

Mr Rob Niblett  
Gloucestershire County Council  
Environment Directorate  
Shire Hall  
Gloucester  
GL1 2TH

**Our refs:** Glouc\_04\_25/09/2008  
and  
Glos Level 1 SFRA

**Your ref:** Level 1 Gloucestershire SFRA

**Date:** September 2008

Dear Mr Niblett,

**RE: Strategic Flood Risk Assessments for Gloucestershire County Council; Cheltenham Borough Council; Cotswold District Council; Forest of Dean District Council; Gloucester City Council; Stroud District Council and Tewkesbury Borough Council.**

Thank you for the opportunity to be involved in working together in partnership on your Level 1 SFRAs (Dated: September 2008). We write to confirm that the Final Level 1 SFRAs have addressed all of the Environment Agency comments made on the first draft and in discussions since. As a result we are pleased to confirm that we consider that your Level 1 SFRA is fit for use in accordance with PPS25.

Please do keep in mind that your SFRA is a 'living document' and as such needs to be reviewed regularly to see whether there have been changes that may effect the assessment (such as; changes to policy; flood events; improvements to techniques and guidance for investigation of flood risks etc.) and therefore whether it is a sound evidence base to inform your plans.

At our meeting 27 August 2008 it was confirmed to us that all Local Authorities within Gloucestershire will be undertaking Level 2 SFRAs. As agreed at this meeting, in accordance with PPS25 we will expect your Level 2 SFRAs to make further analysis of the current data contained within your Level 1 assessments and to supplement this where necessary with further investigations. We would expect this to comply with PPS25 and to use its Practice Guide and other good practice documents to inform its production. As agreed these Level 2 assessments should provide the information necessary for application of the Exception Test, where needed, as well as further investigation for site allocation areas and where necessary into climate change and the source, pathway and receptors of non-fluvial flooding - particularly in regard to the risk of surface water / overland flow and impounded water bodies.

Finally, thank you for working closely with the Environment Agency on this SFRA. We look forward to working together in partnership over the coming year on your Level 2 SFRA's, from the outset, so that all requirements can be satisfied. In the meantime if you have any questions about how you can best incorporate the information within your Level 1 SFRA into your plans please do feel free to contact us.

Yours sincerely,



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Cc. Cheltenham Borough Council  
Cotswold District Council  
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Gloucester City Council  
Stroud District Council  
Tewkesbury Borough Council

