

Improving flood warnings: Final report

Improving Institutional and Social Responses to Flooding

Science Report: SC060019 - Work Package 1a



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Author(s):
Dr Clare Twigger-Ross
Amalia Fernández-Bilbao
Sue Tapsell
Prof Gordon Walker
Dr Nigel Watson

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Research Contractor:
Dr Clare Twigger-Ross, Collingwood Environmental Planning, Unit 1E The Chandlery, 50 Westminster Bridge Road, London SE1 7QY.

Environment Agency's Project Manager:
Jacqui Cotton, Science Project Manager

Collaborator(s):
Chris Rose
Pat Dade
Hugh Deeming
Elham Kashefi

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Steve Killeen

Head of Science

Executive summary

This report presents findings from Work Package 1: Improving flood warnings, part of the Improving Institutional and Social Responses to Flooding project. There were four tasks for this work package with the overarching aim of improving flood warnings through a review and synthesis of relevant social sciences literature coupled with an examination of the current flood warning service from a social perspective.

The tasks carried out for this report were reviews of the literature (Tasks 1 and 2) and of current practices (Task 3) using a workshop, questionnaires and interviews with Environment Agency flood incident management (FIM) staff.

The key conclusions of this report are:

- The current flood warning system needs to be re-focussed as a response-based service, that is with the question changing from “How can we warn lots of people?” to “How can effective responses be encouraged from people and what role does flood warning have within that process. Messages need to be focussed on action, enabling people to respond effectively and embedded in a context of collaboration and engagement.
- The current system must deal with diversity of people/floods/places, because it is the variability in these that determines the outcomes of a flood. The types of flood forecast to increase under climate change are those which have rapid onset and unexpected, but are not at the heart of this current service. The people for whom the current system typically works are likely to be those who already have adequate links with systems, resources and officials. Vulnerability can be characterised as disconnection from systems, resources and officials, and the current system is likely to reproduce those vulnerabilities rather than mitigate for them. This means that people with vulnerability characteristics are those least likely to receive a warning from this current service unless there has been specific effort to target those people e.g. some locally based tailored service
- The flood warning system must be integrated to a far greater degree with response and recovery, and planning and awareness. The divisions between the different parts of the flood risk cycle are artificial: each part is only as good as the rest of the cycle. This can only be done through investing in internal and external collaboration and engagement.
- The system is designed from a technology perspective which means that the communication context is ignored. Communication, trust and credibility of the sources of warnings need to be attended to otherwise investment in accurate flood warning may be wasted.
- Staff working in flood incident management need to have clearer permission and support from head office to enable them be able to initiate and continue to generate innovative local collaborative solutions to flood warning and for that practice to be embedded in the organisation.
- Resources and skills need to be re-thought in terms of the balance between technical and social activities.

To improve emergency planning and risk communication, we recommend:

- Working in collaboration with professional partners and community wardens should become a key part of the flood warning service. We recommend that there is a link with earlier work on Civil Contingency Partnerships to establish

baseline of what is working through the Local Resilience Forums (LRF) at present and develop capacity from there.

- The Environment Agency should establish a baseline in each area of what is being done at present in terms of inter-organisational working for flood warnings and work with others to develop an integrated flood warning plan. If there is nothing in place we suggest that the Environment Agency is proactive and invite others to be collaborators.
- Emergency exercises should focus on worst case scenarios, such as flooding at night and at weekends/bank holidays. The Environment Agency should establish with local authorities a series of exercises on worst case scenarios.
- Dialogue around the perception of risk (both probability and consequences) of flooding should be initiated at the national, regional, area and local level with the view to “normalising” the idea of preparing for flooding. This should be undertaken as dialogue if any trust and credibility is to be developed, and to ensure that the Environment Agency is open to information from others, not just data sets. Preliminary work could be carried out with Flood Risk Management and Corporate Communications and external partners to consider how this could be approached, and what sort of campaign would need to be run.

To develop an approach to dealing with the complexity of flood/area/people characteristics, we recommend:

- A focus on people with vulnerability characteristics, where having greater warning would be helpful for example people with mobility problems would be offered earlier warnings. This should be approached through working with affected people (or representatives of groups of affected people) to establish how best this could be done. Work on disability will provide a foundation for this approach and once evaluated should be able to be built on.
- Develop a better understanding of local areas in terms of their different flood/area/vulnerability characteristics to establish the most effective approaches to flood warning in each area. We suggest that each area spends time collaborating with Category 1 responders to develop a picture of that area in terms of social characteristics. Where work on this is already happening e.g. on the development of social vulnerability maps care should be taken that there is an integrated perspective across parts of the flood risk cycle.

To improve the approach to flood warning methods and messages, we recommend:

- Alternative flood warning communication methods such as door-knocking, face-to-face interactions, two-way conversations on the telephone and so on should be assessed on an equal basis to Floodline Warnings Direct (FWD). The feasibility of carrying out flood warning in collaboration with professional partners and community groups should also be assessed.
- The Environment Agency should explore the benefit of working with existing community groups and networks including parish councils, voluntary groups and warden schemes. The Environment Agency should consider the most effective way of working with the community how effectiveness is going to be shared and whether we need more staff in the area offices to engage with local communities and groups.
- Flood warning methods should be linked to awareness raising efforts. Staff should get to know the social characteristics of their area i.e. groups, influential people, networks, demographics and work with local people to raise awareness and do emergency planning. Through those connections appropriate flood

warning methods should be established at the appropriate levels which may be at the level of the community group, organisation, manager or individual householder.

- The warning messages should include information on response. Based on research and experience from past floods, messages could be tested for effectiveness through focus groups with at-risk residents. We recommend that work is carried out to trial the length and nature of messages.
- Floodline should put the actions to be taken on the same webpage as warning information, to make it easier to find out what to do. The webpage and presentation of information should be designed so as to provide information on action in as an immediate way as possible and should be formally evaluated..
- FWD should be improved so that messages could be given in languages other than Welsh and English and its full capability should be explored (its flexibility for localised information). As a first step, we recommend that a discussion is held with the FWD team to find out what is possible within the current system and to ascertain what issues raised by this research could be addressed within the current framework.

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1 Introduction

This report brings together the work carried out as part of Work Package 1 of the project “Improving Institutional and Social Responses to Flooding”.

The overall objective of Work Package 1 was set out as the following:

‘To produce flood warnings that work, so that they are more targeted, matched to the perceptions and behaviours of different social groupings, including vulnerable communities’.

Currently the flood warning system is not reaching enough people who are at risk, and more specifically that it is not reaching people who are most vulnerable over the flood incident cycle. In addition, there is a recognition that one size of flood warning will not “fit all”, both in terms of the characteristics of the flood e.g. rapid response vs. slow onset and in terms of the difference within communities.

In addition, there are new legislative requirements (disability equality legislation) for the Environment Agency to make sure they consider the needs of specific vulnerable groups when delivering flood warnings. These new requirements are a challenge to the ‘one-size-fits-all’ approach and current flood warnings levels of service.

In order to develop recommendations for improving the flood warning service we undertook a number of tasks on this work package:

Task 1: Review existing knowledge and evidence and provide an overview of different types of flood risk (consequences and effects), which differentiates between:

- Flood type, such as slow rising or rapid onset, and source of flooding, such as fluvial, tidal, groundwater.
- Vulnerability characteristics, such as mobility and social variables in deprivation indices, to help consider other ways of segmenting the population.
- Area characteristics, such as urban/rural, building type.

Task 2: Drawing on literatures of risk perception, risk communication and behaviour change, illustrate how people in the different flood risk situations identified from Task 1 might be expected to receive and respond to flood warnings.

A review of relevant literature for these tasks was carried out as part of this Work Package and a short summary of that is included in the first section of this report. The full document is published separately: Twigger-Ross and Fernandez-Bilbao (2008).

Task 3: Drawing on existing knowledge and evidence, develop proposals for targeting flood warnings to people in different flood risk situations.

A review of current practice across the Environment Agency using a questionnaire and follow up phone interviews with Area staff was carried out together with a workshop for Environment Agency flood incident management staff from all parts of the Environment Agency. The findings from those activities are presented as Appendix 2.

The final part of the work was to develop proposals for more targeted flood warnings. As work progressed on this final task it was clear that there was a need to look at the way flood warning is conceptualised as this has influenced current systems and will continue to influence future systems. Given that, proposals for improving the current system have been brought together into three levels which variously challenge the current conceptualisation. These are presented in the next section.

Task 4: Recommend a programme of work to improve on current flood warning systems

The proposals for improving the current system were discussed with the project board and the Environment Agency project managers and a set of recommendations was developed to form the basis of a programme of work.

2 Improving flood warnings

2.1 Introduction

This section sets out the key findings from the literature and current practice review, characterises the current flood warning system and then presents the proposals.

The proposals aim to address some of the issues that have been identified in the research. In general, our research has found that flood warnings are not tailored to local situations, they aren't focused on response (because they are not specific enough), and they don't consider people with special needs. This report also looks at what needs to happen in order for current best practice to be supported by Head Office, shared between areas and embedded in institutional practices so it is not dependent on the work of individuals.

The proposals to improve the flood warning system are grouped into three levels or approaches which provide ideas for what can be done within the current system and constraints as well as longer term approaches which may involve organisational changes and changes in policy direction.

2.2 Key findings from the research review and current practice

The key findings from literature and this research (Fernandez-Bilbao and Twigger-Ross, 2008) indicate that there are certain characteristics of floods, people and areas together with the risk communication context that have implications for flood warnings:

- warning methods need to be varied to reach different people;
- messages need to focus on actions to enable people to respond effectively;
- communication, trust and credibility of warning sources need to be attended to, otherwise these will undermine attempts to improve methods and messages.

Table 2.1: Key findings on flood, people and area characteristics

Characteristics of a flood	
Examples	Implications for targeting flood warnings
Source/type of flood, such as river, tidal, sewer, pluvial ¹	Whether a flood warning is issued (Environment Agency warns for main river, tidal and some groundwater flooding) Lead or available time for a warning; very short for pluvial to several days for some rivers.
Type of catchment, such as small steep catchments or small urban catchments (rapid response) versus larger, flatter catchments	Lead or available time for a warning. In small flashy catchments (such as Boscastle) warning may not be possible so will need to consider alternatives (awareness raising, evacuation exercises).

¹ This term refers to flooding from direct run-off from land or urban areas (<http://statistics.defra.gov.uk/esg/reports/housing/appendd.pdf>) during or following a rainfall event

Depth and velocity	Has implications for the type of response sought and thus the message. Fast flowing and/or deep waters can cause damage to buildings, evacuation may be more appropriate than moving belongings.
Timing: season, time of day	Has 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. It also has 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.
Social characteristics	
Examples	Implications for targeting flood warnings
'Hard to reach' ² groups, such as low income, non-English speakers, tourists, elderly, living alone, disabled, those with visual or hearing impairments	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 are likely to find themselves least connected during a flood.
Lack of social networks	Lack of social networks also affects whether some people receive a warning, such as from a friend or a neighbour.
Lack of awareness/experience of flood risk	Those with prior experience or awareness of flood risk are more likely to adopt flood warning technologies, respond to warnings or take appropriate action on receipt of a warning. Need to consider innovative ways of raising awareness and engaging communities around flood risk.
Area characteristics	
Examples	Implications for targeting flood warnings
Urban versus rural	<p>Flooding in urban areas has implications for the number of people that need to be warned. Also, urban flooding can have multiple sources of flooding, such as happened in Carlisle, which has an impact on whether a flood warning is issued.</p> <p>There are more basement flats in urban areas and more non-English speakers, therefore more people in groups with vulnerability characteristics.</p>
Vulnerable locations such as caravan parks, schools, hospitals	For instance, caravan parks may be highly exposed and have nowhere for people to seek refuge; additionally, residents may not have good knowledge of the area and/or be aware of the risk of flooding. Need to work with caravan park owners to develop flood warning plans.
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. Need to provide advice on what people should do in these circumstances, for example save personal effects, link up with others in the community who have space for them to go to.

² 'Hard to reach' from a flood warning point of view after Tapsell *et al.* (2005) and Shaw *et al.* (2005)

Risk communication context	
Communication context	Implication for flood warning
Risk communications are not passively received; they are filtered, actively interpreted and evaluated in a social context.	Work with communities to develop flood warning systems jointly; for example, Hambledon Parish Council developed a flood warning system run by the council (Hampshire flood steering group <i>Managing flood risks in parishes: a best practice guide</i>)
Trust in the source of communication and its credibility are crucial in influencing how risk communications are received.	Understand that the contact people have with the Environment Agency will have a bearing on whether it is a trusted source or not. Work on developing trust with local communities. Trust is built up over time and needs 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.	Work with informal networks such as community groups to get people talking about flooding. Give talks to clubs for older people, support events that discuss local flood history, and so on.

From the current practice review (Appendix 2 and 3) we found evidence that there is good practice happening at the area level that does allow flexibility in warnings, focuses on the risk communication context and develops relationships with key community members. Members of area flood incident management (FIM) teams are active in working with other organisations and community groups as part of their flood warning and awareness duties. Responses to our questionnaire and interviews and findings of the workshop show that there is awareness in area staff of the importance of knowing their areas and the social groups and working with them to improve the system. Another issue raised by Environment Agency staff at the flood warnings workshop is the need to move from coverage targets to social targets and have less emphasis on increasing FWD numbers. We also found the following issues:

A key conclusion from the research with staff showed that in general Environment Agency staff agree that the 'one-size-fits' all approach followed by the organisation is not effective. This approach: same methods, messages etc is in contrast with a key comment summarising the shared view that "all floods are different"³. Floods differ in their source, depth, velocity, area affected, time of the day, etc, so having one approach for all floods is not going to be the most effective use of resources. It is clear that much of the good practice with respect to community engagement around flood awareness and warning in the areas is down to individuals' contacts and experience. There is a risk that if/ when these people move on all that knowledge and capacity will be lost. It was expressed that there is a need to embed this good practice in the organisation but without being too prescriptive and allowing for local flexibility. Area staff expressed a perceived lack of support in their work from Head Office ranging from lack of written materials, lack of materials in different languages, lack of flexibility in National campaigns and lack of input of the areas in these campaigns. However, from discussions with a member of the national campaign staff it is clear that the issue is more complex, and perhaps at the heart of it lies the lack of distinction at the area level between awareness and warnings, a distinction that is made at Head Office but possibly due to lack of resources is not so clearly defined at the Area level. Awareness focuses on improving preparedness so that when people do receive a warning they are ready to act. The warning system focuses on getting communications right such that people receive a warning. These are of course related and it was felt in Head Office

³ Participant at the Current Practice workshop 24th May

that there is a perception that the awareness campaign can deliver all the communications needed to make the warnings system work which may be due to the fact that resources for awareness are the only resources clearly focussed on communications. It may be that area level frustration with the national campaign is partly because of a mismatch in perception of what support the areas would like to have and what the national campaign is designed to deliver.

A further issue highlighted by the current practice research was that the current national approach works best for a 'typical' flood: slow rising river flood or other events that can be forecast with the current system, such as some tidal surges and flashy catchments that happen in the day. The flood warning service is not designed for other types of flooding, such as flash flooding or surface water flooding. Because of the reliance on detection and forecasting based on river levels and the presence of telemetry, the system is not able to warn of other sources of flooding.

A key issue for improving flood warnings is to stop thinking about the warning as an 'end'. A flood warning should start a chain of actions that will result in people taking action to protect themselves, their family, neighbours or wider community so that there is no threat to life or property. Within the current approach to awareness there is a dual focus: on getting people to sign up to FWD⁴ and increasing preparedness through engagement. However, there is a key performance indicator⁵ (KPI) for recruitment to FWD, which means that considerable resources are targeted at that activity, giving it a higher priority and profile, making it harder for area staff to take a response focus to their warnings. There are far fewer staff resources for working with communities in the areas than for warning and forecasting.

2.3 Understanding the current flood warning service

Overall the research review shows that there are a wide number of variables that should be taken into account in order to make flood warnings more effective in reaching more people, e.g. area, flood, and people characteristics. We know that these characteristics and combinations thereof affect whether:

- a warning is issued;
- a warning is received;
- a warning is understood;
- a warning is acted on;
- the actions are effective.

Taken together it suggests that it is important to understand the current system and how these characteristics are accounted for within that system.

The current practice review gives a view of the current system and what mechanisms are in place to deliver flood warnings. Figure 2.1 provides a schematic representation of our perception of how the Environment Agency flood warning works currently, focussing on the ways in which individuals, professional partners, and representatives of groups may get a flood warning. The boxes in blue are those methods that are currently used by the Environment Agency and are run through the local area office. The boxes in pink are other ways in which a person may receive a flood warning. The

⁴ Floodline Warnings Direct is the automated flood warning message service.

⁵ A key performance indicator is a target that staff are given to achieve. The KPI with respect to FWD is likely to be an area manager's KPI which is then translated into objectives for other staff. Staff performance is evaluated against KPIs and pay increases are related to that performance.

