshop, all participants were asked to score the 15 priorities above with a value of 1 to 5, 5 being the greatest priority. The results of this exercise are shown in Figure 5-1. The lettering matches the lettering of the list above.

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<sup>10</sup> This relates to increased Government departments' leadership and facilitation being required to support climate resilience standards and guidance in the future – this theme is developed further in Priority 1 within Table 5-3 and the recommendations (section 6)





**Figure 5-1 Results of Day 2 participants' scoring of the 15 priorities**

The eight highest scoring priorities were used in the breakout exercise on the second day of the workshop to answer question 3, What is your preferred approach for achieving these priorities? These eight highest priorities are shown in Table 5-1.



**Table 5-1 Highest eight priorities for standards and guidance from participant scoring**

Ranking	Priority activity
1	Government leadership <sup>10</sup> (Guidance doesn't always lead to resilience – adaptive capacity needed and tough decisions from Government) / Merging of standards, guidance and policy into a single direction
2	Collaboration leading to interlinked and consistent standards between sectors
3	Defining resilience and what we are being resilient to (e.g. weather events or longer-term change)
4	Mandatory requirements are needed / Avoidance of ambiguity with no scope for 're-interpretation'
5	Simple communication and guidance for different parts of a process / Clear guidance on process of assessing risk – for lay-person
6	Agreement on the 'level of service' to be provided between sectors and Government; sectors / orgs then decide on climate values to achieve this LoS
7	Stress test systems to determine thresholds, then become resilient to these
8	An overarching approach to standards is needed with a process of commonality to reviewing, analysing and interpreting UK climate projections and sectoral standards co-developed with regulators, operators, and govt departments.

To answer question 3, participants were asked to consider the following criteria:

- What steps are needed to achieve this priority activity?
- Who might be lead organisation / what resources might be needed?
- What timeframe is there for this step?
- What dependencies or constraints exist?
- What opportunities or synergies are relevant?

The four breakout groups were given priorities 1 & 8, 2 & 7, 3 & 6 and 4 & 5 to avoid a priority bias in any group.

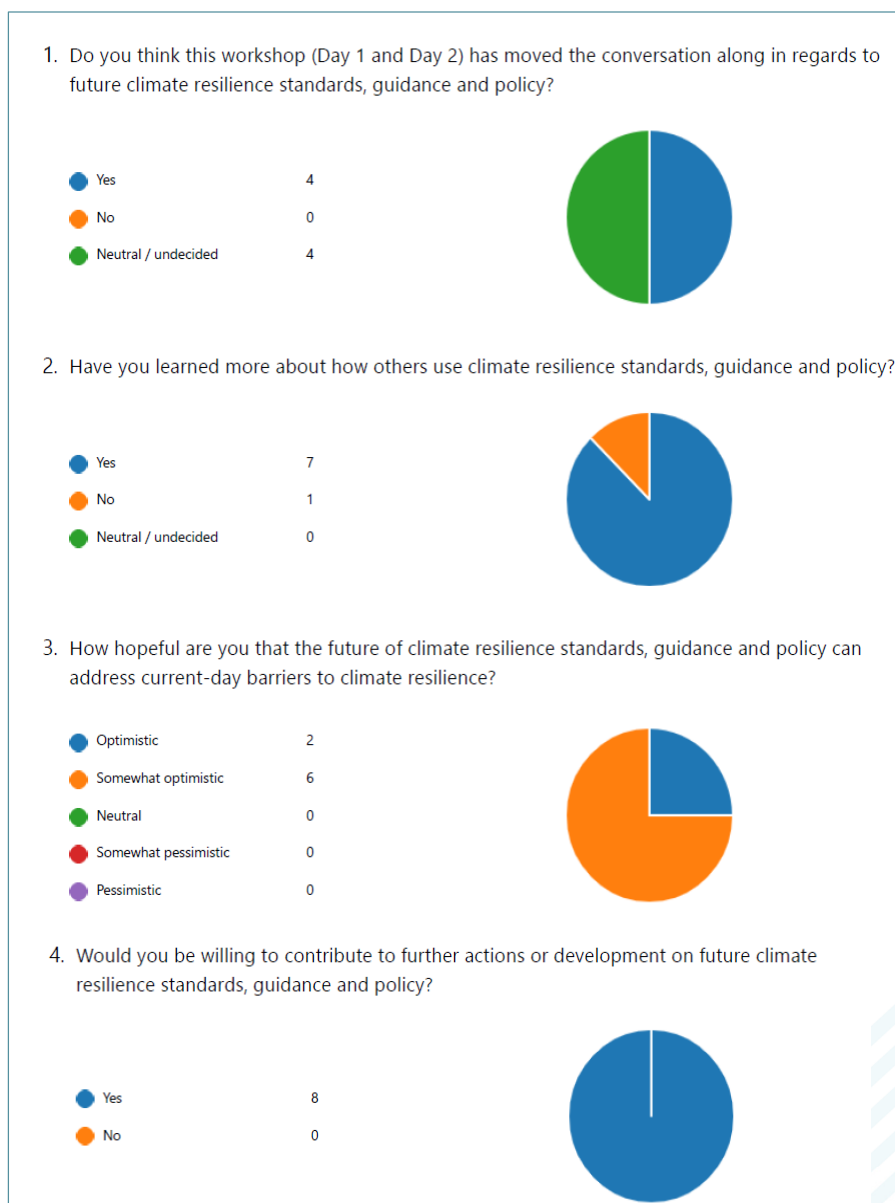
The majority of discussion and output from the four breakout groups was to note a series of steps to achieve the priorities. The output of these discussions is captured in Table 5-2.

