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Public dialogues on flood risk communication

Literature review – SC120010/R3

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We cannot do this alone. We work closely with a wide range of partners including government, business, local authorities, other agencies, civil society groups and the communities we serve.

This report is the result of research commissioned by the Environment Agency's Evidence Directorate and funded by the joint Flood and Coastal Erosion Risk Management Research and Development Programme.

Published by:

Environment Agency, Horizon House, Deanery Road, Bristol, BS1 9AH

www.gov.uk/government/organisations/environment-agency

ISBN: 978-1-84911-370-0

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Dissemination Status:

Publicly available

Keywords:

Flood risk, communication, public dialogue

Research Contractor:

3KQ, Collingwood Environmental Planning, Osprey Communications

Environment Agency's Project Manager:

Jacqui Cotton, Evidence Directorate

Collaborator(s):

Department of Business, Innovation and Skills, Sciencewise Expert Resource Centre

Project Number:

SC120010/R3

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- **Setting the agenda**, by providing the evidence for decisions;
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- **Delivering information, advice, tools and techniques**, by making appropriate products available.

Miranda Kavanagh
Director of Evidence

Executive summary

This literature review summarises the state of knowledge on communicating the risk of flooding to the public as of January 2014. The review considers how different audiences respond to risk communication and the factors which influence that response.

The current systems and techniques for flood risk communication in England and Wales are appraised to understand what outcomes are delivered and whether barriers exist to effective communication.

The review concludes by highlighting six key issues for practitioners to address in flood risk communication.

Coverage

There are some sectors in society in which people are much less likely to receive information about flooding as they do not use either traditional or new the communications channels

Multiple online 'reservoirs' with useful information mean that members of the public cannot easily find the information they want: an alternative would be to have a single, joined up portal.

Communicating risk

Failure to implement good practice (for example in relation to the language or flood alerts) may be associated with a lack of training for people on the ground.

Understanding risk

Many practitioners feel that the main problem for the communication of flood risk is about people's understanding of risk. This is associated with 'segmentation' approaches, which suggest there are some social groups or segments that will never engage with this kind of risk.

Moving from awareness of flood risk to response

Use of social media suggests a change in relationships between key providers and members of the public, with greater involvement of members of the public in sharing and creating information. However, there is some doubt about the extent to which social media are actually reflecting a real shift that could lead to changes in response.

Improving warnings

The research indicates that there is an appetite for probabilistic warnings among members of the public who have experienced flooding. However, there is a need for further research with a broader range of the public to test probabilistic flood warning materials once these have been developed. The research should include both people who have experienced flooding and others who have not to see how their responses differ.

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1 Introduction

The project, 'What does flood risk mean? Co-creating meaningful communications to enable resilience', seeks to:

- build on existing knowledge about people's understandings of flood risk and response to flood warnings and other information about flooding
- generate practical outputs (messages, materials and approaches to the use of different media) designed to increase awareness, encourage engagement and improve response to flood risk, which will be tested through dialogue with members of the public

The purpose of the dialogue is to involve members of the public in:

1. Exploring the meaning of messages about flood risk and the link between understanding the risk and taking action
2. Developing innovative methods and techniques for helping individuals and communities to understand their risk of flooding

The results of this project will inform the way that the Environment Agency presents its flood maps and the way it coordinates with other agencies over these kinds of communications.

The project is also intended to provide a basis for agencies working with communities at risk of flooding to be more consistent and joined up in their communications and action and to develop a more outcomes-focused approach.

Mapping out the ways in which the most important agencies are currently providing information about flood risk will help to understand current approaches to communicating general information about risk and information for situations of immediate or 'live' risk, and then reflect on how these approaches could be improved.

1.1 Project and report objectives

The project aims to address the challenges of improving flood risk communications through the following objectives.

1. Review the current issues surrounding risk communications and lessons learnt from other countries or disciplines.
2. Co-create, with members of the public, ways of helping individuals and communities to:
 - a. better understand flood risk
 - b. link risk to appropriate action
 - c. feel empowered to take action
3. Help agencies adopt a consistent approach to conveying risk and likelihood, enabling them to join up their subsequent activities.
4. Produce recommendations from members of the public and stakeholders on resources which are likely to result in positive changes to how people think and act in response to flood risk.

This report provides the findings from a review of relevant literature (Tasks 1 and 2 of the project) which is intended to:

- set the context of the project by summarising theoretical debates on public understanding and engaging with risk and drawing out case study illustrations where necessary.
- explore the literature on techniques (defined as, but not confined to innovative activities, language, numbers, products or representations) for effective public understanding and engaging with risk to set the context for developing materials, designing and delivering the public dialogue

1.2 Scope of the review

The review covers communications about flood risk that could contribute to creating awareness of the risk and prompting measures to prepare for flooding and increase resilience. These can be classified according to their purpose as shown in Table 1.1. The review covers communications received by local residents and, to a lesser extent, small businesses.

Table 1.1 Purpose of flood risk communications

	Before a flood (static risk)¹	During a flood (live risk)¹
Purpose of communication	Create awareness of flood risk and encourage action to prepare for future flooding	Encourage specific actions to prepare for flood event
Context	Area at risk of flooding but facing no immediate risk	Area at risk of flooding, with the possibility of flooding of property from current or imminent flood event
Types of communication	<p>Visual prompts (for example, flood marks, road signage)</p> <p>Flood risk routinely mentioned in routine transactions (information from estate agents, builders, DIY shops and insurance companies) and in relevant information from public services (local authority, other health, education)</p> <p>Flood risk mentioned in information for vulnerable groups or those who engage with them (for example, care homes and tourists)</p>	<p>Flood warnings (phone, text, tweet, email)</p> <p>Warnings on TV/radio</p> <p>Online flood maps and information</p> <p>Word of mouth (neighbours/local organisations)</p>

Notes: ¹ Static and live risk are discussed in Section 2.3.

1.3 Methodology

This report was developed through a review of existing literature on flood risk communication and interviews with staff involved in flood risk communication in the UK in a range of organisations.

Relevant academic papers and policy reports were initially identified using existing knowledge of literature on flood risk in the UK at Collingwood Environmental Planning, one of three research contractors for the project. The project's Steering Group also provided documents and other materials.

The details of all identified literature were recorded in a spreadsheet, which is available on request. Each item was briefly reviewed and prioritised based on its relevance to the project and to the literature review questions from the project specification.

The literature was divided into government policy documents and other documents. For both these groups, the documents given a high priority were read first to identify relevant themes which were developed into the literature review.

The literature review was supplemented by interviews with key providers of flood risk communications in the UK: the Environment Agency, Met Office, Flood Forecasting Centre and Cabinet Office.

2 Understanding flood risk communication

To inform the literature review, this section presents:

- key definitions including those by the UK government for ‘risk’ and ‘communication’
- a theoretical model to describe ‘understanding’ and ‘engaging’

This is because it is important to:

- examine how several important terms relating to the communication of flood risk are used
- identify the objectives of communicating flood risk to members of the public

2.1 Definitions

2.1.1 Risk

The definition of risk used in this review covers the key elements of probability and consequence or impact. Below is how the term is used in the Cabinet Office’s National Risk Register:

‘... both on the likelihood of [a particular type of event causing a civil emergency] happening over the next five years, and on the consequences or impacts that people will feel if it does. The highest risks are therefore those that are highly likely to happen and have the highest impact if they do.’ (Civil Contingencies Secretariat 2012, p.2)

2.1.2 Communication

In terms of communication, the following definition from the Government Information and Communication Service gives a useful overview of the different elements that contribute to communication:

‘Building relationships with others, listening and understanding them, and conveying thoughts and messages clearly and congruently; expressing things coherently and simply, in ways that others can understand, and showing genuine knowledge, interest and concern; bringing these aspects together to make change happen.’ (Cabinet Office 2011, p.7)

2.1.3 Risk communication

This project focuses on the relationship between communication and response. An important step in understanding flood risk communication is to see it firstly as a process which takes place in a social context and secondly as a process made up of a number of different components, all of which affect the nature, form and impact of the communication.

A definition of risk communication that reflects these characteristics is given a report on Work Package 5 (WP5) of the EU 7th Framework Programme project, CapHaz-Net:

'Risk communication must therefore be understood as a social process which depends on the characteristics of the message, the sender, the audience, the social context of the communication, the characteristics of the hazard itself and also on the mode/channel in which it is delivered.'
(Höppner et al. 2010, p.45)

One important characteristic of risk communication that is not included in this definition is that it deals with uncertain outcomes and the likelihood or probability of impacts occurring, rather than with events whose nature and reach are known in advance.

In the case of flooding, risk communication is intended to make people aware of and prepared for flooding so as to prevent or reduce the harm or damage it could potentially cause. Referring to this purposive nature of risk communication, Woods et al. (2012, p.2) clarified that:

'It typically involves transmitting information about the level and significance of risks as well as decisions, actions, or policies to manage them'.

Being able to link information to action is critical for effective risk management. However, it has become increasingly clear that there is no direct causal relationship between 'transmitting information' about risks and people taking individual or collective decisions or action to manage them. A number of approaches have been developed to explain how this translation happens (or fails to happen) and the factors that make risk communication 'successful'. Examples include:

- understanding communications in the context of 'knowledge systems' which shape how people process, interpret and react to messages (Waylen et al. 2011, p.7)
- a recognition that people, as individuals and collectively as communities, are active receptors of risk information and therefore need to be seen as 'initiators and creators of alternative schemes rather than be expected to be mere receptors of experts' plans' (Speller 2005, p.25).

Understanding risk communication as a two-way process, in which those receiving the communications play an active part in interpreting and responding, changes the focus on risk communication. The new emphasis is on the values and needs of the individual, group or community to whom the communication is directed, and the importance of adjusting communications to these. This enables people to judge their own risk situation and make informed decisions based on factors such as levels of preparedness (Renn 2005, p.55).

This is summed up effectively in the CapHAz-Net WP5 report as follows:

'...we understand risk communication as both a one-way transfer of hazard and risk related information and their management, and as a two-way exchange of related information, knowledge, attitudes and/or values. We see risk communication as a preventive activity that prepares communicating actors for hazard events, that enables them to better cope with hazard events and which helps to reduce adverse impacts on people and social systems.' (Höppner et al. 2010, p.7)

2.2 Understanding and engagement with flood risk

This project looks closely at the relationship between **flood risk communication** and **response**.

The term 'understanding' is used in this section to describe the whole process – going from awareness to consideration of the need to take action and possible options, to actually taking action.

The term 'engaging' is used to cover the part of the process that starts with an individual considering action and which includes:

- thinking about possible responses (response perception)
- deciding whether or not to act
- acting on the decision

This broadens the concept of 'understanding flood risk' from a largely information-based process to one that encompasses the deliberation and action (or inaction) that follow on from information or awareness.

The model of the process of understanding risk shown in Figure 2.1 highlights the different stages in this process. The model represents the way that understanding flood risk is used in this review. Engaging with flood risk is considered to be what happens from Box 2 (Consider action) to Box 3 (Act/Decide not to act). Key decision points within this linear model depend on the perceptions of risk and response.

The model suggests that both understanding of, and engagement with, flood risk can lead to a decision to act or not to act. People weigh up a number of factors in taking decisions on whether and how to engage with flood risk, and flood risk communication is just one of these factors. In practice, there may be many iterations of steps within the process as people come across new prompts to engage with or act on flood risk.

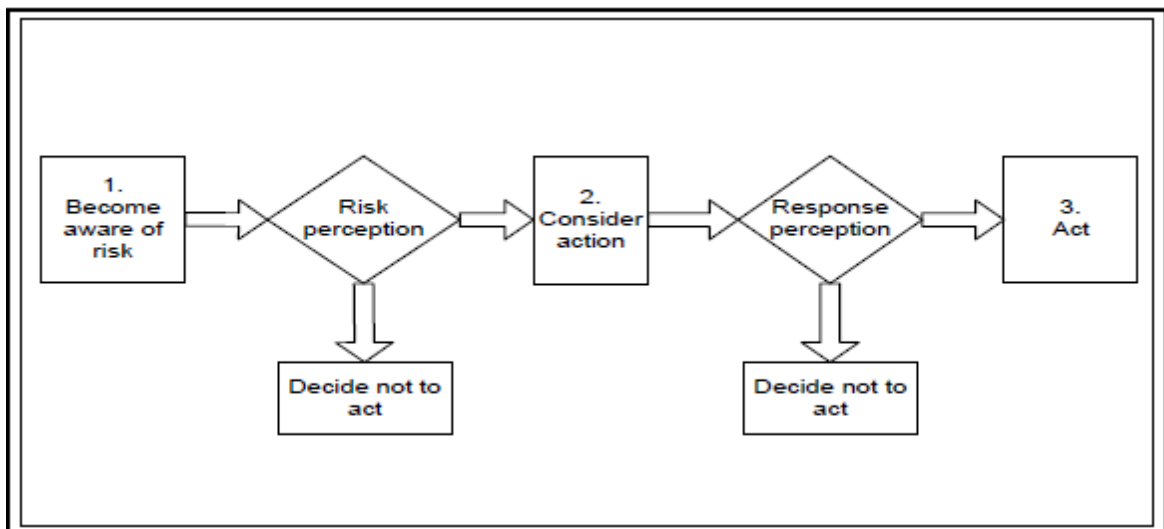


Figure 2.1 Representation of the process of risk perception and response

Source: Harries (unpublished PhD thesis, FHRC Middlesex University, 2007; cited in Rose et al. 2009, p.983).

Understanding how individuals and communities become aware and make sense of risks, and why and how they think about possible responses, has become more sophisticated over time. The idea that the goal of flood risk communication is to provide 'more and better information' is now seen as insufficient (O'Sullivan et al. 2012, p.2271) and this is reflected in UK government policy.

There is considerable evidence that provision of information alone is not sufficient to bring about behavioural change. For example, the CRUE Funding Initiative on Flood

Resilience – a major quantitative and qualitative study of at-risk communities in six European countries – found that:

‘The majority of respondents felt that they were not prepared for flooding. Current preparedness levels were found to be related to previous flood experience. Those who have been flooded previously often have a higher level of preparedness than those without flood experience. Interestingly, perception of living in a flood risk area was found to have no influence on preparedness levels within this sample. This indicates that increasing awareness about flood risk may not have an effect on the public being prepared.’ (Waylen et al. 2011, p.61)

Nevertheless, much risk communication continues to emphasise information and awareness-raising.