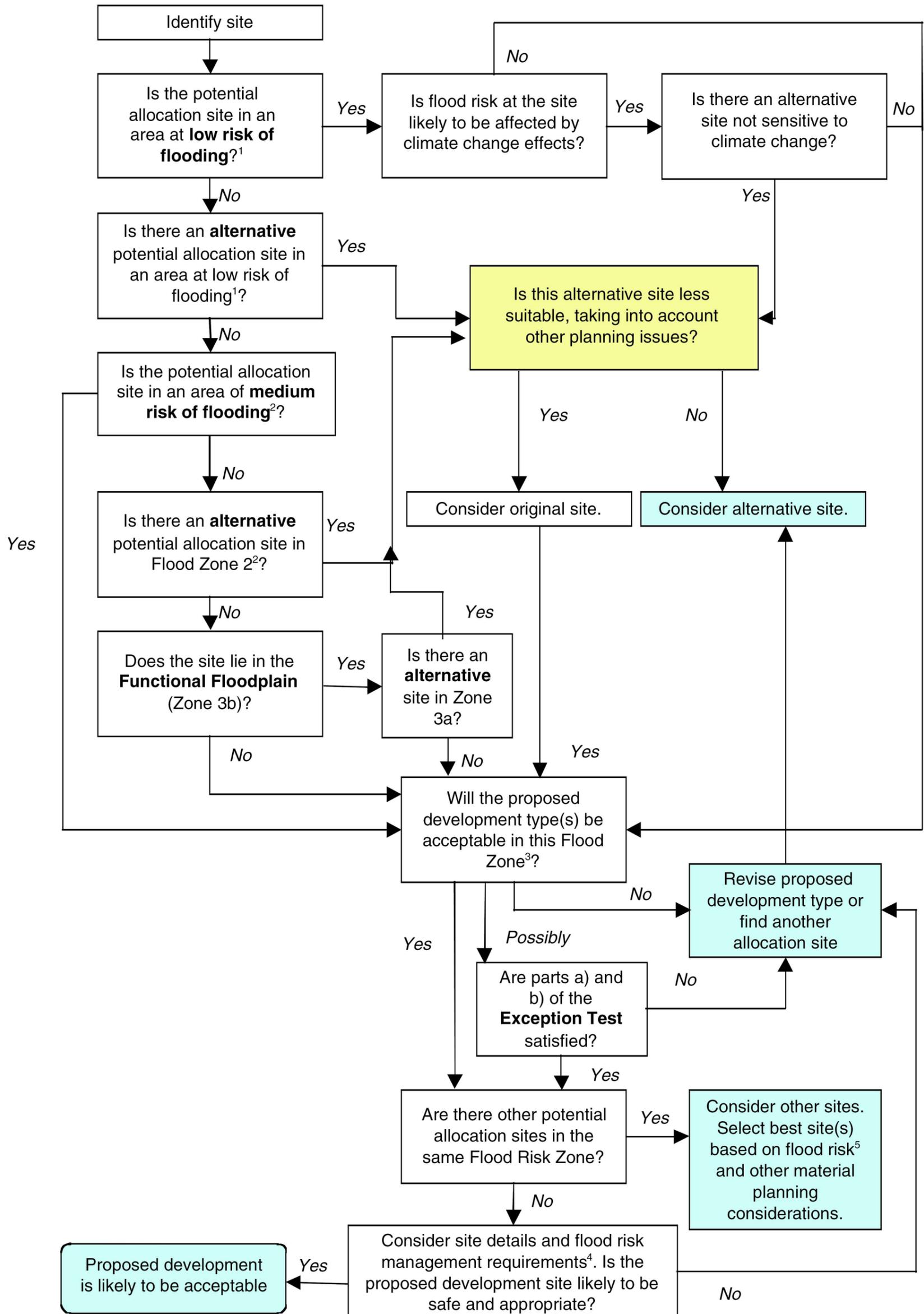
Beccy Dunn – Halcrow Ltd.

**Appendix B - Map Tile Index Cheltenham Borough Council**

Tile Name	Title	Map contents	Location Plan
A1 to A5	Watercourse Map	Main rivers minor watercourses modelled watercourses canals Environment Agency & council owned defences culverts Environment Agency & Local Authority Flood Storage Areas Reservoirs (>25,000m3) Residual Risk Areas Informal Defences	
B1 to B5	Strategic Flood Risk Map Showing Flooding From All Sources	Main River Centreline Flood Zone 2 Flood Zone 3a Recorded Flooding - Impounded Water Body Recorded Flooding - Artificial Drainage Recorded Flooding - Surface Water Recorded Flooding - Unknown	
B6	Strategic Flood Risk Map Showing Flooding From Sewers	Main River Centreline Minor Watercourse Canal Sewer Flooding: High Risk: >15 Properties Sewer Flooding: Medium Risk: 6 to 15 Properties Sewer Flooding: Low Risk: 1 to 5 Properties Sewer Flooding: No Data	
C1 to C5	Strategic Flood Risk Map Showing Flooding Due to Climate Change	Main River Centreline Flood Zone 3a Flood Zone 3b	
D1	Solid Geology Map	Solid Geology	
D2	Drift Geology Map	Drift Geology	
E1 to E4	Historic Flooding	Environment Agency Historic Flood Event Outlines	
F1	Flood Warning	Rain Gauge River Gauge Flood Watch	

## Appendix C

### SEQUENTIAL TEST PROCESS





## Appendix D

### Details of the Environment Agency Flood Zones

#### Introduction

A more detailed understanding of the Environment Agency Flood Zones and their limitations is important, as these are often used (unless more accurate flood outlines are available) for the production of SFRA flood maps.