Where workshop participants identified lead organisation proposals, timeframes, dependencies, constraints, opportunities or synergies, these are captured in Table 5-3.

Learning points from the workshop, using information from Table 5-2 and Table 5-3 are provided in section 5.3 and recommendations informed by the workshop output are provided in section 6.

## 5.2 Workshop feedback

Feedback from those workshop participants who completed a feedback form is provided in Figure 5-2. This showed that there is a generally optimistic view on the future of climate resilience standards, guidance and codes of practice, the majority felt they had increased their knowledge in the area and all wanted to remain involved in development of standards in the future.



**Figure 5-2 Feedback from eight workshop participants**

**Table 5-2 Steps to achieve highest priority activities / recommendations (from workshop participants)**

1	2	3	4	5	6	7	8
Government leadership /authority behind the message to drive the change / Merging of standards, guidance and policy into a single direction	Collaboration leading to interlinked and consistent standards (not guidance) between sectors	Defining resilience and what we are being resilient to (e.g. weather events or longer-term change)	Mandatory requirements are needed / Avoidance of ambiguity with no scope for 're-interpretation'	Simple communication and guidance for different parts of a process / Clear guidance on process of assessing risk - for intended user audience	Agreement on the 'Level of Service' (LoS) to be provided between sectors and Government; sectors / orgs then decide on climate values to achieve this LoS	Stress test systems to determine thresholds, then become resilient to these	An overarching approach to standards is needed with a process of commonality to reviewing, analysing and interpreting UK climate projections and sectoral standards co-developed with regulators, operators, and govt departments.
<ul style="list-style-type: none"> <li>Set out which government departments need to be involved (transport, water, energy, environment, defence....)</li> <li>Determine the impacts and then identify the appropriate risk-based approach</li> <li>Set regulatory performance target and climate scenarios which you are meeting it under</li> <li>Agree across sectors (e.g. Ofwat and ORR) – common set of scenarios (climate projections)</li> </ul>	<ul style="list-style-type: none"> <li>Someone needs to bring people together (i.e. not in the margins).</li> <li>Scoping using ISO 14090 as a starting point, establish the cross-sectoral system.</li> <li>Use NIC framework as a lever (Roles and responsibilities are defined in the NIC report.)</li> <li>Put collaborative fora on to a more formal, resourced footing. i.e. IOAF, LCCP. These are voluntary groups needing supported.</li> <li>There seems to be a need to look at the capability of policymakers (govt, business, banks, investors) and what they need in terms of evidence</li> <li>Clarity of roles – policy/ strategy/ plans / implementations as well as a line of sight</li> </ul>	<ul style="list-style-type: none"> <li>(Similar steps to Priority 6)</li> <li>Assessment decision lifetime (ability to adapt in the future)</li> <li>Assessment of probability of climate risk</li> <li>Assessment of vulnerability of development/decision</li> </ul>	<ul style="list-style-type: none"> <li>Agree a set of principles &amp; policies</li> <li>Set mandatory but also higher, non-mandatory 'excellent' or similar standard</li> <li>Organisations translate the policies into specific direction and guidance</li> <li>Constant / periodic review</li> </ul>	<ul style="list-style-type: none"> <li>For drainage &amp; SUDS – having a standard template for information in the planning application set out by clear submission requirements</li> <li>Govt principles (see P4) set out examples of clear, user-oriented, scale-appropriate guidance</li> </ul>	<ul style="list-style-type: none"> <li>Establish what is the current LoS is for each sector and how might change as the climate changes? Establish the cost to provide said LoS and whether customers/society is willing to pay for this?