



MINISTRY OF DEFENCE

Defence  
Infrastructure  
Organisation

# Building a Climate Resilient Estate

Practitioner Guide 01/12

Sustainable  
Development



## Document Aim:

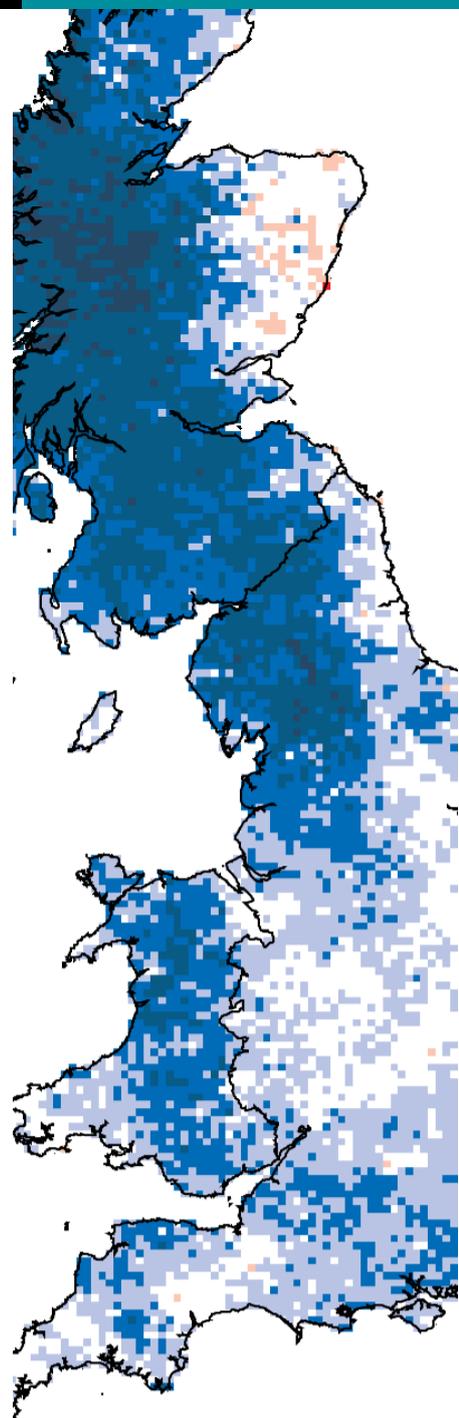
This document gives guidance on implementing the outcomes of Climate Impacts Risk Assessment Methodology (CIRAM) assessments and the development of a climate resilient estate.

## Document Synopsis:

Guidance on:

1. How to implement the Climate Resilience Risk Register (the outcome of a Climate Impacts Risk Assessment – CIRAM);
2. Approaches to managing climate-related uncertainty and risk;
3. Roles and responsibilities.

The guidance will aid the development of a resilient estate and support the continuity of Defence outputs.



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## Document Control

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### Related Documents

MOD SEAT Handbook Section 7 CIRAM	JSP 892 Risk Management
MOD Climate Change Strategy 2012	JSP 440 Defence Manual of Security
MOD Departmental Adaptation Plan 2011	JSP 435 Defence Estate Management
PG 05/10 Integrated Rural Management Plans	JSP 418 Vol.2 Leaflet 1 Environmental Management Systems
MOD Sustainable Development Strategy	DBR/DIO Joint Study Report
DIO Business Continuity Strategy (to be published)	JSP 326 Volume 3 Chapter 3 Leaflet 8 Flood and Water management
Guide on Building a climate resilient estate through land management	Embedding climate resilience in health and safety management (to be published)
Strategic Flood Risk Assessment for Infrastructure Resilience (to be published)	Strategic Risk Assessment for Infrastructure Climate Resilience (to be published)
JSP 503 MOD Business Continuity Management	

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### **Illustrative Examples**

Generic examples have been used to illustrate the recommended approach within the guidance to aid their interpretation.



## INTRODUCTION

1. Data obtained from the UK weather stations since 1914 shows that the UK climate has already changed. For example, according to the [UK Climate Impacts Programme Trends](#) report, annual mean temperatures in Scotland and Northern Ireland have increased by about 0.8°C since 1980s and central England annual mean temperatures have risen by about a 1.0°C since the 1970s. Extreme weather events are also becoming more frequent.
2. The weather can compromise the delivery of defence outputs (see Box 1) on MOD establishments. Existing vulnerabilities are likely to become more challenging with changes in climate including increases in extreme weather events. Building in resilience to current weather vulnerabilities and planning for long-term changes in climate will enhance the continuity of defence outputs, managing the costs and damages caused by current weather, as well as in the longer term ensuring that the estate is resilient to a changing climate.
3. The Climate Impacts Risk Assessment Methodology (CIRAM), developed by Defence Infrastructure Organisation (DIO), identifies the risks to defence outputs from current and future climate or extreme weather events, and identifies actions required to maintain and optimise operational capability. The output of a CIRAM assessment is a Climate Resilience Risk Register (CRRR). CIRAM and a worked example of a CRRR can be found on [Section 7 of the Sustainability and Environmental Appraisal Tool \(SEAT\) Handbook](#).
4. This Practitioner Guide (PG) provides advice on how to build the actions identified in an establishment's CRRR into the establishment's existing management procedures. This PG will be supported by a range of topic specific signposting guidance documents e.g. linking climate resilience to land management, H&S management etc.
5. This PG has been peer reviewed by the Cabinet Office (CO) Infrastructure Resilience Natural Hazards Team, the UK Climate Impacts Programme (UKCIP) and Defra Adaptation to Climate Change team.

### Box 1 Examples of Extreme Weather Events with implications for Defence Outputs

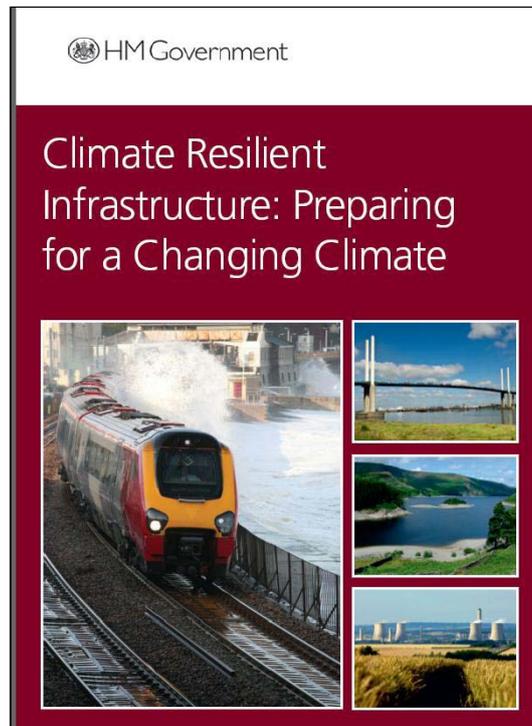


- a. Extreme heat and drought during the summer of 2003 caused water shortages and disruptions. Staff at some MOD establishments in the South West were sent home;
- b. The 2006 heatwave caused temperatures inside some MOD offices in the South East to exceed 30°C. Staff had to be sent home and a number of IT servers failed;
- c. In spring 2007, the continued dry conditions in the North East presented difficulties in controlling fires on the DTE with impacts for training;
- d. During summer 2007, heavy rain caused flooding on many MOD establishments including 11 airfields, 3 of which were unable to operate;
- e. In 2009, the Cumbria floods caused six bridges to collapse, severing the road network and cutting off communities. The Armed Forces were required to provide civil assistance;
- f. In 2010, unusually high early winter snow-fall across the UK closed transport routes (roads, rail and air) and facilities, resulting in many MOD staff being unable to travel to work and impacting on operations.

