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Environment Agency Wales

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Managing the environment in a changing climate

A report to Defra and the Welsh Assembly Government in response to a direction to report under the provisions of the Climate Change Act 2008

November 2010

Annex 1 – Methodology

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Contents

Introduction

This is an annex to our report *Managing the environment in a changing climate*, which sets out our climate risks and adaptation plans in response to a direction under the Climate Change Act 2008 from the Secretary of State for Environment, Food and Rural Affairs and the Welsh Ministers. It should be read together with the main report and the other annexes to understand the approach we have taken, our climate risks and adaptation plans.

This annex explains the methodology we have used to assess our climate risks and develop adaptation plans.

Rationale

We want to embed adaptation in our organisation so that it is at the heart of everything we do. Under our adaptation programme, our departments:

- work with our Evidence Directorate to develop climate evidence to support their needs
- are responsible for developing and delivering their own adaptation plans
- address climate change and adaptation in their decisions
- support strategic adaptation planning for the organisation (such as this assessment and report).

All our departments have done climate risk assessments and developed action plans before this assessment. However, the climate evidence they have available varies according to their work and exposure to climate risks. Departments such as Flooding and Coastal Erosion, where climate change is a key operational consideration, have detailed and quantitative evidence based on climate projections and environmental risk models. Departments such as Recreation, where climate change is not a significant operational risk, have a good understanding of the headline significance of climate projections but do not need detailed or quantitative impact studies. This variation in climate evidence is appropriate for our organisational needs but needs to be considered when undertaking a strategic and comparative risk assessment such as this.

The purpose of this assessment is to make a strategic comparison of climate risks. More specifically, we want to know:

- if climate change puts at risk our ability to deliver organisational objectives with current resources and delivery
- the relative importance of these risks.

This strategic assessment draws together climate evidence already available in our organisation. As we have noted, the detail and quality of this evidence varies between departments according to their needs. In some cases, such as flooding, we have a lot of evidence, indeed more than we need to draw general conclusions about the importance of their climate risks and the priority they need to be given in our adaptation programme. This assessment does not need to reproduce all the evidence

we hold on our climate risks, but does need to summarise it to allow systematic comparisons to understand our priorities.

The methodology set out here focuses on the 'big picture'. It uses a strategic risk characterisation framework to summarise existing evidence and compare risks. This complements the more detailed risk and impact assessments that we make at an operational level.

Our aim to embed adaptation rather than treat it in isolation also has implications for how we identify and appraise adaptation options in this assessment. In many cases, the adaptation responses identified here are *commitments* to embed adaptation in a future decision and do not prejudge the outcome of that decision itself. In some cases, those commitments have already been made in existing strategies.

For example, we commit to manage the impact of water abstraction on the environment and water users by ‘working with Defra, the Welsh Assembly Government and Ofwat to develop and evaluate options for future access to and allocation of water’ (see Annex 2). Clearly it is neither practical nor desirable to identify and evaluate those options in this assessment as it is a much wider decision (that is not necessarily for us to make alone).

Similarly, we have not carried out formal cost-benefit appraisal or stakeholder consultations on the adaptation plans set out in this report. We will instead carry these out during our normal operations as those decisions arise. We have however indicated broad adaptation costs in this report where it is possible to do so, although in some cases there is no clear separable adaptation component to an action.

England, Wales and spatial variation of risk

Climate impacts will vary across England and Wales due to local weather patterns and environmental factors. This regional variation will be important for some of our risks and our adaptation response for these will need to be tailored to local conditions. For example, we expect summer droughts to be more serious in south-east England than north-west England due to low rainfall and high demand for water.

Other climate risks will either not vary significantly across the country or will be so dependant on local factors that clear trends are indiscernible. For example, risk to individual Sites of Special Scientific Interest will depend on local climate, environment and the specific needs of the species present. It is difficult to generalise how such risks vary at a regional or national scale. Similarly, one of our objectives is to promote the proper and efficient use of water and there is little reason to suppose that this will have a clear spatial trend.

Spatial variation is therefore important for some risks but also highly complex and dependent on the risk in question and specific local factors. Such a level of detail and complexity is unnecessary for this strategic assessment, where we are interested in establishing which of our organisational objectives are at most risk. We will of course need to consider spatial variation when considering local adaptation needs, such as flood defences, but it makes more sense to carry out such detailed modelling during the course of our normal operations.