</li> <li>Develop a collective understanding of risk</li> <li>Collectively understand the direct and interdependent implications of that risk on individual and collective sectors</li> <li>Identify and compare needs with existing available information e.g. CCRA, Cabinet Office Assessments and what the gaps are.</li> <li>Make existing information available more easily available and better integrated</li> <li>Identify how to retain levels of service within each sector lead group</li> <li>Review and revise regulatory and funding arrangements to ensure they enable levels of service to be maintained in line with the findings of the process</li> <li>Upgrade</li> </ul>	<ul style="list-style-type: none"> <li>Draft the scope of stress tests for individual sectors to undertake</li> <li>(Define 'system,' work out who the main players are in that system, bring together those partners to agree scope, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Decide who needs to be around the table – gov't, regulator and industry.</li> <li>Gov't departments key to climate change resilience and regulators to have first discussion.</li> <li>Then regulators to discuss with their industry (engagement cycle back to regulator and gov't depts).</li> <li>Set common set of climate scenarios for planning purposes (and gov't to define them), for example "standard" and "higher" scenario</li> <li>Industry to do it themselves / gov't to facilitate</li> <li>Cross-sectoral engagement</li> </ul>

**Table 5-3 Commentary on lead organisations, timelines, dependencies, constraints, opportunities and synergies associated with priority activities 1 to 8<sup>11</sup>**

Priority 1: –Government leadership /authority behind the message to drive the change (Guidance doesn’t always lead to resilience – adaptive capacity needed and tough decisions from Government) / Merging of standards, guidance and policy into a single direction				
Steps	Suggested lead organisation / resources	Dependencies / Constraints		Opportunities / synergies
Determine the impacts and then identify the appropriate risk-based approach	DfT, ORR (Office of Road and Rail)			Priority D & F (Level of service; stress testing)
Inform the estimated the climate change projections to aim for (or specific one identified by DfT, ORR)	DfT, ORR With help from Met Office (MO can only provide science, not policy)			
Set regulatory performance target and climate scenarios which you are meeting it under		Priority D: Agreement on the ‘level of service’ to be provided between sectors and Government; sectors / orgs then decide on climate values to achieve this LoS		
Agree across sectors (e.g. Ofwat and ORR) – common set of scenarios (climate projections)			Priority G: Collaboration leading to interlinked and consistent standards between sectors What will the costs be to maintain today’s standards? Using good practice that we currently have	
Priority 2: Collaboration leading to interlinked and consistent standards (not guidance) between sectors				
Steps	Suggested lead organisation / resources	Timeframe	Dependencies / Constraints	Opportunities / synergies
STEP 1 Someone needs to bring people together (i.e. not in the margins).	Umbrella organisation like NIC for infrastructure (how to address PHE / agriculture?) Suggest CCC sets up resources to make things happen as part of a review?	18 months	Needs an organisation to lead and pull things together across UK	Partnerships in past were relatively independent which can be good
STEP 2: <b>Scoping</b> using ISO 14090 as a starting point, establish the cross-sectoral system. Use NIC framework as a lever. Roles and responsibilities are	Government can lead but seek support from existing bodies such as LCCP, IOAF and wider groups. Sectors work in their own areas using e.g ISO framework to suit own capability / time-horizons.	2 – 3 years max		Tools like ISO 14090 can help any organisation to attain consistency. 14090 encourages bringing adaptation into business as usual using existing organisation tools. Once scoped, things can be set in place to deliver activities etc.