### POLICY

6. The Government recognises climate change adaptation as a priority. Under the UK Climate Change Act (2008) the UK Government is required to undertake an assessment of current and future climate risks to the UK ([UK Climate Change Risk Assessment – CCRA](#)) every five years with the first report to Parliament published Jan 2012; and to establish a National Adaptation Programme (NAP) to address the most pressing climate risks identified in the UK CCRA. MOD is required to contribute to the NAP.
7. Under the 2011 Greening Government Commitments, Government Departments are required to adapt their estate to a changing climate.
8. The Cabinet Office (CO) is leading on work to build resilience into the UK's critical infrastructure from natural hazards through its [Critical Infrastructure Resilience Programme](#) (CIRP) and the production of a Guide to improving resilience of Critical Infrastructure from Natural Hazards. The CIRP encompasses all elements of preventative, protective, incident response and recovery actions. The MOD CIRAM assessments support this CO initiative through ensuring the climate risks and management actions needed at its critical sites are identified. MOD has been complimented on its approach with CIRAM which support the CO initiative through the Resilience Methodology being rolled-out by DBR.
9. The [UK National Security Strategy \(NSS\) 2010 A Strong Britain in an Age of Uncertainty](#) highlights natural hazards such as floods as one of the national security priorities (Tier 1 risks), together with terrorism, cyber attack and international military crises. The NSS emphasises the need to predict, prevent and build resilience to these risks and remain adaptable for the future.

10. The [MOD Sustainable Development \(SD\) Strategy](#), [MOD Departmental Adaptation Plan \(DAP\)](#) and [MOD Climate Change Strategy](#) reflect these policy commitments to assess and understand the climatic risks to the MOD estate and inform business continuity, health, safety and environmental protection (SHEP), estate management and business resilience planning. Both the development and the roll-out of CIRAM are targets set out in the MOD SD Strategy and DAP which meets MOD's statutory and mandatory commitments.



**Figure 1** The UK Government has identified as a high priority to increase the resilience of UK infrastructure to today's natural hazards and prepare for future changing climate. The document *Climate Resilient Infrastructure: Preparing for a Changing Climate* provides Government's policy on adapting infrastructure to climate change.

## **CIRAM**

11. MOD has committed to complete CIRAM assessments for all defence critical establishments by Mar 2013, and other priority operational sites by 2015.
12. CIRAM is applied on a site by site basis, analysing and understanding of site specific information and allowing for adaptation action at the local level. The method uses the latest information on climate change, currently the UK Climate Projections 2009 (UKCP09) and other relevant data e.g. landslide risk from the British Geological Survey (BGS) to identify the future climate changes expected at the sites being assessed.
13. The risks identified in the resulting CRRR will be addressed through relevant management processes at establishment level and through estate strategic planning.

## **ROLES AND RESPONSIBILITIES**

### TLB Climate Resilience Focal Point (CRFP)

14. TLBs are responsible for the roll-out of CIRAM across their establishments. CRFPs have been nominated at each TLB (see contact details at Annex D). Their role is to ensure the Head of Establishments (HoE) arranges for a CIRAM assessment to be conducted. However, DIO resource is available to assist meeting the 2015 targets (see bullet point 26).
15. TLB CRFPs should also ensure the HoEs are aware of their responsibilities regarding the implementation of the CRRR. The TLB CRFP should request annual reports on CRRR implementation (including copies of reviewed CRRR).
16. The TLB CRFPs should provide at the end of the financial year, copies of completed maturity matrices and reviewed CRRR to the MOD CRFP (see bullet points 24 – 25), who will coordinate the production of metrics for the Departmental Adaptation Plan (DAP), and metrics within MOD's SD Strategy, Annual Report and Accounts (ARAC) and other outwardly facing reports.
17. The TLB CRFP should ensure any wider issues requiring a broader pan-TLB wide response (e.g. DE&S equipment or civilian personnel) are raised with the MOD CRFP to coordinate.

### Head of Establishment (HoE)

18. The CRRR is owned by the establishment. It is the HoE's responsibility to ensure that actions arising from the CRRR are incorporated into the establishment's management processes. I.e. ensure that all action owners incorporate their actions into the relevant plans / processes e.g. Business Continuity Plan, SHEF/SHEP Committee.
19. The HoE is required to coordinate the review of the CRRR on an annual basis and a full CIRAM assessment every five years. HoE should also ensure that appropriate CRRR action monitoring mechanisms are in place to inform these reviews.
20. The HoE should ensure that a copy of the CRRR is provided to the TLB CRFP (see Annex F) who will raise any risks identified that require a response from another branch within MOD with the MOD CRFP e.g. Strategic Estate Development and Planning, TLB Command Plans, Health and Safety policy etc. The HoE should also report to the TLB CRFP annually on the implementation of the CRRR.

### DIO – SETL or equivalent

21. It is DIO's responsibility to ensure that all infrastructure climate-related risks are incorporated into their relevant plans and procedures, and in consultation with the HoE, prioritise the infrastructure risks at the establishment.

### MOD CRFP

22. The MOD CRFP (DIO StratPol-SD Energy1b1, see contact details at Annex D) should coordinate any overarching issues arising from the TLBs, liaise with relevant MOD Process Owners (e.g. MOD corporate response) to build

resilience into their business areas and co-ordinate the Government and external reporting requirements.

23. The MOD CRFP will also provide policy support and ensure that CIRAM outcomes and CRRR implementation inform the strategic planning of the MOD estate including SAPT, Strategic Asset Management and Disposals.

#### DIO Sustainable Development Support (SDS)

24. DIO SDS within DIO Ops North Professional Technical Services will provide support in undertaking CIRAM for those establishments identified as being defence critical. SDS will also provide support in CIRAM assessments for the remaining operational and less sensitive establishments where resources allow. The guidance contained within Section 7 of SEAT Handbook will enable non-specialists to undertake CIRAM.

#### Climate Resilience Working Group (CRWG)

25. The CRWG will coordinate a pan-MOD approach to the roll-out of CIRAM and the adaptation of the MOD estate and build resilience to current and future climates. The CRWG will also aid information sharing among TLBs. The TORs for the CRWG is at Annex C.



**Figure 2 Soldiers from 3 Armoured Engineer Squadron work on the temporary footbridge to span the River Derwent (Cumbria) after severe floods in Nov 09 damaged various bridges across the area leaving communities with no easy access to essential services. The UK CCRA has identified that there would be added burdens on UK emergency services in responding to more frequent flooding, heatwaves and wildfires (Picture: Kevin Hegarty, Crown Copyright/MOD 2009).**

## **PARTNERSHIP WORKING**

26. Adaptation should not be delivered in isolation. Effective partnership working with others (partners, landowners, authorities etc.) is essential to planning for and delivering successful adaptation, sharing existing knowledge, good practice and any lessons learned throughout the process. The ability to manage some of the risks and impacts (e.g. flooding) will be enhanced by working collectively, with both internal and external stakeholders.
27. Internal site stakeholders (such as contractors) can provide key evidence and expert site knowledge about establishment climate issues. Additionally, they may be responsible for delivering adaptation actions and monitoring. It is important to ensure engagement with them at an early stage.
28. Collaboration between sites can assist in sharing information and adaptation actions, which is especially important to business continuity management and the selection of backup facilities not at risk of being disrupted by the same weather events.
29. Working with tenant farmers can assist in building climate resilience. For instance, environmental stewardship schemes can enhance adaptation e.g. improving water quantity and quality by reducing the effects of waterlogging, and implementing water capture and storage measures to ensure adequate supplies during drier periods.
30. Building effective local partnerships will also contribute to the Government's priorities on delivering adaptation at the local level. MOD activities to deliver adaptation will also benefit the local community through the provision of services such as emergency planning and civil assistance, green space (wellbeing and cooling during heatwaves) and flood protection e.g. MOD is working with the Environment Agency (EA) and others in restoring, protecting and sustainably managing the Dartmoor peat bogs. Sustainably managed peat bogs absorb heavy rainfall therefore minimising the risk of flooding surges downstream.
31. Energy and water suppliers are responsible for assessing their risks under the Climate Change Act and to ensure the supply of their services are adapted to climate change. By engaging with these service providers, establishments can ensure adequate supply under different climatic conditions
32. Local Authorities (LA) may undertake their own climate risk assessments and studies e.g. the likely climate impacts on key services, flood risk assessments etc. Engaging with the LA will provide the opportunity for establishments to raise any risks highlighted by the CIRAM assessment and to ensure they are addressed by the LA where appropriate. For example, the need to address localised flooding issues in the areas surrounding the establishment and the need for more gritting in access roads during cold periods etc. The work that the LA are undertaking will also help establishments to further understand the climate risks to the area and this will be used to inform CIRAM and the review of the CRRR.