Recognising the many dimensions of flood risk communications should encourage those responsible for it to understand that communications approaches (including messages, modes and techniques) will work differently in different contexts.

Being clear about the goals of communication, whether implicit or explicit, in a particular context, is essential. The CapHAz-Net WP5 report (Höppner et al 2010, p.16) provides the following useful set of objectives.

1. Raise awareness.
2. Encourage protective behaviour.
3. Inform to build up knowledge on hazards and risks.
4. Inform to promote acceptance of risks and management measures.
5. Warn of and trigger action to impending and current events.
6. Reassure the audience (to reduce anxiety or manage outrage).
7. Improve relationships (build trust, cooperation, networks).
8. Enable mutual dialogue and understanding.
9. Involve actors in decision making.

Most of these objectives refer to pre-emergency situations, though numbers 5 and 6 are primarily focused on current or ‘live’ risks.

The CapHAz-Net WP5 report further suggests that flood risk communications can be divided into three broad contexts, defined by their objectives:

- preparation – information
- prevention
- warning

These contexts cannot be considered in isolation. The way that individuals and communities respond to communications in one context is likely to be influenced by previous communications about, or experience of, flooding.

2.3 Communicating about static and live flood risk

The original brief for this review suggested that there are two different contexts for communicating about flood risk: static risk and live risk (see Table 1.1).

The term 'static risk' is used in fields such as psychology and insurance to refer to factors that contribute to risk such as long-term conditions which do not change and which increase risk (for example, an individual's medical condition which increases their risk of certain illnesses). In the context of flooding, static risk factors include:

- living in an area of flood risk
- whether or not the property has ever actually been flooded

But while the concept of static risk factors may be useful in understanding the different elements that contribute to risk, talking about 'static risk contexts' is misleading. Physical conditions such as rainfall, sea tides and saturation of the ground do not always change suddenly to create a new situation of heightened risk, so it may be difficult to say at what point 'static' risk ends and 'live' risk begins. Some conditions that heighten the risk of flooding may be imperceptible – properties affected by groundwater flooding may not seem to be at risk until the water comes up through the floor.

However, there is clearly a difference between communicating risk when the hazard is immediate and palpable, and when it is a possible future situation. The CapHaz-Net WP5 report notes that, in the latter situation, the focus of risk communication is on information and preparation.

'We see risk communication as a preventive activity that prepares communicating actors for hazard events, that enables them to better cope with hazard events and which helps to reduce adverse impacts on people and social systems. Thus, we distinguish risk communication from disaster, crisis and emergency communication that tend to focus on communication activities during and in the immediate aftermath of hazard events.'
(Höppner et al. 2010, p.7)

Communication when a hazard situation is unfolding aims to:

- provide a warning of imminent danger
- encourage action to prevent or reduce damage to the individual and community and to the infrastructure and services on which they depend

It is important to recognise the differences between communicating in conditions of immediate hazard and those in which the hazard is more distant. Nevertheless, there is a close relationship between these situations as how people respond to warnings will be affected by their preparedness. Rather than treat these as different situations or contexts, or even as opposite poles on a continuum, this report looks at the immediacy of the flood risk as one of the factors affecting communication.

2.4 Communicating flood risk to different audiences

Another element that is increasingly being taken into account in communications in general, and risk communication in particular, are the differences in people's response to messages or information and the factors that determine these.

People are no longer seen as one large homogeneous group, but as belonging to different groups that hold different risk perspectives and values (Bennett 1997). It is suggested that the public, or audiences for communications about flood risk, are made up of people with different attitudes and values which shape their response to risk communications. If this is the case, it should be possible to increase the effectiveness of flood risk communications by:

- identifying specific audiences

- describing their attitudes, interests, values and concerns
- targeting communications to appeal to these

3 Factors influencing response to information about flooding

3.1 What is known about how people think about flood risk?

People in Western societies do not generally consider themselves to be at risk of catastrophic events because these are not part of their everyday experience:

‘Many believe they are not at risk of high-consequence, low-probability events, and perceptions of being safe are reinforced every day a disaster does not occur. Perceptions of “being safe” change to those of “being at risk” immediately after the occurrence of a community-wide disaster ... the effect of experiencing an event on motivating preparedness declines as time passes, and perceptions of safety re-emerge and rise back to pre-event levels, typically within a two-year period.’ (Wood et al. 2012, p.603)

There are different theoretical frameworks for thinking about how people perceive flood risk. Wood et al. (2012, pp.602-603) identified three broad approaches:

- **Individual level theories** consider the role individuals play in their behaviour and focus on internal factors.
- **Interpersonal level theories** consider the role other people have on individual behaviour and focus on external factors. Such theories suggest that the behaviour of individuals can be influenced by changing the norms that guide behaviour.
- **Community and group level theories** instead consider understanding behaviour in the context of social institutions and communities, and focus on factors within social systems.

Individual level theories suggest that individuals hold different sets of attitudes and perspectives which determine their perception of risk information. Understanding that people have different attitudes to risk can be used to develop typologies of attitudes to risk as the basis for more structured approaches to risk communications. These approaches are explored in greater detail in Section 3.2.

At the interpersonal level there is work on how people are influenced by others, how norms arise within groups and how that then affects behaviours (for example, acceptance of property level protection or belief in flood warnings).

Community and group level theories have provided insights into the way that social and community contexts influence risk perception. For example, cultural factors such as household structures and role obligations may affect whether or not people receive risk information (Höppner et al. 2011, p.230). These approaches recognise the importance of cultural values in determining how information about risk is interpreted. It is also suggested that the institutions communicating risk themselves reflect or transmit values, which may not be the same as the values of those receiving the communications. The implications are that longer term, two-way processes are needed, rather than one-off communications, so as to understand and address conflicts between values systems.

Similarly, the importance of trust for public acceptance of risk management and the authorities responsible for it has received increased attention (Wachinger and Renn 2010, Walker et al. 2010):

‘Whether people place trust in authorities hinges on whether they deem institutional actions to be based on the same values as they hold themselves ... The main implication for risk **communication** is that it **should aim to build trust** in risk managing bodies.’ (Höppner et al. 2010, p.24)

The level of public awareness of risk events such as flooding can be amplified in the public’s minds through government agencies’ initiatives and programmes (for example, flood warnings) but also through the media, cultural and social groups, and opinion leaders (Kasperson et al. 1988). This process has been described as ‘social amplification’ and ‘likened to the effect of dropping a stone into a pond’. Research on social amplification ‘suggests that public concerns about certain risks may be amplified by previous, sometimes unconnected events’ (Cabinet Office 2011, p.15).

Social amplification of risk implies that risk managers and agencies are inevitably competing with sources of information, which might be based on different attitudes about what is relevant and true (Höppner et al. 2010, p.25). An important insight from this work is that these kinds of communications are essentially selective:

‘... without encouragement to do otherwise (by procedural rules on openness, transparency and settings that stimulate self-reflection) they disseminate and potentially magnify the information that is needed to support their views while attenuating or omitting others.’ (Höppner et al. 2010, p.25)

Those receiving a range of different messages will also be selective in sifting information and picking out those elements that tend to support their own views.

3.2 What is known about the relationship between the way that individuals think about flood risk and their response to flood risk communications?

Communications about flooding have different purposes depending on the context (Table 1.1). Information may be provided with of intention of:

- creating awareness of the possibility of a future flood event so that people are prepared
- promoting action to prevent or limit the impacts of future flooding
- warning people about an imminent flood event and the actions they should take to avoid harm to themselves and others or damage to their property

This section looks at what is known about responses in these contexts and what makes communications more or less effective

3.2.1 Creating awareness and promoting action to prepare for warnings

Individual level theories which emphasise the importance of individual attitudes and perspectives in determining responses to risk information suggest that it is possible to:

- create a typology of attitudes and perspectives
- model how people in the different groups or types will respond to risk communications

For example, a model presented in the CapHaz Net WP5 report shows how differentiation of groups within a community according to their risk attitudes (the groups are given names such as: 'risk manager' and 'risk denier') can be used to develop a strategy for raising risk awareness and changing risk related behaviours through communication. The model, shown in Figure 3.1, is specific to the context of flooding at the community level in Australia but can be transferred to a European context.

This model shows the progression of a flood risk communication strategy over time. It begins with the 'participative phase' that targets those audiences who are more likely to engage with their flood risk early. These may be local champions who are willing to invest time and energy into flood preparedness measures. Lessons are learnt from this process and used in the face-to-face and social marketing phases to target early adopters (responsive) and the early majority (distracted); these groups are aware of the risks and engage in some form of flood risk preparation.

Up to this point in time, the audience have received flood-specific and non-hazard-specific messages and have chosen to willingly engage with their flood risk. The remaining audience now consists of the late majority (resistant) and the laggards and sceptics (very resistant). Engagement is limited with this audience and the goal may only be for them to obey emergency directions and is delivered by the authority of the responsible agency.

While useful in describing different attitudes to flood risk information and the responses likely to be associated with these, this model is limited by its lack of flexibility as it assumes that the audience remain in one of the five categories throughout the process. It does not allow individuals to move between categories (that is, early majority to late majority) nor does it include unique events that might shape the audience's perceptions of flood risk (for example, a flood event part way through the program may result in a decrease in risk deniers and an increase in early adopters). Despite these limitations, the model does highlight the differences within audiences and the implications of these for response.

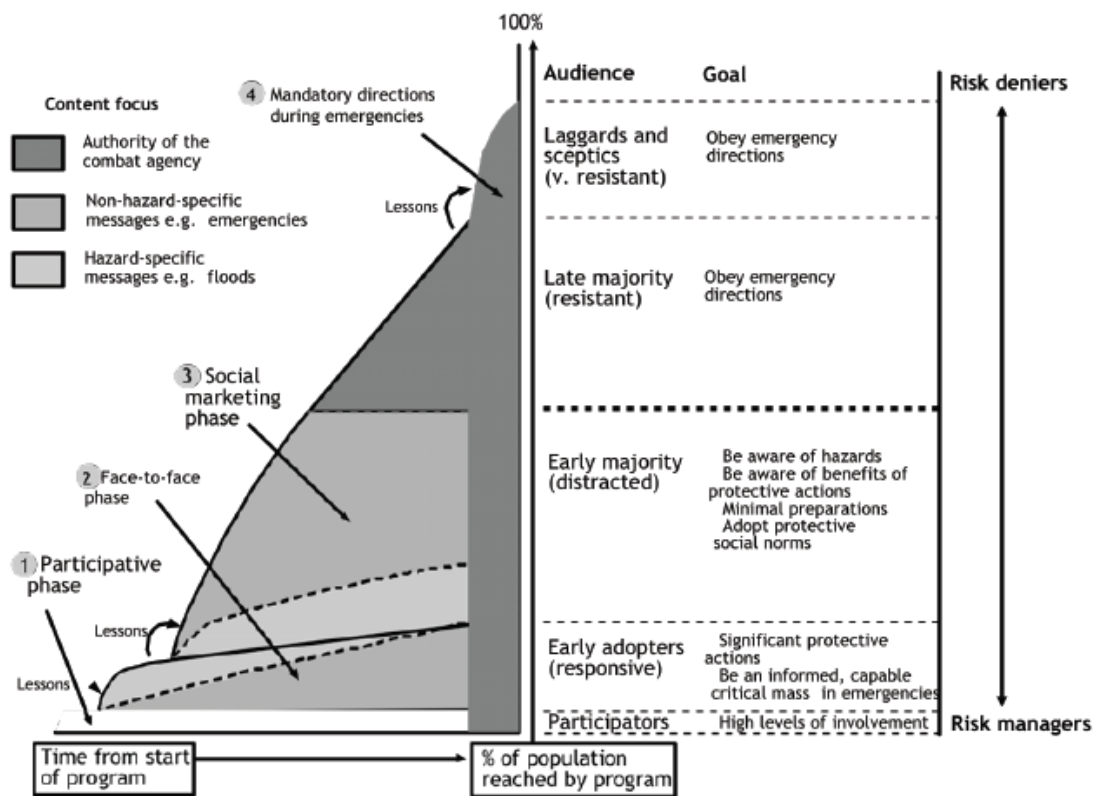


Figure 3.1 Integrated model of risk communication exploring flooding at the community level

Source: O'Neill (2004; cited in Höppner et al. 2010, p.29)

3.2.2 Market segmentation

Interest in the social characteristics that influence response has prompted work by various public institutions to obtain a better understanding of the different audiences for their flood risk communications.

Research for the Environment Agency identified six types of audiences for flood risk communication, with five in at-risk areas (Figure 3.2).

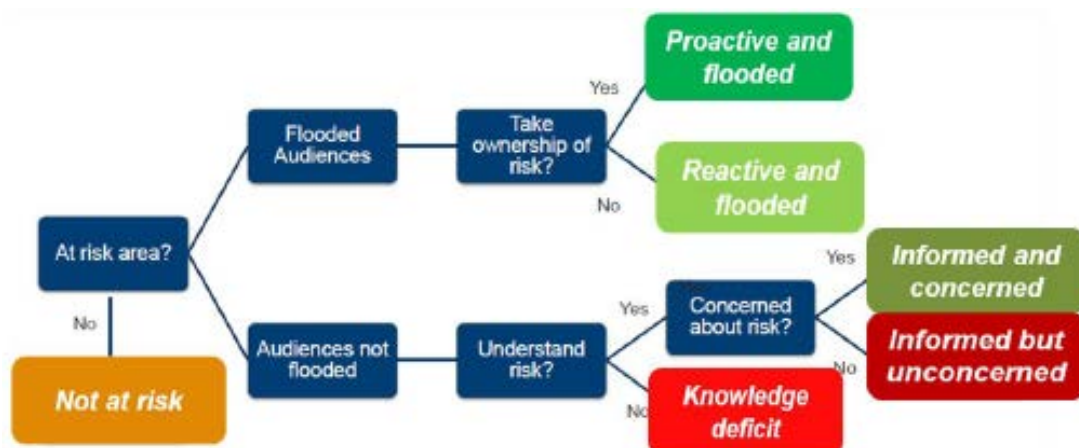


Figure 3.2 Segmentation of audiences

Source: Blue Marble Research (2012, p.5)

The Met Office has also conducted research into audience segmentation to better inform its communications. But as its focus is on response to information about weather more generally, the typology of the segments is different to that in the Environment Agency research.