<sup>11</sup> The content of Table 5-3 is drawn from the views of the workshop participants and do not necessarily represent the views of JBA or the Met Office.

<i>defined in the NIC report.</i>	EA/ SEPA/ NRW/ DAERA could link well into this for the priority flood topic?			
<i>Put collaborative fora on to a more formal, resourced footing. ie IOAF, LCCP. These are voluntary groups needing supported.</i>	IOAF et al could make the case to revisit past collaborations and get funding .. Funding for sub-national climate change partnerships (need for a person to coordinate and facilitate activity)	Could happen immediately	Seems we need to prove 'value' – bringing people together is a good learning step but not always recognised as such. We used to have e.g. ARCC... Cross-sectoral – we took our guide from CCRA	Collaboration can bring in interdependency, links between priorities, tensions between priorities, identify opportunities for co-benefits. Processes like ISO14090 can inform collaboration and help better target knowledge exchange and capacity building
<i>There seems to be a need to look at the capability of policymakers (govt, business, banks, investors) and what they need in terms of evidence</i>				Seek to embed adaptation into existing organisation processes - but it's not going to embed itself

**Priority 4: Mandatory requirements are needed / Avoidance of ambiguity with no scope for 're-interpretation'**

<b>Steps</b>	<b>Suggested lead organisation / resources</b>	<b>Timeframe</b>	<b>Dependencies / Constraints</b>	<b>Opportunities / synergies</b>
<i>Agree a set of principles &amp; policies</i>	Govt Treasury or Cabinet Office co-ordinate / lead (embed in Green Book). MHCLG, DfT, BEIS Defra lead at sector level.	2021		
<i>Set mandatory but also higher, non-mandatory 'excellent' or similar standard</i>	Concept is led by Govt. Applied at local / sector level	2021-3	<i>Avoiding 'locking in' users to inflexible standards</i>	Outlining how implementing resilience measures can increase profit / viability
<i>Organisations translate the policies into specific direction and guidance</i>	Guidance developers at org level or sector level	2021-3	<i>Avoiding 'locking in' users to inflexible standards. Avoid siloed thinking to define inter-dependencies (e.g. power outage and rail failure)</i>	

**Priority 5: Simple communication and guidance for different parts of a process / Clear guidance on process of assessing risk - for intended user audience**

Steps	Suggested lead organisation / resources	Timeframe	Dependencies / Constraints	Opportunities / synergies
<i>For drainage &amp; SUDS – having a standard template for information in the planning application set out by clear submission requirements</i>	EA promote, LLFAs, local authorities enact	2021		<i>Quick win</i> <i>Good example in West London</i> <a href="https://westlondon.sfra.london/checklists/">https://westlondon.sfra.london/checklists/</a>
<i>Govt principles (see P4) set out examples of clear, user-oriented, scale-appropriate guidance</i>	Govt. Department	2021-3	Link to previous questions	

**Priority 6: Agreement on the 'level of service' to be provided between sectors and Government; sectors / orgs then decide on climate values to achieve this LoS**