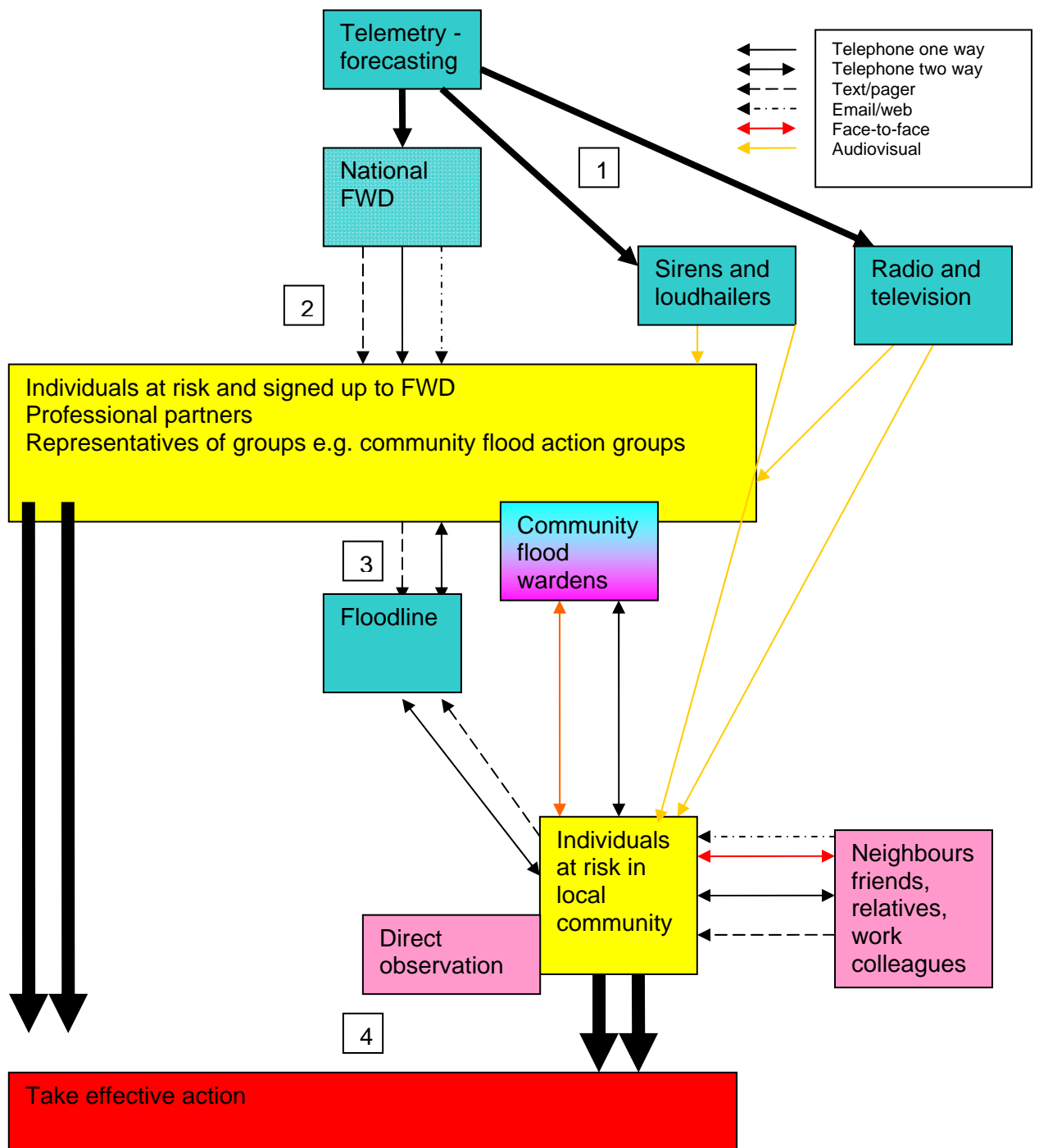
box for community flood wardens⁶ is pink and blue as they are generally supported, but not run, by the Environment Agency.

Within an Environment Agency area a number of flood warning methods will be used, but the primary method for areas considered most at risk is Floodline Warnings Direct⁷ (FWD). FWD, like all flood warning systems, is linked to detection and forecasting (which uses both technical systems and expert judgement) that warns people who are at risk of fluvial and tidal flooding. People who are at risk are invited to sign up for FWD. It is a system that means they can be phoned (landline or mobile), sent texts, paged, or emailed with a warning. The information in the warning does not vary – it will be one of the four flood warning codes and tells people to call Floodline or look at it on the website. Floodline relates to the Environment Agency flooding hotline and the website. Whilst it is nationally controlled there is the ability for areas to put on a locally relevant message which tells people where the flooding is together with some information on what they should do. Finally, the aim is for people to take effective action. The system follows a linear approach with ‘*a number of well accepted processes involved, as follows*’ (Defra, no date):

Detection > Forecasting > Warning > Response

⁶ Community flood wardens refer to people supported, but not directly set up, by the Environment Agency.

⁷ FWD is the primary method for areas with the maximum level of flood warning service .



Key to boxes in Figure 1



Figure 2.1: Environment Agency flood warning system

2.3.1 Limitations of the current system

The current system has a number of limitations which are outlined below.

Coverage of FWD is linked to where there is detection and forecasting, and in 2006/07 51 per cent of properties in the extreme flood outline (those at risk of river or tidal flooding only)⁸ were covered by FWD. FWD is put into an area based on the level of risk (defined as the combination of the probability of flooding (from rivers or the sea) and the number of properties that would be flooded (the current measure for consequences)⁹) together with the ability for telemetry to be in place. The method by which areas will be given FWD is described in the *Flood Warnings Level of Service Work Instructions* (Environment Agency, 2006a). FWD may be put in place, in England, in places where issuing a two-hour warning is possible. This limits FWD to use for flooding where it is possible to have that lead time which does limit it to slow rising river floods or other events that can be forecast with the current system, such as some tidal surges and flashy catchments. Our brief review of recent “Lessons Learned” reports (see Appendix 4) shows that recent serious events have varied from this typical flood.

The two hour flood warning lead time requirement has been questioned (and indeed in Wales the lead time is one hour). For instance the Lessons Learned report of the Boscastle flood (Environment Agency, 2005) concludes on this:

‘The target two-hour lead time for warnings is based on an estimate of the minimum time necessary to obtain the maximum benefit of damage avoided. Research from the US on dam safety, however, shows that up to an hour’s warning can reduce fatalities from sudden flooding from 15 per cent to two per cent.’

Currently, only half of those properties at risk are covered by FWD and of that, between 19 and 56 per cent (national average 30 per cent) are signed up to FWD (Steve Merrett, Environment Agency, personal communication). This limits FWD to only those people who are motivated to sign up. In an area that has FWD coverage, there will be contingency methods of loudhailers, sirens, broadcast methods such as local radio and possibly a community flood warden scheme to cover those people not signed up to FWD. Areas that have been designated as needing a lower level of service will not have FWD, but will have one or other of those methods. People who are part of

⁸ Currently, Environment Agency data on ‘at risk’ areas only covers river and tidal flooding. There is no national map for areas at risk of surface water flooding.

⁹ The Environment Agency is at present conducting a review of the flood risk management project appraisal process. Among other things, this review is looking at whether the number of properties affected is the best measure of consequences.

transient populations, such as tourists and the homeless, will not be reached directly by FWD, although managers of caravan parks or hostels could be signed up to FWD.

FWD focuses on sending messages via technology and so relies on people having and using this technology and the technology being resilient to flooding. There is a technological divide which is likely to increase as a consequence of population trends; for example, the UK population is increasingly ageing and income inequalities are continuing to widen (Walker *et al.*, 2008). Many people do not have access to the internet or other forms of communication (Walker *et al.*, 2008):

“Fifty-one per cent of adults with an income of £10,400 or less have never used the internet, and only 57 per cent of all households in Great Britain are able to access the internet from home (ONS, 2006). For the over 65s, 82 per cent are said to have never used the internet, let alone have access at home (ONS, 2006).”

Further, people who are vulnerable because of low income or older age are not likely to have relevant technology. This limits FWD to those people with the relevant technology and who speak English and/or Welsh. Primary methods can fail or if they rely on electricity this may also fail in a flood/storm event, so any technology needs to be flood/storm resilient. For instance in Carlisle in 2005 power failures affected the automatic voice messaging service (AVM now FWD) and also meant that people were unable to receive warnings from TV or radio. Additionally, in some parts of Cumbria people cannot get good mobile phone signals to receive warnings and many landline phones now rely on mains electricity to power cordless handsets.

FWD relies on people once they receive the initial warning to respond by phoning Floodline or looking on the Environment Agency website to find out more detailed information about their local area. This relies on Floodline working, having up to date and relevant information, and there being enough time to do this. It has limitations for non-English speakers or non-internet users.

The majority of the whole system relies on one way communications which means there is little or no space for people to ask questions, clarify actions etc. It is recognised that there is some capacity in incident rooms for dialogue between Environment Agency staff and professional partners and the public (like the option of speaking to an operator on Floodline) but the point to stress is that this is not at the heart of the system. Further, the opportunities for people to have dialogue about what actions they should take are more likely to happen later on in the flood warning chain and are most likely to happen between neighbours, friends and so on, rather than between members of the public and staff from the delivery organisations.

Although there are methods other than FWD used such as sirens, loudhailers, flood wardens, these are considered as “secondary” methods¹⁰ and from our current practice review although they are used, staff don’t have complete confidence in some of those methods. Methods used to work with people who have vulnerability characteristics are ad hoc, responding to needs within each area, and done with some concern that the work is not endorsed by other parts of the Environment Agency (Twigger-Ross and Scrase, 2006). Because the current FWD system was developed from a technological perspective¹¹ people in general, and specifically people with vulnerability characteristics are not at the heart of this current system, rather processes to warn them effectively only happen reactively, keeping them as exceptions to the current system. We would contend that if those with vulnerability characteristics are put at the heart of the current system then all others will also be reached. For instance, by considering the findings of recent work on the social performance of flood warnings by Tapsell *et al* (2005) which makes recommendations on the most appropriate methods

¹⁰ See *Work Instruction for Flood Warning Level of Service* for details.

¹¹ The current FWD was a response to the limitations of the previous Automatic Voice Messaging service rather than a consideration of the technological and social needs of a warning system.

to reach people with different vulnerability characteristics, for example non-English speakers, people with sensory impairment or those not previously flooded. These were discussed at the current practice workshop and are summarised in Table 1, Appendix 1. A key finding from that research was that face to face interaction was the method that would be most effective with the majority of people with a range of vulnerability characteristics whereas methods relying on telecommunications and technology would be most effective with those who are already connected to services and resources and not those with vulnerability characteristics. Equality legislation is likely to require that the Environment Agency consider specific vulnerable groups when exercising its powers to warn people of flooding, so the need to change the way they warn will be driven both by a desire to have a more effective warning system, and by legislation.

This system has to have an underlying aim to try to reach all individuals at risk, indeed the Environment Agency has a target of reaching 80 per cent of properties within the at risk area with a flood warning (i.e. it will not cover transient populations such as tourists or students). Whilst this is admirable it has perhaps put an emphasis on quantity of people warned rather than looking at how to make sure the warning is understood and acted on. This has focussed on warning individuals in their homes and has made it hard to know how to warn populations who are mobile (e.g. tourists). It is important to consider at what social unit it is most effective to engage in terms of flood warning such that the effectiveness of the flood warning is not dependent on individuals having prior knowledge and experience. For example, for students living in student accommodation it will be most effective for there to be a flood plan for that building which is owned by a warden or someone who is going to be in that position for a period of time. Likewise it makes sense to work with caravan park owners, care home owners etc, which is already happening in some areas (such as Devon and Cornwall).

There is also an issue with the focus of FWD and the current system on protecting property as enshrined in the risk estimates which are a combination of the probability of the flood x the number of houses flooded (FWLoS). The first and foremost objective of a flood warning system should be preventing loss of life and injury. If we imagine an event such as Boscastle in which properties were flooded to the roof in a matter of minutes and where the speed of the flood waters and presence of large debris caused a high risk to life, providing a warning that tells people to move upstairs and move their property may do more harm than good.

Finally, the Environment Agency has a duty to issue flood warnings for specific types of flood. There is frequent debate at meetings and within the Environment Agency about where their remit ends along with concern over how “the public” consider the Environment Agency to be the Agency for Floods. Essentially, they lead on warning for tidal and fluvial floods, are joint partners in terms of response and act as a supporting partner in recovery with a perception that staff can sometimes get involved in recovery efforts that are beyond their remit. This focus on flood warning as the Environment Agency’s sole responsibility means that there is a lack of emphasis on collaboration in other areas where the Environment Agency is not the lead collaborator. It is possible to lead on an action but also to collaborate on that action. Likewise it is possible to be a collaborator, an important “bit player” on other actions. The current system underplays the need for collaboration between professional partners and between professional partners and members of communities even though the Civil Contingency Act provides a structure for that collaboration. The Environment Agency as a Category 1 responder has several main civil protection duties, one of them being ‘*maintaining public awareness and arrangements to warn, inform and advise the public*¹². Two further duties also prescribed for Category 1 responders by the Act are ‘*co-operation*

¹² *Emergency Preparedness*. Guidance on Part 1 of the Civil Contingencies Act 2004, its associated regulations and non-statutory arrangements, p8.

and information sharing¹³. The Civil Contingencies Act has created a 'statutory framework of roles and responsibilities for local responders' (Cabinet Office, no date) that places an obligation on the Environment Agency to work with 'professional partners' in their warning and emergency response duties, but at present this is not reflected within the flood warning system.

2.3.2 Limitations of current messages

Floodline and FWD focus on giving out warnings and these will be one of the four flood warnings: all clear, flood watch, flood warning and severe flood warning. A short message is given out over FWD and is on the website (shown below in italics). Further information can be found by clicking on the icons and also by calling Floodline (bulleted points below).

Flood Watch - *Flooding of low-lying land and roads is expected. Be aware, be prepared, watch out!*

- Watch water levels
- Stay tuned to local radio or TV
- Ring Floodline on 0845 988 1188
- Make sure you have what you need to put your flood plan into action
- Alert your neighbours, particularly the elderly
- Check pets and livestock
- Reconsider travel plans

Flood Warning - *Flooding of homes and businesses is expected. Act now!*

As with Flood Watch, plus:

- Move pets, vehicles, food, valuables and other items to safety
- Put sandbags or flood boards in place
- Prepare to turn off gas and electricity
- Be prepared to evacuate your home
- Protect yourself, your family and others that need your help
-

Severe Flood Warning - *Severe flooding is expected. There is extreme danger to life and property. Act now!*

As with Flood Warning, plus:

- Be prepared to lose power supplies - gas, electricity, water, telephone
- Try to keep calm, and to reassure others, especially children
- Co-operate with emergency services and local authorities
- You may be evacuated

All Clear - *Flood Watches or Warnings are no longer in force for this area.*

- Flood water levels receding
- Check all is safe to return
- Seek advice.

Some Environment Agency staff perceive that members of the public view this system as a set of traffic lights, with each warning indicating an increase in the risk of flooding, with severe flood warning being the most serious. However, people do get issued with severe warnings without being issued flood warnings and vice versa. In addition, not all areas qualify to receive a 'severe flood warning' because this does not just relate to flood risk but also to the number of properties likely to be flooded. Unfortunately, from

¹³ Ibid.

an examination of the actions the “traffic light” perception seems to be reinforced. The actions people are asked to take appear to build on the set before so whilst the warnings are not incremental the actions people are asked to take appear to be.

While the further information does give advice on what people should do, that advice has to be actively sought, with contacting Floodline being the only action given by the initial flood warning. This means that the system is limited to those people who know what action to take on receipt of a flood warning and are able to take that action together with those people who are able to actively seek out information. Knowing what to do in a flood has been found to be a key factor in undertaking protective and damage reducing actions in response to a flood warning and during a flood event. Conversely, not knowing what to do leads to an increase in the stress suffered during the event (Fielding et al, 2007; Carroll et al, 2007). In theory, those who have experienced a flood event should be better prepared to cope with the effects of a subsequent flood.

The messages are very general and it is unclear whether people know what they mean. Because the majority of the system is one way communication there are not the opportunities to ask what, for example, is meant by “safety” in the instruction “move pets to safety”. In addition, ‘safety’ may mean different things in different flood situations or for different properties, e.g. it could be upstairs in a slow rising flood but it could mean evacuation in flash flooding or for a resident in a bungalow. It is clear that given the range of possible flood events and the multiple combinations of other characteristics, e.g. property, people, the same message should not be issued in all cases.

FWD and Floodline only issue messages in English or Welsh, thus limiting their understanding to those who understand English or Welsh. Recent work on the social performance of flood warnings (Tapsell *et al.* 2005) highlights that the current system also does not target disabled people, for instance people with sensory impairment, and other groups. There is now a requirement in law, through Disability Equality legislation, and which has been acknowledged by the Environment Agency in their Disability Equality Action Plan to consider the needs of disabled people. Work is underway to consider the needs of disabled people in regard to flood warning (led by Emma Hayes, FRM Policy).

2.3.3 Conclusion

There are two key issues of context that accentuate the limitations highlighted above:

Firstly, the types of flood that are forecast to increase with climate change are those which have rapid onset and are unexpected, the types of flood that are not at the heart of this current service.

Secondly, the people for whom this system typically works are likely to be those who already have a reasonable level of connection with systems, resources and officials. Vulnerability can be characterised as disconnection from systems, resources and officials, and given lack of focus on that vulnerability then the current system is likely to reproduce those vulnerabilities rather than mitigate for them. The system is designed from a technology perspective without consideration of the implicit model of person/communication system constituted by that technology. This means that people with vulnerability characteristics are those least likely to receive a warning from this current service unless there has been specific effort to target those people e.g. some locally based tailored service.

Taken together these limitations suggest that the current service is designed for slow rising fluvial/tidal floods in predictable catchments where people are motivated to be

signed up to FWD, have the technology and know how to respond. It is a service focussed on getting flood warnings out to people rather than a service focussed on encouraging effective responses from people in floods. This focus on warning was probably and rightly, first driven by the Environment Agency's power to warn. However, we would suggest that this emphasis has become on developing ever better and more accurate warnings with the problem framed as "How do we forecast and warn large numbers of people who are at risk of flooding?". This framing has in part emerged because of the implicit technoeconomic¹⁴ approach that dominates flood risk management which leads to an emphasis on technological solutions ("pieces of kit"). Given this, the focus is, and has been on forecasting¹⁵ and developing FWD as technical projects rather than as part of social systems.

FWD does address that question of how to warn large numbers of people efficiently and that is something valued by staff using the system, but does not, on its own address the more fundamental question of "How can effective responses to flooding be encouraged by the Environment Agency?".