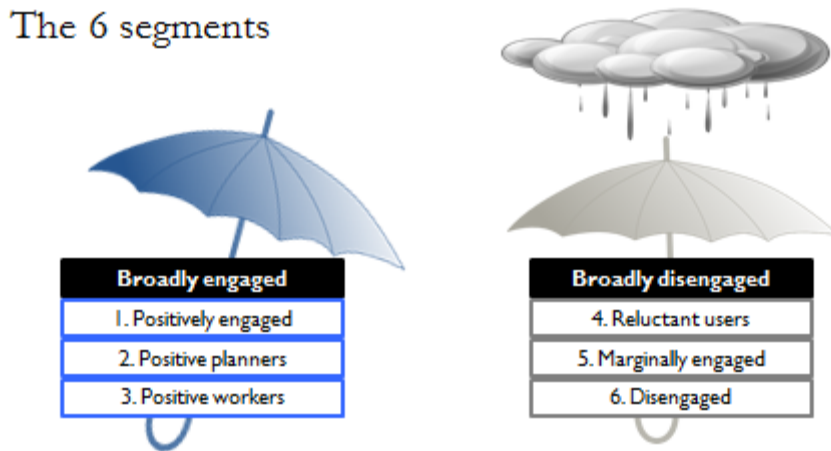


Figure 3.3 Segmentation of audience into six parts

Source: Met Office (2013)

Community and group-level factors can have an important influence on responses to flood risk information as well as on perceptions of risk. Wood et al. (2012, p.604) point out that seeing others – especially familiar people such as friends and relatives – take action to prepare for flood risk is generally a stronger motivation for action than reading or hearing about the need for action.

3.2.3 Warning and encouraging action to respond to current flood risk

The complexity of the way that social factors influence response to flood risk communications in situations of live risk is brought out in Figure 3.4, which looks at responses to warning of flash flooding. The figure shows the variables that can act as prompts for, or inhibitors of, engagement by members of the public. Only some of these factors can be influenced by risk communications; these are discussed below.

Characteristics of the situations in which risk communication occurs are also known to influence response. These characteristics were investigated by the project, 'Improving Institutional and Social Responses to Flooding' (Twigger-Ross et al. 2009). The summary of the findings from that work given in Table 3.1 highlight the different characteristics and contexts that influence responses to flood warnings.

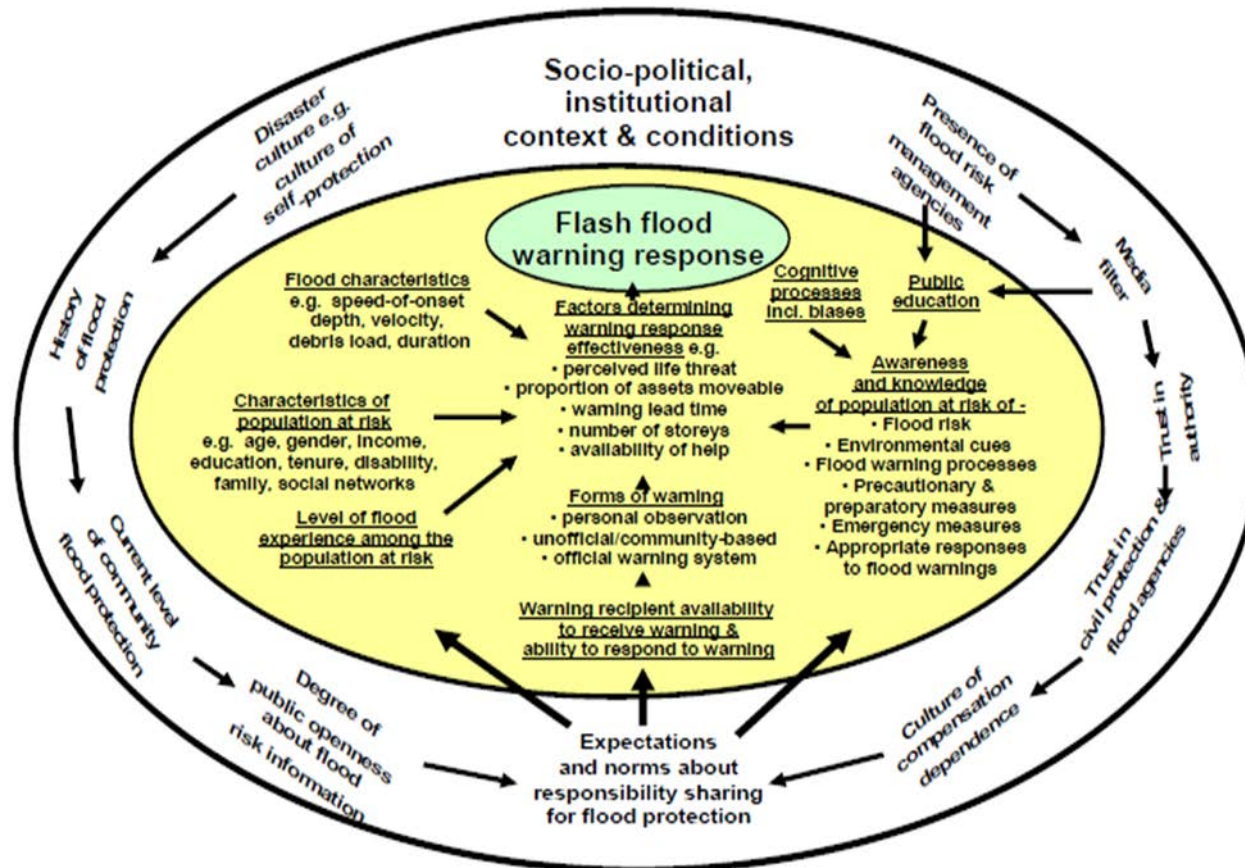


Figure 3.4 Variables determining flash flood warning response either by inhibiting or enabling response by individuals in flood prone locations

Source: Parker et al. (2007, p.94; cited in Orr and Twigger-Ross, 2009, p.29)

Table 3.1 Characteristics of floods, people and areas together with the risk communication context that have implications for responses to flood warnings

Examples	Implications for targeting flood warnings
Characteristics of a flood	
Source/type of flood such as river, tidal, sewer or pluvial ¹	<p>Whether a flood warning is issued</p> <ul style="list-style-type: none"> • Environment Agency warns for main river, tidal and some groundwater and surface water flooding. • No warnings exist for sewer flooding.
Type of catchment such as small steep catchments or small urban catchments (rapid response) versus larger, flatter catchments	<p>Lead or available time for a warning</p> <p>In small flashy catchments (such as Boscastle in August 2004), warning may not be possible so will need to consider alternatives (awareness raising, evacuation exercises).</p>
Depth and velocity	<p>Implications for the type of response sought and thus the message</p> <p>Fast flowing and/or deep waters can cause damage to buildings.</p> <p>Evacuation may be more appropriate than moving belongings.</p>
Timing: season, time of day	<p>Implications for the numbers and characteristics of people that need to be warned, for example, tourists in summer/weekends who will have little or no knowledge of either the flood or the local area.</p> <p>Also implications for the warning method, for example, during the night some people are not going to answer their phone – a siren/loudhailer might be more appropriate.</p>
Social characteristics	
'Hard to reach' ² groups such as low income, non-English speakers, tourists, elderly, living alone, disabled and those with visual or hearing impairments	<p>Targeting these groups has implications for the media used for a flood warning – use of different languages, tailored advice to those who have mobility or visual impairments, but more importantly creating connection for these people with the flood warning service prior to the event itself. Those with less connection to services overall are likely to find themselves least connected during a flood.</p>
Low social connectivity	<p>A lack of social networks affects whether some people receive a warning such as from a friend or a neighbour.</p>

Examples	Implications for targeting flood warnings
Lack of awareness/experience of flood risk	<p>Those with prior experience or awareness of flood risk may be more likely to adopt flood warning technologies, respond to warnings or take appropriate action on receipt of a warning. However, there is also evidence that repeated low impact flood events can lead to people becoming desensitised to their flood risk.</p> <p>People in flood risk areas may also exhibit risk denial and/or risk complacency when considering their own flood risk.</p>
Lower social class	<p>Those in lower social classes are more likely to be at risk from hazards (not specifically floods).³ A 2008 study found that social class and flood risk awareness were positively correlated and that lower social classes were less likely to demonstrate awareness.⁴ However, it is necessary to be cautious when trying to link social class with relative flood risk as the analysis method can influence the outcome.³</p>
Short period of time at current residence	<p>Individuals who have lived in the same property for a short period of time can be less willing to engage in their flood risk compared with relatively established residents in the same area who may be able 'to recognise and read' important visual clues such as unusually swollen rivers.⁴</p>
Area characteristics	
Urban versus rural	<p>Flooding in urban areas has implications for the number of people that need to be warned. Urban flooding can have multiple sources, such as happened in Carlisle in 2005, which has an impact on whether a flood warning is issued.</p> <p>Additional relevant aspects are as follows.</p> <ul style="list-style-type: none"> • The more complex and interconnected nature of urban areas means that any disruptions can have far reaching impacts and may require additional warnings from cascading flood events. • Urban populations tend to have higher levels of access to technological aids, which can have implications for communicating flood warnings.⁵
Vulnerable locations such as caravan parks, schools and hospitals	<p>For instance, caravan parks may be highly exposed and have nowhere for people to seek refuge.</p> <p>Additionally, residents may not have good knowledge of the area and/or be aware of the risk of flooding.</p>

Examples	Implications for targeting flood warnings
Type of building – ‘vulnerable’ properties such as basement flats, one-storey properties	Small properties or single storey houses may offer little storage space and no upper floors to move people and property to out of the way of a flood.
Risk communication context	
Risk communications are not passively received; they are filtered, actively interpreted and evaluated in a social context.	Work with communities to develop joint flood warning systems For example, Hambledon Parish Council in Hampshire developed a flood warning system run by the council. ⁶
Trust in the source of communication and its credibility is crucial in influencing how risk communications are received.	The contact people have with flood risk management institutions such as the Environment Agency will have a bearing on whether these are considered to be trusted sources or not. Trust is built up over time and requires attention to competency, compassion and consistency.
Risk communication takes place between different parts of the community in an informal way, beyond the formal instigation or control of risk managers.	Conversations about flood risk that take place within informal networks such as community groups can have a significant influence on people’s responses. Formal flood risk management institutions can support conversations in this kind of setting, for example, events that discuss local flood history.

Notes:

Source: adapted from Twigger-Ross et al. (2009, Table 2.1)

¹ Pluvial refers to flooding from direct run-off from land or urban areas.

² ‘Hard to reach’ from a flood warning point of view (Tapsell et al. 2005, Shaw et al. 2005).

³ Fielding and Burningham (2005)

⁴ Burningham et al. (2008)

⁵ Elstow (2013)

⁶ Hampshire Flood Steering Group (2002)

Research into householder response to flood risk (Harries, unpublished PhD thesis, FHRC Middlesex University, 2007) indicates that many people who have been flooded once or have come close to being flooded may want to avoid being reminded of the risk. This may discourage them from signing up for flood warnings. In other cases, fear of social stigma prevents action. People are aware of the risk of flooding, but can't see others taking action and don't want to be seen as exaggerating the risk. This concern is often exacerbated by worries that if they recognise the risk, they may be penalised by their insurance company. A number of householders contacted by the Environment Agency during a 2008 campaign to get people at risk to sign up for the flood warning service said that they were concerned about their insurance premiums being increased if they registered.

In relation to local community responses, many individual members of the community will demonstrate the same concerns about the potential impacts of recognising risks. In certain coastal locations where flash flooding can occur, local people have opposed putting up warnings because of the potential impact on tourism. However, when acting as a group, members of the community are more likely to consider wider impacts (for example, for vulnerable people) and the long-term perspective. Support from others means that actions to manage the risks can be carried through. So while community-level risk mitigation behaviours should not be seen as an easy option, they may have more lasting effects.

Informal communications routes can also influence responses to formal flood risk communications. Research suggests that people need to corroborate official warnings against personal information and contacts before they are willing to take action:

Participants in focus groups held as part of joint Defra and Environment Agency research in 2008 into the communication and dissemination of probabilistic flood warnings commented that:

'... a probabilistic flood forecast would be one piece of information that they would use alongside other information (for example, such as media reports, what friends or neighbours may think, personal judgement of the weather and how it may have affected the river). Flood warnings would not be acted on unless they could be corroborated with other information that they sought themselves.' (Kashefi et al. 2008, p.32)

There is considerable interest at present in the extent to which social media such as Twitter, Facebook and Instagram – through their challenge to one-directional, expert- or professional-led communications media – are opening up opportunities for more effective communication of risk.

The approaches to communications discussed earlier focus on the role of institutions and agencies as the initiators of risk messages and how this could be improved to make the message most effectively. Although the literature emphasises the two-way nature of risk communication and the importance of taking account of public perception, understanding and response (including factors that influence perception of and response to communications), the role of individuals and community organisations as initiators of or contributors to risk communications has only recently been examined.

Sutton (2009, p.5) identified five important characteristics which differentiate social media from traditional ('legacy') communications systems:

- collaborative
- decentralised
- lateral
- networked

- community driven

People are no longer dependent on hierarchical communications systems but communicate through their own networks, giving them greater access to information, more quickly and from more sources (Sutton 2009, p.10). Sutton makes the point that, 'decentralized communication is not disorganized communication' (Sutton 2009, p.17) and that, as communications are shared, they get corrected and accuracy tends to increase. Not only do social media allow information to be communicated immediately to large numbers of people, they allow the process of information checking and testing of possible responses ('milling') to occur and potentially speed up this process.

However, there are a number of concerns about the increase in communication of risk information through social media. These include:

- the possibility that misinformation can become established and lead individuals to make mistaken responses
- lack of access to these media by significant sectors of the population, among them groups that tend to be vulnerable to flooding such as the elderly or people with lower levels of education attainment

A recent report suggests that:

'... the power of social media to compete with traditional media (for example, television) during a period of crisis potentially has real consequences for how emergencies are managed.' (DFUSE Project 2013, p.5)

In a context of reduced trust in public authorities, the new communications technologies have created an information marketplace where official communications have to compete with information from other sources. This gives rise to challenges and opportunities for those responsible for managing risk. Table 3.2 summarises these risks and opportunities.

