

# A FRAMEWORK FOR RESERVOIR INUNDATION PREPAREDNESS PLANNING

**October 2009**

This note was produced by the Cabinet Office in consultation with Defra and the Environment Agency, following consultation with Category 1 and 2 responders. The Cabinet Office has issued it as part of our role in supporting local emergency planners, in preparing and planning for possible reservoir inundation eventualities.

Flood Emergencies  
Programme



Civil Contingencies  
Secretariat



## Summary Points

- This note is intended to assist local planning for a possible reservoir inundation emergency. It is particularly addressed to top tier or single tier local authority (LA) Category 1 responders under the Civil Contingencies Act 2004 but will be relevant to other Category 1 and 2 responders under the Act, and to the wider community. It will also be useful for owners and managers of reservoirs to use the guidance to complement their on-site planning work.
- One of the difficulties of reservoir inundation risk is that the potential outcomes range from range from a predictable slow, rising tide flood to a far more damaging force of water. In his report ([http://archive.cabinetoffice.gov.uk/pittreview/ /media/assets/www.cabinetoffice.gov.uk/flooding\\_review/pitt\\_review\\_full%20pdf.pdf](http://archive.cabinetoffice.gov.uk/pittreview/ /media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf)), Sir Michael Pitt suggested that -

*'The conditions following a major dam breach are much more severe than normal flood flows. The effect of catastrophic dam failure is to create a high speed wall of water that sweeps along debris and rubble, killing people and with the energy to destroy buildings and other infrastructure in its path.'*

Planning assumes that, once a dam has breached a worst realistic case scenario should be anticipated in terms of the extent, depth and speed of the flood water. Less dramatic outcomes will invite the standard fluvial/pluvial flooding local response. Planners will need to be alive to the fact that responders and response plans must be flexible enough to cope with both the lower and the upper ends of the range of possible outcomes and to identify the right plan to activate in response to the circumstances faced.

- The impact of a major dam breach may extend across LA and Local Resilience Forum (LRF) boundaries, and possibly regional boundaries. The top or single tier authority in which a dam is located will be responsible for the development of the off-site plan. It will be important to involve all Category 1 and 2 responders who may be involved, within and without the LA boundary, as well as the reservoir undertaker (owner or manager). The planning material provided may be used flexibly, but planners will want to ensure that off-site plans contain all the essential elements outlined in the templates, to aid consistent and coherent planning across the UK.
- The key messages for the public as plans are developed, are that reservoirs are well regulated and have an excellent safety record; however, in the unlikely event of a reservoir collapse, the impact can be significant, and anyone who lives or works in an area that is at risk from reservoir flooding, should ensure that they familiarise themselves with local procedures and plans.

## Introduction

Contingency planning for a range of risks is a key responsibility for all local responders under the Civil Contingencies Act 2004. Sir Michael Pitt, in his review of the flood-related emergencies during the Summer Floods of 2007, observed a lack of preparedness for a reservoir failure and made a number of recommendations for action. He noted that security concerns inhibited the dissemination of information and that, consequently, responders were not as ready to respond as they needed to be. He advocated that LRFs be given more information to enable them effectively to undertake planning, and to engage fully with downstream communities. He recommended that they be provided with inundation maps to enable them to assess risks and plan for contingency, warning and evacuation. He also recommended that the outline maps be made available to the public.

The Government judges that a major reservoir inundation event could have a potentially catastrophic impact. This Guidance provides information and advice for Category 1 and 2 responders under the Act, and planners more broadly, engaged in contingency planning against the risk of reservoir inundation.

## On-Site Planning

On-site planning is undertaken by the reservoir owner or operator. On-site plans should detail how they would respond to a potential or real reservoir failure. They should also contain a detailed description of the on-site triggers and actions required in response to those triggers in an emergency. There is, at present, no legal requirement for an on-site plan. This is a matter which is currently under consideration and may be subject to change. See *Resources and Guidance* below.