2.4 Proposals for improving flood warnings

The proposals for improving the flood warning service have two key elements:

a. Three levels of change towards a more effective flood warning service

Our recommendations are best expressed as levels of progress towards a more effective flood warning service.

Our intention is that:

1. Each level builds on the previous level but an area might be at different levels for different aspects e.g. messages might be at level 3 while methods are at level 1, and may feel able to move ahead in some areas but not in others.
2. Some areas will be already at Level 2 for some aspects whilst others are not. One key finding from the research is that current practice varies from area to area and therefore for this work to be useful, it will require discussion and engagement by Head Office, regional and area staff who can help take the principles of our findings and translate them into practice.
3. Level 3 is where the Environment Agency should be if it wants to have an effective, integrated flood warning service.

At this stage, we have not taken into account the resources necessary to implement the different levels. We also recommend that some sort of appraisal should be done on the different levels to assess effectiveness.

b. Three aspects of the institution where that change will need to happen for the proposals to be effective

We suggest that change to the flood warning service will need to happen in three areas which we are calling institutional framework, organisation and on the ground.

Institutional framework refers largely to the way FRM is framed and discussed in policy, strategy and guidance documents. Making Space for Water has signalled a

¹⁴ Technoeconomic – the idea that if technical knowledge is rigorously tested and demonstrably proved, then consumption choices will be made rationally is contrasted with sociotechnical – the idea that science is a sociocultural phenomenon and that the technical is always in relationship with wider social, economic and political processes (Guy 2004, p687)

¹⁵ For example, Probabilistic Forecasting Scoping Project

shift from “holding back the water” to “living with flooding” and there is discussion around the concept of resilience.

Organisation and skills base refers to the way the Environment Agency chooses to shape FRM teams, fund flood warning, together with the way the organisation works in terms of communicating internally, (horizontally best practice between Areas but also between Areas and Head Office). The way an organisation is structured gives clues as to what is valued. It is also about what is counted, i.e. what are the key performance indicators. From our current practice review and contact with Area staff there is frustration that the Area teams feel when dealing with National targets together with perceived lack of support and understanding for what is being done at the Area level by those in Head Office.

On the ground refers to what happens in practice, such as the different messages used in flood warnings, local flood action groups encouraged to develop flood plans.

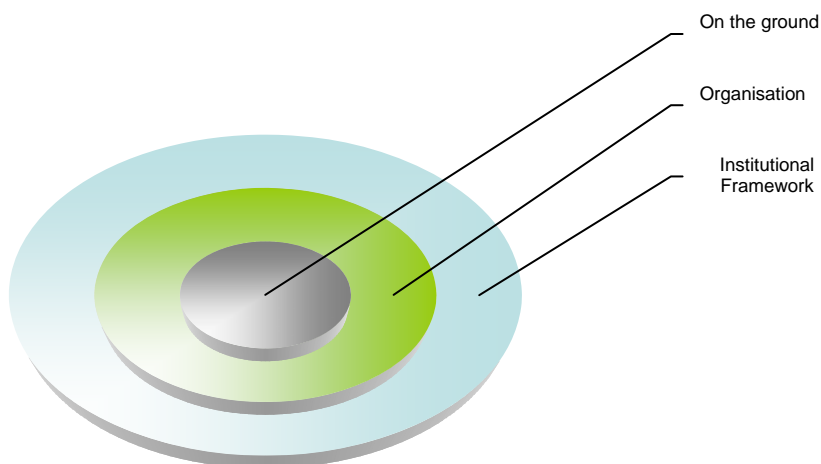


Figure 2.2: Breakdown of institution

Changes in any one of these areas is likely to influence the others and lead to change in other areas. System framework is possibly the most influential as it sets the frame for organisation and on the ground change. We suggest that on the ground changes often remain within that sphere, because of the hierarchical nature of the Environment Agency meaning that good practice does not find its way into the organisation and institutional framework. For example, within the Environment Agency on the ground there are innovative solutions to localised flood warning issues and a number of these were discussed in the current practice review (see Appendix 3). Frequently, researchers find that there are creative, innovative, and above all practical solutions happening on the ground (see Twigger-Ross and Scrase (2006) found examples relating to vulnerability and flooding. However, these solutions remain within that sphere because there is not the organisational structure and ethos, or the system framework to enable general principles to be derived and shared through the organisation. Because of the lack of those supporting structures and policies sometimes a creative idea, often an engagement method is picked up in isolation and unquestioningly spread across all areas. An example would be the use of drop-ins following flooding in the summer of 2007 (Colbourne, 2007). Because of their success in some areas they were taken up as the solution to what the Environment Agency can do following a flood and perhaps implemented without clear consideration for the local context and without consideration of the Environment Agency’s own guidance on *Working with Others: Building Trust With local Communities* (2004).

Levels 1 – Business as usual (with current flood warning investment strategy)

Emergency planning and risk communication

- Collaboration within the Local Resilience Forums and the Civil Contingencies Act will start to have an impact on FRM. Trust and credibility of the Environment Agency will be built up in some areas but again it will be on an ad hoc basis and dependent on key individuals.

Dealing with complexity of flood/people/area characteristics

- Work around the Disability Discrimination Act would continue and put in place provision for people with disabilities. Vulnerability pilot work (led by FIM policy team) will provide practical approaches.
- Work on different sources of flooding should lead to some more integrated approaches.
- Work on rapid response catchments shows different needs for different types of flood.

Approach to flood warning methods

- In this scenario the service stays largely the same with FWD at the centre, with the focus on improving coverage and uptake of the service as currently planned. Secondary methods remain and time put into community engagement remains variable between areas and FIM teams. Focus on internet and electronic methods remains.
- In terms of improving uptake, there has been some piloting using Rose et al's value modes approach and how it might be used to improve the sign up to FWD.¹⁶ This is a positive move because it acknowledges the impact of different values on behaviours.
- In terms of providing a service for floods that do not have two hour lead times, work on rapid response catchments provide some recommendations on what can be done in those situations. It is likely that this work will focus on increasing community resilience and awareness of the risk of flash flooding together with improving emergency planning.
- There is a move towards "community flood warning areas" which are smaller than the current flood warning area and will be based on "communities" rather than rivers/catchments which should avoid duplication of warnings and provide more meaningful warnings.¹⁷ This is a positive step towards focusing the warning service around people and communities

Approach to warning messages

- Some proposed changes to the severe weather warning but no fundamental changes to give more information on how to act in a flood event.

What would be different?

On the ground: A more streamlined FWD service following the development of

¹⁶ See Rose (2008). 'Value mode' strategies applicable to flood issues. In Fernandez-Bilbao, A and Twigger-Ross, C (eds.). (2008) *More targeted flood warnings: A review. Improving Institutional and Social Responses to Flooding Science Report (SC060019) - Work Package 1*. EA/Defra Science Report.

¹⁷ Currently, if someone lives very close to two rivers they will receive a separate warning for each river rather than one warning for the area.

community flood warning areas but this only focuses on the link between detection and warnings. An increased emphasis on sign-up should mean an increased number of people at risk signed up to FWD. Alternative processes for warning/ awareness raising/ emergency response would be tested for “rapid response” catchments. Secondary methods of warning would still be limited.

Organisation and skills base: No immediate change but staff would be involved in Local Resilience Forums to boost collaboration with professional partners. FIM staff would still be stretched and unsupported in any community engagement activities around awareness and warnings.

Institutional framework: There would be no immediate change but ‘on the ground’ changes would be supported by the system, moving it towards a more people-centred service. The structure under the Civil Contingencies Act enables collaboration, but how effective this is will need evaluating more fully. Evidence from the Pitt review suggests it is varied with respect to flooding. However, without a fundamental shift in emphasis at the level of the institutional framework, attempts at change are likely to remain localised.

Strengths: Change is within the existing system, with a focus on increased targets. Incorporates some small steps towards a more integrated, people-focussed service.

Weaknesses: Limited consideration of vulnerability and so those characteristics are reproduced as the current service does not provide flexibility to account for them. If no attempt is made to take into account the needs of different people through the FWD then warnings will not be more targeted. It is unlikely there will ever be 100% coverage of those at risk with FWD so there will always be people without warnings. It is unlikely that 100 per cent of those offered FWD will take it up. In addition, receiving a flood warning does not necessarily lead to undertaking action. Furthermore, changes such as the rapid response work, are happening in response to specific floods like Boscastle and therefore are likely to be piecemeal. The current briefing on Wardens for flooding still puts Environment Agency-initiated warden schemes at the periphery of the flood warning service¹⁸.

¹⁸ “Use of wardens for flooding. Environment Agency briefing note. Katharine Evans

Level 2 – Improving the current service: moving towards a response based service

Emergency planning and risk communication context

- Working in collaboration with professional partners, community wardens and with community flood wardens would be a key part of the flood warning service. Community wardens could be trained in flood awareness as an addition to their existing portfolios. As a general model this would mean working jointly with local authorities/emergency services to develop plans for effective response at the appropriate levels which may mean working with local groups (parish councils, community groups etc), local businesses, housing associations, care home owners to develop emergency flood plans which include flood warning.
- The LRF and related structures will form a focus for linking FRM into the wider emergency planning processes and staff involved in those structures will link with the collaboration that is happening around flood warning. Warnings for all sources of flooding would be integrated, all institutions within an area responsible for different warnings would develop the flood warning plan together.
- Emergency exercises would focus on “worst case” for example flooding at night and at a weekend/bank holiday.

Dialogue and discussion around the perception of risk (both probability and consequences) from flooding should be initiated at the national, regional, area and local level with the view to “normalising” the idea of preparing for flooding. This should not be done in a “marketing” framework but must be undertaken as dialogue if any trust and credibility

Dealing with the complexity of flood/area/people characteristics

- Emergency plans would include consideration of people with vulnerabilities so that they receive appropriate flood warnings as well as having people providing local flood detection information. Because they would be endorsed by a partnership of organisations involved in all aspects of flooding, there would be information about response and recovery within those plans as well (for example where rest centres would be etc). A number of models are currently in place across the Areas (e.g. North Area, North West) together with guidance (e.g. Hampshire Parish Flood Plans). Each area would need to work out what could work best for them within a standard framework. Activity would be appropriate to the levels of flood risk and the vulnerability of populations such that in some areas the flood planning would happen as part of a more general emergency planning process and in other areas there would be dedicated community flood groups focussed on all aspects of flooding. Again there are models of this in place within some existing areas (e.g. North Area, North West).
- People with vulnerability characteristics where having greater warning would be helpful e.g. people with mobility problems would be offered earlier warnings
- Develop a better understanding of the local area and the different flood/area/vulnerability characteristics in order to understand the most effective approaches to flood warning in each area. This could draw on a series of sources of information: strategic flood risk assessments, Census data, meetings with community groups.

Approach to flood warning methods

- FWD would still be at the heart of the flood warning service. However, it would not be considered as the primary method with all other methods as secondary. Each area would need to evaluate the balance of methods. Other methods, specifically, door knocking/face to face interaction, two way conversation on the telephone, etc would be assessed on an equal basis to FWD. Flood warning would be carried out in collaboration with other Category 1 responders.
- The current Environment Agency position on community flood wardens would still be in place, that is, while the Environment Agency supports the community flood wardens their organisation would be carried out through mechanisms other than the Environment Agency local area office e.g. Parish councils and they are likely to still be volunteers, although it may be that existing community wardens could also be involved.
- Flood warning methods would be linked to awareness-raising efforts. Staff would become familiar with the social characteristics of their area (groups, influential people, networks, demographics) and would be engaged with those people to raise awareness and do emergency planning. Through these connections, flood warning methods would be established at the appropriate levels, for example through a community leader (such as a vicar), a charitable organisation with local links (such as Age Concern), managers of care homes, housing associations or hospitals, or through neighbourhoods and social networks, depending on the nature and frequency of flooding in an area.

Approach to the warning messages

- The warning messages would include information on response, starting with the information that is currently available on Floodline so that there would be some indication of what people should do. Whilst this would make messages marginally longer it would reduce the number of stages people have to go through before getting information on what actions to take during a flood. The messages could potentially be tailored to different flood situations. Messages could be tailored for professional partners.
- Based on research and experience from past floods, messages could be tested for effectiveness through, for example, focus groups with at risk residents.
- Floodline would have the actions needed to be taken put onto the same webpage as the warning information to make it more straightforward to get details on what actions to take. Different types of flood warning would be clearly distinguished from each other.
- FWD would be improved so that messages could be given out in languages other than Welsh and English. It should be possible for people to sign up to receive a message in a language they understand.
- Messages would include information about hazards specific to that type of flooding, such as debris in a fast-flowing flood, contamination in a sewer flood.
- FWD would be able to feed back if the warning was or was not picked up so that an area would know if people had really “received” the warning. If the warning was not picked up then another would be sent.

What would be different?

On the ground : More streamlined FWD. More people at risk signed up to FWD and so more people receiving warnings for those floods that have the lead time. Alternative processes for “rapid response catchments” and surface water flooding. More engagement with local community members around emergency planning and flood planning to include flood warning. Use of different community groups in different areas as appropriate to the local situation (for example there may be community wardens in one area, or a local charity may be active in another)

Organisation and skills based: Staff supported to carry out community engagement around flood plans and flood warning. Staff developed to work effectively in collaboration with professional partners within the framework of the Local Resilience Forum. Better links developed between Head Office and areas and the facilitated exchange of best practice. More resource into staff with relevant skills.

System framework: Clear lead from policy for a service that combines technology (FWD, Floodline) with social engagement (working in collaboration). This would also require a change in terms of how flood warning levels of service are designed so that they can be used to support the needs of people with vulnerability characteristics.

Strengths: There would be a process for working with people with vulnerability characteristics and therefore more people should receive better warnings. Collaboration with communities and professional partners is recognised as a core part of delivering the flood warning service.

Weaknesses: This option would still largely rely on individuals at the area level and their contacts and experience and is still based on a linear model and the existing service.

Level 3 – Developing a flood warning service focussed on encouraging effective responses

Emergency planning and risk communication

This level stresses the need to develop a flood warning service that is focused on response. This would mean that the starting point would be “How can effective responses to flooding be encouraged by the Environment Agency?” with a supplementary question of “How can the flood warning service contribute to encouraging effective responses to flooding?” The focus would be the flood incident management service and building capacity for increased resilience rather than on a flood warning service in isolation.

Working in collaboration with professional partners would be at the heart of the flood incident management system. A core group of staff from relevant organisations would work together, as appropriate to ensure that communication, trust and knowledge was built. This core group would work through the FRM cycle, each taking a lead for different aspects of that cycle. Given the move towards the Environment Agency having a strategic overview of all flooding there will be even more need to establish collaborative working.

This core group would link into the Local Resilience Forum, and emergency and community flood/emergency planning more generally. This core group would have a number of paid community flood wardens (or possibly community wardens) linked with it who in turn would be linked to networks of voluntary groups and volunteers who would play a key role in delivering flood warnings and in providing flood detection information. This core group would work to develop plans for effective response at the appropriate levels which may mean working with local groups (parish councils, community groups etc), local businesses, housing associations, care home owners to develop emergency flood plans which include flood warning.

Dealing with the complexity of flood/area/people characteristics

Level 2 would be in place. In addition, more prominence would be given to cross institutional teams who would know the characteristics of their area and spend time liaising over data and responsibilities. Data on characteristics of the people in areas would be useful beyond flooding to other aspects of Environment Agency and Local authority working.

Flood warning methods

FWD would be one of a number of methods for warning people and would not be classified as the only method to be used for a “Maximum” level of service as is currently the case (Work Instruction, Flood Warning Levels of Service 2006). Improvements to FWD as per Option 2 would be made to maximise its effectiveness based on the experience of those working at Area level, but the networks of community flood wardens and volunteers would disseminate warnings to local people, specifically those with vulnerability characteristics.

Flood warning messages

Messages would have been improved as per level 2. Messages would be part of a more interactive service. Flood warning becomes a two way communication: recipients are able to ask questions/ clarification.

What would be different?

On the ground: More people receiving flood warnings and greater access to information around appropriate action due to the greater numbers of people engaging

with different levels of local communities. The network approach should provide a more flexible and responsive flood warning service which could deal better with a range of types of flooding. More streamlined FWD. More people at risk signed up to FWD and so more people receiving warnings for those floods that have the lead time.

Organisation and skills based: More staff involved in collaborative working with other delivery organisations, including the voluntary sector. Embedding of flood warning into work to develop greater community resilience across a range of emergency situations. Paid community wardens – it may be that existing paid community wardens could have flood risk awareness added to their portfolio. Cross-organisational flood incident management teams. Staff core skills to include understanding the social performance of warnings, working in collaboration and working with volunteers. Agreements between organisations at National level including with voluntary organisations.

Institutional framework: Organisational and cultural change that reflects a people centred approach to flood warning embedded in flood incident management. The language of flood incident management will be centred around encouraging effective responses. The organisation will be comfortable as collaborators within FIM. Regional and Head Office staff and documentation would reflect this cultural shift towards a system with much more diffuse boundaries with other organisations.

Strengths: This option would not necessarily focus on certain types of flooding, that is, those events for which a warning can be provided. The focus would be on helping people/communities to help themselves, for example, what signs to look for in a flood, how to respond. The Environment Agency would not necessarily lead on this and it would move away from a defensive position, that is, 'not responsible for some types of flood' to a more collaborative approach to increasing resilience. There may be significant gains in embedding flood awareness and warnings work through work to improve community resilience to all types of emergencies.

Weaknesses: Will take time, a shift in focus within the Environment Agency and Defra, and other organisations. This would also take up resources (which could be reallocations rather than new resource) to put in place and would require more staff with the relevant skills.

2.5 Conclusions and suggested programme of work

The key conclusion from our work is that the current warning system needs to change from a warning based system to a response based system, that is, the question needs to change to become "How can effective responses to flooding be encouraged?" and following that "What is the Environment Agency's role in that?".