Table 3.2 Summary of opportunities and threats of social media for emergency planning

Opportunities of social networking technologies

- Real time
- Ability to ask questions to many
- Trusted by public
- High levels of use
- Potential for data mining of observer information by the public, business networks and government organisations
- Opportunity for harnessing social media knowledge and therefore the public

Threats of social networking technologies

- False rumour (competing with official information)
- Information getting out too early (public observers/leaks)
- Networks/platforms not robust
- Public don't trust them

- Public don't use them
 - Discriminatory demographic effects in relation to the profile of users
 - Skill, resource and willingness of emergency managers to respond to both
-

Source: DFUSE Project (2013, p.7)

Because these media are new and still developing, there is a lot of uncertainty about their use and potential.

The DFUSE project's analysis of the way that Twitter was used in the crisis around the tsunami and subsequent flooding of the Fukushima nuclear plant in Japan in 2011 suggests that, despite the potential for enlightened use of social media (for example, through crowd sourcing of information), some messages were negative and reflected racist stereotyping of the Japanese people.

'This shows that despite the "revolutionary" nature of social media its anonymous and instant nature may lead to negative outcomes in terms of balanced portrayals of events.' (DFUSE Project 2013, p.35)

3.3 Characteristics of good flood risk communications

The good practice principles set out in Table 3.3 relates to the 'flood warning' or 'active risk' context. A great deal of research has been done on communications in this context and there is considerable evidence about what works or doesn't work.

Table 3.3 Attributes of effective flood warnings

Attribute	Details
Factual information	<p>The hazard should be described and how it poses danger to people.</p> <p>The message should say what is happening, what is expected to happen and when it will occur – the effects of a flood should be predicted if possible.</p> <p>The location of the risk should be described in a way that is readily understood by the public.</p> <p>Information should be given about the time available for recipients to act.</p> <p>Messages should contain estimates of probable damage.</p> <p>Information should be specific, accurate and relevant to the individual.</p> <p>Messages should related to an be reinforced by local conditions.</p> <p>Reference to benchmark floods can enhance comprehension.</p> <p>Messages will not be believed if recipients think they are not receiving the whole truth.</p>
Action advice	<p>Information on what people should do to preserve their safety.</p> <p>Information on what people should do to protect their property.</p> <p>Messages should be persuasive to convince people to take action.</p> <p>The warning must convey what is appropriate response.</p>
Source of message	<p>The source of the message should be indentified.</p> <p>Messages that come from credible sources are more likely to be believed.</p> <p>Those issuing a warning message should convey authority.</p>
Consistency	<p>A message should be consistent within itself and across different messages.</p> <p>Messages are more likely to be believed if they are consistent.</p>
Clarity	<p>The warning must be clear concise, and 'user friendly'.</p> <p>The warning must be easily understood by the target audience.</p> <p>Warnings should be worded in simple non-technical and jargon free language.</p> <p>Message content should be attention grabbing and ordered with the most important information first.</p>
Tone	<p>Messages should be positive rather than negative.</p> <p>Messages should suggest action rather than inaction.</p> <p>Messages should encourage social interaction rather than isolation.</p> <p>Messages should be vivid, around emotional interest and relate to local situations.</p>
Alerting function	<p>Warning messages should convey a sense of urgency and arouse some emotion and feeling.</p> <p>Signal words and colours can be used to emphasise the level of risk.</p> <p>The use of appropriate icons can enhance the alerting function.</p> <p>Messages should contain wording which is designed to motivate and arouse.</p>

Source: Haggart (1994; cited in Orr and Twigger-Ross, 2009, p.25)

Although some of the characteristics in Table 3.3 are more relevant to situations where flooding is imminent or happening, there are others that are equally important when talking about flood risk in the absence of a flood event.

- **Action advice:** evidence from US surveys suggests that ‘people are strongly motivated to take action about risk when presented with information about the actions they could take.’ (Woods et al. 2012, p.611)
- **Source of message:** trust in the individual or agency discussing the risk is extremely important in motivating people to take preparatory action.
- **Consistency:** in pre-flood situations, people have more opportunity to interrogate messages. The more risk communication challenges their sense of identity and security, the more likely they are to look for alternative messages to confirm their own views and beliefs. Woods et al. (2012) suggest that public agencies should ensure that the information provided is dense and frequent so as to pre-empt as far as possible the potential distraction from other sources of information.

Another characteristic of good practice flood risk communication, which is particularly relevant to information when flooding is not imminent, is the preference for two-way communications:

‘Several aspects make face-to-face communication more salient and effective [than mass media]: first, it is more personal; second, non-verbal cues can allow the communicator to gauge how the information is being received in real time and respond accordingly; direct communication also allows for dialogue to emerge; and finally, the trust between individuals participating in a two-way exchange goes a long way toward engaging and convincing someone.’ (Moser and Dilling 2010, p.15)

This is the case for flood warnings. Parker et al. (2009), for example, found that older people specifically reacted more positively to a flood warden than to some flood warning technologies. This has been taken into consideration by many organisations; the National Flood Forum, for example, aims to develop flood action groups within communities where relationships of trust can be built up between group members and between local groups and official organisations.

3.4 Barriers to effective flood risk communication and confounding factors

One of the biggest barriers to effective flood risk communication is the failure to get information to the people who need it. Despite efforts by key providers to use a range of communications channels and innovative techniques, there are still significant proportions of the population who do not know about flood risk and who do not receive flood warnings, even though they live or work in flood risk areas.

This problem may affect specific groups within the population, for example, people who have recently arrived in the area to live or work (Burningham et al. 2008, p.226). It may also relate to what media are being used to communicate flood risk information. For example, many public agencies are prioritising web-based communications, sometimes to the exclusion of other communication media. Some specific problems associated with reliance on web-based communications can be summarised as follows.

- A lot of information is put out online, with some organisations’ websites holding a large amount of data (O’Sullivan et al. 2012). These can be visualised as ‘information reservoirs’. However, the use of websites to store and communicate flood risk messages can act as a barrier for groups with low levels of IT usage, such as those over 65 years-old and those with lower levels of educational attainment. Even competent IT users may not

be aware of their existence; this has led to low levels of use penetration of many web-based risk resources (O'Sullivan et al. 2012, p.2277).

- Potential infrastructure damage, caused by flood events, may compromise telecommunications and reduce engagement with live flood risks, unless there are emergency provisions in place (Defra 2013, p.49).

The failure of public institutions or officials to acknowledge emotional responses to the risk of flooding like fear or anger may heighten the concerns of members of the public and act as a barrier to future risk communications (Tinker and Galloway, 2008).

Top-down campaigns and 'one-size fits all' approaches generally ignore local contexts and the varying perceptions of risk that different groups possess (Orr and Twigger-Ross 2009, p.30). This lack of connection between the message and the local community can be compounded if officials do not listen to local stakeholders (ILGRA 1998, p.8; Boudier 2009. p.4).

4 Current flood risk communication system in England

The current chain of flood risk communications from the key providers to members of the public in England was developed after widespread flooding in 2007. The review by Sir Michael Pitt of the way the flooding was managed identified a need for closer cooperation between the Environment Agency and the Met Office. One of the recommendations from the Pitt Review was that the two institutions should work together through a joint centre (Pitt 2008). This led to the creation of the Flood Forecasting Centre (FFC), which combines meteorology and hydrology expertise. It aims to deliver longer lead time flood forecasts and more accurate information to emergency responders.

The current flood risk communication system involves the Met Office, FFC and Environment Agency – as providers of information as well as emergency responders – and many other organisations and members of the public. Figure 4.1 provides a useful overview, from the point of view of the Environment Agency, of some of these relationships.

The Met Office collects and provides weather forecasting data to the National Flood Forecasting System. The FFC brings together meteorological and hydrological sciences and uses the information provided by the Met Office to give a single forecast of flood risk. The FFC is responsible for communicating five-day Flood Guidance Statements to emergency responders. In 2011 the government decided that these forecasts should also be available to members of the public and a three-day Flood Guidance Statement (or ‘Three Day Flood Risk Forecast’) is now published for members of the public on the Environment Agency website.¹ The Environment Agency is responsible for communicating flood warnings.

¹ <http://apps.environment-agency.gov.uk/flood/3days/125305.aspx>

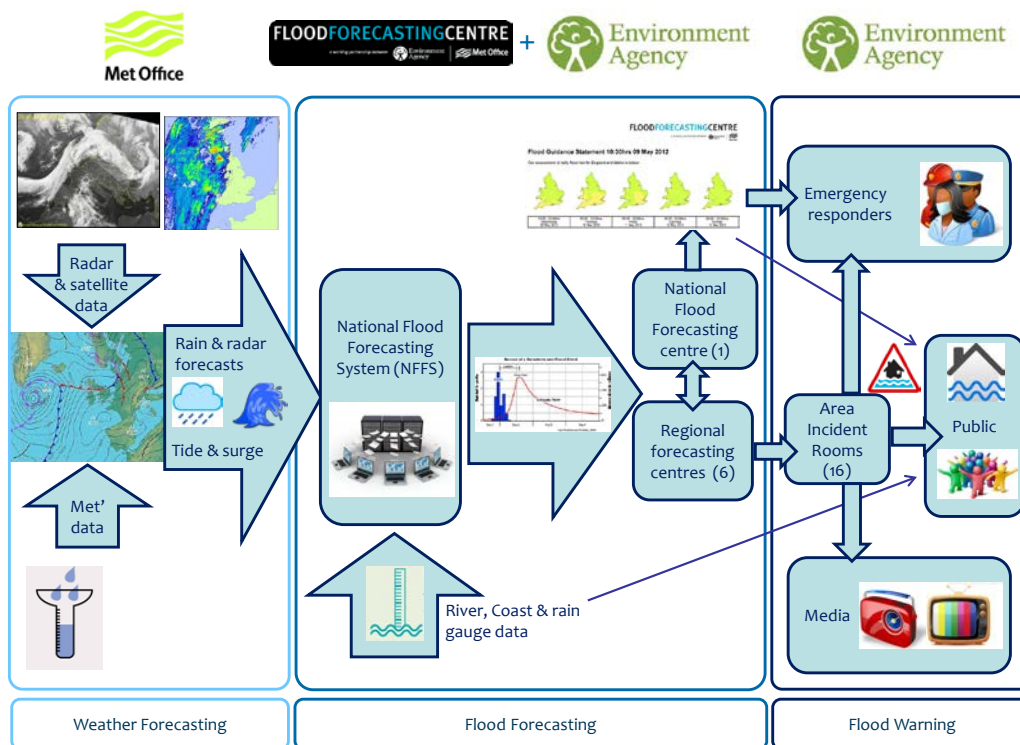


Figure 4.1 Overview of flood decision making, actions and dissemination

Source: Environment Agency unpublished presentation

The flood risk communication system involves multiple relationships between key providers and the institutions responsible for flood response – public emergency services, including local authorities, the police and the fire services, as well as other actors such as water companies and also voluntary organisations like the British Red Cross and WRVS. Each institution has its own stakeholders and lines of communication, creating a need for coordination and consistency in communications.

Flood warnings are disseminated by the Environment Agency through a number of communications routes to its three audiences:

- members of the public (residential or business)
- its emergency response partners
- the media

The warnings are issued to members of the public through television (weather and news bulletins), radio (local stations give information on current warnings), direct calls, text messages, emails and faxes (Figure 4.2). Partners can use a tailored system provided by the Environment Agency to track warnings against assets and matters in their jurisdiction that they need to keep an eye on (Environment Agency 2013).

Organisations and individuals can also seek flood risk information from the Environment Agency website, social media channels, and by registering to receive warnings from Floodline Warnings Direct (FWD).

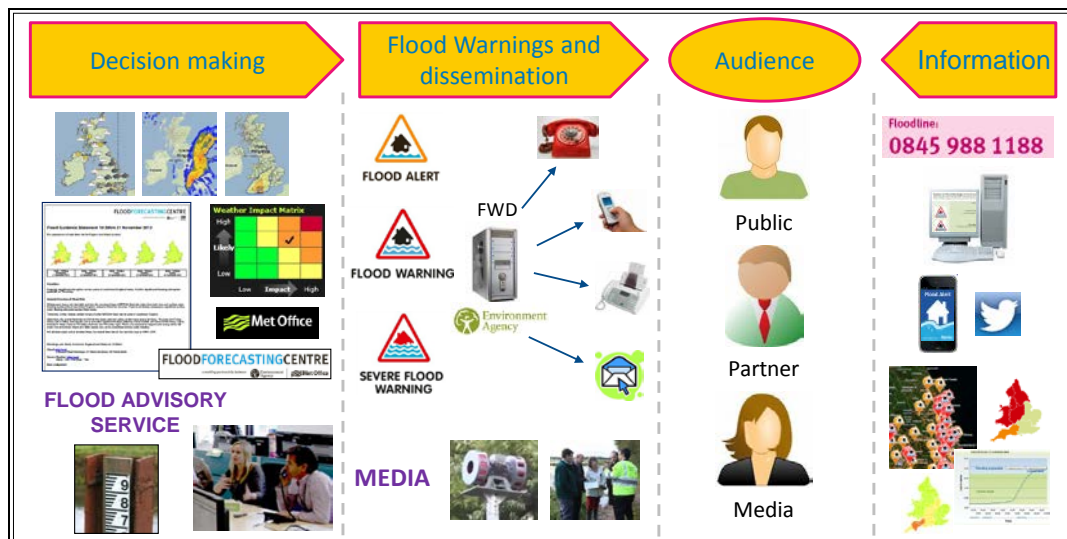


Figure 4.2 Decision making and flood warnings dissemination to the target audience

Notes: Floodline telephone number is now an 0345 number not an 0845 – see <https://www.gov.uk/check-if-youre-at-risk-of-flooding>
Source: Environment Agency (2013b)

The system described above focuses on flood warnings, that is, communications in the context of a current or possible flood risk event. Awareness campaigns are also used, such as the Floodwise campaigns, to get people to register for flood warnings and to improve their own flood preparedness (Environment Agency 2013b). The Environment Agency has the main national role in developing awareness of flooding.

Other authorities and organisations also communicate about background flood risk. These include local authorities and voluntary organisations such as the National Flood Forum. Much of this communication links or refers to Environment Agency information and services such as Floodline and flood maps, and there is a significant degree of consistency in messages.

4.1 Desired outcomes of the current flood risk communication system

If the main purpose of flood risk communications is to get people to take appropriate actions to reduce the negative impacts of flooding, it is important to communicate which actions are considered to be appropriate.