**Figure 3 Engagement with LA can help increase resilience to risks affecting the transport network and access routes to establishments. In the photo, the only access route into Thorney Island which is at risk of flooding (Crown Copyright/MOD).**

33. Local Resilience Forums and Regional Resilience Forums<sup>1</sup> in England and Wales enable collaborative preparation for and response to emergencies. Local Resilience Forums (LRF) sit at the apex of an Area's local civil protection arrangements. The Area covered by an LRF will often match the area of a Police Constabulary, but there are variations. The purpose of an LRF is to ensure that there is an appropriate level of preparedness in that Area to enable an effective multi-agency response to emergencies that may have a significant impact on the communities in that Area. Different arrangements apply in Northern Ireland<sup>2</sup> and Scotland<sup>3</sup>:
34. Site Business Continuity Planners are encouraged to engage with their Local Resilience Forums, to better understand their community risk registers and the natural hazards locally identified.
35. Engaging with the EA Catchment Flood Management Plans, Coastal Forums and Local Coastal Partnerships provides opportunities to further understand flooding and coastal issues and ensure the MOD's priorities are taken into account. See JSP 362 Volume 3 Chapter 3 Leaflet 3 Flood and Water Management for more detail on these initiatives.
36. [Regional Climate Change Partnerships](#)<sup>4</sup> provide an opportunity to understand climate related issues on a regional scale and share best practice for adaptation.

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<sup>1</sup> <http://www.cabinetoffice.gov.uk/content/local-resilience-forums>

<sup>2</sup> <http://www.nidirect.gov.uk/index.htm>

<sup>3</sup> <http://www.readyscotland.org/>

<sup>4</sup> Climate change partnerships have been established for the English regions, Northern Ireland, Scotland and Wales with the aim to share knowledge and learning about tackling the consequences of climate change.

## MANAGING IMPACTS OF CURRENT AND FUTURE CLIMATES

37. The process of managing and building resilience to current and future climate risks is known as “adaptation”. To ensure MOD has a resilient estate in the future, its adaptation management approach should:
  - a. Be able to deal with uncertainties;
  - b. Be flexible; and
  - c. Combine a mixture of risk response strategies i.e. consider different options for addressing the risk including taking advantage of any benefits and opportunities.

### Uncertainty

38. As with most issues concerning the future, there will always be a level of uncertainty regarding climate change projections. Despite these limitations, the climate change projections do provide valid and informative representations on future climate.
39. The level of uncertainty varies between the different climatic variables e.g. temperature, precipitation (see SEAT Handbook Section 7, CIRAM) depending on the current ability to model them. The level of certainty should be reflected in any adaptation strategies and should inform the prioritisation of actions that are more certain e.g. increased likelihood of heatwaves.
40. Uncertainty can be managed by implementing adaptive management approaches (see next section) and/or by identifying different management options that will increase resilience to the range of possible trends identified by the climate data (e.g. projected temperature increases range from 1.4 - 6°C in the SE of England, under the medium emissions scenario by 2050s). The uncertainty whether temperatures will increase by 1.4°C, 6°C or somewhere in between could be managed by planning the actions needed under each possibility. The planning of thresholds and responses against a timeline will allow for financial risks and requirements to be profited.

### Adaptive management

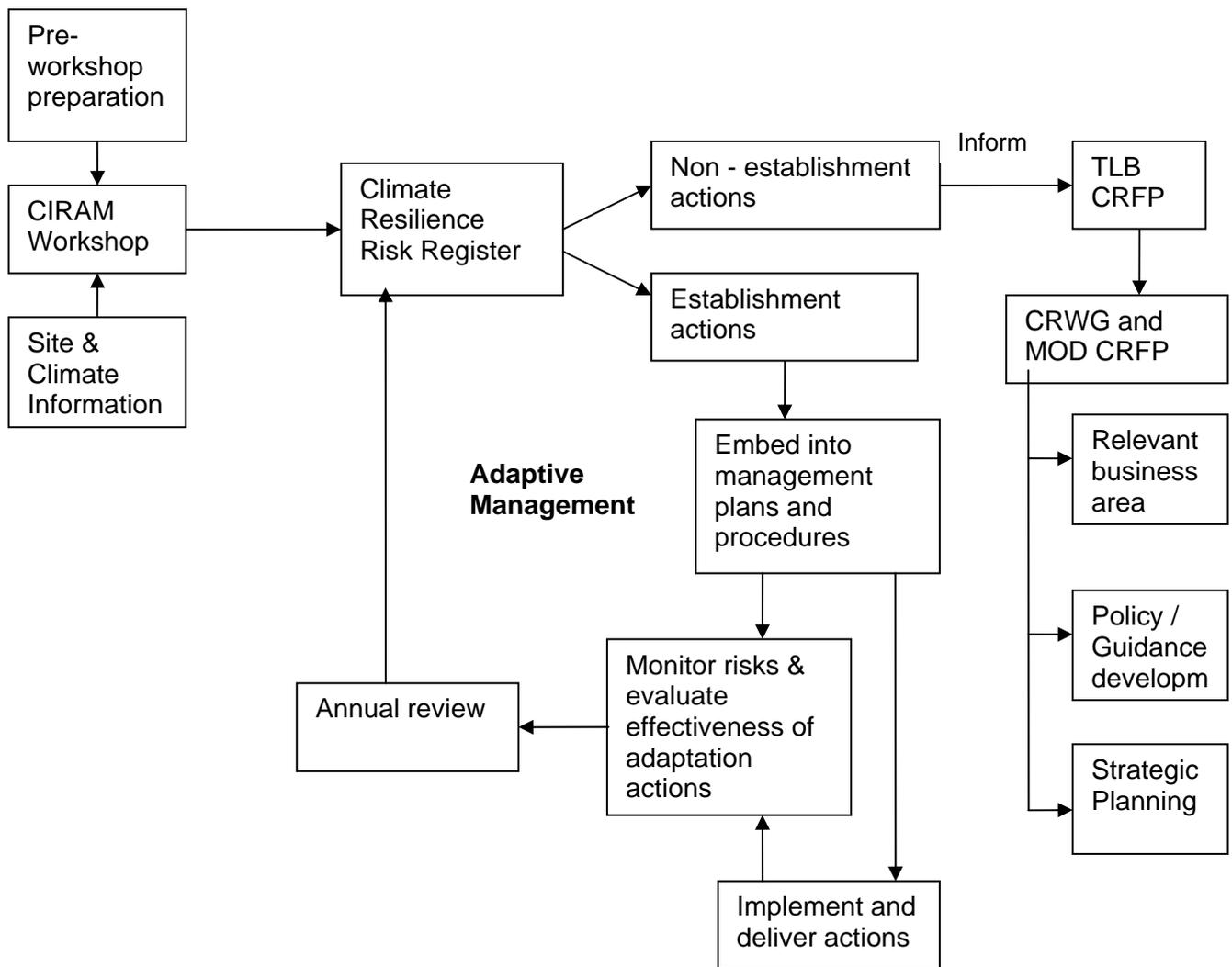
41. Adaptive management approaches are those that control risk and at the same time learn about the nature of the risk itself and the actions required to address the risk.
42. Adaptive management can be continually reviewed, revised and improved accordingly. This involves:
  - a. Implementing the adaptation actions in a phased manner i.e. prioritising risks that are evident now and need to be addressed in the short and medium term (e.g. current vulnerabilities), whilst acknowledging and checking those that are tolerable or less apparent that can be addressed at a later stage;
  - b. Identifying uncertainties and building these into the management of the risks until more informed data becomes available;

- c. Monitoring and evaluating the risks and implementation of the adaptation actions (see paragraphs 28-36) will allow for a greater comprehension of the risks and their consequences as well as the effectiveness of the actions; and
  - d. Adjusting the management approach and actions as additional and more comprehensive information becomes available. This means that the implementation of adaptation actions should be sufficiently flexible to deliver benefits under the range of conditions identified by the climate data (see example in paragraph 21).
43. The annual review of the CRRR and the quinquennial CIRAM assessment cycle is an adaptive management approach.