Further, the current system does not deal with diversity in terms of people/floods/places and yet it is that very diversity (often reduced to "context" or "local variability") that become crucial to know as it is what determines the outcome of a flood.

Finally, the flood warning system needs to be integrated to a far greater degree with response and recovery work as well as planning and awareness work for it to be truly effective. The divisions between the different parts of the flood risk cycle are artificial, each part is only as good as the rest of the system.

From our levels of change we have drawn out specific recommendations which are largely at Level 2 but in the direction of Level 3 change. These are presented below:

In order to improve the emergency planning and risk communication context we recommend:

- Working in collaboration **with professional partners and with community wardens** becomes a key part of the flood warning service. We recommend establishing a baseline of what is working through the LRFs and develop capacity from there.
- The Environment Agency establish baseline in each area of what is being done at present in terms **of interorganisational flood warnings** and work with others to develop an integrated flood **warning plan**. If there is nothing in place we suggest that the Environment Agency is **proactive** and invite others to be collaborators.
- Emergency exercises should focus on worst case scenarios such as flooding at night and at weekends/bank holidays, and the Environment Agency should establish with local authorities exercises to cover worst case scenarios.
- **Dialogue and discussion around the perception of risk** (both probability and consequences) from flooding should be initiated at the national, regional, area and local level with the view to “**normalising**” the idea of preparing for flooding. This should be undertaken as dialogue if any trust and credibility is to be developed, and to ensure that the Environment Agency is **open to information from others, not just data sets**. Preliminary work could be carried out with communications teams and key external partners to consider how this could be approached. What sort of “**campaign**” would need to be run?

To develop an approach to dealing with the complexity of flood/area/people characteristics we recommend:

- People **with vulnerability characteristics** where having greater warning would be helpful e.g. people with mobility problems would be offered earlier warnings. This should be approached **through working with affected people (or representatives of groups of affected people)** to establish how best this could be done. The current work on disability will give pointers and once evaluated should be able to be built on
- Develop a better understanding of local areas and the different flood/area/vulnerability characteristics in order to understand the most effective approaches to flood warning in each area. As recommended in the vulnerability paper (Twigger-Ross and Scrase, 2006) we suggest that each area spends time in **collaboration with Category 1 responders** developing a picture of that **area in terms of social characteristics**. Where work on this is already happening, care should be taken to ensure there is an integrated perspective across parts of the flood risk cycle.

To improve the approach to flood warning methods and messages we recommend:

- **Alternative flood warning communication methods** such as door knocking/face to face interaction, two way conversation on the telephone, etc should be assessed **on a equal basis to FWD**. The feasibility of carrying out flood warning **in collaboration** with professional partners and community groups should be assessed.
- The Environment Agency should work to better understand the benefit of working with existing community groups and networks including parish councils, voluntary groups, warden schemes. The Environment Agency should consider what is the most effective way of working with the community, how effectiveness is going to be shared and whether **they need more staff in the**

area offices with enough time and skills to engage with the local communities and existing groups.

- **Flood warning methods** should be linked to **awareness raising efforts**. Staff should get to know the social characteristics of their area (groups, influential people, networks, demographics) and should be engaged with those people to raise awareness and do emergency planning. Through those connections **appropriate flood warning methods** would be established at **the appropriate levels** which may be at the level of the community group, organisation, manager or individual householder.
- Warning messages should include information on response. Based on research and experience from past floods, messages could be tested for effectiveness through focus groups with at-risk residents, for example. **We recommend that work is carried out to trial the length and nature of messages.**
- Floodline should have the actions needed to be taken put onto the same webpage as the warning information to make it more straightforward to get details on what actions to take. **The webpage and how information is presented is should be evaluated and designed so as to provide information on action in as an immediate way as is possible.**
- FWD should be improved so that messages could be given out languages other than Welsh and English and its full capability should be explored (its flexibility for localised information). **As a first step we recommend that a discussion is held with the FWD team to find out what is possible within the current system and to ask how much could be done to address some of these issues within the current framework.**

Appendix 1: Warnings workshop analysis

This section provides an analysis of the workshop held on 24 May 2007. The objectives of the workshop were to:

- share initial research findings with Environment Agency staff involved in flood warning and awareness at area, regional and national levels of the organisation;
- collect evidence of current practice on flood warning;
- share experiences and views;
- collect feedback and responses on initial findings and interim conclusions.

A workshop report was circulated to participants which was intended to be a record of the day. This section provides a more in-depth analysis of the workshop sessions.

Sharing experience of flood warnings

Workshop participants were asked to share positive and negative experiences of giving flood warnings.

Positive experiences

Most positive experiences centred around three key areas that were closely linked:

- awareness, preparedness and pre-flood activities;
- working with communities and professional partners;
- having good knowledge of their area.

The link with awareness and 'pre-flood' work undertaken by the areas came out quite strongly in some of the points raised under this question. For instance one of the positive experiences was:

'Building up relationships and having conversations around flood issues before the event'

Two related points were raised as positive experiences: where there has been recent flooding, registration to FWD normally increases and people that live in areas that are flooded frequently respond better to flood warnings. Other important aspects of pre-flood work are undertaken in partnership with community groups and professional partners and were mentioned under things that work well: regular exercises and planning with professional partners, treating community groups (both flood specific or not) as professional partners and participation in community plans and working with local parishes on flood plans.

Knowing their communities was another positive experience as it allows Area staff to provide warnings for specific areas such as caravan sites or industrial areas. Rural communities were mentioned as having a good understanding of flooding. Another related aspect of the relationships with professional partners is the need to share data particularly with local authorities.

In terms of positive comments related to flood warning methods, it was highlighted that FWD is faster than the old service and has a capacity to send 8,000 messages in 25

minutes. Relationships with local media and particularly local radio stations were also mentioned as positive experiences.

Another positive experience that was reported is that '*some people take appropriate action on receipt of a warning*' which is important as it reminds us that a flood warning is not an end in itself but should lead to people taking steps to protect themselves and their property.

Negative experiences

Regarding problems they had experienced there was more variety of themes:

- the 'one size fits all' approach
- warning messages
- relationships with professional partners and the public
- lack of alternative methods (other than FWD)
- flood characteristics
- technical issues

Several people used terms such as 'blanket coverage', 'one size fits all' or 'broad brush' to refer to the current Environment Agency approach to flood warnings and awareness. One of the comments was that this approach does not allow Areas to do the work they would like and that it does not enable certain groups of people to respond to warnings, and that more local knowledge is needed. Two related comments were that the 'broad brush' approach is responsible for low FWD registration and that it does not work to target the areas most at risk. The lack of other flood warning methods, that is, alternatives to FWD, was another issue mentioned.

Two negative comments referred to the impacts that visible flood defences have on their work: people assume that they are safe and in some cases, this has led to de-registration from FWD (such as in Carlisle). There is a need to raise awareness of residual risk.

The language used in flood warning messages was also highlighted as a negative aspect: for instance the words '*move yourself*' have been interpreted as '*evacuate*' when this was not the intended meaning. Two comments highlighted that this has also happened with professional partners organising evacuations based on these messages because they receive the same messages as the public.

Another issue linked to this but also to the comments about the '*one size fits all*' approach is that because warning messages are standard, the same words are used in different situations and thus may mean different things because of the '*lack of flexibility in the system*'. The 'broad brush' approach was criticised yet again in relation to the '*overload of warnings on professional partners*'. This happens because professional partners receive a flood warning every time one is released for a group of properties that are in the area they cover. Confusion with the flood warning codes - flood watch and severe flood warning was mentioned as an issue.

Two issues related to contextual factors were raised: the time of the day and where people are when the Environment Agency issue a warning and whether people ignore the warning if they are not perceived as being authoritative enough.

Several technical issues were raised: limited lead time to issue warnings when flooding occurs, not being able to express the level of probability or confidence in flood warnings, dependency on river levels and not rainfall to issue warnings and linked to this, the uncertainty in storm forecasting.

Risk communication

Following a presentation which focussed on flood warnings as a form of risk communication, there was a brief question and answer session followed by a discussion. The main question asked by participants was whether the researchers were aware of other organisations that had to deal with similar issues of communicating risk to the public. Some examples included the US FEMA (Federal Emergency Management Agency) who have to warn the public about floods, hurricanes, earthquakes and electricity companies who warn their customers about power cuts, risk of electrocution and so on during emergencies such as flooding.

Key points from the discussion included:

- increase in complexity to their work
- different types of flooding
- flooding in the context of other day to day risks and emergencies
- working with other organisations
- sharing best practice and data

One of the issues the discussion raised is that taking recommendations from the risk communication research could make their work more difficult. The size of the geographical areas they cover and the density of population in some areas are seen as barriers to knowing their communities. How to target specific groups such as transient populations (e.g. tourists in coastal areas) was another issue raised. As well as complexity within regions, differences between regions were also highlighted. The issue of data needs was again raised in the discussion and a national project looking at providing a database of people at risk was mentioned. Another issue that increases complexity is that floods are different, e.g. by time of the day they happen or by source.

The need for more resources in the Environment Agency's Areas to do their work was mentioned again and the need for this work to be centralised by providing a means for sharing best practice, for instance where there are similar communities in different areas. '*Sharing the issue*' with other organisations such as the fire brigade was also suggested as a possibility for communicating risk. Another point raised with respect to professional partners was whether they should receive the same warnings as the public (which they currently do) or whether they should only receive 'severe flood warnings'.

Some issues with warning messages were raised; for instance, '*You may be at risk*' is sometimes interpreted by the public as not being at risk. Other issues mentioned were that flooding is one risk amongst many (such as health scares) and that some people do not sign up for FWD because they obtain information elsewhere and do not want to be part of another database.

Barriers in the organisation were also identified; for instance, one of the requirements for effective risk communication is trust in the organisation that provides the warning. A participant commented that it is very hard to rebuild trust once it has been lost by, for example, '*sending contradictory letters to the same members of the public*'. Another issue raised is that the '*Environment Agency doesn't explain enough about the technology they use*' to members of the public.

Two further issues were raised in relation to the Environment Agency's flood maps: the data is not consistent and is sometimes poor quality, but is translated into a general 'at risk' message even though levels of risk vary. Another point raised was that there is no consistency between areas covered by FWD and the flood maps on the Environment Agency's map.

Range of methods

This session was split in two parts. The first part followed a presentation on different types of flood events based on characteristics of the flood, the area and the people. A summary table entitled *Highest social performance flood warning methods* was circulated. This table looked at which flood warning methods are more appropriate for different groups of people/characteristics and so on (see Table A1.1).

Table A1.1: Highest performance flood warning methods (from Tapsell et al., 2005)

Recipient characteristics	Highest performing <u>individual</u> methods	Highest performing <u>broadcast</u> methods	Highest performing <u>community</u> methods
Age:			
16-34	<ul style="list-style-type: none"> • Door knocking (by authorities) • Flood wardens • Letters/leaflets • Landline telephone by operator • AVM • Integrated dial-and-listen and AVM systems • Automated water level alerts linked to telephone • Voice and text messages (mobile) • E-mail • Centrally activated in-home alert systems 	<ul style="list-style-type: none"> • Dial and listen services (such as Floodline) • SMS Cell Broadcast¹⁹ • TV broadcast • TV crawlers²⁰ • Radio • Radio Data Systems²¹ • Centrally activated local radio alerts • Broadband internet 	<ul style="list-style-type: none"> • Mobile loudhailer • Flood sirens (no voice capability) • Dedicated public address systems
35-54	<ul style="list-style-type: none"> • Door knocking (by authorities) • Flood wardens • Letters/leaflets • Landline telephone by operator • AVM • Integrated dial-and-listen and AVM systems • Automated water level alerts linked to telephone • Voice and text messages (mobile) • E-mail • Centrally activated in-home alert systems 	<ul style="list-style-type: none"> • SMS Cell Broadcast • Radio • Radio Data Systems • Centrally activated local radio alerts • Broadband internet 	<ul style="list-style-type: none"> • Mobile loudhailer • Flood sirens (no voice capability) • Dedicated public address systems
55 and over	<ul style="list-style-type: none"> • Door knocking (by authorities) • Flood wardens • Letters/leaflets • Landline telephone by operator • AVM • Integrated dial-and-listen and AVM systems • Automated water level alerts linked to telephone • Centrally activated in-home alert systems 	<ul style="list-style-type: none"> • TV broadcast • TV crawlers • Radio • Radio Data Systems • Centrally activated local radio alerts 	<ul style="list-style-type: none"> • Mobile loudhailer • Flood sirens (no voice capability) • Dedicated public address systems
SEG:			
A, B	<ul style="list-style-type: none"> • Door knocking (by authorities) • Flood wardens • Letters/leaflets 	<ul style="list-style-type: none"> • Dial and listen services (such as Floodline) • SMS Cell Broadcast 	<ul style="list-style-type: none"> • Mobile loudhailer • Flood sirens (no voice capability)

¹⁹ Cell Broadcast (CB) is a mobile technology that allows messages (currently of up to 15 pages of up to 93 characters) to be broadcast to all mobile handsets and similar devices within a designated geographical area. The broadcast range can be varied from a single cell to the entire network. <http://www.cellbroadcastforum.org/whatisCB/index.html>

²⁰ Information running along the bottom of the TV screen during programmes, such as CNN 'Breaking News'

²¹ This technology allows stations to transmit additional types of information via encoded digital signals that can be received and displayed by the user's radio. For instance: an RDS-capable radio can display the title and artist or current song playing, local traffic information, an advertiser's phone number while a commercial is playing and so on. <http://radio.about.com/library/bldef-108.htm>

Recipient characteristics	Highest performing <u>individual</u> methods	Highest performing <u>broadcast</u> methods	Highest performing <u>community</u> methods
	<ul style="list-style-type: none"> • Landline telephone by operator • AVM • Integrated dial-and-listen and AVM systems • Automated water level alerts linked to telephone • Voice and text messages (mobile) • E-mail • Centrally activated in-home alert systems 	<ul style="list-style-type: none"> • TV broadcast • TV crawlers • Radio • Radio Data Systems • Centrally activated local radio alerts • Broadband and dial up internet 	<ul style="list-style-type: none"> • Dedicated public address systems
C1, C2	<ul style="list-style-type: none"> • Door knocking (by authorities) • Flood wardens • Letters/leaflets • Landline telephone by operator • AVM • Integrated dial-and-listen and AVM systems • Automated water level alerts linked to telephone • Voice and text messages (mobile) • Centrally activated in-home alert systems 	<ul style="list-style-type: none"> • SMS Cell Broadcast • TV broadcast • TV crawlers • Radio • Radio Data Systems • Centrally activated local radio alerts 	<ul style="list-style-type: none"> • Mobile loudhailer • Flood sirens (no voice capability) • Dedicated public address systems
D, E	<ul style="list-style-type: none"> • Door knocking (by authorities) • Flood wardens • Letters/leaflets • Landline telephone by operator • AVM • Integrated dial-and-listen and AVM systems • Automated water level alerts linked to telephone • Centrally activated in-home alert systems 	<ul style="list-style-type: none"> • Radio • Centrally activated local radio alerts 	<ul style="list-style-type: none"> • Mobile loudhailer • Flood sirens (no voice capability) • Dedicated public address systems
Language:			
English speaker	<ul style="list-style-type: none"> • Door knocking (by authorities) • Flood wardens • Letters/leaflets • Landline telephone by operator • AVM • Integrated dial-and-listen and AVM systems • Automated water level alerts linked to telephone • Voice and text messages (mobile) • E-mail • Centrally activated in-home alert systems 	<ul style="list-style-type: none"> • Dial and listen services (such as Floodline) • SMS Cell Broadcast • TV broadcast • TV crawlers • Radio • Radio Data Systems • Centrally activated local radio alerts • Broadband and dial up internet 	<ul style="list-style-type: none"> • Mobile loudhailer • Flood sirens (no voice capability) • Dedicated public address systems
Non-English speaker	<ul style="list-style-type: none"> • Flood wardens • AVM • Integrated dial-and-listen and AVM systems • Automated water level alerts linked to telephone • Text message (mobile) • Centrally activated in-home alert systems 	<ul style="list-style-type: none"> • SMS Cell Broadcast 	<ul style="list-style-type: none"> •
Disability:			
Hearing Difficulties	<ul style="list-style-type: none"> • Door knocking (by authorities) • Flood wardens • Letters/leaflets • Text message (mobile) • E-mail 	<ul style="list-style-type: none"> • SMS Cell Broadcast • TV broadcast • TV crawlers • Broadband internet 	<ul style="list-style-type: none"> •

Recipient characteristics	Highest performing <u>individual</u> methods	Highest performing <u>broadcast</u> methods	Highest performing <u>community</u> methods
	<ul style="list-style-type: none"> Centrally activated in-home alert systems 		
Visual Difficulties	<ul style="list-style-type: none"> Door knocking (by authorities) Flood wardens Landline telephone by operator AVM Integrated dial-and-listen and AVM systems Automated water level alerts linked to telephone Voice messages (mobile) Centrally activated in-home alert systems 	<ul style="list-style-type: none"> Dial and listen services (such as Floodline) TV broadcast Radio Radio Data Systems Centrally activated local radio alerts 	<ul style="list-style-type: none">
Mobility Difficulties	<ul style="list-style-type: none"> Door knocking (by authorities) Flood wardens Letters/leaflets Landline telephone by operator AVM Integrated dial-and-listen and AVM systems Automated water level alerts linked to telephone Text message (mobile) E-mail Centrally activated in-home alert systems 	<ul style="list-style-type: none"> Dial and listen services (such as Floodline) SMS Cell Broadcast TV broadcast TV crawlers Radio Radio Data Systems Centrally activated local radio alerts Broadband internet 	<ul style="list-style-type: none">
Learning Difficulties	<ul style="list-style-type: none"> Door knocking (by authorities) Flood wardens Landline telephone by operator 	<ul style="list-style-type: none"> TV broadcast Radio Centrally activated local radio alerts 	<ul style="list-style-type: none">
Flood experience:			
Flooded	<ul style="list-style-type: none"> Door knocking (by authorities) Flood wardens Letters/leaflets Landline telephone by operator AVM Integrated dial-and-listen and AVM systems Automated water level alerts linked to telephone Voice and text messages (mobile) E-mail Centrally activated in-home alert systems 	<ul style="list-style-type: none"> Dial and listen services (such as Floodline) SMS Cell Broadcast TV broadcast TV crawlers Radio Radio Data Systems Centrally activated local radio alerts Broadband and dial up internet 	<ul style="list-style-type: none"> Mobile loudhailer Flood sirens (no voice capability) Dedicated public address systems
Not flooded	<ul style="list-style-type: none"> Door knocking (by authorities) Flood wardens 	<ul style="list-style-type: none"> Radio 	<ul style="list-style-type: none"> Mobile loudhailer Dedicated public address systems

The issue of '*investing time before a flood*' was raised again; because of limited resources, it is important that the public know what to do when they receive a warning. Those who have been previously flooded should in theory be better prepared to respond to another event, but a participant expressed concern that '*people often expect the next flood to be no worse than the last flood or worst flood in the past*'.