## Off-Site Planning

The main **objectives** of preparing for and responding to reservoir inundation will be to:

- ensure that all those at greatest risk of reservoir inundation have the information they need to prepare themselves and their property
- prevent injuries or death in the event of reservoir inundation
- minimise the potential for disruption to society
- ensure business continuity can be maintained as far as possible
- expedite the recovery of services and the return to normal daily life.

One of the main challenges faced by those planning for reservoir inundation is that the nature and extent of the inundation can vary widely. A gradual and controlled drawdown to avert a major dam collapse or to effect repairs can cause flooding that will resemble severe weather flooding. Responders will be able to manage the response largely by reference to their severe weather flood plans. However, a major dam collapse may cause widespread devastation and will require all partners to cooperate in the preparation, response and recovery stages. The plans and templates provided (see Resources below) set out the key stages and principal roles and responsibilities of partners. Where inundation maps indicate that an inundation zone is likely to be multi-regional, Regional Resilience Teams in the Government Offices in the Regions will need to be engaged and may provide the focal point for information flows.

## Main Areas of Focus in Local Planning

The main areas on which Category 1 responders should focus are:

- **evacuation planning** focussing on the need to reduce the risk to health and safety of both those living in a potential inundation zone and those who will be carrying out the evacuation;
- developing **business continuity** plans to ensure that relevant organisations can continue delivering their essential services or restore, replace or recover their services as quickly as possible;
- **co-ordinated multi-agency planning** to agree clear individual roles and responsibilities for Category 1 and 2 responders and others, including the reservoir undertaker, in the event of an emergency, ensuring that complementary procedures are in place across LA or LRF boundaries;
- **communicating public messages** on reservoir safety and on the procedures to be followed in the event of an emergency, ensuring that local authorities work closely with neighbouring authorities in a coordinated programme to make the public aware of the risk of reservoir inundation and how an emergency would be managed if it occurred, to ensure that recipients do not receive conflicting information from different partners or authorities; and
- assessing the suitability of **local recovery plans** and other linked plans to ensure their robustness and their suitability for use in a reservoir inundation context.

## Warning and Informing

Under the Civil Contingencies Act, Category 1 responders have a responsibility to engage in pre-emergency awareness-raising work, and to warn and inform the public during emergencies. LRFs will need to develop their own warning strategies for use in the event of an emergency. Suggested approaches to this have been included in the off-site plan templates. In addition to this, those most at risk of flooding will need to be made aware of that risk and of the proper procedures to follow in the event of an emergency. A Warning and Informing strategy has been developed, which LRFs may find useful to help them to develop warning and informing messages that are consistent with the national messages and those that might be issued by neighbouring authorities (see Resources below). A suite of warning and informing material has been designed, from which LRFs will be able to select templates for local delivery.

To complement the work that will be undertaken at local level to inform those who live or work in a potential reservoir inundation zone, in the coming months, a new online information resource will become available via the Environment Agency website. A search tool will provide details of whether or not a particular location is in a potential inundation zone. Users will be instructed to contact the relevant Environment Agency office if they wish to view and inundation map for a particular reservoir. This online search facility will be supplemented by a series of website pages, giving information on reservoir safety, answers to frequently asked questions and details of how to prepare for reservoir inundation.

## Resources and Guidance

In addition to the off-site plan templates and the warning and informing material mentioned above, other resources and sources of advice comprise:

- **Reservoir Off-Site Plans Guidance and Checklist**  
This guidance gives background information about the planning process for reservoir inundation and the principles around which the templates have been constructed. The checklist provides a summary list of all the areas that should be encompassed in off-site plans. A table sets out options for a plan maintenance, validation and exercise regime.  
<http://www.cabinetoffice.gov.uk/ukresilience/emergencies/reservoir-inundation.aspx>.
- **Off-Site Plan Templates**  
Templates have been developed for both a generic off-site plan and a specific off-site plan. The templates have been refined following consultation with LRF partners across England and Wales. It is recommended that planners use the templates as a platform for their off-

site plans to ensure a consistent approach across regions; however, the templates are not prescriptive and do not, as drafted, cover all possible local circumstances or local agreements. They should be amended locally to make them fit for purpose.