However, we do need to particularly consider differences in risk between England and Wales, which may arise due to:

- spatial variation in climate or the environment
- different organisational objectives between England and Wales due to devolved policy
- different adaptation responses between England and Wales due to devolved policy.

We have recognised this in our assessment by:

- allowing risks to be rated differently for England and Wales if appropriate
- framing the assessment around separate organisational objectives for England and Wales where appropriate to devolved policy
- proposing different adaptation responses for England and Wales where appropriate to devolved policy.

Methodology

Our approach follows the UKCIP, Defra and Environment Agency framework (2003, Figure 1).

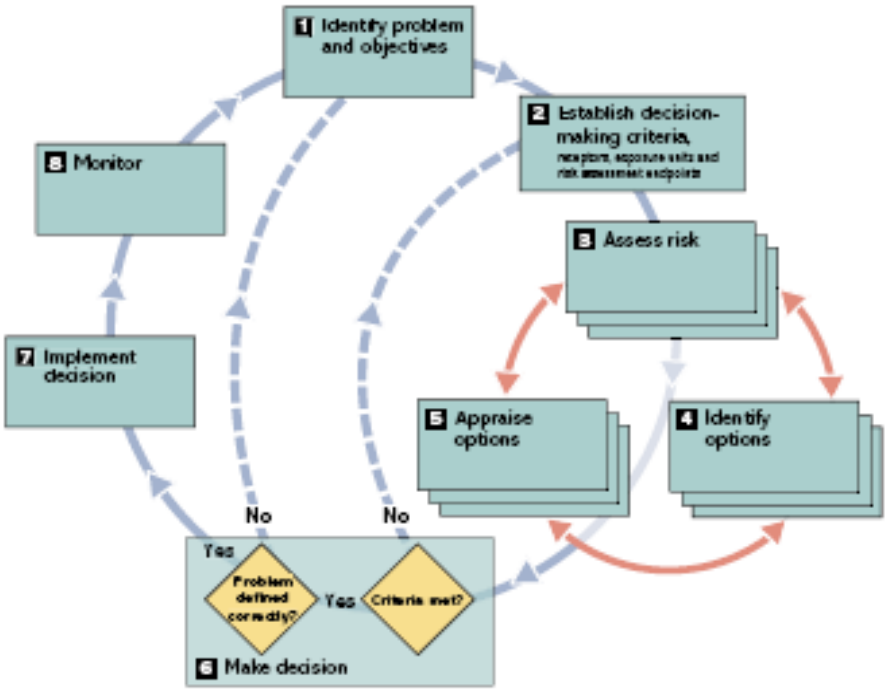

Figure 1 – Our assessment approach

This approach is consistent with Defra and the Environment Agency's framework for environmental risk management (Defra et al. 2000) and also draws on frameworks for strategic risk analysis (Environment Agency 2007, WGBU 2000).

The individual steps of our approach are described below.

1 Identify problem and objectives

Our statutory direction asks us to assess climate impacts on our statutory and non-statutory duties. Statutory guidance explains that this should be taken to include functions, missions, aims and objectives.

For the purposes of this assessment, we have interpreted our objectives to cover our regulatory, operational, advisory and partnership roles.

Box 1 shows the 58 objectives we have used for this assessment. Note that these are intended to represent the range of activities carried out by the Environment Agency for the purposes of this assessment. They are not a definitive list of our statutory duties nor a complete list of our regulatory duties.

Box 1 – Organisational objectives used for this assessment

Inland flooding

1.1 We, our professional partners and the public will have a greater understanding of inland flood risk.
1.2 We will work effectively with our professional partners and the public to manage risk and reduce the probability of inland flooding.
1.3 We will reduce the consequences of inland flooding.
1.4 Our inland flood management programme provides environmental benefits.

Coastal erosion and flooding

2.1 We, our professional partners and the public will have a greater understanding of coastal flood and erosion risk.
2.2 We will work effectively with our professional partners and the public to manage risk and reduce the probability of coastal flooding and erosion.
2.3 We will reduce the consequences of coastal flooding and erosion.
2.4 Our coastal flood and erosion management programme provides environmental benefits.

Water resources

3.1 We will aim to ensure that abstraction has no unacceptable impact on the environment or water users.
3.2 We will aim to ensure that there is enough good quality water for people, businesses, industry and agriculture most of the time.
3.3 We will publish information on the demand for water and available resources.
3.4 We will aim to ensure that water is used properly and efficiently.

Water quality

4.1 We will monitor sewage treatment works and trade discharges, as well as the quality of freshwater, groundwater and tidal waters (up to three miles from the coast).