#### Combining risk response strategies

44. The differing risks will have their own level of certainty and, therefore, may require a bespoke response strategy. There will likely be a number of different options available to manage any particular risk. The costs and benefits for each option should be determined before a management option is chosen. This should be made in context of the establishment and TLB's risk appetite and balanced against available resources. Annex A provides examples of risk response strategies.
45. Effective adaptation should combine a mixture of the response strategies (rather than a simple risk/response way) including:
- a. Transferring / sharing the risks or losses e.g. via partnership working;
  - b. Building in climatic resilience i.e. preventive, detective and directive controls;
  - c. Living with some risks and ensuring capability can respond and recover i.e. corrective controls (business continuity and recovery plans);
  - d. Accepting some losses i.e. tolerate risk strategies; and
  - e. Exploiting potential opportunities e.g. introducing new behaviours, processes or activities; and exploiting and encouraging new technologies that have wider sustainability and operational benefit.

**Figure 4 The Process of CIRAM Implementation and Adaptive Management**

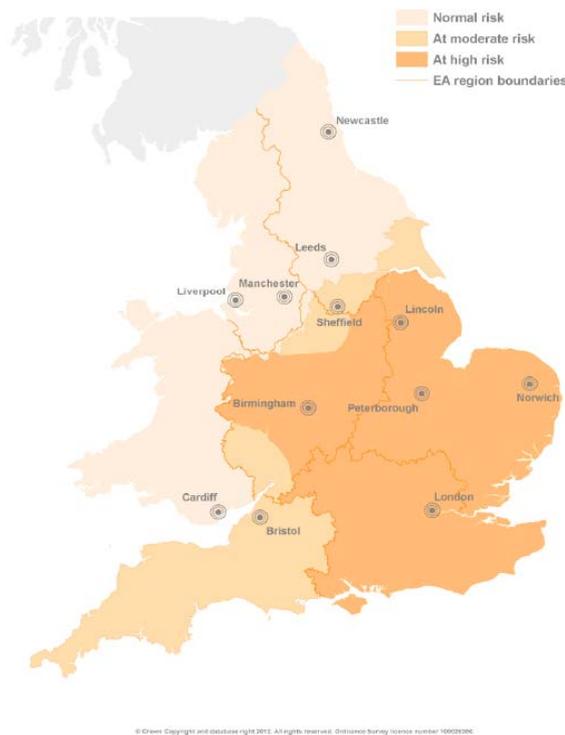


**EMBEDDING THE CRRR ACTIONS INTO EXISTING ESTABLISHMENT PROCESSES**

46. Processes and procedures will vary between MOD establishments. The following sections provide advice on embedding the CRRR actions into the relevant management processes and procedures. These include:
  - a. Business Continuity Management (BCM) and Security Management;
  - b. Facilities and Asset management, including Integrated Estate Management Plans (IEMPs); Environmental Management Systems (EMS); and Integrated Rural Management Plans (IRMPs).
47. The TLB CRFP will ensure that the establishments CRRRs are reflected within their own processes e.g. DE&S Defence Risk Tool.

## Business Continuity Management

48. Business Continuity Management (BCM) encompasses a range of business management processes and plans (JSP 503) including risk management, emergency management and disaster recovery. BCM identifies what needs to be done before an incident occurs to protect people, premises, technology, information, supply chains, stakeholders and reputation. This enables the development of strategies and contingency plans to manage the consequences of disruption, mitigate the impact on critical activities or outputs, and recover business back to normal levels of operation as soon as possible afterwards.
49. Defence outputs and infrastructure may be vulnerable to disruptions caused by weather and climate related events. Incorporating adaptation into BC planning and management provides the capability reacting to and recovering from disruptions due to weather events, while protecting personnel welfare and safety.
50. While some BC planners may already take into account the potential impacts of some weather-related events, BC planners must also recognise the events that are likely to be more frequent or intense in future, and which may occur at unexpected times of the year, e.g. in 2011 heatwaves occurred in April and September.
51. CIRAM assessments to date have shown that weather/climate related impacts are occurring on the MOD estate with consequences for the continuity of defence outputs. Examples of issues that should be considered in BCM include:
  - a. Flooding, extreme cold conditions and high winds may affect transport links to establishments, restricting personnel and supply access;
  - b. Drought may restrict the availability of potable water, which may constrain certain estate activities and even force site closures;
  - c. Extreme weather may cause power outages resulting in loss of IT and communication capability; and
  - d. Prolonged high temperatures may lead to overheating of buildings, impact on the productivity of staff due to reduced thermal comfort.
52. The CRRR and the establishment climate information should inform all site, business unit and infrastructure business continuity and recovery analysis and planning, and the risks reflected as appropriate in any Site BC and Recovery Plans (copies of the current, relevant CRRR and climate information can be kept with the supporting information for those plans).
53. Detailed guidance on all aspects of business continuity management, including conducting business impact analyses, planning and exercising is given in JSP 503. Site BC Planners are expected to be familiar with and apply JSP 503.
54. Site BC planners will need to liaise with all lodgers on the site, including facilities management, supply chains, security and health and safety.



**Figure 5 Map shows drought risk areas across England and Wales as at 30 Mar 12 (Source: EA). The risk of drought is set to increase across the UK, particularly in the East and SE of England and the Midlands. See also Figure 6.**

### Security Management

55. CIRAM assessments have provided evidence that severe weather events can threaten the physical security of MOD establishments, for example:
  - a. Drains, watercourses and culverts located beneath perimeter fences or acting as security features could dry up during drought conditions providing an easy access into the site;
  - b. Coastal sites could be at risk of coastal erosion causing damage to perimeter fences;
  - c. During high winds and storm conditions, the integrity of security fences, perimeter intruder detection systems, closed circuit television and security lighting could be compromised directly and indirectly e.g. from falling trees.
56. The security of the users of the site could also be compromised by extreme weather events, e.g. sites that are particular at high risk from high wind.
57. CIRAM assessments can help HoEs identify threats to the security of the establishment. The CRRR and climate information should be used to inform the Security Plan and Security Risk Register for the establishment.
58. Detailed guidance on all aspects of security management is given in JSP 440.
59. If the CIRAM assessment identifies that a particular climate variable is impacting the condition of physical security assets (e.g. fence, security lighting etc.) at the establishment, the Establishment Security Officer (ESyO) should determine the need for enhancement works.
60. The quarterly security meetings provide an opportunity to also monitor / review climate related risks. Any findings from the quarterly reviews should be used to inform the annual review of the CRRR.

## Estate Management

61. Weather and climate can affect the current and future condition of estate assets. These may cause reduced performance or failure of assets and potentially impact on an establishment's operational output. Therefore it is essential that the estate related risks identified by the CIRAM assessment are factored into the Integrated Estate Management Plans (IEMP) or equivalents. This will allow the establishment to maximise the effectiveness of limited resources, prioritising maintenance and development.
62. The Site Estate Team Leader (SETL) or equivalent should ensure that the CRRR inform the IEMP or equivalent, as these will assist when identifying failings in the estate, set priorities on general maintenance and develop requirements to make the estate more operationally effective.
63. The CRRR and the climate information can help inform:
  - a. The assessment of current threats and constraints to the future use of land and infrastructure, e.g. when the establishment is located in an area at high risk of heatwaves, flooding or coastal erosion;
  - b. Current and target asset condition assessments;
  - c. Where assets fail to meet statutory and mandatory compliance due to weather events e.g. water systems at the establishment and Legionella management;
  - d. New works plans and programmes e.g. Minor New Works (MNW) and Capital Works(CW);
  - e. Planned maintenance. This includes Planned Preventative Maintenance, Condition Improvement Maintenance, Life Cycle Maintenance and Condition Improvement Maintenance. It will be important to reduce the vulnerability of assets to weather corrosion and damage and improve their replacement cycle;
  - f. Grounds maintenance. The creation and proper maintenance of 'green'<sup>5</sup> and 'blue'<sup>6</sup> infrastructure can help towards increasing resilience to certain risks such as flooding. For example, green open space and green roofs can help reduce runoff during heavy precipitation, while ponds can act as storage areas and provide cooling in urban heat islands;
  - g. Response Maintenance. When restoring assets that have been damaged by a weather event (e.g. strong winds), it will be important to take the climate information into account when designing permanent solutions to restore that asset; and
  - h. Project Documentation. Requirement Documents and Statement of Need (SoN) to ensure that any projects and design standards are resilient to a changing climate.