Lack of resources was further raised to justify the approach of targeting those at highest risk who flood more frequently. But a problem with this approach was raised by another participant who said that those who are rarely flooded or flooded once in their lifetime would expect the same level of service as people who are frequently flooded. A number of participants criticised current Environment Agency performance targets

because these focus on achieving higher coverage of FWD (more people signed on to the service) rather than improving the flood warning service.

Another criticism of the risk-based approach is that the degree of confidence in levels of risk varies, for instance, between rural and urban areas because of the complexity of urban hydrology.

The second part of this session asked two specific questions related to using a range of methods:

- What is already in place in the Environment Agency to allow this?
- What needs to be put in place?

What is already in place?

There was a general agreement that a range of flood warning methods are needed. A key issue raised is the need for good quality data particularly on where certain groups/people are located. It was suggested that the '*Civil Contingencies Act could provide the framework for data sharing between agencies*'. Related to this, some progress has been made on Community Risk Registers held by local authorities. The need for a greater understanding of different social groupings in the areas, these groups' perceptions of flooding and the changes in population was also raised.

Regarding other methods that are already in place, local wardens that focus on most vulnerable people and Neighbourhood Watch community message systems were mentioned. Current use of broadcast agreements, such as those with local radio stations, was also mentioned and found to be particularly useful as these methods allow for tailoring of messages in contrast to FWD. Loudhailer routes are also in place in some areas.

Awareness was raised along with issues on letters sent out nationally, such as timing and lack of flexibility of the content. The need for a greater focus on awareness was also highlighted by participants who were critical of the Environment Agency's focus on coverage of FWD. Making awareness a performance indicator was suggested.

Participants also suggested that Environment Agency Area team should get together to make representations to Head Office. Secondments of Head Office staff to the Areas were suggested as a possible way of developing understanding of area work.

What needs to be put in place?

More resources or making better use of existing resources was one of the suggestions, and the recognition that different areas may need different resources. More use of other groups such as community groups and professional partners was suggested as a potential resource. Working with Local Resilience Forums was also mentioned, and that national government should help with data availability in relation to the Civil Contingencies Act and the Community Risk Register.

Engagement and community planning to improve preparedness was suggested by participants: '*there is a need for 'upstream' engagement (the culture of preparedness) through community emergency planning, not just flood planning*'.

Lack of knowledge on what to do on receipt of a warning and being able to undertake action were highlighted as areas that needed improvement by several participants: '*there must be processes in place to help those warned to act effectively on receipt of the warning*'.

Changes in the culture of the Environment Agency were also suggested, in particular moving from being '*not socially focussed: engineering, data monitoring, science*' and directing more focus to social performance targets rather than to numerical targets only. A related issue is that there is currently no effectiveness measure for the different flood warning methods. Linked to this was more quality in the approach; providing a more targeted warning service was suggested instead of just increasing coverage. Increasing '*internal communication: learning, practice, understanding Areas*' and more flexibility and support from Head Office for the areas were suggested as potentially positive changes.

Overall framework

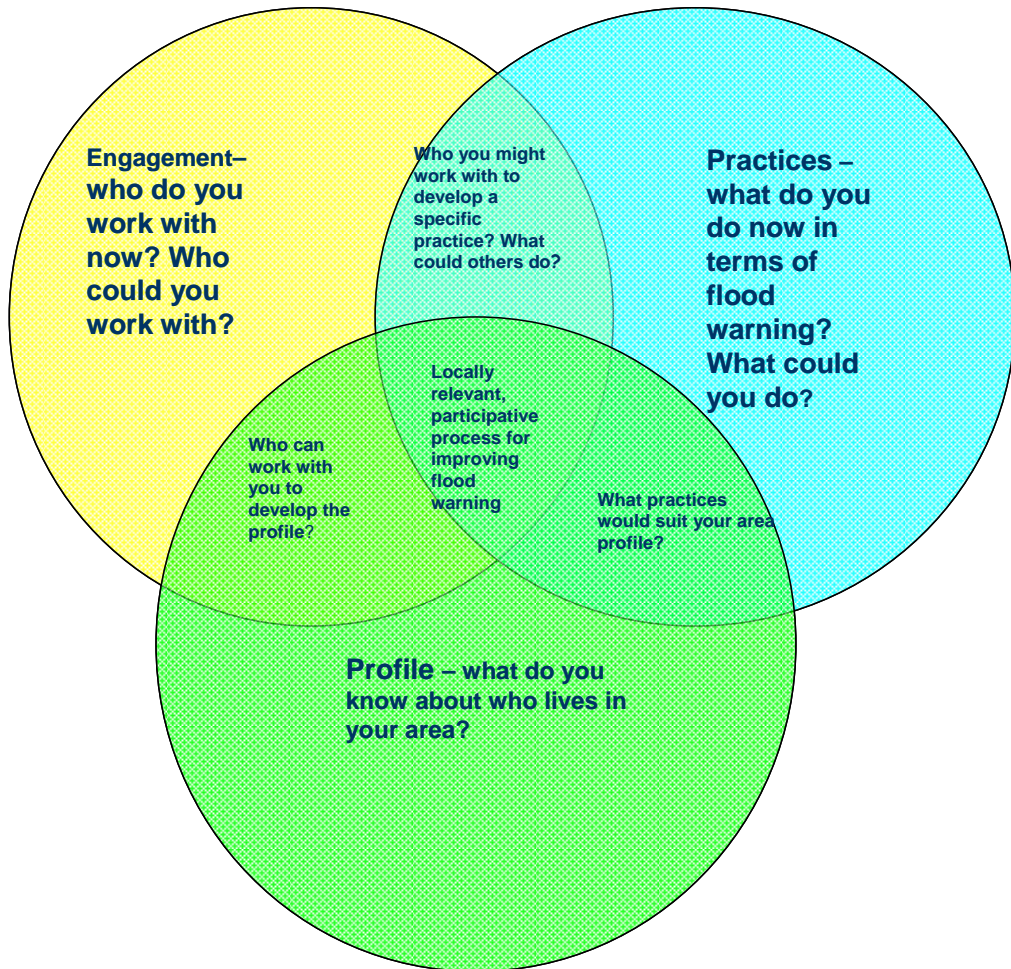
A suggested framework for improving flood warnings was presented (see Figure A1.1 below). The framework was based on the interim findings from the research and literature review. The framework consisted of three overlapping aspects: knowing their area, practising appropriate engagement and tailoring flood warning practices.

The initial response to the proposed framework was in general positive, but some participants had reservations about the usefulness of the framework and the way it would be implemented by the Environment Agency.

Summary of findings from flood warnings workshop 24 May 2007

- Links between warnings, awareness and preparedness- we should not focus just on warnings there is a need to build relationships and do work before the flood. In addition, warnings should not be an 'end' but should start a chain of actions.
- Need to move from coverage targets to social targets, from a 'quantity' to a quality approach, i.e. providing more targeted warnings and improving awareness and people's knowledge of what to do rather than increasing numbers on FWD.
- Participants agreed with the need to know their areas. Data needs have to be resolved and this could be by working with community groups and professional partners.
- More flexibility and support for areas is needed from Head Office as well as a way of exchanging good practice.

Figure A1.1: Framework



Appendix 2: Current practice of flood warnings in the Environment Agency

This section reviews current practice of flood warnings at the area level. In particular, we aimed to gain more understanding of the following:

- the range of flood warning methods used by the areas and how they decide on which method to use
- types of messages that are delivered
- awareness
- which organisations and/ community groups they work with
- what is working well and not so well
- what support would they like from the Environment Agency to improve their approach to flood warnings

The main focus is on warning the public and not on technical aspects such as forecasting. However, this section touches on some technical aspects as they have been mentioned by participants in the research.

This section brings together and analyses three related sources of information:

- A questionnaire survey of area Flood Incident Management (FIM) staff covering flood warning, awareness, and how they work with communities and other organisations undertaken in April 2007.
- Follow-up interviews with seven area staff in July-August 2007.
- A workshop focussing on flood warning methods and messages with Environment Agency staff held in London in May 2007 (analysis included in Appendix 1 of this report).

The questionnaire survey and the workshop were carried out in April and May 2007 respectively and thus ahead of the extensive summer floods. The follow-up interviews were conducted in July and August and although only one of the areas where staff were interviewed experienced flooding, the recency of these events may have had some influence on other responses.

Methodology

As mentioned above, three different sources of information have been analysed and brought together in the results section. Information was collected through:

- A questionnaire to flood incident management staff
- Follow up interviews with respondents to the questionnaire
- A workshop with Environment Agency staff

Questionnaire to FIM staff

A questionnaire included at the end of this section was sent to flood incident management staff at the area level. A total of 14 responses were received. However, the responses are not wholly comparable, as in some instances staff from an area

completed the questionnaire but in others, the questionnaire was filled in jointly by several areas in a region. The following table shows the number of questionnaires returned for each region.

Table A2,1: Questionnaires returned by Environment Agency staff

Region	Number of questionnaires returned (areas)
Anglian	3 (Central, Eastern, Northern)
North East	2 (Dales, Ridings)
Midlands	1 (all areas)
North West	2 (Central, North)
Thames	1 (all areas)
Southwest	2 (Devon and Cornwall, Wessex (North))
Southern	1 (all areas)
Welsh	2 (Northern, South East)

The responses give a picture of current approaches to flood warnings, methods used and what staff perceive to be working well. In addition, the questionnaires provide information on flood awareness, how staff work with communities and other organisations on flood warnings and awareness, and the support the areas would like from Head Office (HO) in order to improve their work.

Follow-up interviews

Seven interviews were conducted in July-August 2007. The interviews were aimed at following up some of the answers given to the April questionnaire and exploring some of the key issues emerging. Interviews were conducted over the phone and lasted approximately 30 to 45 minutes. Notes taken during the interviews were written up, then sent back to the Environment Agency staff involved to check for accuracy and completeness. Some of the general questions included were:

- What is the most used warning method in their area? How do the different methods work- in tandem or different areas/ people?
- Most used approach to warnings?
- How do they decide which method to use?
- What messages are sent via each method?
- Do you think there could be improvements to the method/ message?
- Working with community groups/ professional partners?
- Support needed from Head Office (HO)

Workshop

A workshop involving Environment Agency staff took place in London on 24 May 2007. The workshop focussed on flood warnings and particularly on warning methods and communication of risk. The programme was made up of four short presentations together with small group and plenary discussions. The objectives were to:

- share initial research findings from the review of literature and R&D (Fernández-Bilbao and Twigger-Ross, 2008) with a range of area, regional and national staff working in flood warning and awareness;
- collect evidence of current practice in flood warnings;
- share experiences and views;
- collect feedback and responses on findings and interim conclusions.

A workshop report was sent to participants and further analysis of this workshop is presented in the previous appendix.

Analysis of questionnaire responses, interviews and workshop findings

Thematic analysis was undertaken of the three separate sources of evidence. Using a thematic analysis approach allows links between concepts to be developed and interrogated. The findings are reported by drawing out the key themes across the three methodologies employed.

As described above, three different methods for the data collection were employed in order to achieve a more complete picture of current practice of flood warning at the area level. The use of more than one research method is known as triangulation. Triangulation is commonly employed to *'provide a more complete set of findings than could be arrived at through the administration of one of the methods alone'*²².

Findings

Findings are presented by key themes under several headings and cover:

- flood warning methods used, what works well, potential improvements
- working with communities and/or other organisations
- approach to awareness, what works well or not, work with communities and/or other organisations
- experiences of the recent floods
- support from Head Office that the areas would like and questions or comments
- flood warning methods used

A key message from the workshop was that the 'one size fits all' approach does not work and the Environment Agency should use a range of methods. The 'broad brush' approach was criticised and participants recognised the importance of having a range of methods to warn different people in different circumstances. Linked to this is the need to know their area, as this is key to targeting flood warnings: mobility of population, presence of transient populations and caravan parks, the main ethnic groups and their perception of flooding and how they can be warned.

The following table shows the distribution of questionnaire responses on what methods are used in the areas. Not surprisingly given the current Flood Warning Level of Service (FWLoS) work instruction, all the areas use FWD and all participants in the follow up-interviews declared that FWD is the most used method.

Table A2.2: Flood warning methods used by the areas

Methods of flood warning used	FWD	Flood wardens/local community representatives	Sirens	Loudhailers	Local radio	TV	Other
Number of responses using method (total of 14)	14	14	10	12	14	11	Floodline Door-knocking Family getting warnings for vulnerable people.

²² Bryman, A. (no date) in Encyclopaedia of Social Science Research Methods, Sage Publications. Available: <http://www.referenceworld.com/sage/socialscience/> Accessed: 3/10/07

Choice of flood warning method

The interviews explored how these methods are used, whether in tandem or in different areas. In all instances, FWD is the preferred method by the Environment Agency to issue flood warnings. Other methods, particularly sirens, loudhailers and local TV and radio, are used either to complement FWD or in areas where the service is not in place. Local radio is considered an effective media to distribute flood warnings to large areas. However, one respondent qualified this by explaining that this is only effective when the flood is 'big news' (North East Region, Dales) or there are several flood warnings in place. A small event which causes one or two flood warnings would usually be forecast once and there is the risk that the station will turn to national programmes afterwards.

Generally, the method used depends on the area and whether it is serviced by FWD which in turn depends on levels of risk and number of properties, as set out in the Flood Warning Level of Service (FWLOS) work instruction mentioned by several interviewees. From the interview responses, FWD is seen as a good method and a clear improvement from AVM. There was also concern that alternative methods are not very effective, such as sirens or loudhailers.

Different methods are not generally used to target different groups and the selection of methods is based on technical capability. There is one exception (below) in which one interviewee said their area uses community members to warn very elderly residents in sheltered accommodation.

Face-to-face communication of flood warnings

Face-to-face communication was mentioned at the workshop as an effective way of communicating flood warnings. All respondents said that they work with flood wardens²³ and community groups. The general feeling is that these groups are useful. Flood wardens are sometimes used as a secondary method or in places where there is no other method, though it is not advised (by the Environment Agency) to use them as a primary method. In general, the responses indicate that the Environment Agency provides support to these groups or individuals, such as information, administrative support (such as printing), templates for community flood plans or direct phone access to the emergency room, but the groups run themselves. The role of these groups varies; some provide information to the Environment Agency such as river levels, but in general they are used to reinforce warnings given by the Environment Agency and knock on doors. One participant explained that they do not issue warnings through flood wardens, whose role is more to reinforce the message and explain what the warning means to other members of the community. Maintaining the contact with these groups, such as through telephone calls or regular meetings is considered key by several people.

'...they don't have Environment Agency flood wardens (health and safety issues) but the Environment Agency gives community groups support, often through parish councils, so when the operational flood warning level is reached they also give warnings to the community group wardens. This means the designated wardens can decide if they are going to take further action, for example knock on doors early if there is a potential flooding situation. The community group wardens have a direct line to the incident room and that enables dialogue with people who are aware and understand the issues.'
(Interview, North, North West Region).

Another interviewee commented that as part of work to improve community resilience to emergencies in his area, flood wardens would be set up. These wardens would have

²³ 'Flood wardens' generally mean 'community flood wardens' and not Environment Agency flood wardens.

direct numbers to the emergency room and would also have knowledge of where vulnerable people were located in their community and would be able to link with emergency services. Similar groups have been set up in the North area of the North West Region, particularly following the January 2005 flooding. These groups were originally set up for flooding and some of them then moved on to other emergencies.

One possible issue raised is that this approach may not be suitable for all communities, as it relies on extensive local knowledge and flood wardens knowing their community. It was suggested that this could work quite well in small communities, but its applicability to larger areas/towns would be more difficult.

Targeting different groups and communities

In terms of targeting different groups, one staff member mentioned an example of a disabled lady in their area who asked for a family member to be registered with FWD; in the instance of a flood, the family member would receive the warning and check that she was ok or help her if required. However, this was an isolated example and not a common practice in that area. The same person explained that in one area in particular, flood warnings go to one community member who is then in charge of warning the residents, some of which are very elderly and may be confused or frightened by receiving a warning. They also use the same approach in sheltered accommodation where for instance the building manager, who usually lives on site, receives the warning and warns the residents.

'A relationship has developed following older residents feeling alarmed by direct flood warnings; thus, a community member has taken on the role of being a flood warden. The flood warden receives all flood warnings on behalf of the community members at risk and informs them as appropriate. Similarly, in some sheltered accommodation sites, a block of flats and bungalow site, the manager (who usually lives on site) gets the warning and they pass it on to the residents. This seems to work quite well but has not been tested by a major flood.'
(Interview, Devon and Cornwall, South West Region)

It was also mentioned that the new community flood warning areas will increase the number of flood warning areas and should make warnings more meaningful for communities and more targeted. In particular, a respondent explained that current flood warning areas can be too large and do not allow for targeted information. However, another interviewee said that providing more locally targeted warnings would realistically not be possible in his area, as there is only one duty office and the team covers a very large area.