#### Environment Agency Fluvial Maps

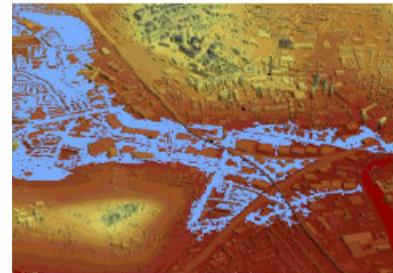
Data for fluvial Flood Zones 3 and 2 is derived from a number of sources. Most fluvial flood outlines are derived from the “JFlow” generalised computer modelling, which is a ‘coarse’ modelling approach. Some observations of flooding by the Environment Agency’s predecessors are included, for instance the extent of the severe 1947 floods, and this usually applies to Flood Zone 2. If a flood event extends further than Flood Zone 2 then the outline would be changed to reflect the wider flood risk area.

Caution must be exercised in interpreting JFlow derived flood outlines due to the large number of assumptions incorporated into the JFlow model. For instance, at some locations the river centreline incorporated into the model was found to be erroneous with the result that the associated flood plains deviate from the natural valleys.

All Environment Agency Flood Zone Maps show the flood extent without the influences of defences.

#### Updates of the Environment Agency Flood Maps from Modelling

In many places the results of flood mapping studies have superseded the JFlow model. Generally these studies included high quality hydrological research, surveyed river cross sections, and more precise digital modelling such as ISIS, TuFlow and HecRas.



Although fluvial flooding is dependent on the standard of maintenance of watercourses and structures, the degree of maintenance allowed for tends to vary from model to model, with the result that flood maps based on modelling do not offer a uniform approach in this respect. As a consequence, serious blockages occurring during a flood might produce much more flooding than shown on previous modelling for a similar hydrological event.

#### Updates of the Environment Agency Flood Maps from Recent Events

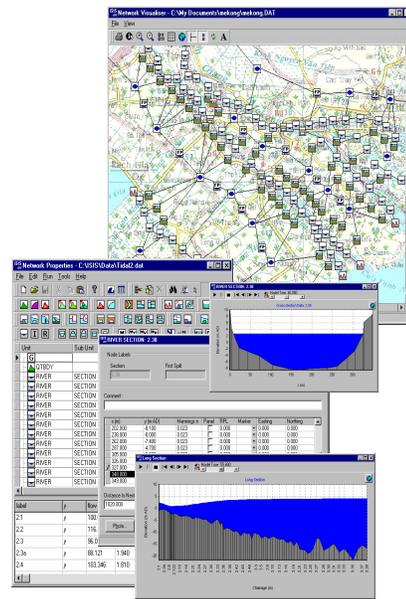
Records of recent flood events have been used to modify the flood map. In these cases the Environment Agency has determined the return frequency of the observed event and modified the appropriate flood zone accordingly.

## ISIS Software Graphic Interface

When evidence of flooding is based on aerial photographs, there is often uncertainty about a) whether the flooding has emanated from the river or is the result of other land drainage, b) the precise flood return period and c) whether the flooding was the result of blockage or some other maintenance factor.

### Non Main River flooding in the Environment Agency Flood Maps

Fluvial Flood Zone maps show some non main river watercourse flooding as well as main river watercourse flooding. Main rivers are principal watercourses defined by Section 93 of the Water Resources Act, 1991 and shown on a formal map held by the Environment Agency – the Environment Agency flood zones. Larger ordinary watercourses are shown on the background Ordnance Survey mapping.



All watercourses with a catchment area greater than 3km<sup>2</sup> have been modelled using JFlow software.

### Areas Benefiting from Defences

The current flood maps, although they are based on the “undefended situation”, show selected raised formal flood defences (built since 1998), and selected “areas benefiting from defences” (ABDs). This is land where flooding is prevented by defences, although it is assumed that the defences are robust, leak free and maintained, which is not always the case. Improved channels are not normally regarded as defences for the purposes of flood zone mapping.