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<sup>5</sup> Green infrastructure includes living roofs, trees, road verges, parks, open spaces, playing fields, woodlands, allotments and gardens.

<sup>6</sup> Blue infrastructure includes water storage areas, ponds, fountains, culverts, rivers, wetlands etc.

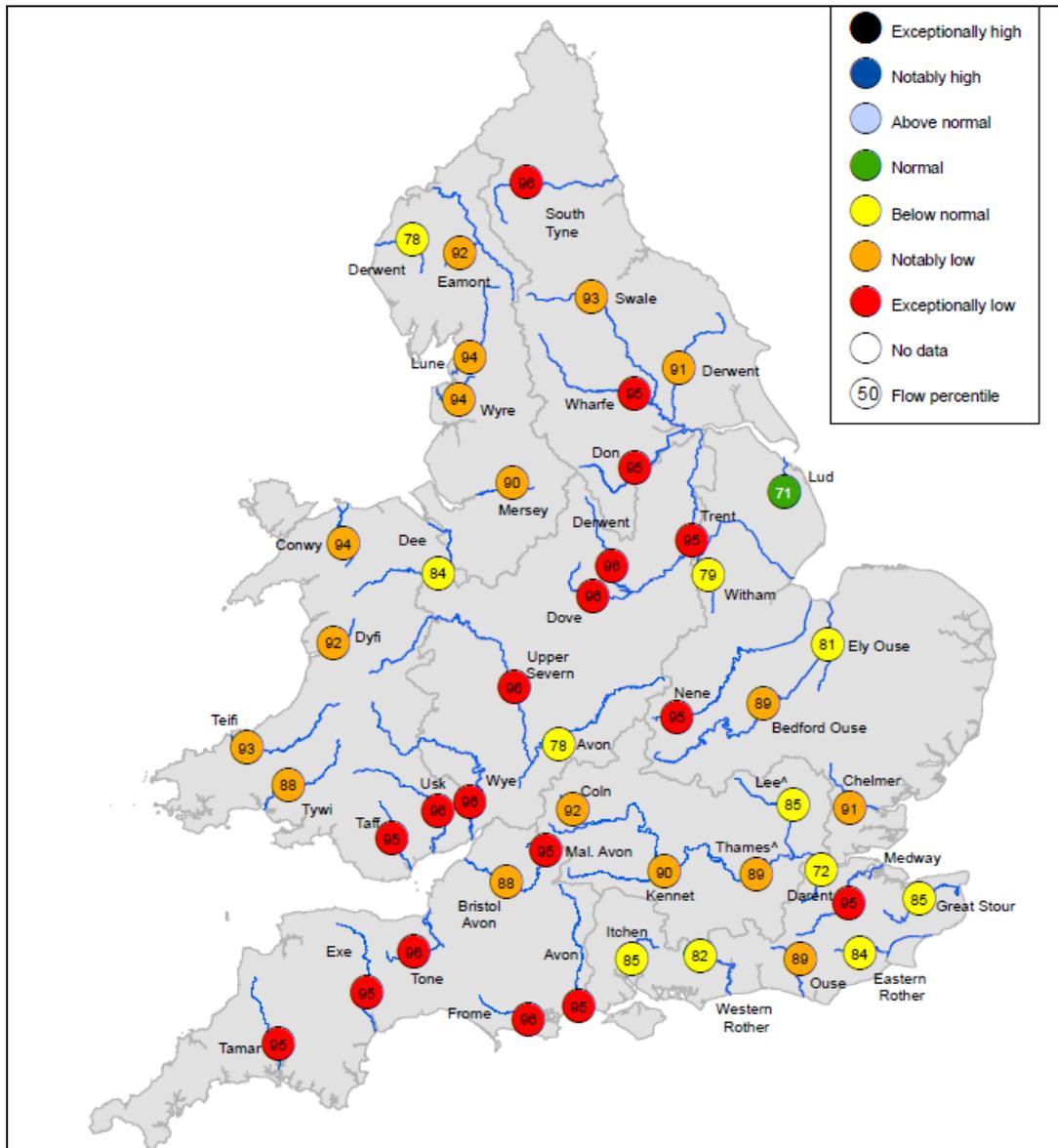
64. Not all estate management related risks will require extensive funding. The IEMP provides an opportunity for the HoE and SETL to analyse and optimise the utilisation of assets and the opportunity to relocate certain functions to different rooms, buildings, assets to minimise climate related risks. For example rooms that overheat and/or get high solar gain could be used as storage rather than offices; or assets within large offices that overheat could be relocated taking into account thermal zoning and comfort within that room.
65. The SETL is responsible for receiving Reactive Maintenance Reports from the Site Estate Delivery Team. Additionally, the HoE and SETL undertake regular inspections of all assets confirming with End Users whether or not their operational input is being constrained by the estate. These reports and inspections provide an opportunity to monitor impacts from weather events on the establishment e.g. number of response maintenance needs that have been caused by surface water flooding. The HoE should ensure that any key new information arising from these exercises is captured in the annual review and update of the CRRR. The annual review of the IEMP provides an opportunity for this and to incorporate any improvements made to the CRRR into the IEMP.

#### Environmental Management Systems (EMS)

66. The EMS is a tool to help deliver MOD's environmental compliance with legislation and mandated requirements as set out in JSP 418. It forms an Annex to the IEMP.
67. Weather and climate events are likely to create risks in delivering environmental compliance and sustainability targets at an establishment level. These may include threats to health and safety and the environment, the potential financial consequences of non-compliance or pollution incidents and lead to potential remediation costs and damage to MOD's reputation. For example, the management of water quality will be affected by changes in climate, including increased prevalence and duration of algal blooms and low flows (see Figure 6) during dry warm periods that may lead to discharge consents failure and health issues.
68. The HoE should ensure that the CRRR and establishment climate information are used to inform the establishment's EMS. The Safety Health Environmental Protection (SHEP) representative and/or the Environmental Committee (EC), Environmental Protection Working Group (EPWG) at the establishment are advised to review this information and agree how to incorporate the relevant risks into the significant environmental aspects register. It is also their role to ensure that any actions are implemented and monitored accordingly.
69. The CRRR and establishment climate information can also inform:
  - a. Environmental significance assessments for the establishment (Environmental Aspects Pro-forma). For example, energy management will be affected by increased likelihood of higher temperatures and solar gain. As buildings become uncomfortably hot, users may start using mechanical cooling systems e.g. individual fans, which may impact on the ability of the establishment to meet its targets on energy use and carbon reduction;
  - b. Environmental significance assessments; and

c. Whether further corrective and preventive controls are needed.

70. The SHEP officer and EC/EPWG are responsible for undertaking self-assessment evaluations. These assessments combined with the quarterly EMS reviews provide an opportunity to monitor the risks identified by CIRAM, especially if they are the cause of environmental incidents and compliance failures. Any findings should be reported to the HoE for the annual review and update of the CRRR.
71. The annual review of the establishment EMS provides an opportunity for incorporating any improvements made to the CRRR into the EMS.