<http://www.cabinetoffice.gov.uk/ukresilience/emergencies/reservoir-inundation.aspx>.

- **Warning and Informing Material**

This document outlines the policy and principles to be engaged when warning in the event of an emergency and informing the public about reservoir emergencies. It includes a template public information leaflet. Generic FAQs and suggested answers will be issued and updated via the Gateway.

<http://www.cabinetoffice.gov.uk/ukresilience/emergencies/reservoir-inundation.aspx>.

- **Business Continuity Planning**

Generic guidance to assist business continuity planning is in Chapter 6 of *Emergency Preparedness*, the statutory guidance issued under the Civil Contingencies Act 2004. This material is available at the UK Resilience website (

[www.cabinetoffice.gov.uk/ukresilience/preparedness/businesscontinuity.aspx](http://www.cabinetoffice.gov.uk/ukresilience/preparedness/businesscontinuity.aspx))

- **Reservoir On-Site Plan Templates and Guidance**

On-Site emergency plans are prepared by reservoir owners or managers and detail how they, or those responsible for the operation of a reservoir, will respond to a potential or real reservoir failure. Defra has produced draft guidance and templates

<http://www.defra.gov.uk/environment/flooding/reservoir/flood-plans.htm>.

- **Security Protocol**

A national protocol for the handling, transmission and storage of reservoir inundation maps has been developed. It sets out the process for controlling and managing the dissemination, distribution and handling of reservoir flood maps to ensure that any sensitive information is exchanged securely. A copy of the Protocol can be obtained by calling the Defra Flood Management Helpdesk: 020 7238 6239 or by emailing:

[neill.guha@defra.gsi.gov.uk](mailto:neill.guha@defra.gsi.gov.uk).

- **Reservoir inundation maps**

These will be disseminated via the National Resilience Extranet to those LRFs that have subscribed to it. LRFs that do not have any access to the NRE may be able to obtain hard copies only of the detailed maps from the Environment Agency Area Team on request to aid development of Off-Site Plans for the high risk reservoirs. In the event of an emergency, LRF members and EA Area Teams will be able to request a PDF of any completed mapping via the EA's Incident Communication Service.

- **Guide to Reservoir Safety**

This is an Environment Agency Brochure. It gives some interesting facts and figures, explains some key reservoir terminology and provides

information on the regulatory role of the Environment Agency. It is available at

[http://www.environment-agency.gov.uk/static/documents/Reservoir\\_safety-revised\\_2\\_\(3\).pdf](http://www.environment-agency.gov.uk/static/documents/Reservoir_safety-revised_2_(3).pdf).

- **Further training**

The Emergency Planning College is the leading provider of training for emergency preparedness. Details are available at

<http://www.cabinetoffice.gov.uk/epcollege.aspx>.

*Many of the issues relevant to contingency planning for reservoir inundation are common to other emergencies and will already have been addressed as part of normal contingency planning. Other issues will be new or different from those faced in other areas. The guidance and templates aim to provide comprehensive advice; however, all relevant organisations are asked to consider and feed back to the Civil Contingencies Secretariat in the Cabinet Office, either directly or via Regional Resilience Teams, their views on areas where they consider that additional specific information and advice would be valuable in improving their preparedness planning.*

## Where to go for Advice

The following paragraphs outline the different organisational responsibilities in relation to reservoirs, and where questions from members of the public, reservoir owners (undertakers), panel engineers, etc. should be directed.