Box 1 – Organisational objectives used for this assessment (continued)

4.2 We will implement the EC Water Framework Directive and other EC directives; to ensure that all relevant water quality standards are met.

Regulated business

5.1 We will ensure that waste is recovered or disposed of in ways which protect the environment and human health, by regulating waste management operations (including collection, transport, treatment, storage and disposal) and enforcing waste management controls in a nationally consistent manner.

5.2 We will provide comprehensive monitoring data (in conjunction with local authorities, as necessary) to enable the amount of waste arising and the final disposal method to be tracked and recorded for each significant waste stream.

5.3 We will assist regional bodies and local government in developing waste plans and strategies that reflect the waste hierarchy and the national waste strategy.

5.4 We will encourage and determine applications for new and existing installations within the timescales laid down in the EP Regulations.

5.5 We will set permit conditions in a consistent and proportionate fashion based on Best Available Techniques and taking into account all relevant matters including: sectoral and site-specific compliance costs; and the resulting local, national and trans-boundary environmental benefits.

5.6 We will control industry discharges to watercourses through the powers provided by the Environmental Permitting Regulations 2010.

5.7 We will work with local authorities towards delivering the objectives of the National Air Quality Strategy and to support the development of regional air quality strategies.

5.8 We will regulate aerial and liquid radioactive discharges, and solid radioactive waste disposal, in accordance with statutory duties, statutory guidance and Government policy, and the security of radioactive sources used in non nuclear industry.

Land quality

6.1 We will act as advisors to Government on development of, or revision to, policies, strategies and legislation to ensure that they provide the right measures for effective resource protection and climate change adaptation and mitigation, for example review of the Sludge (Use in Agriculture) Regulations 1989; the Biowaste Directive; the proposed Soil Framework Directive; Contaminated Land Policy; the Rural Climate Change Forum; the review of the Common Agricultural Policy and Rural Development Plans for England and Wales.

6.2 We will support and contribute to the successful implementation of Government policies and strategies for example Defra's Soil Strategy for England, the Welsh Assembly Government's Environment Strategy or the sustainable use of soil policy.

6.3 We will carry out regulatory duties, for example the Contaminated Land (England and Wales) Regulations 2006; the Sludge (Use in Agriculture) Regulations 1989; Nitrate Pollution Prevention Regulations 2008; the Water Resources (Control of Pollution), Silage, Slurry and Agricultural Fuel Oil (England and Wales) Regulations 2010; Cross Compliance.

Box 1 – Organisational objectives used for this assessment (continued)

6.4 We will develop and support catchment based approaches to tackle diffuse pollution and improve water quality and other environmental objectives specified by the Water Framework Directive (that is, support the Environment Agency to fulfil our Competent Authority role for River Basin Planning). For example: pollution reduction programmes; Voluntary Initiative on Pesticides; the England Catchment Sensitive Farming Delivery initiative and Environment Agency Wales Catchment initiative; and the Campaign for the Farmed Environment.

6.5 We will produce, or collaborate on, climate change and resource protection guidance for urban and rural land managers. Promoting practices and incentives that encourage land managers to protect soil and water, or clean up contaminated land. For example Farming for the Future fact sheets; thinksoils; Good Farming – Better Environment; and the sustainable management of contaminated land guidance.

Conservation and ecology

7.1 We will contribute to the implementation of the UK Biodiversity Action Plan, the England Biodiversity Strategy and the Wales Environment Strategy, and in particular the delivery of those actions for which the Environment Agency has lead responsibility.

7.2 We will further the conservation of Sites of Special Scientific Interest and in managing our own land, to enhance its biodiversity, cultural and recreational potential.

7.3 We will ensure that all Environment Agency consents where we cannot conclude no adverse effect on the integrity of a Special Protection Area, Special Area of Conservation or Ramsar site are reviewed and either affirmed, modified or revoked as appropriate, and that any new consents are dealt with in accordance with the requirements of the Conservation of Habitats and Species Regulations 2010.

7.4 We will ensure that 'environmental damage' to protected species and natural habitats, and any imminent threat of such damage, in inland waters or from EA-regulated activities, is identified and addressed in accordance with the requirements of the Environmental Liability Directive.

7.5 We will implement the EC Water Framework Directive via the management of biological pressures, development and ownership of monitoring tools, and overseeing the design and implementation of Programmes of Measures.