Flood warning messages

Messages sent via each method

A question on which messages were sent out by the different warning methods was not included in the questionnaire, but was asked in the follow-up interviews. In most cases, participants agreed that the same message went out by all methods. The messages are standard national messages based on Environment Agency flood warning codes²⁴.

²⁴ The Environment Agency issues four warning types which 'are not issued as a sequence of messages. They are used, as appropriate, to indicate the impact of flooding in a given area' (Environment Agency, 2005b, p7). These warnings are:

- Flood Watch (Flooding of low lying land and roads is expected. Be aware, be prepared, watch out!)
- Flood Warning (Flooding of homes and businesses is expected. Act now!)
- Severe Flood Warning (Severe flooding is expected. There is extreme danger to life and property. Act now!)
- All Clear (Flood Watches or Warnings are no longer in force for this area).

Source: www.environment-agency.gov.uk

One interviewee explained there are some differences in the level of flood warning that the public and professional partners sign up for: professional partners, the media and certain members of the public (such as farmers) sign up to receive flood watches. In some cases, flood watches have been found to be confusing to the public who think of them as flood warnings or flood alerts, but they are issued when river levels are still very low. The issue of confusion over warning codes was mentioned by another participant: she felt that people sometimes don't understand the difference between flood warnings and flood watches.

Issues with the flood warning codes

Confusion with the different warning codes was raised as an issue by several participants in the interviews, questionnaire and at the workshop, particularly on the meaning of 'flood watch' and 'severe flood warning'. An Environment Agency staff member from the Sussex area mentioned that in the recent flood, the media have referred to flood warnings as flood alerts and highlighted that it would be useful to use a language understood by the recipients.

'There tends to be confusion over the flood codes in general and the website can be very confusing when looking to see what flood warnings are in force. Floodline and the access to information can also be very confusing and time consuming if people do not know the quick dial codes for their area.'
(Interview, North, North West)

The Environment Agency was also perceived to have had a 'traffic lights' approach to flood warnings, though this was changed because people would wait for the red to take action. Environment Agency staff's experience is that some people still think this way with the new service and expect a four-stage warning that will go from flood watch to severe flood warning in the event of a flood.

'We changed from 'traffic lights' service because people would wait for the red to take action. People still think like that with the current system and expect a four-stage warning that will go from flood watch to severe flood warning if there is a flood. The media have talked about the four-stage service as well which adds to the confusion. For instance, in Pickering 50-60 properties were flooded but only a flood warning was issued, there were complaints that a 'severe flood warning' should have been issued. But the original guideline is that if there are more than 100 properties in an area then a 'severe flood warning' is issued. This was contested by Wales where there may be areas with a few properties but high risk to life as they may be flooded to first floor level, so they have a dispensation to use severe warnings based on risk to life.'

(Interview, Dales, North East Region).

Information and content of the flood warning message

One respondent said that the warning messages do not provide enough information about how to respond, so more awareness of what to do during a flood is essential. The set content of the messages is also an issue; for instance, one participant used the example that 'move upstairs' is not an appropriate instruction for those who live in a bungalow. There is also the issue of potential misinterpretation: a participant in the workshop mentioned that 'move yourselves' was sometimes interpreted as 'evacuate' instead of just moving upstairs, for example. A further issue raised is the tone of the message which may sound patronising to recipients:

'For instance, 'move people and pets' is not appropriate if we are only expecting one inch of water. The standard messages sent by FWD or by fax may sound patronising to recipients. Being able to edit the messages would allow for better targeting of services.'

(Interview, Dales, North East Region).

Other problems with the messages received by professional partners were highlighted at the workshop; in particular, professional partners may be overloaded with warnings because they receive a warning every time one is issued to the public. Sometimes they can also reinterpret warnings and organise an evacuation when it is not really needed.

What is perceived as working well?

This section summarises Environment Agency staff's perceptions of what is working well in terms of flood warnings.

Flood Warnings Direct (FWD)

Overall, 12 of the questionnaire responses mentioned FWD as working well in some capacity. Of those 12, six said it was working well overall, four said it worked well with professional partners and/or with those signed up to it, one said it worked well *"with the back up/reinforcement of local flood warden schemes"*, and two said the speed and effectiveness of the new system *"saves at least 30-40 minutes in getting a flood warning out, as no longer need to record a message onto Floodline"* (North East, Ridings). Satisfaction with the increased speed and capacity of FWD to send messages was also expressed in several interviews.

Working with communities

Six responses mentioned relationships with the local community as working well. Specifically, one response mentioned working with communities to build up trust, another highlighted their arrangements with local community representatives and flood wardens to pass on flood warnings to vulnerable people within the communities, a third mentioned *"close communications with community groups where they activate their local community plans"* and a fourth mentioned *"good flood warden community groups (help raise awareness of flooding and FWD)"*. A key theme that emerged from the interviews is that early work with communities (before the flood) is most effective as it is participating in community events. Working with community groups, not only flood-specific ones, and with professional partners was highlighted as working very well for some participants at the workshop. Linked to this is knowing the community and area including where certain sites, such as caravan parks, or groups are.

Working with professional partners

Four of the responses mentioned relationships with professional partners as working well, emphasizing good working relationships with those partners with one specifying *"linking with local authorities on emergency planning"*. From the interviews, it seems that relationships with professional partners are perceived as working really well. These relationships are maintained through participation of the Environment Agency in emergency and flood planning with local authorities, parish councils and emergency services. Flood exercises were mentioned as a good way of getting to know their professional partners. In addition to this, one member of Environment Agency staff highlighted that one such exercise had been useful to think about vulnerable people and how they would get to them in an emergency. Working closely with emergency

services was mentioned in several interviews; the collaboration takes different forms such as participation in meetings, workshop, emergency planning, etc. Some of these relationships are quite close: in one instance, the Environment Agency staff member mentioned that she did door knocking (for awareness) with a member of the emergency services; another respondent highlighted that Environment Agency staff and other professional partners support one another in meetings and that there is no 'blame culture' among them.

Workshops and seminars, in which the Area staff provide information and or an opportunity for professional partners and community groups to come together, are mentioned by several interviewees as a positive thing. They also contribute with other forms of information such as flood packs. The importance of regular contact with community groups and professional partners came up in several interviews.

Other methods

Local radio was mentioned in six responses and TV in two as working well. One of the responses said that local radio worked well 'on major events' and not so well on minor ones. Another participant was sceptical of using national media for flood warnings:

'National media is no use for warnings - they are after big stories.'
(Interview, Dales, North East Region)

Other things that get a mention include: tackling high priority areas, working with other teams in FRM and good scenario training for duty officers.

Most recent flooding in the areas

Most responses stated that their areas had experienced recent floods, although some had not been major floods. Responses to nine questionnaires stated that their areas had been flooded in January or March 2007, although some said it had not been a major flood. Other floods occurred in 2000, 2002, 2005 and 2006. In terms of warnings for the most recent flood, respondents indicated that the following had worked well:

- FWD (3)
- Direct links to community groups (1) and professional partners (2).
- Timely warnings (4). One large business received warning in time to move equipment and stock. Timely warnings also helped to install flood protection barriers and in one area early sandbagging saved 70-80 properties.
- Direct communication with the public during (2) and after the flood (1).
- Staff effort (4).
- Good communications with/supportive media (3).

What is perceived not to work well?

Issues with FWD

Four questionnaire responses mention the coverage and/or take up of FWD as one of the things that does not work so well. Another respondent mentioned a series of issues with FWD including: the length of the process of warning, the lack of flexibility in the flood warning areas which does not allow areas to create new areas in an emergency, defence failure and duty officers feeling that they do not have control and confidence in FWD as a national system.

Issues with FWD were further explored in the interviews. Low uptake was seen as a problem, in one case this is as low as three in 10 properties in flood risk areas. This

was also mentioned by participants in the workshop who suggested that the one size fits all approach, i.e. using the same letters or other campaign materials nationally, may be responsible for the low uptake. Participants in the workshop declared that more social data is needed in order to tailor flood warnings. A greater understanding of social groupings and different perceptions of flooding is also needed according to participants to the workshop.

People that are away or move house are another problem. Unless they provide an alternative telephone number or notify the Environment Agency that they have moved, they will not receive flood warnings. The experience of some Environment Agency staff is that many members of the public are 'complacent' about flooding and do not see themselves at risk. One proposed solution is to invest more resources in awareness raising activities: for instance one member of Environment Agency staff highlighted that door knocking is effective for getting people on FWD particularly if they have not been flooded before. The national letters are often treated as junk mail by those without prior experience. Awareness and information prior to a flood were also suggested as a way of complementing the warnings. This is also because there is not enough space in a flood warning message to provide enough information on what to do.

Technical issues

Technical issues highlighted included the availability of FWD, given that it is based on telemetry²⁵. In addition, historical records are needed in order to define criteria for trigger levels. More modelling was pointed out as a possible solution for this issue.

Dependency on river levels rather than rainfall for warnings was mentioned in one questionnaire response and also at the workshop. Linked to this, a key emerging theme from the interviews is the difficulty of issuing a flood warning. The Environment Agency have been criticised in the summer 2007 floods for not having issued a severe flood warning following a severe weather warning from the Met Office. One of the interviewees mentioned that the decision of issuing a flood warning cannot be based solely on weather forecasts which usually have a great associated uncertainty, sometimes as high as 50%.

'The process of issuing a flood warning is a lot more complicated than just following a severe flood warning, and takes a lot of courage to make the decision' (Interview, Dales, North East Region)

Lack of flexibility and specificity of FWD

The interviewee in the Cornwall area felt that FWD is largely designed for a fluvial flood and not specific enough for tidal flooding. In addition, FWD is provided in areas where there is a minimum number of properties. This respondent explained that there are several small places in her area that do not qualify to receive a flood warning at the moment but where in the event of a flood, loss of life could be expected. They are currently reviewing their flood risk areas to identify where a higher level of service needs to be provided.

'Currently targets are largely based on the numbers of people. But in their area there are lots of small communities with only a few properties, thus smaller numbers of people at risk. But they are at high risk and potentially there could be loss of life if flooded' (Interview, Devon and Cornwall, South West Region).

²⁵ 'Telemetry is a technology that allows the remote measurement and reporting of information for the system designer or operator' (<http://en.wikipedia.org/wiki/Telemetry>). In this context, telemetry refers to the technology that allows the Environment Agency to monitor river levels, receive trigger levels and issue flood warnings for a certain area.

FWD cannot give messages in different languages (except for Welsh) and this is a problem for targeting non-English speakers. Some people considered that the service has certain flaws in terms of not being able to store messages in other languages (only Welsh at the moment):

'Nationally, we chose southern female accent for clarity of pronunciation of our messages. However, operationally and technologically using other languages is not feasible with the current service.'

(Interview, Sussex, Southern Region)

Issues with other methods

Five questionnaire responses questioned the effectiveness of loudhailers as a flood warning method. Issues with sirens were also mentioned by two respondents, in one instance this is because they are not fit for purpose, being World War II sirens, and in the other case because of the confusion that sirens may cause because people do not know that the siren is used for. Relationships with the media were mentioned by two respondents in the Anglian region as one aspect that needs to be improved. Local TV and radio were mentioned by another respondent as not working well on minor events. In the follow up interview, the Environment Agency person explained that this is because small events are not big enough news so they do not get as much coverage as a large event. In a large event, flood warnings would be included as part of all broadcasts.

'Anything that happens outside of normal office hours does not work so well. If an event escalates within office hours that is fine, but should something happen in the night, our warnings have a limited effectiveness.'

(Interview, Central, North West Region).

Other problems regarding sources of flooding information were pointed out in the responses to the questionnaire, in particular Floodline not being a multi agency service that provides a one stop shop and lack of local information on the Environment Agency's website which can also be confusing when not updated. The latter also came up in the interviews in particular that time of warning is sometimes not updated when the warning/ message was updated. This leads to people feeling neglected and feeling that the warnings are not up to date. The lack of local information on the website was also highlighted. Including information on, for example, where to obtain sandbags was considered useful, although recognising that providing this level of detail could be resource intensive.

Confusion with different sources of flooding and responsibilities of the Environment Agency was also mentioned in the interviews.

'For example, in January 2005 people were under three feet of water before the river flooded and before they got a warning. This is because flooding was coming from drains, but because people felt they hadn't been warned in time the Environment Agency got bad press, with no other agencies coming forward to admit to a problem. When flooding happened again in October 2005, the other agencies did admit that it was their responsibility, because it was from a source that the Environment Agency did not have responsibility for.'

(Interview, North, North West Region).

More partnership working in this issue was suggested as a possible solution. Difficulty in getting hold of partners because their phone numbers are out of date was also mentioned in one questionnaire response.

Confusion over the roles and responsibilities of the Environment Agency and other professional partners. Issues remain over who does what during incidents, for instance one member of Environment Agency staff commented that emergency services are sometimes asked to provide sandbags, while the Environment Agency receives calls asking whether certain roads are closed which is not their responsibility. A way of addressing this issue is suggested by the same person: more awareness raising.

Lack of awareness

The lack of awareness and preparation of the public was mentioned by one respondent to the questionnaire. Tourists in an area or caravan sites was another problem.

‘Currently, there is no specific way of targeting tourists or transient population - those who rent cottages depend on the owners signing up for flood warnings via FWD if eligible and then explaining how this works to the people that rent their properties. But it is difficult to monitor this type of property, as it is not always obvious if a property is holiday accommodation or rented.

Camping sites and caravan parks are a particular problem - they are often located in areas at risk of fluvial or tidal/coastal flooding. We encourage these places to register to receive flood warnings and to produce evacuation plans so they know what to do on receipt of a warning; hopefully, recent flooding will increase the likelihood of this type of site making preparations. It is important that visiting tourists and residents staying on camping and caravan sites at risk are fully aware of the risk; thus we encourage site owners to display information (either in the form of a sign/notice board or a leaflet) to inform people of the risk and that there is an evacuation plan in place should flooding occur and detailing where muster points are for people to assemble at and be accounted for.’
(Interview, Devon and Cornwall, South West Region)

The lack of lead time is another issue raised at the workshop. Flood warnings cannot be issued until certain criteria are met, which is a problem for rapid-response catchments; in Cornwall, most of the catchments are rapid response. This area has set up an operational information system for professional partners. When severe weather warnings are received from the Met Office or when there is heavy rainfall, the Environment Agency in this area warn their professional partners so they can prepare for a potential flood.

Recent flooding experienced by the areas

In terms of what didn't work so well in the most recent flood events experienced by the area staff, there were several issues with FWD and warnings for instance in relation to messages: the same message going to all the registered properties in one area although some of those properties were at much lower risk; the FWD message being very severe and scaring some residents; misunderstanding of the messages by the media or the public (a flood warning issued above Lewes led the media to infer that Lewes was at risk). People not registered to receive flood warnings, people being away from home at the time or holiday homes empty and thus no warning received by owners where other issues related to flood warnings. In a further instance, a flash flood did not allow enough lead time to issue a warning.

One respondent said that local authorities were slow in their response and did not supply sandbags in time. Another respondent had trouble getting hold of professional partners and noted the need to keep an up-to-date database of such numbers. More training for duty officers is needed, according to one respondent.

In what ways do the Environment Agency work with other organisations (including community/ voluntary groups) with regards to flood warnings?

The importance of working with other organisations was one of the key findings of the warnings workshop particularly because the Environment Agency cannot do everything as they lack both the knowledge and resources. The need to improve work with professional partners and community groups/ leaders was also a key conclusion of the workshop.

The following table shows which organisations the Environment Agency is working with and were mentioned in the questionnaires.

Table A2.3: Other organisations involved in flood warnings

Other partners	Professional partners/LRFs/ Emergency planning units (including local authorities/ emergency services	Media	Flood wardens	Community groups	Parish councils	Other
Number of mentions (total of 14)	12	2	4	4	5	Coastguard Royal Institute of Chartered Surveyors European colleagues At risk public

In terms of how they work with these organisations, some type of flood plan is mentioned in nine questionnaires. These include: multi-agency response plans, community plans, local flood plans and emergency plans.

Parish councils are found particularly useful by four respondents in helping to establish flood warden schemes and working with communities on local flood plans. Work with local parishes on flood plans was one of the positive experiences mentioned at the workshop. Flood wardens not only help disseminate warnings but they are also mentioned in one response as helping with awareness rising, watching river levels for the Environment Agency and door knocking.

Other types of situations where the area staff work with partners are: designing new flood warning areas, providing feedback for evaluating triggers, helping with warning dissemination and helping members of the public understand flood warning codes.

Maintaining relationships with communities and professional partners

Overall, most interviewees mentioned that participating in community or other local events is part of their work. Providing a point of contact for local groups was highlighted in one interview as useful and local residents had been much more positive about flooding issues since having a local contact. One related issue mentioned at the workshop is that the Environment Agency does not explain enough about the technology they use to members on the public.

‘Had a persistent complainer who kept writing in and was taking up a lot of staff time in responding, so she was invited to come into the incident room and have a look at the systems we had, how we forecast and warn and what we can and can’t do. She was very impressed with what we did and requested that we meet other residents in her area which is Keswick – 300 people came to the meeting and from that a group emerged, the Keswick Flood Action Group, which has been a very useful group and has engaged over other issues including pre-feasibility issues and other issues relating to reducing flood risk.’
(Interview, North, North West)

Past major floods seem to have acted as catalysts for relationships and undertaking actions. One interviewee explained that after having experienced bad flooding 2000 in Sussex, they helped relationships with professional partners: they worked together in response and recovery during and after the event and later on awareness rising, flood plans, flood wardens and so on.