### Climate Change Effect on Flood Zones

In the absence of better information, the current fluvial Flood Zone 2 can be considered an estimate of the extent of fluvial Flood Zone 3 within 100 years. Similarly, Flood Zone 3a can be considered an estimate of the extent of fluvial Flood Zone 3b within 100 years.

As noted, current Environment Agency formal flood maps generally do not take into account the effect of climate change on winter rainfall and tide levels, or the effect of changes in the levels of tectonic plates on tide levels.

## Appendix E –Pitt Review Reccomendations

### RECOMMENDATION 1

Given the predicted increase in the range of future extremes of weather, the Government should give priority to both adaptation and mitigation in its programmes to help society cope with climate change.

### RECOMMENDATION 2

The Environment Agency should progressively take on a national overview of all flood risk, including surface water and groundwater flood risk, with immediate effect

### RECOMMENDATION 3

The Met Office should continue to improve its forecasting and predicting methods to a level which meets the needs of emergency responders

### RECOMMENDATION 4

The Environment Agency should further develop its tools and techniques for predicting and modelling river flooding, taking account of extreme and multiple events and depths and velocities of water.

### RECOMMENDATION 5

The Environment Agency should work with partners to urgently take forward work to develop tools and techniques to model surface water flooding

### RECOMMENDATION 6

The Environment Agency and the Met Office should work together, through a joint centre, to improve their technical capability to forecast, model and warn against all sources of flooding

### RECOMMENDATION 7

There should be a presumption against building in high flood risk areas, in accordance with PPS25, including giving consideration to all sources of flood risk, and ensuring that developers make a full contribution to the costs both of building and maintaining any necessary defences.

### RECOMMENDATION 8

The operation and effectiveness of PPS25 and the Environment Agency's powers to challenge development should be kept under review and strengthened if and when necessary.

### RECOMMENDATION 9

Householders should no longer be able to lay impermeable surfaces as of right on front gardens and the Government should consult on extending this to back gardens and business premises.

### RECOMMENDATION 10

The automatic right to connect surface water drainage of new developments to the sewerage system should be removed.

### RECOMMENDATION 11

Building Regulations should be revised to ensure that all new or refurbished buildings in high flood-risk areas are flood-resistant or resilient.

### RECOMMENDATION 12

All local authorities should extend eligibility for home improvement grants and loans to include flood resistance and resilience products for properties in high flood-risk areas.

**RECOMMENDATION 13**

Local authorities, in discharging their responsibilities under the Civil Contingencies Act 2004 to promote business continuity, should encourage the take-up of property flood resistance and resilience by businesses.

**RECOMMENDATION 14**

Local authorities should lead on the management of local flood risk, with the support of the relevant organisations

**RECOMMENDATION 15**

Local authorities should positively tackle local problems of flooding by working with all relevant parties, establishing ownership and legal responsibility.

**RECOMMENDATION 16**

Local authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and condition.

**RECOMMENDATION 17**

All relevant organisations should have a duty to share information and cooperate with local authorities and the Environment Agency to facilitate the management of flood risk.

**RECOMMENDATION 18**

Local Surface Water Management Plans, as set out under PPS25 and coordinated by local authorities, should provide the basis for managing all local flood risk.

**RECOMMENDATION 19**

Local authorities should assess and, if appropriate, enhance their technical capabilities to deliver a wide range of responsibilities in relation to local flood risk management.

**RECOMMENDATION 20**

The Government should resolve the issue of which organisations should be responsible for the ownership and maintenance of sustainable drainage systems.

**RECOMMENDATION 21**

Defra should work with Ofwat and the water industry to explore how appropriate risk-based standards for public sewerage systems can be achieved.

**RECOMMENDATION 22**

As part of the forthcoming and subsequent water industry pricing reviews, Ofwat should give appropriate priority to proposals for investment in the existing sewerage network to deal with increasing flood risk.

**RECOMMENDATION 23**

The Government should commit to a strategic long-term approach to its investment in flood risk management, planning up to 25 years ahead.

**RECOMMENDATION 24**

The Government should develop a scheme which allows and encourages local communities to invest in flood risk management measures.