The responsibilities detailed below are the first point of contact. However, the responsible organisation may redirect specific questions elsewhere. The contacts given are for non-emergency situations. In the event of an emergency, the relevant emergency services, the supervising engineer for the reservoir in question, and the Environment Agency's Emergency Hotline: 0800 80 70 60 should be contacted. These procedures are detailed in the Off-Site Plan templates

### **DEFRA – FLOOD MANAGEMENT DIVISION** (for reservoirs in England)

Defra is the lead government department for flooding in England, including reservoir inundation. Defra will take responsibility for answering questions in relation to overall national policy, legislation, and legislative changes. Defra should be contacted in relation to:

- Legal interpretation of the Reservoirs Act
- The Flood and Water Management Bill
- Public consultations on the Bill and subsequent regulations
- Ministerial direction to reservoir owners (undertakers) to produce reservoir flood plans
- EU Floods Directive

- Security issues surrounding the handling, transmission, and storage or reservoir inundation maps (RIM) and associated documents
- Appointment of engineers to the reservoir panels
- Guidance and templates for preparation of on-site emergency plans

Questions for Defra FM should be directed in the first instance to Neill Guha (Tel; 020 7238 6170, email: [neill.guha@defra.gsi.gov.uk](mailto:neill.guha@defra.gsi.gov.uk)), or to the Flood Management Helpdesk: 020 7238 6239.

Flood Management  
 Department for Environment, Food and Rural Affairs  
 Area 2D, Ergon House  
 Horseferry Road  
 London  
 SW1P 2AL

Website: [www.defra.gov.uk/environment/flooding/](http://www.defra.gov.uk/environment/flooding/)

**WELSH ASSEMBLY GOVERNMENT – DEPARTMENT OF ENVIRONMENT, SUSTAINABILITY AND HOUSING** (for reservoirs in Wales)

The responsibility for managing flooding in Wales, including reservoir inundation, lies with the Department of Environment, Sustainability and Housing of the Welsh Assembly Government. WAG will take responsibility for answering questions in relation to overall national policy, legislation, and legislative changes. WAG should be contacted in relation to:

- Legal interpretation of the Reservoirs Act
- The Flood and Water Management Bill
- Public consultations on the Bill and subsequent regulations
- Ministerial direction to reservoir owners (undertakers) to produce reservoir flood plans
- EU Floods Directive
- Security issues surrounding the handling, transmission, and storage or reservoir inundation maps (RIM) and associated documents
- Appointment of engineers to the reservoir panels
- Guidance and templates for preparation of on-site emergency plans

Questions for should be directed in the first instance to the Flood and Coastal Erosion Risk Management Branch (Tel; 029 20825412) email: [Robert.Bailey@Wales.gsi.gov.uk](mailto:Robert.Bailey@Wales.gsi.gov.uk)

Flood and Coastal Erosion Risk Management Branch  
 Climate Change and Water Division  
 Department of Environment, Sustainability and Housing  
 Welsh Assembly Government



Cathays Park  
Cardiff  
CF10 3NQ

### **ENVIRONMENT AGENCY (EA) – RESERVOIR SAFETY TEAM**

The Environment Agency is the “enforcement authority” under the Reservoirs Act 1975. The EA Reservoir Safety Team will answer questions in relation to the EA’s role as enforcement authority under the Act, as well as procedural questions in relation to the existing regulatory regime. EA Reservoir Safety Team should be contacted in relation to:

- General issues relating to reservoir safety
- Issues relating to safety and compliance with the Reservoirs Act for individual reservoirs
- The role and duties of reservoir undertakers
- The role and duties of supervising and inspecting engineers
- Technical questions in relation to the reservoir inundation maps
- Requests from undertakers or panel engineers for permission to view detailed inundation maps (in accordance with the National Protocol).

Questions for EA Reservoir Safety Team should be directed in the first instance to Ian Hope (Tel: 01392 442001)

email: [reservoirs@environment-agency.gov.uk](mailto:reservoirs@environment-agency.gov.uk)

or to the Reservoir Safety Helpdesk: 08708 506 506.