Similarly in Cumbria, an interviewee told us that good relationships with the community had been developed after the 2005 flood and highlighted Environment Agency flood surgeries as important both from the point of view of gathering information and also for residents to talk about their problems. She also highlighted that since the 2005 flood there is better co-operation between organisations and better understanding of who does what.

In what ways do areas raise awareness of flooding?

The importance of awareness

Participants in the workshop agreed that in order to improve flood warnings, more emphasis on awareness is needed: people need to know about flooding and what to do when they receive a warning. Linked to the above point, it was considered that there is too much emphasis on meeting numerical targets within the Environment Agency, (for example coverage objectives), and that there is a need to move to more social targets, (Such as. increasing in awareness). This aim of achieving set targets was, according to many workshop participants, acting as a constraint in allowing Area staff to carry out more effective work within communities. Some participants even felt that awareness should also be a performance indicator.

A further issue highlighted is that because of limited resources more time should be invested before floods so that people understand a flood warning when they receive one and know what actions to take.

Awareness was highlighted as key by the Environment Agency staff from Cornwall. Most of their catchments are rapid response.

'Fluvial flooding in Cornwall can occur very rapidly as catchments respond quickly during heavy rain, which can make it difficult to issue timely warnings in some cases. Thus public awareness of flood risk is crucial, particularly in rapid-response catchments. We have set up an 'operational information' fax which can be sent to professional partners and the media so that when they receive severe weather warnings from Met Office or when there is heavy rain fall, they issue information to professional partners so they can prepare for a potential flood. We can also issue this to the media so that they can broadcast a heads-up to the public.'

(Interview, Devon and Cornwall, South West Region)

The issues of helping communities 'help themselves' or be prepared for emergencies was also mentioned by another interviewee who explained that they are working with local authorities and encouraging local districts to have emergency plans to cover not only flooding. This is aimed at increasing community resilience so when an emergency occurs they can help themselves until the emergency services can get to them.

Recent flooding was highlighted at the workshop as potentially increasing registration to FWD and increasing awareness; frequently flooded places may respond better in a flood. However, other participants highlighted the downside of this: people do not expect a worse flood than the one they have previously experienced. Various Environment Agency staff said they were hopeful that the summer 2007 events would increase awareness of the risk of flooding and more people being prepared for it. In particular, one interviewee highlighted that people would have seen the devastation that floods create and the fact that they can happen in summer.

Awareness-raising methods

Thirteen respondents to the questionnaire said that they carry out local flood awareness campaigns, which include Floodline, advertising in the media and on taxis and buses, road shows and door knocking in some cases. However, the national flood awareness campaign was only mentioned by four respondents. Visits to schools or local groups were mentioned in all responses, although some respondents thought they were not allowed to visit schools. At the workshop, it emerged that this is not the case and area staff are allowed by HO to visit schools as part of their awareness work.

Groups that Environment Agency staff work with include the elderly, disabled, and business groups such as caravan park owners. Flood wardens and community groups are also used for awareness; one respondent said that working with community groups allows them to establish the different social groups in their area. The same respondent said that community groups are useful to help recruit for FWD and to communicate messages to the wider community, for instance via the community newsletter. These groups can also feed back local information to the Environment Agency.

The development of multi-agency, incident, emergency or community flood plans is seen as another way of raising awareness mentioned by a large proportion of respondents. Another response mentions working with the local authority in areas that have been flooded recently to provide information on local issues and multi-agency response. An advertised drop in session with residents in new areas found to be at risk of flooding are mentioned by the same respondent.

Organising or participating in flood related events was also highlighted as a key awareness-raising activities included having information at exhibitions or anniversaries of historical floods, flood weeks and river festivals. Council or other newsletters were mentioned in three responses.

What is perceived as working well in terms of awareness?

Face-to-face communication works well, according to ten responses, and 'can prevent or correct misunderstandings and misconceptions' according to one respondent. This takes place in different ways:

- Attending asset management public meetings.
- Information stands in local supermarkets/libraries, and so on (4).
- Flood fairs and other events (2).
- Door knocking (3).
- Informing local councillors who can pass on the message to their wards.
- Drop-in sessions.
- Meetings with residents (2).

Radio advertising is mentioned in four responses and other media in three. Floodline advertising in taxis was highlighted by all three responses in the Anglian region. However, one respondent in the Anglian region mentions the difficulty to evaluate these methods in terms of people undertaking appropriate actions or signing up to receive flood warnings. Direct mailings to new FW areas are mentioned in one response as something that works well. Working in partnership with other FRM teams and the Environment Agency is mentioned by the same respondent as something that works well.

What doesn't work so well in terms of awareness?

Problems with national approach

Problems with Head Office mailings and/or adverts was highlighted in eight questionnaire responses, the main reasons being:

- strong wording of letters which upsets some people and does not trigger the desired response;
- sending excessive amounts of paperwork;
- sending letters in English to non-English speakers;
- sending letters to people who don't know who the Environment Agency is;
- lack of coordination of national campaign with the local one or wrong timing of national campaign;
- confusing and contradictory mailings;
- lack of locally relevant information in the mailings;
- insufficient flexibility for areas to influence the national campaign, poor response to the mailings.

The workshop participants had similar issues with the national approach to awareness campaigns. National campaigns were also mentioned in several interviews. There is a perceived gap between national MARCOMS and local activities and often they are seen as holding back local campaigns. Timing and planning of the national campaign was mentioned as a problem: national campaigns tend to be last minute or not give information to the areas while the areas try to plan their local campaigns in advance and work on awareness throughout the year. One participant felt that national campaigns should be planned in advance for better co-ordination and also for the areas to link awareness to other events, such as anti-burglary campaigns. She felt that their awareness work would be more effective if Head Office did higher level awareness while the areas did local work.

The Environment Agency is perceived as being too driven by recruitment (to FWD) which is a corporate target of the organisation. This is seen as reducing the resources for the areas to do awareness work: 'recruitment takes a lot of time from awareness and appropriate action campaigns' this interviewee also told us. The corporate character of the Environment Agency also results in awareness posters, messages, etc being created at the national level. This has created a perception of lack of flexibility from Head Office, who have been too prescriptive for the areas. Warnings are seen by this respondent as a 'hook' that need to start a series of actions: people need to know what to do, where to get more information, and so on.

Lack of flexibility came up in relation to awareness; for instance, national campaigns are more focussed on fluvial than tidal risk. However, unlike other Environment Agency staff, this person said that they had had input into the national letter:

'We have had a greater input into the materials produced nationally for flood awareness such as in mail shots and we have been asked to share what works well for us locally, so that best practice can be shared through the organisation. In conjunction with national initiatives, we carry out local hand-stitched awareness work so that we focus on the at-risk communities and their needs.'
(Interview, Devon and Cornwall, South West Region)

Lack of resources

Lack of resources was another particular problem both in terms of lack of personnel and also flood awareness material such as posters, leaflets that would be useful from Head Office. The same person mentioned being constrained by Head Office on what they can do, by not being able to contact any residents who have been previously contacted by the Head Office team.

Other issues

Responses to questionnaires included the following issues on awareness:

- The lack of motivation in people who have not been flooded before or who were flooded a long time ago is mentioned by two respondents.
- Not enough interaction with the public (said one respondent).
- The Thames region response highlights the particular problems of raising awareness in London, 'due to huge migrant variability/ethnic variability/sheer number of people and mobility of population'.
- Problems with the media, particularly newspapers (five responses).
- 'Random displays in public places' mentioned by one respondent as something that does not work well.

In what ways do Environment Agency staff work with other organisations on flood awareness?

'Building up relationships and having conversations on flood issues before an event' was highlighted in the workshop as key. The following table summarises responses to questionnaires on which organisations the Environment Agency links with on flood awareness.

Table A2.4: Other organisations working on flood awareness

Other organisations	Professional partners/ LRFs	Media	Local authorities	Community groups; flood wardens	Parish council	Business	Other
Number of mentions (11 in total)	5	3	4	5	3	3	Advert on 'Dial-a-ride' National Flood Forum, Housing Association, Flashpoint Lifeskill centre, British Holiday and Home Park Assoc.

In terms of how staff work with these groups, the following responses were obtained:

- Encouraging community groups/parish councils to prepare flood plans (4).
- Helping to develop multi-agency response plans/local community plans (2).
- Setting up flood warden schemes.
- Joint publications, newsletters to partners.
- Local events (2).

In terms of how could partnership working be improved, one interviewee said that having regular meetings and 'knowing each other's calendars' is key. This means that if professional partners are conducting awareness-raising events, these could include

flood awareness messages. Using partners' websites and offices to display Environment Agency messages was also mentioned by the same member of staff:

'The Environment Agency needs to get partners to deliver its message.'
(Interview Sussex, Southern Region)

Information and support from Head Office?

One of the questions asked what additional information or support from Head Office would assist area staff's work.

Information, materials and other resources

More and clear information and literature for people at risk is highlighted by four respondents, such as how to protect their properties before a flood, how to prepare for a flood and how to clean up after a flood, i.e. more emphasis on awareness and preparedness. Similarly, support for community groups and information for community flood plans were mentioned along with more general information on flood proofing products, as the Environment Agency is now receiving many enquiries about these.

A related issue was mentioned by another interviewee: the residents of a small area of West York had been encouraged by Environment Agency staff to invest in flood protection measures such as flood boards. The area was flooded in 2000 and there was not enough money to build defences, so means to stop the water entering the home seemed an appropriate option for the village. Unfortunately, these measures were tested for the first time in a recent flood and failed. This has raised several issues: flood boards and other measures may only work for certain properties and 'quick' floods (where water disappears after a few hours).

'There is a lot of emphasis on installing these measures but properties need to be surveyed to see if they are suitable. There is also an issue of possible loss of trust in the Environment Agency which recommended these products to the residents, thinking it would be a good solution.'
(Interview, Dales, North East Region)

The importance of education, need for publications in other languages and advice on how to approach different religions were also mentioned by respondents. Raising the profile of flooding and linking to big events, such as the Chelsea flower show, was another suggestion. Improving access to FWD for professional partners was requested by another respondent.

More clarity and guidance on messages was requested: for instance, there is confusion over 'severe flood warnings' and whether they should only be issued to professional partners. Also confusion with 'flood watches': the website says 'no flood warnings in force' when there are flood watches in force.

Fewer funding cuts and generally more funding, for example. for awareness and community flood warnings were also highlighted by respondents. More information in terms of best practice, feedback from R&D projects, facts and figures from post incident surveys, etc were requested from another respondent. More support for duty officers was also mentioned, for instance in terms of training and also semi-automated systems so that they do not miss things, given that they may be volunteers.

Flexibility for the areas

More flexibility from Head Office for area teams is another key requirement along with also receiving support and advice but allowing a 'bottom-up' approach for campaigns. One respondent would like the national campaign team to spend more time with area staff in order to understand local needs and support needed. This is also the view of another respondent who would like the head office to listen to what the areas are saying as they are closest to the public. Additionally the 'one size fits all' approach that is preferred by HO does not suit many areas. There is also a feeling that head office constraints the areas in what they can do, for example not contact people at risk who have been previously contacted by head office.

'The areas need work instructions, people need to be clear and understand their boundaries and then can be left alone to get on with work. They also need mechanisms to share good practice between areas. It would work by having each year new work instructions given in summer, that then the region would interpret and give to areas to get on with their work. Then having some 'end of year' mechanism by which gauge performance, what has worked well and be able to share best practice between areas' (Interview, Sussex, Southern Region)

There was also the impression that a lot of work is done by the areas at the local level and that it would be useful to have a way of sharing this information. This has been highlighted as a key need for instance how to warn similar communities in different areas.

Influence at the national level

One respondent felt it would be useful for the Environment Agency to influence certain organisations at national level rather than talking only with local officers (such as the Association of British Insurers), or talk with local authorities at national level through the Cabinet Office, allowing information to trickle down to local level. Colin Berghouse's work on capabilities and infrastructures should be shared with utilities particularly in relation to the importance of continuity plans and influence at national level.

What questions/comments or further information do you have with regards to flood warning or flood awareness?

Most of the comments under this question referred to awareness. Two questions/comments were related to the awareness campaigns, one of the respondents raised the question of where the campaigns 'side of things is going' and what the implications would be for FIM; the second comment related to the national public awareness campaign: the 'big launch' is to be scrapped in favour of hooking onto other events throughout the year.

Another respondent commented that the more information and leaflets that could be distributed in order to raise the profile of the Environment Agency and flooding, the better. One respondent highlighted that in order to increase awareness '*using other groups will be vital and necessary. To achieve our goals we may have to relinquish control and our corporate image*' (Southern Region).

In the light of Defra budget cuts, one respondent questioned whether all awareness activities should be refocused on increasing FWD take up. The remaining comments focused on flood warnings: one respondent asked what is in place to warn sensory impaired people, particularly technically (such as the use of minicomms), but also

identifying where sensory impaired people live. The terminology of flood warning codes and particularly the use of 'severe warning' was highlighted again by a respondent. Finally, the comment from the Southern region on flood warnings was that *'as we move to more community flood warning areas a more local, flexible approach is required. One size does not fit all.'*

Discussion/key findings

This section summarises the key findings from our review of current practice.

Flood warning methods used

Although all areas said that they use a variety of methods, FWD is the primary method used which reflects current work instructions. Some pointed out limitations such as coverage and lack of flexibility in terms of languages or messages; however, the general view was that, ideally, all at-risk populations should be offered FWD. Some people suggested improvements to be able to warn in other languages, for instance, but most of the improvements referred to increasing telemetry and areas covered. Low take-up is another problem mentioned by participants.

The Flood Warning Level of Service (FWLoS) Work Instruction²⁶ (mentioned by several participants) states that 'secondary methods' of warning dissemination should be introduced as a contingency in areas where FWD is a primary method. This is in case FWD should fail or become unavailable. The work instruction also states that secondary dissemination methods should be used in areas of low FWD take-up (under 70 per cent). In line with the working instructions, other methods are seen as useful back-up for FWD or for areas not covered by the service.

Environment Agency staff seem ambivalent on the use of flood wardens and community groups. The importance of face-to-face communication in delivering warnings was highlighted at the workshop, where several participants talked about the importance of using community representatives to reach certain members of the public. Recent research by Tapsell *et al.* (2005) on the social performance of flood warning methods showed that door knocking and flood wardens are consistently high-performing methods across all social groups. Moreover, these face-to-face methods perform much better than other approaches with certain groups such as non-English speakers, disabled, sensory impaired and those with no flood experience.

The questionnaires and interviews show that the value of community groups and flood wardens is recognised but staff are restricted on what support they can give these groups.

The FWLoS explains what the Environment Agency defines as the appropriate level of service required for each flood warning area. Regarding the use of flood wardens, this work instruction states that '*flood wardens do not form part of the recommended dissemination methods for Flood Warning Levels of Service. As a result any locations where the primary method of dissemination is flood warden should be reviewed to see if an alternative method can be implemented*' (p.22). The work instruction recognises that flood wardens 'offer valuable support to the community during times of flooding' but states that the Environment Agency should encourage local and parish councils and flood action groups to take ownership of flood warden schemes. The Environment Agency can provide information and advice. The only instance where flood wardens can be used as a primary method is where these schemes already exist and FWD cannot be provided. However, the work instruction establishes that new flood warden schemes should not be introduced as a primary method.

A recent Environment Agency briefing note on the use of wardens²⁷ for flooding aims to clarify the position of Head Office. This note states that:

²⁶ Version 2, 5/5/06.

²⁷ The note refers to wardens as 'volunteers' but accepts that the title Flood Warden can be used.

'We wholeheartedly support the practice of using volunteers in local communities in times of flooding, as they do an extremely important job in giving the community cohesion and support during and after flooding.'

However the note also sets some ground rules, particularly on who should set up flood warden schemes:

'Ideally separate volunteers for flooding shouldn't be established, as the most effective method is to add a flooding role to volunteers who already do work in their local community, such as neighbourhood watch schemes... this way enthusiasm doesn't wane after several non-flood years. If there is no pre-existing volunteer scheme then communities should be encouraged to take the lead in establishing their own volunteers.'

The briefing note points to parish councils as *'the most obvious local choice'* to lead on setting up these schemes and states that this approach has worked very effectively in several Areas. The note goes on to say that Head Office does not oppose area FIM teams setting up their own schemes as long as it is done in line with the FWLoS work instruction and there are sufficient resources in area teams. The note states that this work *'must not impact on the delivery of our core Flood Warning Service'* and while some Environment Agency flood warden initiatives work well, the long-term aim is to move to *'multi-hazard response and community engagement'*.

In terms of what role wardens or volunteers should have, the briefing note states:

'To check that people have received the warnings, to check on vulnerable people and provide us with a conduit for pushing out local flood information to the community. They are also extremely valuable to the community after flooding during the recovery phase. If we're able to, we would also like to use them as a means of back up should our primary methods of warning fail.'

This may not be a problem, as encouraging other groups to set up flood wardens may be better as these groups probably have better knowledge of the area and vulnerable people and it is not such a drain on staff resources.

Another reason for using flood wardens is that known and trusted sources help in communicating risk (Shaw *et al.*, 2005). A 'trusted source' does not necessarily imply an official source: in a recent post-event survey of the North East on behalf of the Environment Agency (Environment Agency, 2006b), informal warnings from neighbours, relatives or friends and personal telephone calls were found by respondents to be the most informative warnings. The survey analysis also concluded that Environment Agency warnings were no more effective than warnings from other sources in driving appropriate action.

Only a couple of examples were mentioned of using different dissemination methods to target different groups. The interviews show low awareness in the Environment Agency that different groups may need different warning methods. This is not consistent with the findings of the workshop where it emerged that different types of methods are appropriate for different circumstances.

As well as targeting different groups, another reason for using a variety of methods is to reinforce the warning message and ensure consistency across the different sources (Shaw *et al.*, 2005). Disaster research shows that *'if people do anything after receiving a flood warning, they will try to confirm it some way'* (Drabek, 2000, p367). Those who receive a warning are encouraged to seek more information by phoning Floodline or accessing the internet, which should help to confirm the warning.