In a situation when there is no likelihood of a flood event occurring in the near future, the Environment Agency (www.gov.uk/prepare-for-a-flood) identifies five appropriate actions which people should take to **be prepared for flooding**:

- Find out if you're at risk – check flood risk maps (for rivers and the sea, surface water and reservoirs)
- Sign up for flood warnings
- Make a flood plan
- Improve your property's flood protection
- Get insurance

The Environment Agency's internal annual public survey on flood risk understanding measures the extent to which actions to prepare for flooding are being achieved.

In terms of appropriate response to a flood warning, some information was provided by the Environment Agency on its old website² and now on GOV.UK (www.gov.uk/prepare-for-a-flood/get-help-during-a-flood). Users are signposted to the National Flood Forum's website (<http://www.nationalfloodforum.org.uk/about-to-be-flooded/>) for further information and advice.

From the Flood Warning page on the old Environment Agency website, users were told to ring Floodline or to click for further information. As shown in Figure 4.3, this information included:

- the flood warning status
- the location of the flooding
- a description of the expected conditions relevant to flooding

However, the information was largely descriptive and did not state clearly what actions people should take. From the main Flood page, users could find a page headed 'During a flood' which had a long list of generic actions, but no specific guidance as to the immediate priorities for people in the location.

² The Environment Agency website moved to GOV.UK on 1 April 2014.

Wickham to Titchfield on the River Meon

Current status:



Flood Warning

Flood status last changed at 04:02 on 22 Jan 2014

Location:

Wickham, and Titchfield on the River Meon

[View map of flood warning area](#)

Region:

Southeast

Latest Information:

- River levels from Wickham to Titchfield remain high and out of bank along the catchment. High groundwater in the Meon valley will maintain these levels. A Met Office Heavy Rainfall Alert is in force for Sunday. The latest forecast is for a band of rain to cross the area bringing widespread totals of 8mm but local maximums up to 17mm. The heaviest rain will clear by Sunday afternoon with light to moderate showers following behind. The river is responsive to rainfall and Sunday's rain will cause a small increase in levels with the risk of flooding to vulnerable properties at Titchfield where flows are out of bank and impeded by bridges. The risk of property flooding in Wickham is lower but residents should remain prepared and be aware of the risk of flooding from surface water too. This Flood Warning will be updated at 14:00 on Monday 27 January 2014.

12:28 on 26 Jan 2014

Floodline:

Call Floodline on 0845 988 1188, select option 1 and enter Quickdial number 0122322 to get more information

Related Flood Warning Areas

This Flood Warning area is also situated in a larger geographical area, where we provide a general Flood Alert early notification to possible flooding. Follow the link(s) below to check if a Flood Alert is in force for the following area(s):

Flood Alert

[Lower Meon](#)

Previous statuses:

- No warning 14:52 on 14 Jan 2014
- Warning no longer in force 14:22 on 13 Jan 2014
- Flood Warning 09:48 on 06 Jan 2014
- No warning 12:22 on 30 Oct 2013

Figure 4.3 Example of information provided alongside a Flood Warning on the Environment Agency's old website in January 2014

Notes: Floodline telephone number is now an 0345 number not an 0845 – see <https://www.gov.uk/check-if-youre-at-risk-of-flooding>

4.2 Social media: a challenge to the existing flood risk communication system?

All emergency responders are engaging with social media as more people are using this to get their information.

Each Environment Agency office and some senior staff have their own Twitter accounts, while the Met Office has a single Twitter account.³ The Met Office aim is to push people to its website, which is the main source of its information. However, the Met Office also seeks to use Twitter to develop more personalised communications with younger people and people who would have been unlikely to engage with it in the past.

Customer services staff at the Met Office reported that they try to build up a relationship between the staff member tweeting and Twitter followers. They do this by including their own name in the tweets and trying to keep the tweets personal. They retweet important messages and also answer one-to-one queries on Twitter, using 'lines to take' given to them by the press office. When enquiries are too complex to answer on Twitter, staff will try to arrange phone calls or emails to answer the enquiry. They also write blogs and use Twitter to link to them.

The Met Office also considers it important to monitor Twitter conversations on related topics. It therefore monitors Twitter to see if any subjects related to its work are 'getting out of control'. Staff then attempt to 'steer conversations' and respond to individual Tweets to clarify the situation. Twitter supplements other observational techniques and has progressed from being a 'side show' at the Met Office to being monitored 24/7 with monthly reports being produced.

Information could also come from members of the public. At the time of writing, the Met Office was looking into the use of Instagram in the future and perhaps advancing its Weather Observation Website (WOW). The website (<http://wow.metoffice.gov.uk/>) allows members of the public to enter their own weather observations; these are then combined with the location, time and date, and added to the website map.

³ With approximately 180,000 followers at the time of writing this report (January 2014)

5 Techniques for flood risk communication

When reviewing the techniques used for flood risk communication, this report makes a distinction communication channels and techniques. This distinction is useful as it allows techniques to be distinguished from their communication routes and enables analysis of their respective roles in flood risk communication.

Communication channels, media or routes transmit flood risk messages to the intended audiences. However, many communications channels use a number of different techniques. For example, Twitter would be considered a communications channel but can transfer written messages, numbers, probabilities, infographics, images and video content – all of which are considered to be flood risk communication techniques.⁴

A **flood risk communication channel, media or route** is understood as a way that a flood risk communication technique is communicated to particular audiences via, for example, the organisation's own communications, established media (TV, radio, newspapers and so on), social media, emergency responders or information 'brokers'.

A **flood risk communication technique** is defined generally as a way or method of carrying out a particular task. It is therefore a way or method of communicating flood risk. Within the context of this review, a flood risk communication technique is defined as an action or activity to describe or talk about flood risk so as to promote understanding and engagement. This definition includes, but is not confined to, language, numbers, representations and any other content, products or activities that draw attention to flood risk.

5.1 Current chain of communication about the risk of flooding, from key providers to the public

There are several typologies currently available to distinguish between different flood risk communication channels or routes. Routes can be classified based on:

- the direction of communication
- the role of the message receiver
- whether or not they are structured and pre-planned

The **direction of communication** for flood risk can be either one-way or two-way. One-way routes are used by flood risk management institutions such as the Environment Agency to communicate with members of the public; examples include television/radio broadcasts and Twitter Alerts. However, there may also be two-way communication routes between these institutions and members of the public. Examples include telephone calls by members of the public to flood managers, long-term

⁴ Twitter users can also direct other users to websites through the inclusion of hyperlinks within Tweets. Websites are considered to be a communications route and so, in this case, one communications route is being used to direct users to another communications route, which in turn may lead to a flood risk communication technique conveying a flood message, such as a flood risk map.

community engagement and Twitter hashtag discussions such as the two hour #floodaware discussion organised in November 2013.⁵ (Environment Agency 2013c).

The **role of the message receiver** can also be used to distinguish between flood risk communication routes. There are some situations in which the receiver passively receives the flood message (push) and others where they actively seek and acquire the flood message (pull) (Parker and Priest 2012). Push warnings, where warnings are not sought by the receiver, can include the individual receiving information through text messages, fax and from door-knocking by officials. In contrast, pull warnings are actively sought by the individual and may be acquired in a number of ways including:

- visiting the Environment Agency's flood information web page
- installing and checking the Flood Alert mobile phone app (see Section 5.5.7)
- calling Floodline (the Environment Agency's flood emergency phone line)

Flood risk communication routes can also be distinguished by their **status** as either 'official' or 'unofficial' within flood warning systems. Official warnings are normally structured and pre-planned, whereas unofficial warnings may be less structured and more ad hoc. For example, an unofficial flood warning system illustrates the role that social networks can play in disseminating flood warnings, whereas these aspects are absent from the official flood warning system.

The main types of current official flood risk communication routes that are coordinated at a national level are summarised in Table 5.1, where they are classified according to the direction of the communication (one-way or two-way) and the role of the receiver in accessing the flood risk message (push or pull).

Some communication routes can be both one-way and two-way within the organisation issuing the alert. For example, organisations may use Twitter to broadcast warnings to their audiences and regard it as a one-way form of communication. However, these warnings may initiate conversations within the audience or between members of the audience and those issuing the information. This could lead to questions from the audience and replies from the organisation, leading to the communication becoming two-way.

The various communication routes are identified in Table 5.1 as push and/or pull with some routes containing elements of each. Several routes require the receiver to first register before relevant messages are sent to them (for example, Floodline Warnings Direct and Twitter). These routes contain elements of both 'push' and 'pull' warnings, as the receiver needs to actively seek them out initially but after this does not need to actively seek them out in the future.

⁵ <http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/news/150932.aspx>

Table 5.1 Summary of flood risk communication channels and routes

Route	Type	Link risk to action	Used for	Issues associated with use	Example ¹	Source of evidence
Situations where there is no immediate risk of flooding						
Participatory methods	Two-way Pull: Individuals choose to take part	Activities are linked to flood preparation and flood recovery, and include flood scenarios	Raising flood risk awareness Engaging and empowering members of the public	Time and resources may be constraints to using this method	The Participatory Flood Risk Communication Support System (Pafrics), Japan	Fukuzono et al. (2006)
Educational activities	One-way/two-way Pull: Individuals choose to take part	Activities are linked to flood preparation and flood recovery, and include flood scenarios	Raising flood risk awareness Engaging and empowering members of the public	Time, resources and a willing audience are needed	Hull Children's Flood Project	http://www.lancaster.ac.uk/lec/sites/cswm/Hull%20Children%27s%20Flood%20Project/HCFP_home.php
Youth flood websites	One-way/two-way Push: Users directed to websites through existing mechanisms Pull: Have to seek out websites	Website pages can contain information on flood risk management issues	Raising awareness of flood risk management issues	May have a low penetration rate by online users unless the website is widely promoted and easily accessible	Junior Floodsite	http://www.floodsite.net/juniorfloodsite/html/
YouTube	Two-way Push: Updates are sent to YouTube followers or	Videos can contain advice on flood risk preparedness actions	Raising flood risk awareness Communicating flood risk information and	Discussions can go beyond the subject of flooding and be abused by internet 'trolls' and by those	Met Office (7,305 subscribers)	http://www.youtube.com/user/TheMetOffice

Route	Type	Link risk to action	Used for	Issues associated with use	Example ¹	Source of evidence
	video links forwarded to users Pull: Initially to subscribe to the specific YouTube account or by seeking out the YouTube page		videos of past flooding events	looking to voice their anger at the organisation		
Online blogs	Two-way Push: Updates are sent to blog subscribers Pull: Initially to subscribe to the specific blog	Articles can contain information on recommended flood preparedness actions to take	Raising flood risk awareness	May have a low penetration rate by online users unless the blog is widely promoted and easily accessible	Met Office News Blog (4,889 followers)	http://blog.metoffice.gov.uk/
Twitter discussion sessions	Two-way Pull: Need to be following the Twitter account and contribute by asking the experts questions	Discussion sessions can allow the audience to ask questions on flood preparedness actions to take	Raising flood risk awareness Answering flood questions Communicating with a large, tech-savvy audience	Discussions can go beyond the subject of flooding and be abused by internet 'trolls' and by those looking to voice their anger at the organisation	Environment Agency Planned Discussions (hashtag: #floodaware)	www.environment-agency.gov.uk/news/150932.aspx ²
Vimeo	One-way/two-way Pull: Environment Agency YouTube	Videos can be specific to the local area and relatable to the target audience	Raising flood risk awareness Communicating local flood memories	May have a low penetration rate by online users as Vimeo might not be well known enough	Lower Severn Community Flood Education Network channel	http://vimeo.com/channels/cofast

Route	Type	Link risk to action	Used for	Issues associated with use	Example ¹	Source of evidence
	channel					
Google+ and Facebook	Two-way Push: Updates are sent to Google+ followers Pull: Initially to subscribe to the specific Google + account	Updates can contain information on recommended flood preparedness actions to take	Raising flood risk awareness Communicating with a large, tech-savvy audience	Discussions can go beyond the subject of flooding and be abused by internet 'trolls' and by those looking to voice their anger at the organisation Limited usage of Google+	Met Office (98,723 followers)	https://plus.google.com/+metoffice/posts
Flickr and Instagram	Two-way Pull: Need to seek out Flickr page	Uploaded images show the damage that flooding can do and may reinforce the need to be aware of flood risk	Raising flood risk awareness Displaying images of flood events	May have a low penetration rate by online users as it might not be expected that Flickr would be used in this way	Environment Agency (4,063 photos)	http://www.flickr.com/photos/environment-agency/
Methods for flood contexts and when there is no immediate risk of flooding						
National/ local/ community leaders	Two-way Push: Speeches and interviews Pull: Constituent/ community questions	Individuals can communicate information on recommended flood preparedness actions to take May be greater uptake as it comes from a	Raising flood risk awareness Communicating flood preparedness advice	The popularity and credibility of national/ local/ community leaders will be variable and may influence the audience's perception of the message and how they react to it	Flooding advice from the then Environment Secretary, Owen Paterson, to people in at-risk areas during the floods in late 2013 to early 2014 floods – he	https://www.gov.uk/government/news/environment-secretary-owen-paterson-flooding-update

Route	Type	Link risk to action	Used for	Issues associated with use	Example ¹	Source of evidence
		trusted and/or credible source			urged people to sign up to Environment Agency flood warnings and to take action to protect themselves and their properties	
Flood websites	Push: Users directed to websites through existing mechanisms Pull: Have to seek out websites	Website pages can contain information on recommended flood preparedness actions to take	Raising flood risk awareness Communicating flood preparedness advice	May have a low penetration rate by online users unless the website is widely promoted and easily accessible	Environment Agency website	https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather
Property reports	One-way Push: Provided when purchasing a property	Reports contain assessment of flood risk to property	Long-term flood risk planning and mitigation Raising flood risk awareness	The data are owned by the Environment Agency and are subject to data licences.	Property conveyance reports produced by value added resellers	
Context of immediate flood risk or flooding						
Direct flood warnings via calls, text messages and emails	One-way Pull: Need to register for the service	Warnings can lead the audience to take flood preparedness actions	Raising awareness of live flood risk	People need to know about the potential for direct warnings in order to sign up to them	Environment Agency Floodline Warnings Direct (direct calls, text messages and	https://fwd.environment-agency.gov.uk/app/olr/home