**Figure 6 Map showing river flow summary in Apr 11 when river flows were below normal for the time of year at all but one of EA indicator sites, with one third of sites exceptionally low for the time of year (Source: EA). According to UK CCRA, the risk of low river flows is likely to increase across the UK.**

## Integrated Rural Management Plans (IRMP)

72. An IRMP defines the long-term land management strategy for the rural estate. It forms an Annex to the IEMP.
73. The management of the rural estate will be impacted on by weather and climate events, for example:
  - a. Military Training. Increased risk of uncontrollable fires (increased likelihood of longer warm and dry periods) may cause restrictions on the use of pyrotechnics;
  - b. Forestry. Changes in temperature, precipitation and wind are likely to cause changes on the suitability of tree species across different regions in the UK and increased tree damage, with increased pressures for the management of the woodland estate;
  - c. Nature Conservation. Biodiversity is likely to be vulnerable to changes in climate depending on the type of habitat and species, their location and their ability to adapt.
  - d. Historic Environment, e.g. archaeology may be at risk due to changing soil conditions including flooding and drought;
  - e. Access & Recreation. Increased likelihood of longer periods of warm and dry weather is likely to increase visitor numbers in the rural estate and this could increase the risk of damage to the condition of protected areas and the risk of fire;
  - f. Coastal Management. Many coastal establishments are already at risk to sea level rise and coastal erosion.
74. The CRRR and establishment climate information should be used to inform:
  - a. IRMP meeting review discussions;
  - b. The relevant Component Management Plan, so that issues addressed by the subject matter experts;
  - c. Component Plans Constraints and Opportunities table.
75. IRMPs are reviewed every 5 years, with actions reviewed annually allowing for actions identified within the CRRR to be incorporated at this stage within the IRMP Summary Action Plan. The CRRR and establishment climate Information can be kept with the supporting information for the IRMP.
76. The IRMP review stage provides an opportunity to liaise with stakeholders including Statutory Bodies e.g. Natural England, English Heritage) and National Park Authorities and share best practice on land management and environmental change.
77. Supporting guidance *Building a climate resilient estate through land management* will provide further detail on the risks for the rural estate.



**Figure 7 Bridge (in the photo), track and riverside damage by flash flooding at DTE Otterburn caused training disruptions and increased relief costs**

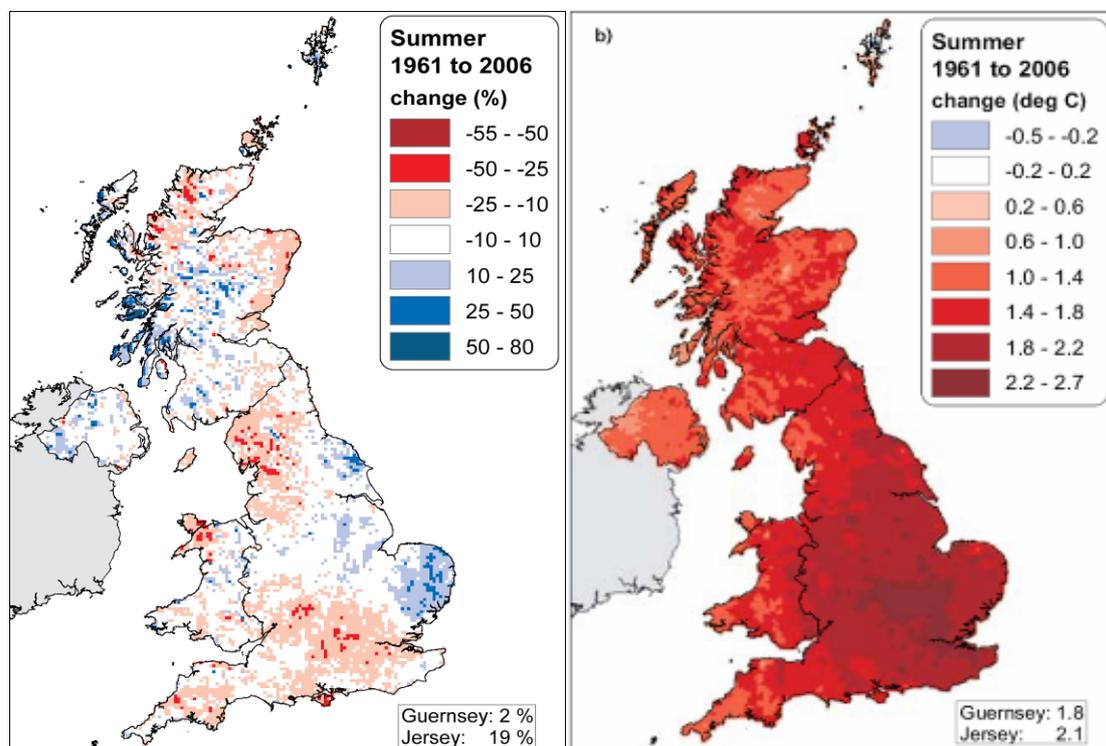
## **IMPLEMENTING AND PRIORITISING CRRR ACTIONS**

78. The HoE should ensure that risk action owners (identified within the CRRR) incorporate their agreed risks within their existing management plans and procedures in a flexible manner which will involve:
  - a. Prioritising the adaptation actions identified in the CRRR and implementing them in a phased manner; and
  - b. Ensuring that actions can be modified or adapted in the future to allow for increased knowledge about the nature of the risks and critical thresholds. For example the flood defences at RMB Chivenor are designed to withstand rising sea levels over the next 25 years and can be adapted further if sea levels rise faster than originally projected.
  
79. Risk action owners should prioritise their actions balanced against a number of variables:
  - a. The risk appetite of the establishment and the TLB;
  - b. The wider benefits that the action might provide, including the management of other risks affecting other operational requirements;
  - c. Budget or resources required to deliver the action and the broader cost savings and/or gains e.g. win-win actions which build climate resilience and contribute to reducing carbon emissions, see Annex A;

- d. The certainty of the risk;
  - e. Level or magnitude of risk.
80. The HoE should also begin to plan for the mitigating of risks that require phased medium or long term response strategies and consider any funding lines that may need to be put in place.

Use of climate projections and weather data

81. The climate has already changed throughout the 20<sup>th</sup> century (see examples at Figure 8). To date, decisions and planning (including engineering designs) have been based on historic climate data which assumed the climate was and would remain relatively stable. Previously used records of past climate are not a good guide for the future. The UK Government has identified as a priority the need for policies, plans and projects with long term implications to take into account future climate projections to ensure they are resilient to future climate.
82. As part of the CIRAM process, the establishment will have been provided with tailored climate change projections and data on other issues such as flood risk. The HoE should ensure that this information is retained in order to inform decisions and options on the management and development of the establishment rather than relying on historic datasets.
83. The HoE and risk action owners can use the projections to compare against any trends resulting from monitoring climatic risks and weather events. This will help ascertain whether critical thresholds are likely to be exceeded more frequently in future. The MOD CRFP can also be contacted for advice.



**Figure 8 Maps showing observed changes in summer precipitation (left) and temperature (right) in the UK from 1961-2006. Source: UKCIP.**

## MONITORING AND EVALUATING

84. The HoE should ensure that any risks identified within the CRRR are monitored over time. Existing monitoring mechanisms in place e.g. reactive maintenance reports done by contractors, EMS environmental incidents recording procedures can be adjusted to document those weather events that cause failure or reduced performance of the estate.
85. The frequency, duration, intensity of weather events, their impact and consequences on operational output and the detail of the mitigation actions taken at the time to maintain / restore normality should be recorded, where appropriate into existing recording mechanisms.
86. Data collected as part of the monitoring activity may include:
  - a. Type of weather incident e.g. heavy rain, sustained dry conditions, high ambient temperatures that caused failure or reduced performance;
  - b. Duration of the event e.g. number of days, hours etc. This information will be valuable when identifying critical thresholds at the site;
  - c. Measurements e.g. degrees of temperature, if available, will be valuable when identifying critical thresholds at the site. Some establishments will have a Met Office station on site, however local weather stations can also be consulted);
  - d. The immediate effect of weather incidents such as flood, subsidence, fire, physical damage, roads impassable, areas inaccessible etc.;
  - e. Areas affected e.g. buildings, staff (hours lost), water supply ;
  - f. Time needed to manage the issue and restore normality;
  - g. Resources, repairs and any associated costs; and
  - h. Detail of how business delivery was affected.
87. How weather events impact on the surrounding areas of the establishment should also be recorded as they may have an impact on operational capability. For example:
  - a. Water management issues in surrounding areas e.g. excessive surface capping causing flooding on the establishment;
  - b. Transport network issues preventing access to site;
  - c. Disruption to energy and water services.