**RECOMMENDATION 25**

The Environment Agency should maintain its existing risk-based approach to levels of maintenance and this should be supported by published schedules of works for each local authority area.

**RECOMMENDATION 26**

The Government should develop a single set of guidance for local authorities and the public on the use and usefulness of sandbags and other alternatives, rather than leaving the matter wholly to local discretion.

**RECOMMENDATION 27**

Defra, the Environment Agency and Natural England should work with partners to establish a programme through Catchment Flood Management Plans and Shoreline Management Plans to achieve greater working with natural processes.

**RECOMMENDATION 28**

The forthcoming flooding legislation should be a single unifying Act that addresses all sources of flooding, clarifies responsibilities and facilitates flood risk management.

**RECOMMENDATION 29**

The Government and the insurance industry should work together to deliver a public education programme setting out the benefits of insurance in the context of flooding.

**RECOMMENDATION 30**

The Government should review and update the guidance Insurance for all: A good practice guide for providers of social housing and disseminate it effectively to support the creation of insurance with rent schemes for low income households.

**RECOMMENDATION 31**

In flood risk areas, insurance notices should include information on flood risk and the simple steps that can be taken to mitigate the effects.

**RECOMMENDATION 32**

The insurance industry should develop and implement industry guidance for flooding events, covering reasonable expectations of the performance of insurers and reasonable actions by customers.

**RECOMMENDATION 33**

The Environment Agency should provide a specialised site-specific flood warning service for infrastructure operators, offering longer lead times and greater levels of detail about the velocity and depth of flooding.

**RECOMMENDATION 34**

The Met Office and the Environment Agency should issue warnings against a lower threshold of probability to increase preparation lead times for emergency responders.

**RECOMMENDATION 35**

The Met Office and the Environment Agency should issue joint warnings and impact information on severe weather and flooding emergencies to responder organisations and the public.

**RECOMMENDATION 36**

The Environment Agency should make relevant flood visualisation data, held in electronic map format, available online to Gold and Silver Commands.

**RECOMMENDATION 37**

The Environment Agency should work with its partners to progressively develop and bring into use flood visualisation tools that are designed to meet the needs of flood-risk managers, emergency planners and responders.

**RECOMMENDATION 38**

Local authorities should establish mutual aid agreements in accordance with the guidance currently being prepared by the Local Government Association and the Cabinet Office.

**RECOMMENDATION 39**

The Government should urgently put in place a fully funded national capability for flood rescue, with Fire and Rescue Authorities playing a leading role, underpinned as necessary by a statutory duty.

**RECOMMENDATION 40**

Defra should amend emergency regulations to increase the minimum amount of water to be provided in an emergency, in order to reflect reasonable needs during a longer-term loss of mains supply.

**RECOMMENDATION 41**

Upper tier local authorities should be the lead responders in relation to multi-agency planning for severe weather emergencies at the local level and for triggering multi-agency arrangements in response to severe weather warnings and local impact assessments.

**RECOMMENDATION 42**

Where a Gold Command is established for severe weather events, the police, unless agreed otherwise locally, should convene and lead the multi-agency response.

**RECOMMENDATION 43**

Gold Commands should be established at an early stage on a precautionary basis where there is a risk of serious flooding.

**RECOMMENDATION 44**

Category 1 and 2 responders should assess the effectiveness of their emergency response facilities, including flexible accommodation, IT and communications systems, and undertake any necessary improvement works.

**RECOMMENDATION 45**

The Highways Agency, working through Local Resilience Forums, should further consider the vulnerability of motorways and trunk roads to flooding, the potential for better warnings, strategic road clearance to avoid people becoming stranded and plans to support people who become stranded.

**RECOMMENDATION 46**

The rail industry, working through Local Resilience Forums, should develop plans to provide emergency welfare support to passengers stranded on the rail network

**RECOMMENDATION 47**

The Ministry of Defence should identify a small number of trained Armed Forces personnel who can be deployed to advise Gold Commands on logistics during wide-area civil emergencies and, working with Cabinet Office, identify a suitable mechanism for deployment.