Route	Type	Link risk to action	Used for	Issues associated with use	Example ¹	Source of evidence
Television and radio broadcasts	One-way Push: Updates are given in the form weather and news bulletins	Bulletins can raise awareness and provide flood preparation information	Raising flood risk awareness Reaching a large audience	Flood risk warnings may be exaggerated to make them 'newsworthy'	emails) BBC News and Weather	
Flood Guidance Statements (FGS)	One-way Push: Five-Day FGS (sent by the Met Office) Pull: Three-Day FGS (need to access website)	Links level of flood risk to the need to be 'aware', 'prepared' or to 'take action' depending on the severity of flood risk	Providing information on live flood risk The Five-Day FGS is for Category 1 and 2 emergency responders; the Three-Day FGS is for members of the public (residential and business) and the media	Five-Day FGS can enter the public domain and lead to requests for additional information that is only meant for Category 1 and 2 emergency responders	Three-Day Flood Risk Forecast	Flood Forecasting Centre guidance materials http://apps.environment-agency.gov.uk/flood/3days/125305.aspx
Emergency responders	One-way/two-way Push/Pull?	Individuals can communicate information on recommended flood preparedness actions to take May be greater uptake as it	Raising flood risk awareness Communicating flood preparedness advice	Limitations of time and personnel available to communicate flood risk while acting to reduce flood impact and increase flood preparedness	Blue light services (police, fire service and so on)	

Route	Type	Link risk to action	Used for	Issues associated with use	Example ¹	Source of evidence
		comes from a trusted and/or credible source				
Online weather warning updates	One-way Pull: Audience must visit the Met Office website to access the information	The warning levels tell users to be 'aware', 'prepared' or to 'take action' depending on the severity of the warning	Raising awareness of hazardous weather, for example, high rainfall	Focuses on weather and will only indicate flood risk if a result of heavy rainfall	Met Office National Severe Weather Warning Service	http://www.metoffice.gov.uk/public/weather/warnings/#?tab=map&map=Warnings&zoom=6&lon=-0.57&lat=53.21&fcTime=1389657600
Twitter Alerts	One-way/two-way Push: Updates are sent to Twitter account followers Pull: Initially to sign up to alerts	Alerts can contain information on recommended flood preparedness actions to take	Raising flood risk awareness Communicating with a large, tech-savvy audience	Messages are restricted to 140 characters (although this ensures they are concise)	Environment Agency Twitter account: @EnvAgency (~143,000 followers)	twitter.com/EnvAgency
Online Flood Warning Widget	One-way Push: Warnings are displayed on non-Environment Agency websites	Warnings contain information on flood likelihood and encourage users to sign up to Floodline Warnings Direct	Raising flood risk awareness	Widget may not always be displayed prominently on websites and may not be seen	Environment Agency Widget embedded into external websites such as the National Flood Forum	http://nationalfloodforum.org.uk/?page_id=34

Notes:

Current as of January 2014.

¹ Numbers given are as of January 2014.

² Archived on 18 March 2014 (<http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/news/150932.aspx>)

5.2 Techniques

A number of techniques exist to communicate flood risk messages through language, numbers and probabilities, products, representations and innovative activities (see Table 5.2). These techniques are not used in isolation and are disseminated through various communication routes.

The techniques can link risk to action and be useful in raising flood risk awareness, as well as providing information on flood preparedness actions that members of the public can implement. For example, games and educational activities can be used to raise flood risk awareness across a range of audiences. However, there are issues associated with the use of these techniques. For example, flood risk maps may be useful to increase flood awareness at an area level, but may not include flood risk information for individual properties or actions that can be done to reduce flood risk.

The use of language through news/blog articles and flood risk messages is important because it can reach a wide range of audiences and can be used to inform other techniques such as educational activities. Representations of flood risk information can also be used and may include the use of infographics, images and video content. These visual techniques can contain specific flood risk information that can be conveyed through a range of communication routes.

In addition to these techniques, there may be a need to communicate flood warnings to members of the public in response to an urgent live flood risk. Such techniques are coordinated and managed at a local level and utilise local area knowledge such as public building and message board locations and groups of people at risk (see Table 5.3). Some of these techniques (for example, door-knocking) may involve a large number of personnel, carry their own risks and may only be sustained over short periods (Defra 2013). The use of familiar faces or organisations, such as landlords and the police, can also act as a credible source of flood risk information.

Table 5.2 Selected communication techniques for flood risks coordinated at a national level

Technique	Issues associated with use	Communication route(s)	Example	Source of evidence
Live flood maps (maps showing where flood warnings are in place)	Do not always provide details of actions that individuals should take in relation to the flood warnings Level of resolution may not allow users to see risk to specific properties or locations	Flood websites, television broadcasts, Twitter Alerts, Google+, emergency responders and online blogs	Environment Agency: live flood warning information	https://flood-warning-information.service.gov.uk/
Flood risk maps	Can be misunderstood by non-technical users Cannot search at the individual property scale	Flood Guidance Statements, flood websites, Google+, Twitter Alerts, online blogs, campaigns and emergency responders	Environment Agency: Risk of Flooding from Rivers and Sea	http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=538452&y=178286&scale=8
Games	Time, resources and a willing audience are needed	Participatory methods, flood websites and online blogs	Living with Environmental Change's Snakes and Ladders game	http://www.lwec.org.uk/stories/snakes-and-ladders-rescue
Educational activities	Time, resources and a willing audience are needed	Participatory methods, flood websites, youth flood websites, online blogs and campaigns	Hull Children's Flood Project	http://www.lancaster.ac.uk/lec/sites/cswm/Hull%20Children%27s%20Flood%20Project/HC_FP_home.php
Video content	Producing video content will cost time and resources May not be viewed by audience	Flood websites, television broadcasts, YouTube, Vimeo, Twitter Alerts, Google+, online blogs, television and radio broadcasts, and campaigns	Environment Agency flood update videos	http://www.youtube.com/user/EnvironmentAgencyTV/videos
Images		Flood websites, television broadcasts, online Flood Warning	Environment Agency Flickr	http://www.flickr.com/photos/environment-

Technique	Issues associated with use	Communication route(s)	Example	Source of evidence
		Widget, online weather warning updates, Twitter Alerts, Google+, online blogs, YouTube, Vimeo, Flickr, campaigns and emergency responders	account	agency/with/11293529363
Infographics		Flood websites, television broadcasts, Twitter, Flickr, Google+, online blogs and campaigns	Environment Agency Tidal Surge 2013 Infographic	http://www.flickr.com/photos/environment-agency/11293529363/
Numbers	Can be misunderstood by non-technical users, for example: 'This area has a chance of flooding of greater than 1 in 30 (3.3%)' might be confusing to audiences	Television and radio broadcasts, flood websites, Flood Guidance Statements, Google+, online blogs, campaigns, emergency responders, and national/ local/ community leaders	Environment Agency 'Risk of Flooding from Rivers and Seas' flood risk descriptions	http://watermaps.environment-agency.gov.uk/wiyby/WiybyMapQueryResults.aspx?lang=en&scale=8&cx=540020&cy=177624&topic=floodmap&layerid=0&x=538863&y=178593
Innovative activities		Participatory methods, flood websites, online blogs and campaigns	Sustainable Flood Memory Project	http://vimeo.com/channels/cofast/15657750
Language/ written communications		Online Flood Warning Widget, television and radio broadcasts, Flood Guidance Statements, online weather warning updates, Twitter Alerts, Twitter discussion sessions, flood websites, online blogs, Google+, campaigns and national/ local/ community leaders		

Table 5.3 Communication routes for local responders for urgent flood warnings to members of the public for live flood risks

Techniques

- Mobilising police officers to go round on foot and knock on doors
 - Site sirens
 - Messages through loudhailer or other amplified means from car or helicopter
 - Electronic/variable message boards, for example, at the roadside
 - Announcements in public buildings, shopping centres, sports venues, transport systems and so on
 - Automated telephone/fax/e-mail/text messages to subscribers
 - Media announcements including the use of social media
-

Notes: As recommended by the National Flood Emergency Framework for England (Defra 2013, p.51)

5.3 Use of flood risk communication techniques for different purposes

Although many innovative and valuable techniques are being developed for flood risk communications, 'they are often disparate and not embedded in more comprehensive long-term communication strategies' (Höppner et al. 2010, p.101). A strategic approach to flood risk communication is suggested based on the recognition that communications have three main purposes:

- preparation and information
- prevention
- warning

Each of these types of communication has its own challenges and uses techniques in different ways, even though the techniques themselves may sometimes be the same.

It would appear that a lot of work has been done in England to develop, trial and mainstream effective approaches and techniques for flood prevention and warning. However, there is less clarity about how to effectively prepare people for flooding and give them the information that they will need to take action. This includes what Preston (2012, p.34) refers to as:

'affective preparedness pedagogies ... 'not concerned with cognitive processes or behaviours, but based on the principle that coping with crises requires emotional effort, for example, through "facing up to the risk", in order to make cognitive development or changes in behaviour possible.'

This is not to say that positive examples of this kind of preparedness communications do not exist, but rather that they tend still to be seen as experimental (see below).

5.4 Good practice

A lot of basic knowledge about communications applies to the communication of flood risk. This includes:

- be clear about the purpose of the communication
- keep messages simple
- avoid technical language and jargon
- identify the audience
- make the communication relevant to the audience

The use of technical language, including reference to probabilities, is known to act as a barrier to communicating flood risk. For example, the Environment Agency's '8 Principles for Flood Risk Communications', includes 'Keep the language of risk simple' (Environment Agency 2012, p.23) and key providers are increasingly using visuals, stories, qualitative language and non-specific ranges of risk and indicators of severity. But despite the progress made, it is still easy to find examples of opaque language (see Figure 5.1).

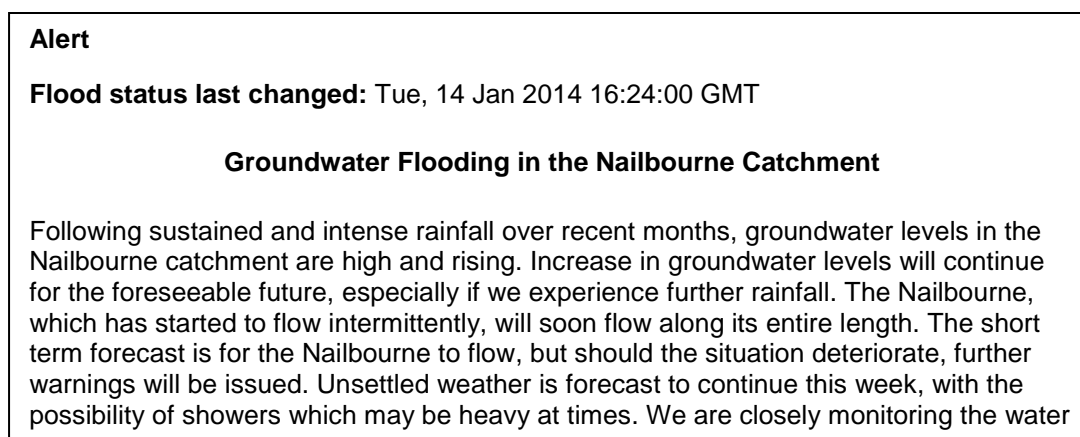


Figure 5.1 Example of an Environment Agency Flood Alert

Source: Environment Agency website, 14 January 2014

In relation to techniques for communicating uncertainty, it is vital to remember that not all people have the same information needs. For example, Spiegelhalter (2011, p.1393) points out that:

'... there are few reproducible experimental findings for assessing best practice in visualizing uncertainty. Instead, reviewers have emphasized how graphics can be adapted to the aims of the communicator, stressing the importance of the context of the communication exercise and the needs and capabilities of the audience.'

Nevertheless, focus groups on probabilistic flood warnings held in different parts of England in 2007 to 2008 identified some common points.

- Advance warning helps people to make more informed choices. Advance warning was seen to be of particular benefit for vulnerable people in the community, such as those needing regular medication or those with babies or young children.

- People generally inferred that warnings had some degree of uncertainty. So being informed of the levels of uncertainty and forecasted probabilities was seen as potentially useful additional information.
- People who were not actively engaged with flooding issues on a regular basis wanted clear guidance as to what action they should take as a result of a warning.
- There was no clear consensus as to how probability information should best be conveyed, but some general patterns could be identified:
- Simple qualitative terms alone (such as 'likely' or 'probable') were not generally welcomed as they were seen to be too open to interpretation. But when combined with percentage indicators, this was seen as more convincing.
- Participants at risk of fluvial flooding particularly liked the idea of being able to access a map that could provide them with regularly updated forecast information for their houses.
- Very few people find graphs useful or understandable.
- The use of colour accompanying information about probabilities was seen to be significant, as value judgements about the probabilities were inferred by these. The older participants, in particular, said they would rely on the colours to decide what action they should take, regardless of what the percentage was.

Outside the context of flood warning and prevention, research across Europe suggests that there is a need for a more sophisticated approach to getting people to 'face up to' their flood risk and to think about what they can do to prepare for it. A report on 11 case studies in four European countries (Finland, Ireland, Italy and Scotland) in communities at risk of flooding highlights a tendency for respondents to leave mitigation to external agencies rather than taking ownership of the risk themselves, despite their having high levels of awareness and worry. The report suggests that flood risk communications ought to outline the remit and responsibilities of all agencies involved in flood risk management clearly to encourage reflection on what individuals can do for themselves (O' Sullivan et al. 2012; reported in Twigger-Ross et al. 2014, p.66).

However, there are valuable examples of new approaches to talking about flood risk that start beyond conventional (one-way) methods of risk communication and are based on engaging communities through dialogue and discussion.

- **Bringing together local and expert knowledge can increase community resilience.** A model involving the co-production of knowledge, bringing together expert knowledge with local knowledge about the micro-level detail of flooding and institutionalising this local knowledge, has been shown to be effective in building resilience capacity (Lane et al. 2011; reported in Twigger-Ross et al. 2014, pp.69-70). Local people may have greater trust in and buy-in to measures that they have contributed to identifying and developing.
- McEwen and Jones (2012, p.680) identified the importance of 'knowledge as doing rather than thinking'. Their research analysed the nature of local knowledge and how it can be captured, shared, used and institutionalised for the development of community resilience. Community Risk Registers as well as Community Flood Plans serve as possible routes for institutionalising local knowledge not only in relation to preparation and

anticipation of floods, but also to enhance resilience during an emergency. (Twigger-Ross et al. 2014, p.69)

- **Building trust within the local community is an essential part of building community resilience.** Different approaches to building trust have been used successfully. Examples include working with local leaders or starting by working on issues that are a priority for local people rather than on actions that are the priority for the project.
- **The use of participation as a means to empower people** (Meyer et al. 2011). The use of flood risk maps and video projects, when used as participatory methods, has shown to empower members of the public and to result in improvements to map content as well as increased awareness of flood risk. Good practice in the timing of participatory approaches is shown in Figure 5.2.