Fisheries

8.1 We will ensure the conservation and maintain the diversity of freshwater fish, salmon, sea trout, eels, lamprey and smelt, and to conserve their aquatic environment.

8.2 We will enhance the contribution migratory and freshwater fisheries make to the economy, particularly in remote rural areas and in areas with low levels of income.

8.3 We will enhance the social value of fishing as a widely available and healthy form of recreation.

Box 1 – Organisational objectives used for this assessment (continued)

8.4 We will deliver the Wales Fisheries Strategy in collaboration with the Welsh Assembly Government.
8.5 We will implement the EC Water Framework Directive via the management of biological pressures, development and ownership of monitoring tools, and overseeing the design and implementation of Programmes of Measures.
8.6 We will contribute to the implementation of the UK Biodiversity Action Plan, the England Biodiversity Strategy and the Wales Environment Strategy, and in particular the delivery of those actions for which the Environment Agency has lead responsibility.
8.7 We will ensure that 'environmental damage' to protected species and natural habitats, and any imminent threat of such damage, in inland waters or from EA-regulated activities, is identified and addressed in accordance with the requirements of the Environmental Liability Directive.

Navigation
9.1 We will maintain and improve navigation on the navigable waters (mostly rivers) for which the Environment Agency has responsibility and licence boats using these waters as a statutory Navigation Authority; to maintain its assets in a condition which ensures the safe use of its waterways.
9.2 We will promote urban and rural regeneration.

Recreation
10.1 We will promote greater recreation, in particular for the use of waterways we manage by all sectors of society, and provide improved facilities for users
10.2 We will manage our own lands to enhance their cultural and recreational potential.
10.3 We will work to deliver the Strategic Plan for Water Related Recreation in Wales.

Sustainable places
11.1 Better local environments enhance people's lives and support a sustainable economy.
11.2 New and existing developments have a reduced environmental impact and well planned environmental infrastructure.
11.3 Spatial and economic planning meets environmental standards and objectives, and addresses climate change.

Climate change
12.1 We play our full part in helping England and Wales meet greenhouse gas emissions targets in ways that minimise other environmental impacts. This includes administering the EU Emissions Trading System and the CRC Energy Efficiency Scheme.
12.2 We help people and wildlife adapt to climate change and reduce its adverse impacts.
12.3 We will reduce our carbon emissions by 33 per cent by 2015 from 2006-07 levels.

Box 1 – Organisational objectives used for this assessment (continued)

Our business continuity and estates

13.1 We will provide suitable facilities (property, fleet and other assets) to support employees' roles and the delivery of our corporate strategy.

13.2 We will drive efficiencies in our working practices and ensure high use of our assets.

13.3 We will acquire land to deliver our functional objectives.

13.4 We will minimise and mitigate the effects of a disruption on the business from an unforeseen event, plus meeting the requirements of the Civil Contingencies Act.

13.5 We will provide suitable safeguards to ensure our people, systems and property work effectively in the future. To find more efficient ways of coping with disruption, through contingency planning, alternative ways of working and so on.

Note that we have numbered objectives consistently throughout our assessment so they can be tracked easily.

2 Establish decision-making criteria

This is a strategic assessment to characterise our risks and inform an adaptation programme. Our decision-making criteria have therefore been selected to help us prioritise our risks.

From a strategic, organisational perspective, priority is largely determined by four factors:

- Proximity - when our objectives, resources or delivery plans need to change in response to climate change.
- Importance – how much the impacts on each objective matter to us.
- Inertia – how quickly we can adapt.
- Resources – how much effort adaptation requires.

Proximity affects a risk's priority because more imminent risks are more urgent than distant ones.

The importance of a risk's impacts affects its priority because some impacts matter more than others. This can be either a quantitative difference (for example, Risk A harms more people than Risk B) or a qualitative one (for example, if one objective is considered more important than another).

Inertia refers both to how quickly we can adapt and how easily we can change that adaptation response. This affects risk priority when we need longer to get ready for some risks than others. For example, some measures take a long time to implement (for example infrastructure) or require long-term commitments (for example shoreline management plans).

Resource requirements are important where we need to reassign or raise significant money or manpower to manage risks. All else being equal, risks with high resource requirements are of more concern than those with low requirements.

3 Assess risk

Risk screening

We have screened out objectives that are not sensitive to climate change to concentrate the assessment on those that are.

Objectives can be:

- sensitive to climate and included in the assessment;
- insensitive to climate and excluded from the assessment;
- influenced by climate and excluded from the assessment but noted for the adaptation programme.