Reservoir Safety  
Environment Agency  
Manley House  
Kestrel Way  
Exeter  
EX2 7LQ

Website: [www.environment-agency.gov.uk/business/sectors/32427.aspx](http://www.environment-agency.gov.uk/business/sectors/32427.aspx)

### **ENVIRONMENT AGENCY – LOCAL AREA OFFICE**

The Environment Agency has offices across England and Wales. These are divided into eight regions and each region has a number of areas within it. Each area office is responsible for the day to day enforcement of the Reservoirs Act in its area. The Environment Agency is also undertaker for approximately 170 reservoirs under the Act. These are managed by the area office in which they are located. The relevant EA area office should be contacted in relation to:

- Issues relating to the EAs role as undertaker for the reservoirs in its area
- Requests to view outline inundation maps for reservoirs located in its area

Contact details for EA area offices can be found on the EA's website at [www.environment-agency.gov.uk/contactus/36324.aspx](http://www.environment-agency.gov.uk/contactus/36324.aspx).

### **CIVIL CONTINGENCIES SECRETARIAT (CCS)**

The Civil Contingencies Secretariat is part of the Cabinet Office and will primarily answer questions relating to off-site planning and the role and duties of Category 1 and Category 2 responders (under the Civil Contingencies Act). CCS should be contacted in relation to:

- Interpretation of the Civil Contingencies Act
- Duties of Category 1 and 2 responders and the role of the Local Resilience Forum
- National issues relating to off-site emergency planning.
- Guidance and templates for preparation of off-site emergency plans

Questions for CCS should be directed in the first instance to Eleri Pengelly (Tel; 020 7276 5299, email: [CCS.Reservoirs@cabinet-office.x.gsi.gov.uk](mailto:CCS.Reservoirs@cabinet-office.x.gsi.gov.uk)).

Reservoir Inundation Preparedness  
Civil Contingencies Secretariat  
Cabinet Office  
22 Whitehall  
London  
SW1A 2WH

Website: [www.cabinetoffice.gov.uk/secretariats/civil\\_contingencies.aspx](http://www.cabinetoffice.gov.uk/secretariats/civil_contingencies.aspx)

### **LOCAL AUTHORITY**

Upper tier or single tier local authorities are responsible for the co-ordination of off-site emergency planning for reservoirs in their area. Regardless of the predicted extent of flood water from a reservoir, the top tier LA in which the reservoir is located will take the lead in relation to emergency planning for that reservoir. They should be contacted in relation to:

- Issues relating to local emergency planning arrangements for reservoirs located within its boundaries

Contact details for local authorities can be found on the DirectGov website at [www.direct.gov.uk/en/DI1/Directorries/Localcouncils/index.htm](http://www.direct.gov.uk/en/DI1/Directorries/Localcouncils/index.htm).

### **OTHER BODIES WITH RESPONSIBILITY IN RELATED AREAS**

The following organisations may also have some responsibility in this area, and may be able to answer some queries:

- Department for Communities and Local Government (CLG): CLG is responsible for spatial planning policy, including planning for new developments in the vicinity of reservoir or in reservoir inundation zones.
- The Institution of Civil Engineers (ICE): The ICE is the leading professional body for civil engineers in the UK and is consulted by the Secretary of State for Environment, Food and Rural Affairs in relation to the appointment of engineers to the reservoirs panels.

## Additional Sources of Information

Below are the details of some websites and documents that discuss Reservoir Inundation and Safety and/or related Warning and Informing outside the UK context and within the UK. Some of the material includes case studies, self help information and useful guidelines to follow in the event of a dam failure. A brief description or extract from the described website or document is inserted to provide an insight into its content. Hyperlinks have also been included.

### UK websites

The [British Dam Society](#) is an Associated Society of the [Institution of Civil Engineers](#). It exists to advance the education of the public and the profession in technical subjects relating to planning, design, construction, maintenance, operation, safety, environmental and social issues. Its website includes information on reservoir safety [www.britishdams.org/reservoir%5Fsafety/](http://www.britishdams.org/reservoir%5Fsafety/).