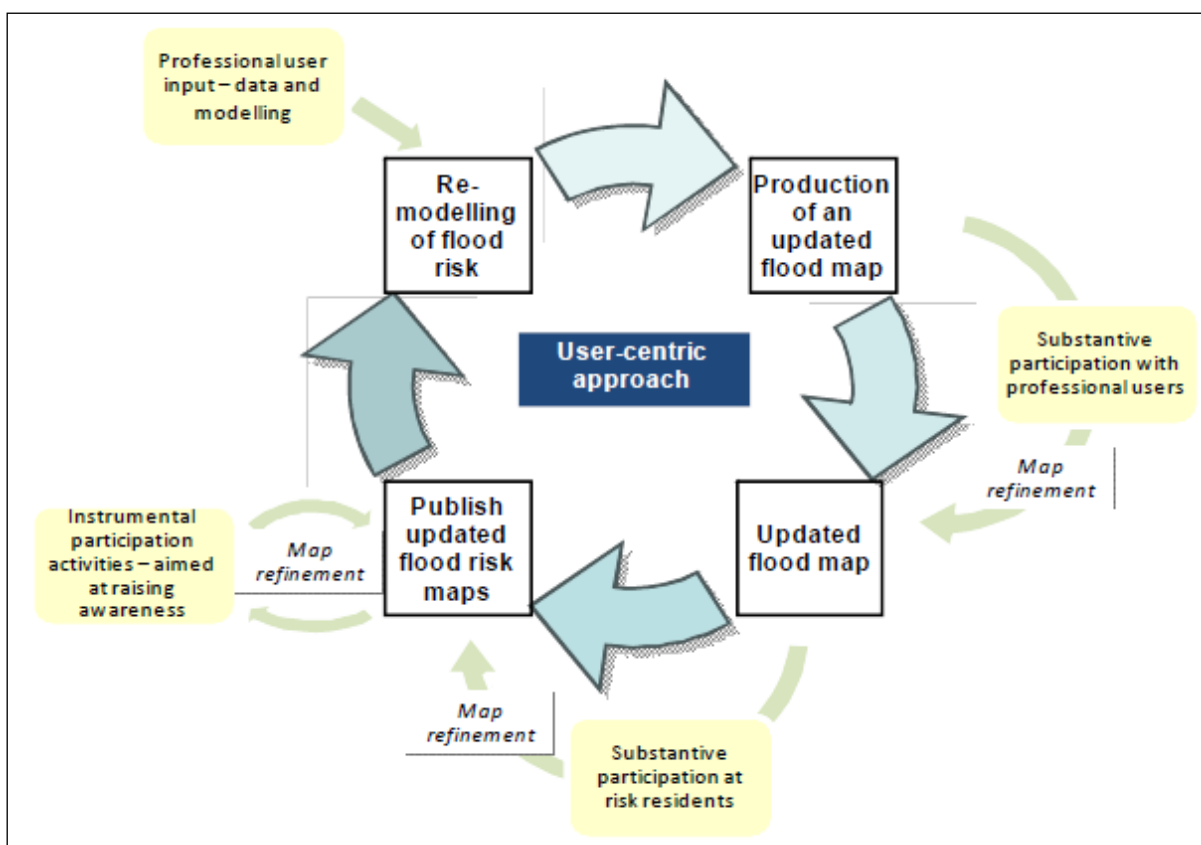


Figure 5.2 Timing of participatory approaches in the risk mapping cycle

Source: Meyer et al. (2011, Figure 9.6)

Dialogue offers an opportunity to explore what can be done in relation to different contexts and objectives of flood risk communications. In its 'Guiding Principles' document,⁶ Sciencewise sets out the main characteristics and focus of public dialogue. For Sciencewise, public dialogue is about:

- talking with the public about ethical and societal issues related to public policy
- the instigators of the dialogue being willing and able to change their minds

⁶ <http://www.sciencewise-erc.org.uk/cms/guiding-principles/>

- getting public and different perspectives to help explore issues, aspirations and concerns when shaping policy
- gathering public experience in science and technology issues

Dialogue could be particularly useful for exploring static risk contexts which are not so focused on direct actions and are more diffuse.

5.5 Examples of flood risk communication techniques

5.5.1 Flood marks

Flood marks and other forms of visualisation can be used to communicate past water levels of historical floods. These can be located on the side of buildings, bridges or on signs. Figure 5.3 shows some examples.

Following the extensive floods of 2002 in central Europe, many communities in Saxony in Germany installed or extended historical flood marks with the objective of maintaining the awareness of the flood hazard at a high level. A survey of companies in the central business district of Dresden revealed concerns that the area-wide installation of these flood marks would lead to bad publicity, which would tarnish the image of the area. Eventually it was decided that flood marks should only be installed on public buildings (Kreibich et al. 2005, p.170). There does not appear to have been any clear evidence to suggest the installation has had a detrimental effect on the area as some feared. Petrow et al. (2006) stated that, with respect to Dresden, it seems to have been helpful to install or extend historical flood marks immediately after an event (such as 2002), as well as implementing flood commemoration days and to carry out regular information gatherings at which the public is informed about precautionary and mitigation measures that they can implement.



Figure 5.3 Flood marks on a lock keeper's cottage at Molesey on the River Thames (left) and signs to show the height of previous large floods in Virginia, USA (right)

In Germany, flood ‘information tables’ have been developed in some locations. These are similar to flood marks. They are often gauge boards with historical flood marks on them, together with other information such as photographs and explanatory information (Figure 5.4).

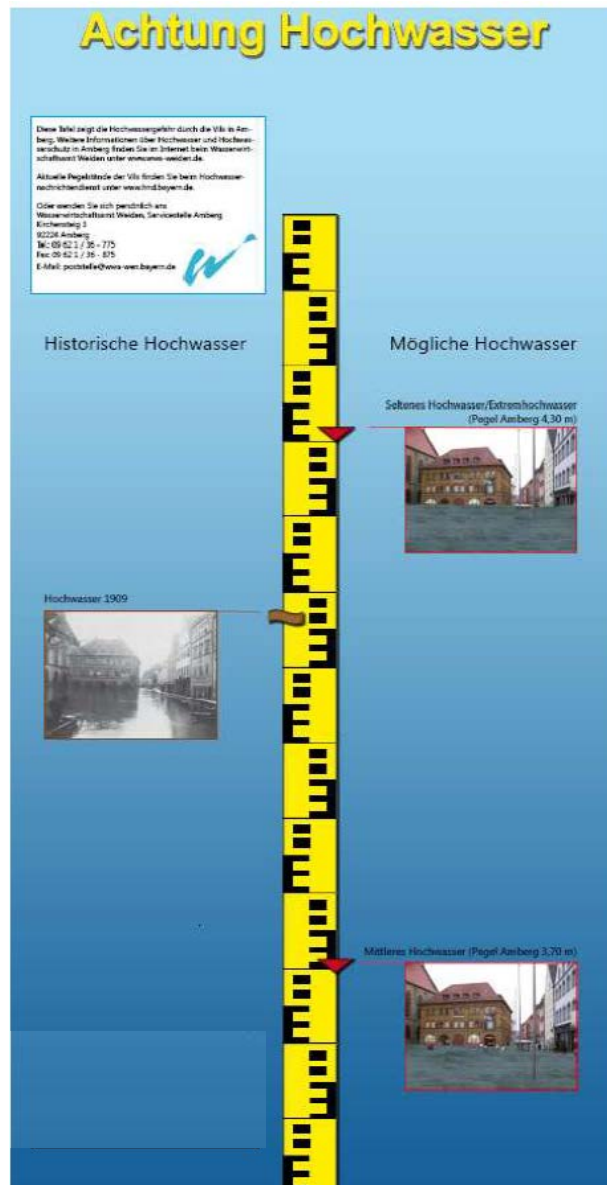


Figure 5.4 Example of a flood information table in Germany

5.5.2 Flood games

Flood risk messages can also be communicated to a variety of audiences through the use of games. These can be in the form of traditional board games such as snakes and ladders tailored to convey messages to emergency planners and insurers on how communities can recover more quickly from serious flooding. One such example is the snakes and ladders game developed by the Living with Environmental Change (LWEC)

at Lancaster University.⁷ The game is suitable for anyone over the age of 10 and is based on real life experiences from the June 2007 floods in Hull.⁸

A number of online games produced in the past 10 years focus on UK flood risk management. It is unclear from the available literature how successful these games have been in helping communicate flood risk management policies and ideas to their intended audiences. One example is 'FloodRanger', an educational game about managing flood defences along rivers and coasts (see Figure 5.5). It costs £29.99 and is aimed at flood defence practitioners, local authorities, insurers, universities and schools.⁹



Figure 5.5 Screenshot from the FloodRanger game

There are also free online games available for both adults and children developed to allow members of the public to understand their specific flood risk and to increase their knowledge about mitigating actions to reduce flood risk.

The 'Crucial Crew What If' game produced by Essex County Council aims to engage young people in a series of interactive games about emergency situations, which includes flooding (see Figure 5.6). It seeks to raise flood risk awareness and forms part of the Council's obligations to engage with a wide range of audiences under the Civil Contingencies Act 2004.

Another free online game is FloodSim¹⁰ which its website describes as:

'an accessible online policy simulation that helps raise public awareness of issues around flood policy and provides feedback to insurers and policy makers about public attitudes towards different flood protection options'.

⁷ <http://www.lwec.org.uk/stories/snakes-and-ladders-rescue>

⁸ More information on the game can be found on the Hull Floods Project website: http://www.lancaster.ac.uk/lec/sites/cswm/Hull%20Floods%20Project/HFP_%20FSL.php

⁹ <http://www.discoverysoftware.co.uk/FloodRanger.htm>

¹⁰ <http://playgen.com/play/floodsim/>

The game was funded by Aviva¹¹ as part of its corporate responsibility strategy in the UK. It puts the player in charge of flood policy in the UK for three years with players making decisions on flood defences, housebuilding and communication of flood risk to the public (see Figure 5.6).



Figure 5.6 Images from the Crucial Crew What If game (top) and FloodSim (bottom)

5.5.3 Flood videos

Flood risk can be communicated through videos hosted on websites and video sharing sites such as YouTube and Video. These videos can provide information and raise awareness of static and live flood risk.

Production of video content may take substantial time and resources to do effectively. It is not guaranteed to be viewed by the audience and the number of views will still depend on the strengths and weaknesses of the dissemination methods used. Typical methods could include flood websites, television broadcasts and social media (for example, Twitter, Google+, Facebook, YouTube, and video and embedded in blogs). The Environment Agency has produced videos on flood risk preparation¹² and on its flood awareness campaign.¹³

Videos can also act as an easily accessible communication method for community groups to convey their own specific flood risk messages. The Lower Severn

¹¹ Norwich Union was Aviva's British arm before 2009 and funded the project in 2008

¹² 'Be Prepared for Flooding', <http://www.youtube.com/watch?v=nZeP-ggJkK>

¹³ 'Flood Awareness Campaign: Warning and Informing', <http://www.youtube.com/watch?v=M7OSqoUuUC8>

Community Flood Education Network group, for example, created a video channel in 2011 to raise awareness of flooding in its area¹⁴ as is part of the Co-FAST (Community Flood Archive Enhancement through Storytelling) project . The channel's videos discuss flood events from 1947 to the present day in Gloucestershire and are narrated by local residents who experienced the events.

5.5.4 Flood maps

Static flood risk maps can be effective in communicating areas that are at flood risk. The Environment Agency also has maps online that show the risk of flooding from rivers and seas; Figure 5.7 shows an example.

There have been some incidences where uncertainty in the results has also been communicated on flood maps. One example is flood mapping carried out for the River Lee in Ireland as part of the Catchment Flood Risk Assessment and Management Study (CFRAMS). This provides an approximate idea of the horizontal uncertainty in the flood extent in the flood map for three annual probabilities (Figure 5.8).