Steps	Suggested lead organisation / resources	Dependencies / Constraints
<i>Cabinet Office has 5 weather / climate scenarios through which infra operators must maintain service using four elements of resilience (resistance / redundancy / reliability / response &amp; recovery)</i>	Cabinet Office are quiet in these discussions but they are the responsible department esp. for Civil Contingencies. They do a sector specific risk assessment but not shared with the community of climate adaptation. Active in local resilience forums and civil contingencies. They don't think enough about changing future risk	
<i>Establish what is the current LoS is for each sector and how might change as the climate changes? Establish the cost to provide said LoS and whether customers/society is willing to pay for this?</i>	DEFRA MCLG DoT Individual investing Departments/Agencies/Regulators Joint Regulators Group	Interdependencies between these but disconnected decision making. Need a collective understanding of risk
<i>Develop a collective understanding of risk</i>	CCC	Check it fits with the science – Met Office Role
<i>Collectively understand the direct and interdependent implications of that risk on individual and collective sectors</i>	CCC A Citizens Assembly for Climate Adaptation/Climate Risk?	
<i>Identify and compare needs with existing available information e.g. CCRA, Cabinet Office Assessments and what the gaps are.</i>	CCC	
<i>Make existing information available more easily available and better integrated</i>	CCC	
<i>Identify how to retain levels of service within each sector lead group</i>	Individual responsible agencies	
<i>Review and revise regulatory and funding arrangements to ensure they enable levels of service to be maintained in line with the findings of the process</i>	DEFRA/Treasury	Cascade through rel. Govt Depts



**Priority 7: Stress test systems to determine thresholds, then become resilient to these**

Steps	Suggested lead organisation / resources	Timeframe	Dependencies / Constraints	Opportunities / synergies
<i>Draft the <b>scope</b> of stress tests for individual sectors to undertake (Define 'system,' work out who the main players are in that system, bring together those partners to agree scope, etc.)</i>	'System' managers (in sectors) e.g Bank of England Sector associations or bodies	1 year to set up process – pilot? Identify those needed to test. 2 years to deliver	Individual organisations would need directed by Cabinet Office? Regulators? Resources – who will pay?	Cross-sectoral issues can be identified Insurance companies might want to help funding Pension funds? Could be grouped by sector – airports/ retail/ construction/ etc.

**Priority 8: An overarching approach to standards is needed with a process of commonality to reviewing, analysing and interpreting UK climate projections and sectoral standards co-developed with regulators, operators, and gov't departments.**

Steps	Suggested lead organisation / resources	Opportunities / synergies
<i>Decide who needs to be around the table – gov't, regulator and industry.</i>		
<i>Gov't departments key to climate change resilience and regulators to have first discussion. Then regulators to discuss with their industry (engagement cycle back to regulator and gov't depts).</i>	Gov't to work with regulators Need to engage with those on the ground (e.g. asset managers) – business to regulator discussions?	Regulators working together
<i>Set common set of climate scenarios for planning purposes (and gov't to define them), for example "standard" and "higher" scenario</i>		
<i>Industry to do it themselves / gov't to facilitate</i>	Each industry to complete Gov't to provide the resources/money	

### 5.3 Distillation of learning points from the workshop output

The workshop output detailed in Table 5-2 and Table 5-3 has been used to summarise learning points and to inform recommendations in section 6. Priorities discussed and promoted in the workshop can be grouped within four areas:

1. Government leadership / facilitation is required, including defining resilience
2. Government departments need to work with sectors to determine risk acceptance (Levels of Service)
3. Sectors need to establish their own methods to derive their uplifts to achieve the required Levels of Service
4. Sectors to each develop their own mandatory requirements and to collaborate with others to determine thresholds (specific levels in a weather parameter that trigger a specific impact) through stress testing

Leadership is seen as coming from a wide range of organisations including Government Departments, the National Infrastructure Commission (NIC), the Committee on Climate Change (CCC), the Infrastructure Operators Adaptation Forum (IOAF) and the Environment Agency.