The Environment Agency website ([www.environment-agency.gov.uk/business/sectors/32427.aspx](http://www.environment-agency.gov.uk/business/sectors/32427.aspx)) contains information on the legislation; reservoir safety and regulation; and public information leaflets.

Defra ([www.defra.gov.uk/environment/flooding/reservoir/safety.htm](http://www.defra.gov.uk/environment/flooding/reservoir/safety.htm)) and Cabinet Office ([www.cabinetoffice.gov.uk/ukresilience](http://www.cabinetoffice.gov.uk/ukresilience)) are the lead government departments with responsibility for reservoirs and resilience respectively.

### Overseas work

The [Association of State Dam Safety Officials](#) is a US organization of state and federal dam safety regulators, dam owners/operators, dam designers, manufacturers/suppliers. Its website has a section titled Educating the Public: <http://www.damsafety.org/committees/?p=3a29f6b0-cffa-4231-a447-b86e8a930210>.

The [Federal Emergency Management Agency](#) (FEMA) has some useful information on its website for those who want to know about dam failure and is aimed at the general public. More specifically they have three sections, titled: [Before Dam Failure](#), [During a Dam Failure/Flood](#), [After Dam Failure/Flood](#).

[Planning to warn and evacuate communities potentially threatened by dam-failure flooding: some problems revealed by the experience in New South Wales](#) is a detailed and thorough document that explains some of the issues that were faced in New South Wales with regards to warning and informing. Other relevant research and policy material is also available via this site.

[Emergency Evacuation Plan for Dam Failure and Flooding - Allatoona Dams](#), is a US emergency plan that aims to establish procedures for warning, evacuating, and sheltering people who would be endangered in the event of dam inundation. It also has a section titled: *Public Information*. In this section it has standard wording for a headline news release that could be used to inform the media in a dam inundation situation.

[Pueblo County Emergency Operations Plan](#) is similar to the emergency plan for Allatoona Dams but its purpose is to, “provide for a flood warning and emergency response system in order to protect the lives and property of citizens and visitors to Pueblo County”. This plan discusses what the chain of communication would be in the event of a dam failure.

[Experts: Term ‘100-year’ flood misleads public](#) is a news article that examines how terminology can affect public behaviour or perception of risk in the event of flooding.

[Tennessee Department of Environment and Conservation](#) has an online mapping system that locates all dams in the state. Similarly, [New York Dam Safety](#) they also have an online mapping system.

[Tuttke Creek Dam Safety Assurance Program](#) is a web site that provides information on the local Dam Failure Warning System. It contains the following:

- [Evacuation Guidance](#) for downstream residents;
- [Maps](#) of the evacuation zone (index map and sub-zone/neighbourhood maps);
- Listen to the Evacuation [warning tone](#);
- [Fact sheets](#) (downloadable as PDF files);
- [Press releases](#) (downloadable as PDF files);
- [Newsletters](#) (downloadable as PDF files);
- [Public meeting notices](#) (downloadable as PDF files);
- [Information on Dam Safety Preparedness Exercises](#); and
- [Contact information](#) to submit comments or questions, or to have your name added to the mailing list.

[European Club of Icold – Working group on Safety on Existing](#) is a document that contains a section about Warning and Informing systems that have been adopted in other European countries.

[Dam Failure](#) is a PDF document that discusses in some detail the warning and informing system that is in place in Boulder County, USA, as follows –

*It is called the Emergency Warning and Evacuation Service (EWES) and is part of the Emergency Preparedness Network (EPN). The existing 9-1-1 database of telephone numbers and addresses is used in combination with detailed maps to help determine the geographic boundaries of an area impacted. The system is capable of calling up to 2,000 numbers in one minute. It is designed to deliver recorded information to endangered people in advance of a disaster or any major event.*