Sensitive objectives are those whose achievability depends on climate change. For example, Objective 1.2 (We will work effectively with our professional partners and the public to manage risk and reduce the probability of inland flooding) is sensitive as climate change will affect the probability of flooding. Sensitive objectives are climate risks.

Climate influenced objectives are those whose achievability does not depend on climate change but where we might want to work differently as a result. This applies in particular where we work with others to secure environmental outcomes. In such cases, our objective is usually a process, such as regulation, rather than a specific outcome. For example, Objective 5.4 (We will encourage and determine applications for new and existing installations within the timescales laid down in the EP Regulations) is climate influenced because our regulatory processes are not at risk but we might need to change them to achieve the same outcomes as the climate changes.

Climate influenced objectives are often either indirect risks to us or opportunities to work with others.

Insensitive objectives are not affected by climate change. For example, our requirement to provide data on waste disposal is not affected by climate (Objective 5.2).

Conceptual models

A conceptual model describes the relationship between a hazard and an endpoint at risk. It is a useful way of explaining which processes and outcomes we are thinking about in our assessment.

We have used the DPSIR (Driver-Pressure-State-Impact-Response) approach to explain how each sensitive objective is affected by climate drivers. We have also included key non-climate drivers where relevant. Although these conceptual models describe plausible mechanisms by which climate or other drivers may affect our objectives, they do not quantify or prioritise them, nor do they make any comment on the importance of impacts caused.

Characterising risks

We characterised risks to our objectives using four characteristics:

- Impact proximity
- Impact importance
- Response speed (inertia)
- Response resource requirements

We collected evidence on impacts and responses including:

- the size of impacts on the environment;
- the extent to which these affect each objective;
- uncertainty and range of estimates of impact;
- when climate impacts on the environment and our objectives could become noticeable;
- when climate impacts on the environment and our objectives threaten achievement of our objective under business as usual;
- spatial variation in impacts where relevant;
- potential opportunities.

The proximity of impacts was rated as either:

- Now – current resources and delivery could already be potentially unsustainable.
- Short-term – current resources and delivery could be unsustainable by 2030.
- Medium-term – current resources and delivery could be unsustainable by 2060.
- Long-term – current resources and delivery could be unsustainable by 2100.

Note that the timing of climate impacts depends partly on emission scenarios, which diverge considerably in the latter half of the century. This means that risks rated with a proximity of now, short-term or medium-term are relatively insensitive to emission scenario. Risks that are most sensitive to emission scenarios will therefore all be classified as having a long-term proximity. This is a simple way of separating risks that are sensitive to emission scenario in the assessment, and avoiding the need to consider scenarios unnecessarily.

We evaluated potential impacts and responses against business thresholds by rating them as either:

- Severe – our objective could be unachievable with current resources and delivery and this could have major impacts on the wider organisation (for example, legal challenge or undermines licence to operate).
- Substantial – our objective could be unachievable with current resources and delivery and this could have some impact on the wider organisation.
- Moderate – our objective could be unachievable with current resources and delivery but this will have little or no impact on the wider organisation.

- Minor – there will be some impact on our objective with current resources and delivery.
- Negligible – there will be virtually no impact on our objective with current resources and delivery.

Note that these are 'thresholds' for the purposes of the statutory guidance.

The response speed (inertia) was rated as either:

- Long-term – longer than two corporate planning cycles (10+ years).
- Medium-term – within two corporate planning cycles (10 years).
- Short-term – within one corporate planning cycle (5 years).
- Rapid– within 2 years.

Resource requirements were rated as either:

- Major – we cannot fully adapt without significant additional external resources.
- Substantial – we cannot fully adapt without some additional external resources.
- Moderate – we will need to reallocate resources between departments.
- Minor – we can reallocate resources from within the same department.

Uncertainty, probability and confidence

Risk assessments should consider both the likelihood and magnitude of possible outcomes. However, it is difficult to formally separate likelihood and magnitude in a strategic climate risk assessment such as this because:

- climate change is dynamic so the likelihood and magnitude of impacts will vary progressively as climate change worsens;
- many environmental impacts of climate change are better understood as progressive trends (albeit with uncertain timing and scale) rather than stochastic risks (those that can be assigned a specific probability of occurrence);
- the assessment is framed around strategic organisational objectives that encompass many discrete outcomes with their own probability and magnitude, which are difficult to aggregate meaningfully.