## Box 2 Data collected for adverse weather at Abbey Wood in Feb 09



**Weather incident** – very cold with heavy snow (22” inches)

**Duration** – 7 days (2-9 Feb 09)

**Temperature ranges** – -8 to +4°C

**Immediate impacts** – Local roads icy and in some areas impassable. Routes around site also very icy.

**Areas affected** – Many staff unable to travel to work. Bus services suspended. Train services delayed or cancelled.

High risk of slips around site and whilst travelling to and from work. Risk of vehicle/structural damage around site due to drivers losing control of vehicles.

**Associated costs** – unknown

**Impact on operational output** – Business continuity plans were instigated and although some staff could work from home there was an impact on productivity. If risk is not managed then will impact on ability to support frontline operations

### Identification of critical thresholds

88. A critical threshold is the boundary between the tolerable and intolerable levels of risk. These include climate and impact thresholds e.g.:
  - a. The amount of precipitation required to cause a flood that disrupts operations;
  - b. The temperature (degrees °C) that causes IT servers to overheat and fail;
  - c. The temperature (degrees °C) that causes buildings to overheat and affects users' comfort and productivity;
  - d. The wind speed that causes damage on site and/or affects users' safety; and
  - e. The level of disruption on the road and rail network that affects business output e.g. number of days that key staff cannot get to work due to snow.
89. Extreme weather events are likely to increase in frequency and intensity. The critical thresholds for assets and personnel will be exceeded more often. This will lead to increased frequency of failure and reduced performance unless adaptation measures are put in place.
90. Risk action owners should examine data on weather events and external factors e.g. as part of the CRRR annual reviews or quinquennial CIRAM assessments to identify existing vulnerabilities and weaknesses in the current response mechanisms. This will aid in identifying the critical thresholds, how often they are breached and how well they are managed.

91. Monitoring how often critical thresholds are breached will help understand differences between short-term extreme weather events and longer-term trends consistent with changes in climate. This will help assess the applicability of climate projections and inform the prioritisation of actions accordingly.
92. The collation and evaluation of data on weather events and other external factors will aid understanding of climatic trends and extreme weather events. It will assist in identifying recurring issues, critical thresholds and inform the establishment's risk assessment.

### **REVIEW OF THE CRRR AND QUINQUENNIAL CIRAM ASSESSMENT**

93. The HoE should review the risk register annually, e.g. in combination with existing establishment processes such as IEMP annual review, SHEP Committee meeting. This review should reflect and evaluate any:
  - a. New data on weather events obtained from monitoring the previous year;
  - b. Identification of critical thresholds;
  - c. Increased understanding of the risks identified within the CRRR and effectiveness of the adaptation actions; and
  - d. New / emerging risks.
94. The Risk scores should be adjusted accordingly to reflect any improved understanding of the risk. A full CIRAM assessment should be repeated on a five year basis. The MOD CRFP should be contacted for updates in climate data when undertaking the quinquennial CIRAM assessment.
95. A copy of the revised CRRR should be provided to the TLB CRFP together with a progress report on the implementation of the actions contained within the CRRR.
96. The HoE must ensure that any changes arising from the review are subsequently reflected within establishment management processes.

**RISK MANAGEMENT STRATEGIES**

<b>MOD terminology</b>	<b>MOD Definition on JSP 892</b>	<b>Adaptation examples</b>
<b>Terminate</b>	Some risks will only be treatable to acceptable levels by terminating the activity	Accepting the loss of coastal site due to high risk of coastal erosion and flooding. Achieved through strategic estate planning
<b>Transfer</b>	Transfer the responsibility / burden of risk to another organisation that is more capable of managing the risk	Ensuring estate contracts (Regional or Stand Alone PC, PPPs, PFIs) incorporate climate change adaptation.  Partnership working with Local Authorities, transport and utility providers e.g. Abbey Wood joint venture with the LA to resolve flood issues improving vehicular access to the site.
<b>Treat</b>	Continue with the activity whilst constraining the risk to an acceptable level. This option can be further broken down into four different types of controls:	
	Preventive control: limiting the possibility of undesirable outcome being realised	Increasing the resilience of new and existing infrastructure through adapting new builds and refurbishments.  Improving maintenance regimes (proactive rather than reactive) e.g. monitor and clear drainage systems more frequently in order to minimise the risk of flooding  Limiting certain activities during extreme circumstances e.g. use of water resources to wash vehicles during a drought; limiting public access to training areas during hot and dry weather.
	Corrective control: correcting undesirable outcomes which have been realised	Business Continuity Plans etc. that reflect climate risks will enhance the establishment's ability to recover from disruption from extreme weather events e.g. disruption of the energy supply.
	Detective control: identifying occasions of undesirable outcomes having been realised	Annual review of CIRAM risk registers.  Monitoring of risks to determine their significance and critical thresholds, e.g. monitoring the high temperatures and low precipitation levels that will cause discharge consents to be breached.  Auditing of projects for compliance with SA and DREAM on climate change adaptation.
	Directive control: ensuring that a particular outcome is achieved	Include adaptation measures within renewed contracts.  Include adaptation measures within H&S risk assessments e.g. ensure long trousers are worn on training areas during warm weather to minimise the risk of tick-borne diseases, use hats and use of sun-cream protection to minimise the risk of heatstroke.

<b>Tolerate</b>	The risk might be tolerable without any control action required, the ability to address the risk may be limited or the cost of taking action is disproportionate to the cost of the risk	Weather related impacts that are a nuisance rather than disrupting operational outputs;  Unaffordable actions; i.e. accepts the level of risk to output due to limited funding
<b>Take the Opportunity</b>	Consider opportunities to take a risk. Describes any specific action(s) taken to improve the probability of an opportunity and or its beneficial consequence(s).  This option should be considered whenever we are tolerating, transferring or treating a risk: in mitigating a threat, is it possible to derive additional benefit; or identifying resource that can be used elsewhere to benefit the organisation.	Introduce new activities, behaviours, practices or species e.g. in training establishments with high risk of heatwaves, change the training programme timings to “Tropical hours” as for Cyprus.  Exploiting and encouraging new technologies that have wider sustainability and operational benefit e.g. rainwater harvesting and renewables.

UKCIP has also created definitions for adaptation options that “treat” the risk (or exploit potential opportunities) in terms of their benefits and cost-effectiveness:

- a. No-regrets options – those actions to build climate resilience that are cost-effective and provide benefits now and under different future scenarios e.g. avoiding building in high risk areas, reducing leakage from water utility infrastructure;
- b. Low-regret options – those actions to build climate resilience that need low and moderate levels of investment but largely increase the capacity to cope with climate risks under different future scenarios e.g. Ensuring that new builds and refurbishments allow for further modifications in the future such as increased ventilation and drainage capacity; and
- c. Win-win options – those actions to build climate resilience that also contribute to reduce carbon emissions and wider sustainability objectives e.g. incorporating green roofs into developments.

## **CLIMATE RESILIENCE WORKING GROUP – TERMS OF REFERENCE**

**(as at 14 Mar 11)**

1. **Role.** The Climate Resilience Working Group (CRWG) will coordinate a pan-TLB approach to adapt the MOD estate and build resilience to current and future climates.
2. **Objectives.** The objectives of the CRWG are to:
  - a. Gather and share climate resilience information:
    - (1) Agree and coordinate the programme to roll-out Climate Impact Risk Assessment Methodology (CIRAM) assessments across the MOD estate;
    - (2) Provide support for the collation of data and reporting on the roll-out and implementation of CIRAM as required by the MOD Climate Change Strategy;
    - (3) Provide support for the analysis of the risks at national and regional level;
    - (4) Share information, good practice and knowledge on assessing and increasing resilience to climate risks; and
    - (5) Coordinate production and distribution of communications to the MOD practitioner community relating to climate resilience on the MOD estate.
  - b. Frame and develop climate resilience policy for the MOD:
    - (1) Take forward any climate related issues arising from CIRAM assessments that are unable to be considered at establishment level e.g. policy, equipment, regional engagement, Other Government Departments etc.;
    - (2) Clarify and identify any gaps/overlaps in processes, procedures and policies;
    - (3) Coordinate the production of policy and guidance on adapting the MOD estate to climate change e.g. estate and land management, health and safety, and inform other policy areas such as security and business continuity; and
    - (4) Feed the outcomes of CIRAM assessments into strategic initiatives.
  - c. Implement climate resilience and build capacity in MOD:
    - (1) Monitor the implementation of the Climate Resilience Risk Registers resulting from the CIRAM workshops, ensuring that risks and actions are reflected into the relevant establishment management plans and procedures; and
    - (2) Identify gaps in skills and training.
3. **Initial areas for discussion.** Initial topics under consideration include:

- a. Agree and coordinate the roll-out programme of CIRAM assessments across the defence critical establishments;
  - b. Agree identification and roll-out of CIRAM at “other priority operational sites”;
  - c. Identify other estate projects that would benefit from CIRAM assessments;
  - d. Agree roles and responsibilities for CIRAM and adaptation within TLB management structures and procedures;
  - e. Explore future role of CIRAM to support any SDSR initiatives;
  - f. Issue guidance on the implementation of the Climate Resilience Risk Register and adaptation actions (including core services and Minor New Works);
  - g. Embedding CIRAM into Estate Business Management System (EBMS) and other management processes;
  - h. Embed climate adaptation within contractual frameworks including NGEC;
  - i. Coordination of adaptation sections within the TLB SD Action Plans;
  - j. Coordinate data collection and reporting to ESDeG, DESB etc;
  - k. Identify and disseminate training opportunities for relevant MOD and contract staff; and
  - l. Produce and coordinate any communications material e.g. factsheets on how to build resilience in utilities, services, and infrastructure etc.
4. **Constitution.** The CRWG will report to the Estate Sustainable Development Group (ESDeG). DIO Strategy and Policy will host the CRWG and will provide secretarial support. It will be chaired by the DIO StratPol-SD Energy.
  5. The CRWG will meet quarterly (to be confirmed) during the roll out of CIRAM to Defence Critical establishments. Once this phase is complete, the CRWG will determine whether biannual or annual meetings are more appropriate. Initial meeting will be by physical attendance but VTC methods will be used thereafter where practicable.
  6. The minutes will be made available to the CRWG membership within four weeks of each meeting.
  7. **Membership.** The CRWG will have a core permanent membership, formed from the TLB Climate Change Adaptation Focal Points, DIO Strategy and Policy, DIO Sustainable Development Support Team, DE&S equipment community, Defence Training Estate representative and MOD policy. Other roles will be asked to participate as issues arise e.g. NGEC focal point.
  8. Provisional membership will include:
    - a. Chairman - DIO StratPol-SD Energy
    - b. Secretary - DIO Climate Change Adaptation Policy Adviser
    - c. TLB Climate Change Adaptation Focal Points (acting as focal points for TLBs own business continuity, estate, H&S and environmental protection related issues. The DE&S CCAFP will also represent the equipment community)
    - d. DIO Sustainable Development Support Team
    - e. DTE focal point

f. Business Continuity / Resilience Policy focal point

FOOTNOTE: TORs will be reviewed to ensure requirement and governance fits with DIO EOM.

**SJC (UK) PILLAR 1 POINTS OF CONTACT****Army (Brigade) Joint Regional Liaison Officers**

Area	Name	Location	Mil No	Civ No	Mobile	
51 Bde	Lt Col John Kelly	Stirling	94741 4870	0131 3104870	07881 986775	51X-G3-JRLO
15 Bde <b>S</b>	Lt Col Graham Whitmore	York	94777 2184	01904 662184	07909 952375	15X-G5JRLO-SO1S
15 Bde <b>N</b>	Lt Col Chris Green	York	94777 2289	01904 662289	07920 785934	15X-G5JRLO-SO1N
42 Bde	Lt Col Ray Carolin	Preston	94554 2413	01722 260413	07739 918945	42X-G2-JRLO
143 Bde	Lt Col Guy Chambers	Shrewsbury	94461 2669	01743 262667	07967 111807	143X-G3-JRLO
160 Bde	Lt Col David Lowles	Brecon	94351 2381	01874 613381	07970 628545	160X-JRLO
49 Bde <b>E</b>	Lt Col Richard Dixon-Warren	Chilwell	94451 2918	0115 9572918	07748 148174	49X-JRLO-E
49 Bde <b>EM</b>	Lt Col Andy McCombe	Chilwell	94451 2919	0115 9572919	07747 008561	49X-JRLO-EM
43 Bde	Lt Col Richard Aubrey-Fletcher	Tidworth	94342 4113	01980 656413	07825 118634	43X-CMDGP-JRLO
43 Bde Dep	Maj John Wort	Tidworth	-	-	07753 816598	<a href="mailto:resilient@btconnect.com">resilient@btconnect.com</a> / 43X-CMDGP-DJRLO
145 Bde	Lt Col Alan Miller	Aldershot	94222 2858	01252 347858	07771 835075	145X-G2G3-JRLO
2 Bde	Lt Col Richard Clements	Shorncliffe	94281 2530	01303 225530	07775 587356	2X-JRLO
LONDIST	Brian Fahy	London	94631 2433	0207 4142433		LONDIST- SO1UKOpsPlans
LONDIST	Lt Col Sarah Streete	London	94631 2252	0207 4142252	07760 300188	LONDIST-SO1UKOps
HQ NI	Lt Col Huw Morgan	Lisburn	9491 63503	0289 2263503	07824 607770	Huw.morgan547@mod.uk

### RAF Regional Liaison Officers

Scotland	Wg Cdr Bob Lander	Leuchars	95151 7462	-	07833 912924	LEU-RAFRLO Scotland
North	Wg Cdr Hugh Stewart	Linton-on-Ouse	95871 7407	-	07801 900780	LIN-RAF Regional Liaison Officer North
East	Wg Cdr John McCarthy	Cottesmore	95341 7312	-	07979 537682	CTS-RLO
East Midlands	Wg Cdr Tim Owen	Marham	95221 6432	01760 446112	07767 663359	MRM-RAFRLO East England (Owen Tim Wg Cdr)
London/ South-East	Wg Cdr Nick Fox	Odiham	95235 7363	-	07770 721494	ODI Ops-RAF RLO
South-West	Wg Cdr Rob Tripp	Lyneham	95481 6805	-	07796 568380	LYN-BSW-RAF RLO South West
Wales	Wg Cdr Philip Greville	Valley, or St Athan	95581 6709 95421 7127	-	07802 348513	SAR-RLO Wales (Greville Phil Wg Cdr)
West Midlands	Wg Cdr Nick Nicholson	Shawbury	95531 7257	-	07771 730553	SHY-OPS-RLO (Nicholson Nick Wg Cdr)
Northern ireland	Sqn Ldr Andy Malbon	Aldergrove	9491 56570	-	-	ALG JHFNI-OPS OC

### RN Regional Liaison Officers

Scotland	Vacant	Faslane	93255 4333	01436 674333		
North	Lt Cdr Charles Wood	HMS CALLIOPE	-	0191 4778607	-	NRCNE-RNRLODNLO
Wales and West of England	Lt Cdr Jonathan Lee	HMS FLYING FOX	-	0117 9786016	07930 473741	NRCWWE-RNRLO
East of England	Cdr Paul Hill	HMS PRESIDENT	93645 7328	0207 4817328	07881 658683	President-CO

**MOD CLIMATE RESILIENCE FOCAL POINTS**

<b>TLB</b>	<b>Post &amp; email</b>	<b>No</b>
Land	LF-CESO(A)-SO2 Sustainable Dev	96770 1262
JFC	JFC-Infra-Hd	9360-55840
	JFC-CESO-Deputy	9352 30248
DE&S	DES Infra-Estates Co-ord	9355 67297
Air	Air SPP-INFRA SO2 IDO POL&CO-ORD	95221 7187
	Air-CE-CESO SD SO1	95221 5418
Navy	FLEET-CAP (CESO) EESO SO1C	93825 4097
DIO DTE	DIO Ops DTE-HQEstDel5	94381 8773
DIO TEST	DIO Ops South-EMNES4	07970602387
MOD	DIO StratPol-SD Energy1b1	9355 83523