**RECOMMENDATION 48**

Central government crisis machinery should always be activated if significant wide-area and high-impact flooding is expected or occurs.

**RECOMMENDATION 49**

A national flooding exercise should take place at the earliest opportunity in order to test the new arrangements which central government departments are putting into place to deal with flooding and infrastructure emergencies.

**RECOMMENDATION 50**

The Government should urgently begin its systematic programme to reduce the disruption of essential services resulting from natural hazards by publishing a national framework and policy statement setting out the process, timescales and expectations.

**RECOMMENDATION 51**

Relevant government departments and the Environment Agency should work with infrastructure operators to identify the vulnerability and risk of assets to flooding and a summary of the analysis should be published in Sector Resilience Plans.

**RECOMMENDATION 52**

In the short-term, the Government and infrastructure operators should work together to build a level resilience into critical infrastructure assets that ensures continuity during a worst-case flood event.

**RECOMMENDATION 53**

A specific duty should be placed on economic regulators to build resilience in the critical Infrastructure.

**RECOMMENDATION 54**

The Government should extend the duty to undertake business continuity planning to infrastructure operating Category 2 responders to a standard equivalent to BS 25999, and that accountability is ensured through an annual benchmarking exercise within each sector.

**RECOMMENDATION 55**

The Government should strengthen and enforce the duty on Category 2 responders to share information on the risks to their infrastructure assets, enabling more effective emergency planning within Local Resilience Forums.

**RECOMMENDATION 56**

The Government should issue clear guidance on expected levels of Category 2 responders' engagement in planning, exercising and response and consider the case for strengthening enforcement arrangements.

**RECOMMENDATION 57**

The Government should provide Local Resilience Forums with the inundation maps for both large and small reservoirs to enable them to assess risks and plan for contingency, warning and evacuation and the outline maps be made available to the public online as part of wider flood risk information.

**RECOMMENDATION 58**

The Government should implement the legislative changes proposed in the Environment Agency biennial report on dam and reservoir safety through the forthcoming flooding legislation.

**RECOMMENDATION 59**

The Risk and Regulation Advisory Council should explore how the public can improve their understanding of community risks, including those associated with flooding, and that the Government should then implement the findings as appropriate.

**RECOMMENDATION 60**

The Government should implement a public information campaign which draws on a single definitive set of flood prevention and mitigation advice for householders and businesses, and which can be used by media and the authorities locally and nationally.

**RECOMMENDATION 61**

The Environment Agency should work with local responders to raise awareness in flood risk areas and identify a range of mechanisms to warn the public, particularly the vulnerable, in response to flooding.

**RECOMMENDATION 62**

The Environment Agency should work urgently with telecommunications companies to facilitate the roll-out of opt-out telephone flood warning schemes to all homes and businesses liable to flooding, including those with ex-directory numbers.

**RECOMMENDATION 63**

Flood risk should be made part of the mandatory search requirements when people buy property, and should form part of Home Information Packs.

**RECOMMENDATION 64**

Local Resilience Forums should continue to develop plans for door-knocking, coordinated by local authorities, to enhance flood warnings before flooding and to provide information and assess welfare needs once flooding has receded.

**RECOMMENDATION 65**

The Met Office and the Environment Agency should urgently complete the production of a sliding scale of options for greater personalisation of public warning information, including costs, benefits and feasibility.

**RECOMMENDATION 66**

Local authority contact centres should take the lead in dealing with general enquiries from the public during and after major flooding, redirecting calls to other organisations when appropriate.

**RECOMMENDATION 67**

The Cabinet Office should provide advice to ensure that all Local Resilience Forums have effective and linked websites providing public information before, during and after an emergency.

**RECOMMENDATION 68**

Council leaders and chief executives should play a prominent role in public reassurance and advice through the local media during a flooding emergency, as part of a coordinated effort overseen by Gold Commanders.

**RECOMMENDATION 69**

The public should make up a flood kit – including personal documents, insurance policy, emergency contact numbers (including local council, emergency services and Floodline), torch, battery or wind-up radio, mobile phone, rubber gloves, wet wipes or antibacterial hand gel, first aid kit and blankets.