There was a strong consensus among all participants on the following:

- Stress tests are required to understand the vulnerabilities that develop as climate change unfolds and the actions required to create a coherent resilience framework;
- That national leadership across all sectors is required, with governance frameworks that ensure application of effective standards and guidelines;
- That capacity building at all levels is necessary;
- The need for a clear understanding of the concept of resilience;
- Establishing current and desired future levels of service for each sector;
- Much that is written as 'guidance' that should be turned into requirements ('requirements' – see section 2 for definitions).

## 6 Recommendations

The following recommendations cover work areas (research questions, specifications) for the future SPF/ UKRI programme. From the project workshop, eight priorities (see Table 5-1) emerged as needing early delivery (18 months to 3 years) and a longer-term programme is warranted.

The following recommendations form a 'road-map' for staged further work, building upon the themes that have emerged during this project and delivering solid outcomes within the stated desired timescales.

### 6.1 Recommendation detail

#### RECOMMENDATION 1

Priority areas can be combined and the following is recommended as a set of initiatives funded by UKRI:

1. Set up a Climate Change Adaptation (CCA) Policy Leadership Task Force with a 'task and finish' theme under the responsibility of the Climate Cabinet Committee (to achieve buy-in from Ministers across departments), supported by UKRI, CCC, Met Office, sector experts including the financial community, regulatory representatives, and industry bodies, along with citizens' representation (similar to the assemblies set up to examine GHG reduction). This task force would outline, with one year, a National Adaptation Policy Framework (NAPF) using the ISO 14090 framework to identify priorities, key early actions, specify roles and responsibilities. Part of this would include the longer-term programme and funding sources to deliver the following (in no particular order):

1. A common understanding of resilient levels of service that it is practical / affordable to maintain in the face of climate change in each sector;
2. A convergence and harmonisation exercise across sectors, involving current and emerging standards, guidance and policy (a 'horizontal' activity) in a 5-10 year timeline. This has to encompass reviews of fitness for purpose [examples – how well are standards applied, is the language good or a barrier? Are the compliance steps a barrier?] and language, and robustness (i.e., the ability of a standard's requirements to remain embedded over time and not be diluted through 'get out' clauses in other documents);
3. A gap analysis to identify where standards are not yet available and would support delivery of the service level standards identified in point 1. Develop standards to fill those gaps;
4. Identification of capacity gaps at key decision-making levels in the sectors and in governance arrangements, and plans for training and capacity building activities;
5. A communications strategy and associated communications plans;
6. Funding for industry bodies e.g. LCCP, IOAF as knowledge sharing partnerships that can aid the governance arrangements<sup>12</sup>;
7. An overarching, horizontal governance structure that takes all the above and sets in place mechanisms to link this to a new Standards, guidance and policy Framework, into implementation plans that are monitored, evaluated and learned from. This would require vertical governance arrangements working in parallel.

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<sup>12</sup> We note that the NIC's Regulation Study of 2018 (<https://nic.org.uk/studies-reports/regulation/>) called for Ofcom and Ofgem to be given a resilience duty (as Ofwat has) – NIC reiterated that in the 2020 resilience study (see section 6.2) and raised whether this should be extended to transport regulation.

## RECOMMENDATION 2

Charge the Task Force (Recommendation 1) to address the other seven priorities within the NAPF i.e. those that did not attain a high score from the workshop analysis, within two years of its formulation. These were:

1. Setting minimum standards based on climate science of risk exposure that matches life of assets and timetable for achieving this / Determining the targets of resilience for each sector (for example, aligning with the CCC minimum requirement of adaptation to 2°C global increase)
2. Align resilience standards with carbon net zero standards (i.e. clear goal in each) / Mitigation not isolated from adaptation
3. Share good (and bad) practice from different sectors
4. Clearer steer on dealing with projection uncertainty / Guidance on which RCPs should be used for different cases
5. 'Kite mark' for successful application of guidance / Quality assurance
6. Climate change allowances needed where they don't exist, e.g. for overheating for buildings
7. Standardised agreement needed on reporting