A key issue from the literature review is that some people do not use technology such as mobile phones or the internet. For example, 51 per cent of adults with an income of £10,400 or less have never used the internet, and only 57 per cent of all households in Great Britain are able to access the internet from home (ONS, 2006). For the over 65s, 82 per cent have never used the internet, let alone have access at home (ONS 2006).

Flood warning messages

Three clear issues with respect to flood warning messages emerged:

- confusion over flood warning codes;
- lack of flexibility in setting messages;
- lack of knowledge and information on what to do on receipt of a warning.

Participants in the workshop, survey and follow up interviews drew attention to several issues related to the existing flood warning codes: for instance confusion caused by the use of 'flood watches'. People may not be familiar with the terminology and confuse these with flood warnings; to add to the confusion the press have referred to flood warnings as flood alerts. Keeping flood watches and severe flood warnings for professional partners and issuing 'flood warnings' for the public seems a sensible solution. However, will this increase 'false alarms'?

Another issue related to the warning codes is that some people and the press see it as a four-stage process similar to the traffic lights system, where everyone receives a flood watch, then a warning and eventually a severe flood warning in that order. This is not the case, as not all members of the public would be signed up to receive a flood watch. Additionally, not all areas qualify to receive a 'severe flood warning' because this relates to the number of properties likely to be flooded. Although the number of properties at risk may be relevant to Environment Agency staff, warning recipients are only interested in whether *their* property is likely to be flooded. This issue has also been mentioned in recent research: qualitative work by Fielding *et al.* (2007) found that people who had no experience of flooding had reported that they would wait for a severe flood warning before taking any action.

Regarding the standard and fixed nature of the message, if the aim of a flood warning is for people to take action to protect themselves or their property, using the same message would not be appropriate for different situations.

Taking action following a warning is far from simple for the people involved. Mileti and Peek (2000, p183) describe the six-stage process that people go through on receipt of a warning:

- *The first stage is hearing the risk information.*
- *In the second stage, the risk information must be understood. Understanding is not meant to refer simply to interpretation, but also to the attachment of meaning to the information. Those meanings can vary among people and may or may not conform to the understandings intended. A 50 per cent probability may be interpreted as almost certain by some or relatively unlikely by others. In this sense, understanding includes the perception of risk.*
- *The third stage is belief in the risk information and in the accuracy of what is being communicated; in this way, belief also includes risk perception.*
- *The fourth stage is the personalization of risk; that is, the perceived implications of the risk being communicated on the receivers themselves; thus, personalization also encompasses risk perception.*

- *The fifth stage involves people deciding what to do about the risk, while the sixth involves performing that behaviour.*

Even if people receive a warning and understand its meaning, the third stage is belief in the information and accuracy of what is being communicated, and fourth, personalization of the risk. This will not be relevant if people are told to 'move upstairs' when they are living in a bungalow.

The third issue with current messages is that they do not contain enough information on what people should do (although they are encouraged to seek more information through floodline and the Environment Agency website but some people are not able to access the internet). Even more than receiving a warning knowing what to do is a key factor. The literature reviewed by Fielding *et al.* (2007) shows although there is a known link between flood knowledge and response, information on what to do on receipt of a flood warning is sparse, especially when it is most needed during the event. People's behaviour can be mistaken as irrational or panicky when it is merely lack of knowledge on what to do. Not knowing what to do can also lead to increased stress during the flood. Fielding *et al.* (2007 p16) conclude that '*a lack of relevant knowledge therefore not only constrains appropriate response, it also exacerbates the long-term adverse effects of flooding with personal, social and economic consequences*'. Participants in focus groups in Carlisle (Carroll *et al.*, 2007) reported being unsure of what to do during the flood, that is, whether to stay or leave their properties or wait for rescue, and found the experience 'traumatic' with many feeling 'terrified and isolated'. Stress induced by a flood event has been shown to influence whether a household reports health effects from a flood (Green *et al.*, 1994).

Flood warnings: what works well and potential improvements

FWD is perceived as a much better service than its predecessor AVM in terms of speed and capacity. Other things that are seen as working well are relationships with community and other groups, where these exist. Relationships with professional partners are generally going well and this may be due to the Civil Contingencies Act. Maintaining regular contact with these groups is particularly important. The Environment Agency has an advisory role and takes part in a number of different types of joint events.

Several issues are highlighted as not working well. Many of those are purely technical, such as a lack of telemetry or other data. Other issues relate to the characteristics of a flood, such as the lack of lead time to issue a flood warning. A further issue is that FWD seems to be geared up for fluvial flooding rather than tidal. Confusion related to the source of flooding and the responsible agency is a further issue. Economic studies undertaken to determine whether it is economically viable to provide flood warnings do not take into account risk to life. This was an issue in Boscastle (see Appendix 4), where this was one of the reasons for not providing a flood warning service. Another reason was the fact that providing two hours lead time would not be possible.

In terms of diversity of recipients, the lack of capability of FWD to warn in different languages is seen as important, but generally no other social groups are mentioned except sheltered accommodation and caravan site issues in Cornwall and Devon. Caravan parks are considered a highly exposed floodplain and their residents have specific requirements in terms of flood warnings, particularly as their residents may have limited knowledge of the area and may not be aware of flood risk. Caravan parks are often located in floodplain environments that have lower land costs and high aesthetic and recreational value (McEwen *et al.*, 2002). There are several examples of loss of life in campsites. In 1996, an intense storm occurred over the Arás catchment near Biescas in the central Pyrenees. Eighty-seven people were killed as a result of the

subsequent flood of a campsite (White *et al.*, 1997). Five of the 24 victims of the 2002 floods in the South of France were tourists or campers (Ruin *et al.*, 2006).

The issue is that FWD may be designed to work with a 'typical flood': fluvial, slow-rising with more than two hours lead time, preferably during day time²⁸ office hours and in an area where there is awareness of flooding and consequently high take up. FWD possibly works really well in areas where the population are aware and have access to several information technologies that allows them to receive a warning and also to obtain information on what to do. Recent flooding (see Appendix 4 for a summary of recent lessons learnt reports and summer 2007) show that this is not the case: e.g. summer flooding, rapid response, flooding from different sources, flooding of town centres outside flood plain and no recent flooding experience. This is likely to get worse with climate change, e.g. more extreme events. Linked to this is population and other socio-economic changes, such as more development on floodplains, more elderly people moving to bungalows on the coast, transient populations and so on. These are all reasons to make the service more flexible so it can work with other types of flood and target different people, and improve or focus on awareness and emergency response as 100% coverage is likely to be impossible.

Working with other organisations and community groups

Area staff work with many groups and professional partners particularly in relation to several types of flood plans. This work is not only centred around flood warnings but also awareness and emergency planning. The Environment Agency see themselves as mostly providing information and advice to other professional partners. They understand the importance of maintaining frequent contact and providing support to community groups. Flood exercises, meetings and building partnerships are all recognised as important by Environment Agency staff.

Awareness

Awareness is key and linked to the effectiveness of flood warnings. The issue of people not knowing what to do on receipt of a warning can partly be addressed by raising more awareness.

In terms of the type of awareness activities that the areas undertake, and which seem to work well, there is a lot of emphasis on local events and working with local communities. There is wider recognition that 'face to face' communication is the ideal approach to awareness as this can reduce misunderstandings and answer the public's questions. The local approach to awareness is particularly valued and there is a sense that the Areas should have more flexibility 'to do their own thing'. Being able to influence the timing and content of national awareness campaigns and better co-ordination is seen as particularly important.

Working with other agencies and community groups in several types of flood plans: from multi-agency response plans to community plans is seen as a useful way of increasing awareness. This approach addresses not only awareness but also increases community resilience and effective and co-ordinated response to flooding. This is particularly important for 'rapid response' catchments. Since flood warnings are an imperfect system it makes sense to strengthen these other activities.

In terms of other issues with awareness, lack of resources is another key problem. Some areas cover a large number of properties but may have only one person in charge of awareness. Lack of awareness materials is another key problem.

²⁸ See Appendix 4. The Boscastle report concluded that loss of life was avoided partly because the event happened in day time.

Recent flood events, particularly large events, seem to act as catalysts for new relationships and flood-related activities. The recent flooding should improve awareness of the risk of flooding but also the devastation it can cause.

Support from Head Office

As well as allowing the areas to be more flexible in their approach to warnings and awareness, several other forms of support were highlighted. Head Office is seen as being able to provide materials for flood awareness. More clear instructions, training and possibility of exchanging good practice between areas is also important. Head Office could also influence other organisations at national level but leave the detailed local work to areas.

The feeling is that the areas need clear instructions, enough resources and some form of 'sharing best practice' but also to be left to their own devices and to use and maintain their local knowledge, experience and relationships

QUESTIONNAIRE SENT TO FLOOD INCIDENT MANAGEMENT TEAMS

Region	
Area	
Area Flood Incident Management Team – Contact Name	
In what ways are people in your area warned about flooding just before and during a flood incident (please tick all that apply and include any not mentioned)	<p>Flood Warnings Direct Flood wardens/local community representatives knocking on doors Sirens Loudhailers Local radio Local TV</p> <p>Other</p>
Thinking about your current approach to flood warning , what would you say works well in terms of helping to make the community resilient?	
Thinking about your current approach to flood warning , what would you say doesn't work well?	
<p>In what ways – if any – do you work with other organisations (including community/voluntary groups) to develop and implement your flood warning approach?</p> <p>Please give details of which organisations you work with and which are particularly useful</p>	
In what ways are people in your area made aware of flood risks at times other than during a flood incident?	<p>Local flood awareness campaign Visits and talks to local groups/schools Development of an Incident Plan</p> <p>Other</p>
Thinking about your current approach to flood awareness campaigns what would you say works well?	
Thinking about your current approach to flood awareness what would you say doesn't work well?	

In what ways – if any – do you work with other organisations (including community/voluntary groups) to develop and implement your flood awareness approach? Please give details of which organisations you work with and which are particularly useful	
When was the last flood in your area?	
What worked well in terms of flood warning?	
What did not work so well in terms of flooding warning?	
What information/support do you need from Head Office in order to continue or improve warning people effectively about floods?	
What questions/comments or further information do you have with regards to flood warning or flood awareness?	
Would you be happy for one of the research team to follow up these questions with a short phone call [30 minutes] over the next few weeks?	Yes No
Would you like to be kept in touch with the research project via email?	

Appendix 3: Summary of lessons learnt from recent flood events (2004-5)

FLOOD EVENT	FLOOD CHARACTERISTICS	AREA/PEOPLE INFORMATION	DAMAGES CAUSED TO PEOPLE, PROPERTIES, ETC	FLOOD WARNINGS ISSUED, ETC	KEY ISSUES
FLASH FLOODING IN THE SOUTH WEST PART OF THE NORTH YORKSHIRE MOORS ON 19 JUNE 2005	Flash flooding (surface water flooding caused by extreme rainfall). The rainwater ran off very dry land along roads and overwhelmed surface drains and sewers which caused large part of the damages. Streams and rivers also overflowed making things worse. Within 20 minutes of the thunderstorm appearing floodwaters were entering properties, and cars, trees and livestock were being washed away.	Rural; one campsite had to be evacuated (no detailed info in report).	<p>Nobody was killed although some people had to be airlifted to safety. The flash floods damaged 121 properties, some of them partially or completely washed away, destroyed or damaged bridges and roads and swept hundreds of animals to their death. Miles of dry stone walls and fencing were washed away and hundreds of tonnes of trees, vegetation and silt were washed into roads, streams and rivers.</p> <p>Electricity supplies were lost for 2,500 homes in the immediate area and 38,000 homes in the region during the storms.</p> <p>Floodwaters disappeared almost as quickly as they came and the clear up operation began the next morning on 20 June. The damage caused to roads and bridges caused major disruption in the following weeks.</p>	<p>No flood warning issued; Met Office issued a severe weather warning. Flash flooding occurred before river gauge levels affected.</p> <p>Only after intense rainfall did the Environment Agency become aware of flash flooding.</p> <p>Most of the areas affected have no history of flooding. The Environment Agency report concluded that it is extremely difficult to forecast where and to what extent storms will cause flooding. Even if forecasts could be provided it is unlikely that there would be sufficient time to warn homeowners or businesses.</p> <p>As in Boscastle the best means of warning is public awareness of Met Office severe weather warnings. The Environment Agency</p>	<ul style="list-style-type: none"> Flash flood not forecast in an area with limited experience of flooding. No flood warning issued.

FLOOD EVENT	FLOOD CHARACTERISTICS	AREA/PEOPLE INFORMATION	DAMAGES CAUSED TO PEOPLE, PROPERTIES, ETC	FLOOD WARNINGS ISSUED, ETC	KEY ISSUES
				should support the Met Office in improving public awareness of severe weather warnings.	
TIDAL SURGE EVENT 11-13 FEBRUARY 2005	Coastal flooding	Coastal area, presence of caravans and bungalows which had to be evacuated.	No properties flooded; damages to some coastal defences. In Anglian Region the predicted high tide (>5M) at Kings Lynn on the 13th was sufficient to trigger a precautionary evacuation of high-risk caravans and bungalows situated directly behind sea defences between Snettisham and Hunstanton.	Severe flood warning issued Foreshore Road area of Scarborough (North East Region).	<ul style="list-style-type: none"> • Coastal flooding. • Presence of vulnerable properties, bungalows, caravans which had to be evacuated.
NORTHERN ENGLAND AND SOUTH WALES JANUARY 2005	<p>Flooding from drains, sewerage systems and culverts, as well as from rivers. The extreme flows meant that the most extensive flooding occurred as a consequence of flooding from rivers.</p> <p>Heavy rainfall fell on soils already saturated by previous rainfall. This was accompanied by storm force winds.</p>	Carlisle - urban area	<p>Two elderly women died in their homes. There was substantial damage to infrastructure and much economic disruption, with early estimates of the scale of losses exceeding £450 million.</p> <p>Winds gusting to hurricane force caused many trees to fall, widespread road blockages, and significant power failures across Cumbria, including Carlisle.</p> <p>Other services were seriously affected. In Carlisle, the police station, fire station and local authority offices were all severely flooded. The main electricity grid substation, telephone exchange and sewage works were also flooded. All organisations had difficulty mobilising staff because of weather conditions</p>	<p>The event affected may steep river catchments that respond rapidly with short lead times. Heavy rainfall was forecast but the magnitude of the event was not identified.</p> <p>Forecasts did not always give enough lead time and warnings were issued on the basis of observations by our staff.</p> <p>In some places flooding from surface, sewer or groundwater occurred before a flood warning was issued.</p> <p>Flood warnings were issued via AVM before widespread power loss. We also warned people at</p>	<ul style="list-style-type: none"> • Steep/rapid response catchments that allowed short lead times. • Heavy rainfall forecast but not the magnitude of the event. • In some cases, people were flooded from other sources before they received a warning • Power failures affected AVM and meant that people were unable to receive warnings from TV or radio.

FLOOD EVENT	FLOOD CHARACTERISTICS	AREA/PEOPLE INFORMATION	DAMAGES CAUSED TO PEOPLE, PROPERTIES, ETC	FLOOD WARNINGS ISSUED, ETC	KEY ISSUES
			and because many staff were suffering from flooding or damage to their own homes.	<p>risk by using local media, loudhailers and knocking on doors.</p> <p>BBC Radio Cumbria gave hourly updates.</p> <p>In Carlisle power cuts affected telephone communications. Power cuts also meant that people were unable to receive warnings from TV and mains-powered radio.</p>	
BOSCASTLE AND NORTH CORNWALL 16 AUGUST 2004	<p>Flash flooding caused by extreme rainfall which also caused a rapid increase in river flow.</p> <p>Geographically small-scale event that caused a high risk to life and structural damage potential.</p> <p>Speed, depth and velocity of flood waters and large quantity of debris created high risk to life and buildings.</p>	<p>Presence of tourists and visitors. A drop in centre for residents to tell their stories and bring information to Environment Agency officers was useful and well received.</p>	<p>The event has similarities to the Lynmouth flooding of 1952 in which 34 people died, but daylight and the fast action of local residents and emergency services meant there were no fatalities. Helicopters airlifted up to 150 people to safety and a further 34 were rescued by the fire brigade. Sixty houses were flooded in Boscastle and forty elsewhere in North Cornwall, with water depths reaching up to first floor levels. Many houses were partially or completely demolished by the floodwater</p>	<p>The event was not forecast. There is currently no direct telemetry or flood warning capability in the Boscastle catchment. The catchment is too short and steep to provide a flood warning with a two-hour lead-time. An assessment carried out in 2000 showed that flood warning improvements were not economically justified, since the assessment was not based on risk to life. In this case prompt action by the residents of Boscastle to alert the coast guard and fire brigade certainly saved lives, as rescue services and helicopters arrived at the scene within an hour.</p>	<ul style="list-style-type: none"> • No telemetry or flood warning service in the area. • Rapid-response catchment, two-hour warning not possible. Also providing a flood warning was deemed not 'economically justified'. This assessment was not based on risk to life. • High risk to life caused by the speed, depth and velocity of floodwaters and the high debris content. • The fact that the event happened in daylight and the local knowledge of Boscastle residents was recognised as saving many lives. • One-stop-shop centre for residents found to be useful.

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List of abbreviations

AVM	Automatic Voice Messaging
FIM	Flood Incident Management
FRM	Flood Risk Management
FTE	Full-time equivalent
FW	Flood Warning
FWD	Floodline Warnings Direct
FWLoS	Flood Warning Levels of Service
HO	(Environment Agency) Head Office
KPI	Key Performance Indicators
LRF	Local Resilience Forum
MARCOMs	Marketing and Communications (at the Environment Agency)
PR	Public Relations
R&D	Research and Development
VSB	Virtual Sounding Board
WP	Work Package

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