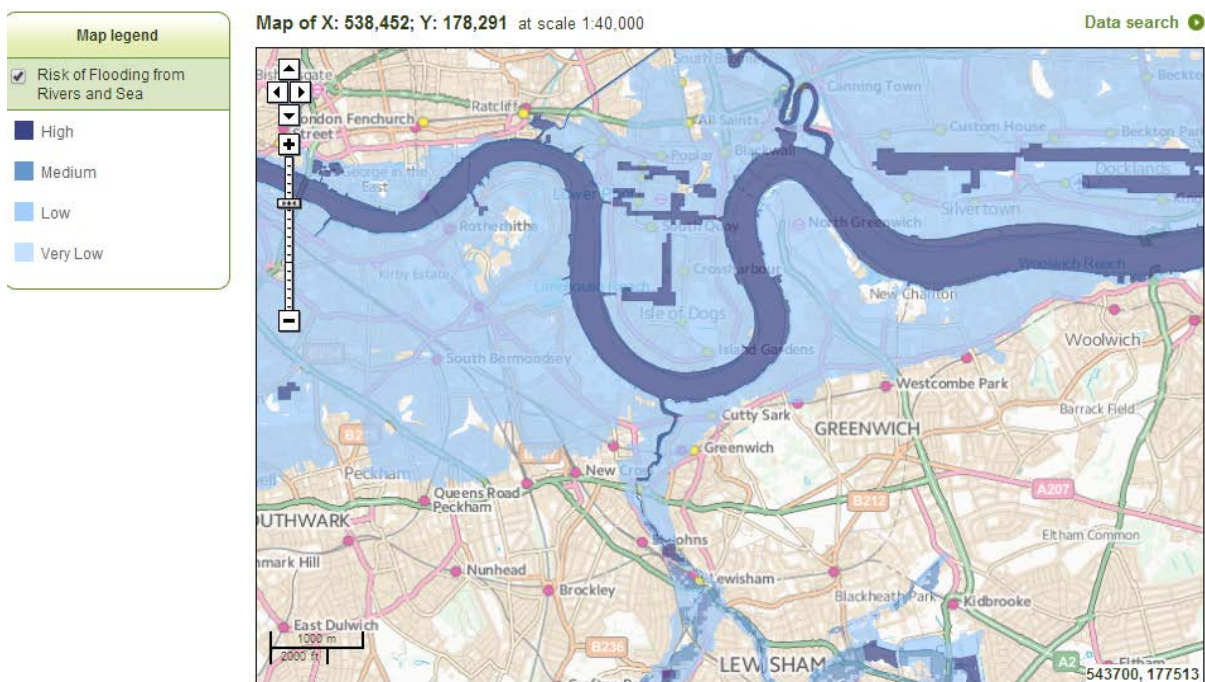
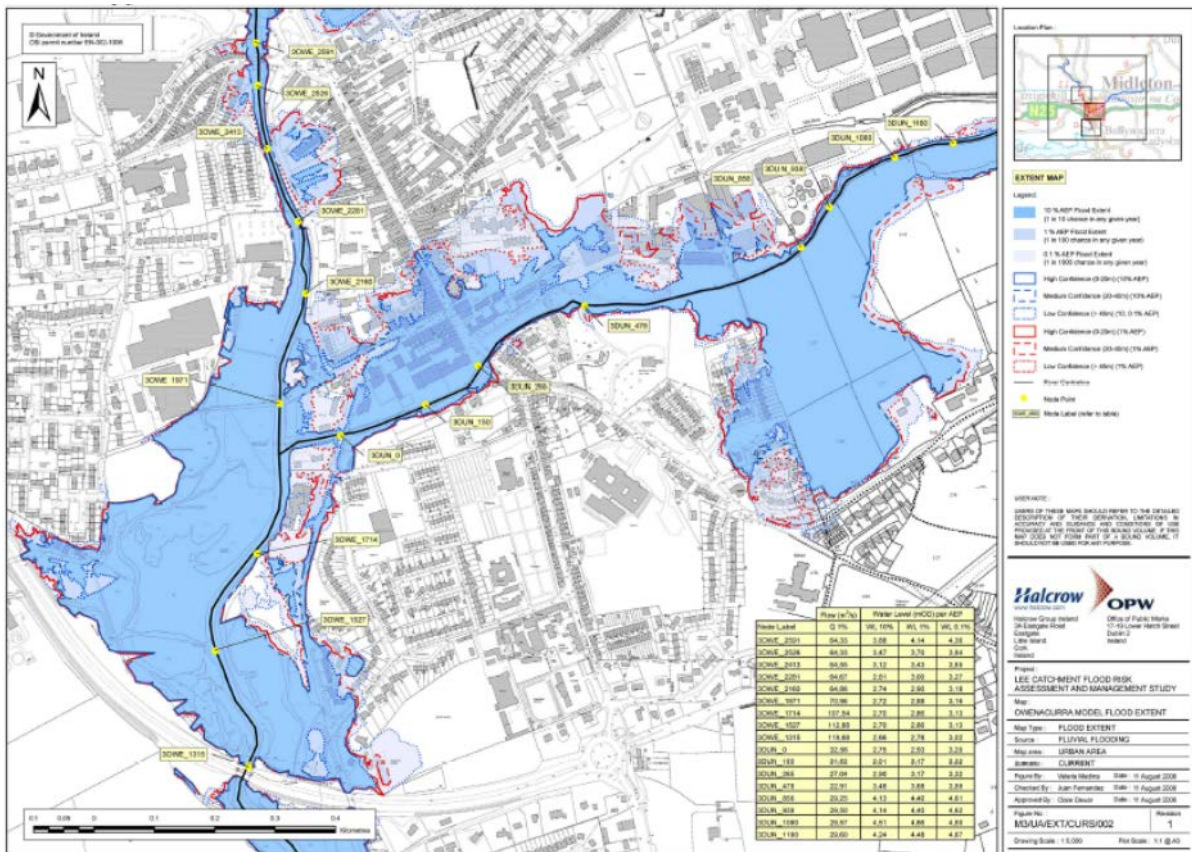


Figure 5.7 Environment Agency map showing the risk of flooding from rivers and seas in London

Source: <http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=538452&y=178291&scale=8>

¹⁴ <http://vimeo.com/channels/cofast/15657750>



- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- High Confidence (0-20m) (10% AEP)
- Medium Confidence (20-40m) (10% AEP)
- Low Confidence (> 40m) (10, 0.1% AEP)
- High Confidence (0-20m) (1% AEP)
- Medium Confidence (20-40m) (1% AEP)
- Low Confidence (> 40m) (1% AEP)

Figure 5.8

Source: et al. (2008)

Flood extent map for the Lee CFRAMS (top) enlarged legend used to show the level

Berry

5.5.5 Infographics

Infographics have also been used by the Environment Agency and other organisations to raise flood risk awareness. The results from a 2013 survey of UK drivers (AA members) on their views of flood risks by the Environment Agency and the AA was developed into an infographic to help communicate the results in a visually appealing way (Figure 5.9, top panel).

Infographics have also been used to present information on the impacts of recent flood events. The Environment Agency did this for an infographic to provide information on the effects of the December 2013 tidal surge (Figure 5.9, bottom panel).

These infographics can then be disseminated through a variety of methods such as social media channels and the printed press.

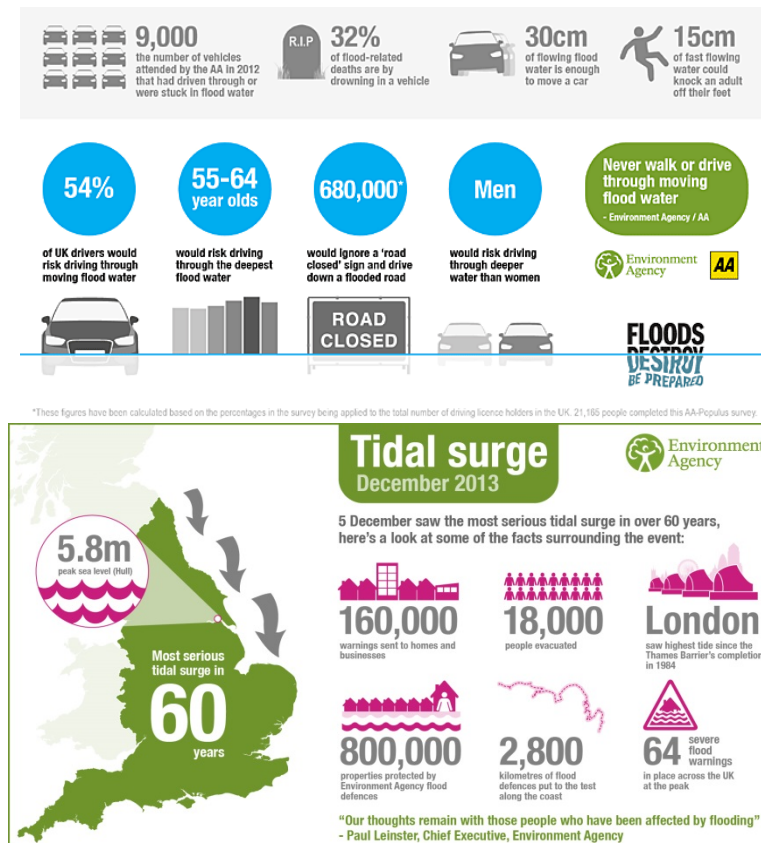


Figure 5.9 Recent flood infographics from 2013

Source: Top panel: Environment Agency and AA infographic from:

<https://www.theaa.com/newsroom/news-2013/dangerous-flood-water.html>

Bottom panel: Tidal Surge infographic from: <https://www.flickr.com/photos/environment-agency/11293529363/in/photostream/>

5.5.6 Flood information events

Flood information events aim to increase flood risk awareness in a specific area and can include flood awareness days, flood exhibitions and flood fairs.

A flood awareness day was held in Norwich in 2006 combining all the emergency and community flood response services.¹⁵

¹⁵ <http://www.4x4response.net/photo-gallery/2006/89-flood-awareness-day.html>

Flood exhibitions can also be used to raise flood risk awareness by members of the public as done by the Thames Barrier in 2011. This event took place as part of the nationwide flood preparation day called Exercise Watermark and included staffed displays on flooding, maintenance and reliability, and how to take action and plan for the future.¹⁶ More recently in 2013 FloodSmart ran a free, week-long photography exhibition aimed to increase awareness of flooding in Chesham.¹⁷ These events occur across the country and may also be known as ‘flood fairs’.

5.5.7 Commercial applications using licensed data

The Environment Agency licenses its flood data to be displayed through a number of value added resellers (VARs). These can include websites such as the BBC and BING maps, and also through a Live Flood Warnings website run by Shoothill.¹⁸

Flood risk messages can also be accessed by members of the public from their smartphones. CH2M HILL¹⁹ has a successful Flood Warnings smartphone app, which has a large audience reach (Figure 5.10). This app is available for free on the iTunes store.²⁰

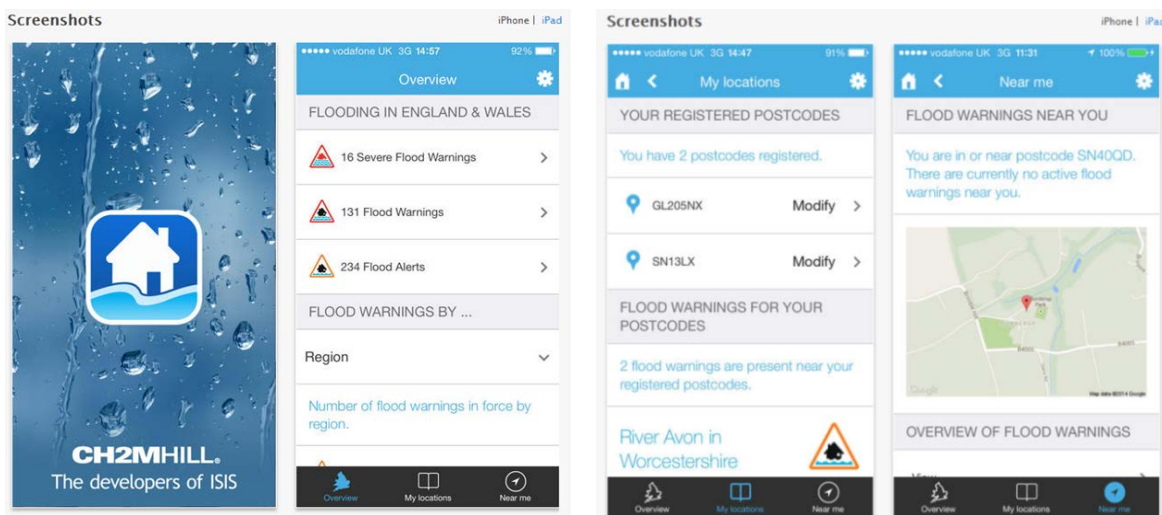


Figure 5.10 Screenshots of the CH2M HILL Flood App for iPhone

Flood data licensed by the Environment Agency are increasingly becoming ‘open data’ under an ‘Open Government Licence’. The data are believed to include real-time river levels and flood maps that could become available as free and commercially reusable data (Arthur 2014).

A Flood Hack event in February 2014, led by Number 10 Downing Street, gathered data engineers and developers together to develop IT solutions to respond to flooding (Lee 2014). Solutions included:

- a method to instantly report damaged flood defences
- a method of pushing out SMS text warning messages to people in flood areas based upon their location to masts

¹⁶ <http://www.tiredoflondontiredoflife.com/2011/03/visit-thames-barrier-flood-awareness.html>

¹⁷ ‘Chesham in Flood: Photography Exhibition’, <http://www.buckscc.gov.uk/events/library-events/chesham-library/chesham-in-flood-photography-exhibition/?e=21021>

¹⁸ Shoothill FloodAlerts, <http://www.shoothill.com/FloodMap/>

¹⁹ The app was created by Halcrow, which was acquired by the CH2M HILL group in 2011.

²⁰ <https://itunes.apple.com/gb/app/flood-alert/id420666016?mt=8>

- a web page with important contact details in the case of a power cut

A full list of solutions along with associated descriptions and links can be found online.²¹

²¹ <https://hackpad.com/UK-Flood-Help-February-2014-QFpKPE5Wy6s>

6 Issues for current flood risk communication practice

While recognising the considerable progress that has been made in recent years in flood risk communication, policymakers, practitioners and members of the public see the need for further improvement. The following list indicates some initial issues emerging from the review.

6.1 Coverage

There are some sectors in society in which people are much less likely to receive information about flooding as they do not use either traditional or new communications channels

Multiple online 'reservoirs' with useful information mean that members of the public cannot find the information they want easily. An alternative would be to have a single, joined up portal.

For some practitioners, this is not seen as really a problem of coverage, but more one of understanding (see below).

'People saying "we weren't told" – but there is a point at which the providers can't do any more, there will always be people who say that they didn't hear the message.' (Key provider interviewee)

6.2 Communicating risk

Failure to implement good practice (for example, in relation to the language of the communication or flood alerts) may be associated with a lack of training for people on the ground.

6.3 Understanding risk

Many practitioners feel that the main problem for the communication of flood risk is about people's understanding of risk. This is associated with 'segmentation' approaches, which suggest that there are some social groups or segments who will never engage with this kind of risk.

6.4 Moving from awareness of flood risk to response

Use of social media suggests a change in relationships between key providers and members of the public, with greater involvement of members of the public in sharing and creating information.

However, there is some doubt about the extent to which social media are actually reflecting a real shift that could lead to changes in response.

6.5 Improving warnings

The research indicates that there is an appetite for probabilistic warnings among members of the public who have experienced flooding. However, there is a need for further research with a broader range of the public to test probabilistic flood warning materials once these have been developed. The research should include both people who have experienced flooding and others who have not to see how their responses differ.

Different forms of probabilistic warnings should be developed by experts in communication and graphic design in conjunction with the Environment Agency and the public.

6.6 Role of dialogue and participation in increasing understanding of and response to flood risks

Some of the issues raised above require practical responses such as staff training. Others could valuably be addressed through public dialogue so as to:

- provide insights to address communications issues (for example, in the case of flood risk maps)
- model dialogue-based risk communication approaches

It is known that dialogue is useful in encouraging engagement with flood risk. So the involvement of local, non-technical individuals to support the development of flood risk communication materials may increase their success (O'Sullivan et al. 2012).

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