**RECOMMENDATION 70**

The Government should establish a programme to support and encourage individuals and communities to be better prepared and more self-reliant during emergencies, allowing the authorities to focus on those areas and people in greatest need.

**RECOMMENDATION 71**

The Department of Health and relevant bodies should develop a single set of flood-related health advice for householders and businesses which should be used by all organisations nationally and locally and made available through a wide range of sources.

**RECOMMENDATION 72**

Local response and recovery coordinating groups should ensure that health and wellbeing support is readily available to those affected by flooding based on the advice developed by the Department of Health.

**RECOMMENDATION 73**

The Government, the Association of British Insurers and other relevant organisations should work together to explore any technological or process improvements that can be made to speed up the drying out and stabilising process of building recovery after a flood.

**RECOMMENDATION 74**

The monitoring of the impact of flooding on the health and wellbeing of people, and actions to mitigate and manage the effects, should form a systematic part of the work of Recovery Coordinating Groups.

**RECOMMENDATION 75**

For emergencies spanning more than a single local authority area, Government Offices should ensure coherence and coordination, if necessary, between recovery operations.

**RECOMMENDATION 76**

Local authorities should coordinate a systematic programme of community engagement in their area during the recovery phase.

**RECOMMENDATION 77**

National and local Recovery Coordinating Groups should be established from the outset of major emergencies and in due course there should be formal handover from the crisis machinery.

**RECOMMENDATION 78**

Aims and objectives for the recovery phase should be agreed at the outset by Recovery Coordinating Groups to provide focus and enable orderly transition into mainstream programmes when multi-agency coordination of recovery is no longer required.

**RECOMMENDATION 79**

Government Offices, in conjunction with the Local Government Association, should develop arrangements to provide advice and support from experienced organisations to areas dealing with recovery from severe flooding emergencies.

**RECOMMENDATION 80**

All central government guidance should be updated to reflect the new arrangements for recovery and Local Resilience Forums should plan, train and exercise on this basis.

**RECOMMENDATION 81**

There should be an agreed framework, including definitions and timescales, for local-central recovery reporting.

**RECOMMENDATION 82**

Following major flooding events, the Government should publish monthly summaries of the progress of the recovery phase, including the numbers of households still displaced from all or part of their homes.

**RECOMMENDATION 83**

Local authorities should continue to make arrangements to bear the cost of recovery for all but the most exceptional emergencies, and should revisit their reserves and insurance arrangements in light of last summer's floods.

**RECOMMENDATION 84**

Central government should have pre-planned rather than ad-hoc arrangements to contribute towards the financial burden of recovery from the most exceptional emergencies, on a formula basis.

**RECOMMENDATION 85**

Local Recovery Coordination Groups should make early recommendations to elected local authority members about longer-term regeneration and economic development opportunities.

**RECOMMENDATION 86**

The Government should publish an action plan to implement the recommendations of this Review, with a Director in Defra overseeing the programme of delivery and issuing regular progress updates.

**RECOMMENDATION 87**

The Government should establish a Cabinet Committee with a remit to improve the country's ability to deal with flooding and implement the recommendations of this Review.

**RECOMMENDATION 88**

The Government should establish a National Resilience Forum to facilitate national level multi-agency planning for flooding and other emergencies.

**RECOMMENDATION 89**

The EFRA Select Committee should review the country's readiness for dealing with flooding emergencies and produce an assessment of progress in implementation of the Review's recommendations after 12 months.

**RECOMMENDATION 90**

All upper tier local authorities should establish Oversight and Scrutiny Committees to review work by public sector bodies and essential service providers in order to manage flood risk, underpinned by a legal requirement to cooperate and share information.

**RECOMMENDATION 91**

Each Oversight and Scrutiny Committee should prepare an annual summary of actions taken locally to manage flood risk and implement this Review, and these reports should be public and reviewed by Government Offices and the Environment Agency.

**RECOMMENDATION 92**

Local Resilience Forums should evaluate and share lessons from both the response and recovery phases to inform their planning for future emergencies.