We have found it difficult to reliably attach probability estimates to strategic ratings of impact and response and take the view that doing so would be misleading and in any case would not add much to the assessment since we are more interested in understanding the relative priority of risks rather than their absolute magnitude.

We have instead represented uncertainty in our assessment in two ways:

- by attaching confidence estimates to ratings of impact and response;
- by expressing uncertainty and variability in these ratings as ranges rather than point values.

Confidence in the evaluation of impacts was rated as:

- Very low – based on expert judgement or weak evidence only.
- Low – based on few, incomplete, inconclusive impact studies.
- Medium – based on expert interpretation of a number of (potentially conflicting) impact studies.
- High – based on impact studies that give a consistent picture but do not explore uncertainty fully.
- Very high - based on many impact studies that give a coherent picture and explore uncertainty fully.

Confidence in the evaluation of responses was rated as:

- Very low – we do not have sufficient understanding of the impact to be able to suggest any possible response.
- Low – we do not have a good understanding of our response.
- Medium – we understand the nature and scale of the response required (for example, change of policy, major legislative intervention and so on.
- High – we have scoped the feasibility of specific responses.
- Very high – we have scoped the feasibility of specific responses and have developed policy for best practice.

We have dealt with uncertainty and variability in impact, response and confidence by expressing ratings as ranges rather than a single value where appropriate. Ranges have been characterised as ‘best case’ and ‘worst case’ extremes and imply upper and lower estimates based on the presented evidence rather than formal scenario analysis (see Table 7 in Annex 3).

4 Identify options

We have identified adaptation actions for all our sensitive and influenced objectives over:

- the next year;
- the next 5 years (our corporate planning cycle);
- the long term in outline.

The actions we have identified are SMART:

- Specific to sensitive objectives;
- Measurable;
- Achievable;
- Realistic;
- Time-limited (and will be completed either in one year, five years or longer term).

In some cases, climate change presents opportunities to work differently or achieve desired outcomes. We have identified these where this is the case.

Each action has an identified owner who is responsible for its delivery, though these names are not given in Annex 2.

5 & 6 Appraise options and make decisions

It is important that adaptation actions are properly appraised to check that they are effective and offer good value. However, it is difficult to appraise the strategic actions identified here because:

- it is preferable to appraise them at the point of delivery and as part of our normal business processes (this also helps embed adaptation);
- many of the actions here are strategic commitments rather than specific proposals;
- there is often no distinct adaptation component to environmental decisions that can be appraised separately.

For these reasons, we will make sure that adaptation is properly embedded in our decision-making processes rather than appraised separately here.

However, we do recognise that appraisal is essential and needs to be done well. We have systematic guidance for appraising all potential schemes (for example flood management schemes) to get maximum value for money (in terms of benefits from reducing risks and consequences) from our Grant in Aid expenditures and to ensure their sustainability. We have a duty to follow relevant Government guidance in these appraisals, such as the HM Treasury *Green Book* and associated annexes on adaptation and managing public risk.

Stakeholders

We recognise that we need to work with others to adapt and many of our actions involve providing advice or partnership working. However, we have not consulted directly on the actions presented in this report because we are a public body and we need to consult on our adaptation actions in the context of discharging our duties rather than separately. We will therefore consult on specific adaptation actions during our normal operations. This will also help embed adaptation within our organisation.

It is also worth noting that many of the actions presented in Annex 2 are either strategic commitments to review working practice rather than specific proposals on what we might do differently, or are taken from existing plans that have already been widely consulted on.

7 Implement decisions

We will set up an adaptation programme to deliver the adaptation actions identified in this report including:

- research to better understand risks;
- actions to reduce risks;
- working and consulting with stakeholders;
- identifying and delivering opportunities from climate change;
- addressing barriers to adaptation.

Our adaptation programme will:

- be sponsored by one of our Directors;
- ensure that we prioritise our actions to address climate risks in the priority areas listed above; that we take appropriate action to mitigate other specific risks and that we monitor changes to all our risks over time;
- continue to contribute to the Government's Adapting to Climate Change Programme, hosted by Defra;
- monitor implementation of our plans and report on our progress;
- identify and share good practice approaches to managing climate risks;
- ensure that our staff and partners have the knowledge, skills and tools they need to address climate change;
- ensure that our research and analysis is coordinated both internally and with our partners;
- review and update our assessment as our understanding improves or our objectives change.

8 Monitoring

We will monitor adaptation progress and climate change by:

- establishing corporate adaptation indicators to track our programme;
- monitoring environmental change through our normal systems (for example, hydrometric monitoring).

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