## RECOMMENDATION 3

Stress testing would be a useful early activity to get a systemic picture of weaknesses in the system. Stress testing identifies thresholds, demonstrating that increasing resilience is not linear as climate change increases. Thresholds in this context are specific levels in a weather parameter (e.g. 24°C) that trigger a specific impact; hence, they are specific to particular sectors and individual climate risks. Some sectors are known to have carried out stress tests of this nature, such as Network Rail and certain water utilities.

These stress tests should be sector-specific with cross-cutting issues being identified that can apply across sectors. This exercise would ideally take place within two years and then should then be repeated in 5-10 years with a view to test systems across sectors to demonstrate the benefit of changed policies, standards and guidelines. It is thought this activity could be instigated by Cabinet Office owing to its Civil Contingencies role.

By following the suggested long-term road map, the UK will attain a high degree of systemic resilience to the future climate, recognising the value of a cross-cutting policy approach supported by harmonised, coherent standards in all sectors and at all levels of society.

## 6.2 Alignment with recommendations of the NIC

During the project's consultation period, the National Infrastructure Commission (NIC) released its Anticipate, React, Recover report<sup>13</sup>, that made a series of recommendations for the UK Government. These are summarised below:

*We need to:*

- *Face uncomfortable truths, make decisions*
- *Value resilience properly*
- *Proactively test and plan*
- *Take opportunities to adapt*

*We recommend doing this through:*

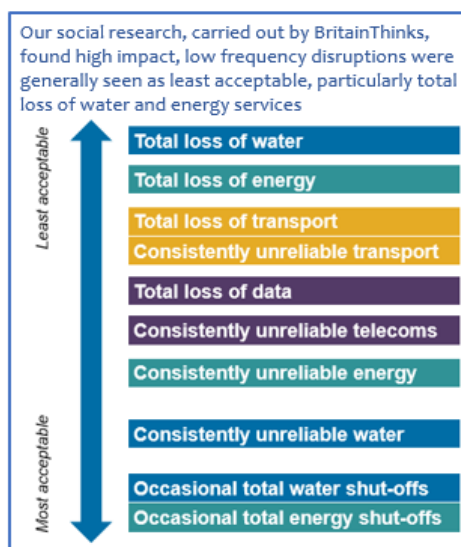
- *A framework for thinking about resilience*
- *Supported by three recommendations:*
  - *government should publish a full set of resilience standards every five years*
  - *infrastructure operators should carry out regular and proportionate stress tests*
  - *Infrastructure operators should develop and maintain long term resilience strategies*

These recommendations show close alignment with those in section 6.1. Specifically regarding standards, Tom Hughes of the NIC gave a UKCR webinar on 8<sup>th</sup> July 2020 at which he presented the slide shown in Figure 6-1.

### Recommendation 1: standards

- Resilience standards provide **clarity** and **transparency**
- **Government's responsibility** to set standards
  - Insurer of last resort, market failures, wide impacts of disruptions
  - Difficult choices, trade-offs, prioritisation
- Standards must be informed by **independent evidence**
- Government must use standards to **drive improvements** in resilience
  - Assess structures, powers and incentives
  - Review standards regularly

NATIONAL  
INFRASTRUCTURE  
COMMISSION



11

**Figure 6-1 NIC recommendations related to climate resilience standards<sup>14</sup>**

<sup>13</sup>Available at: <https://www.nic.org.uk/publications/anticipate-react-recover/> (accessed 5/11/20)

<sup>14</sup> Available at: <https://www.ukclimateresilience.org/news-events/webinar-creating-climate-resilience-in-the-uk-what-does-this-mean-and-how-might-we-achieve-it/>

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