

## IMPROVING COMMUNICATION STRATEGIES FOR EFFECTIVE FLOOD RISK MANAGEMENT

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### Abstract

The role of flood risk management has become increasingly important in recent national and European legislation. For example, the Report of the Flood Policy Review Group informs policy in Ireland and promotes a shift towards flood management as an alternative to flood prevention. The management as opposed to the prevention of floods is also endorsed in the EU Floods Directive and requires member states to reduce and manage flood risks posed to human health, the environment, cultural heritage and economic activity by 2015. Effective communications strategies are recognised as essential components of flood risk management. However, strategies are commonly based on an information deficit model, which assumes that providing more information to the public at risk will produce more 'rational' responses. These strategies are based on the assumption that the public at risk will behave in a prescribed and predictable way when presented with the same flood related information. Such models however, fail to account for the uncertainty associated with the different ways in which people's knowledge systems process and interpret this information. This uncertainty is referred to as interpretive uncertainty. It is not uncommon therefore, for very different and sometimes undesirable behavioural responses to result from those at risk when presented with flood related information.

This paper presents the findings of a study that challenges the information deficit models and proposes instead that communications strategies for flood risk management reflect differences in individuals' knowledge systems and the way in which information is processed and interpreted. The work is part of a larger ERA-Net CRUE project (*URflood*) and draws on the findings of a series of Irish case study areas. These include Ballinasloe, Co. Galway; Clonmel, Co. Tipperary; Wexford Town, Co. Wexford and an area in the catchment of the River Dodder in Dublin. Locations were chosen to encompass fluvial, pluvial, coastal, residual and 'new' flood risks. Extensive quantitative research was carried out in each case study area through self-completion postal questionnaires. Questionnaires were structured around key themes of risk awareness and perception, preparation for floods, previous flood experience, appropriate methods of receiving flood information and the understanding of uncertainty and risk in flood communications. Results from this survey are presented and both barriers and obstacles in flood communications strategies are identified. Following from this, recommendations are made for improving communication strategies. The paper will be useful to those involved in developing or improving local flood risk management plans in Ireland.

## 1. Introduction

Flood risk is increasing due to the effects of climate change and increased urbanisation of watersheds. The use of structural flood defences to deal with this increased risk is no longer sustainable, resulting in the recognition of flood risk management as an effective approach to minimising disaster cost. This concept is now engrained in both national and European legislation (Report of the Flood Policy Review Group, 2004; European Parliament and the Council of the European Union, 2007). Effective communication is recognised as an essential component of flood risk management. However, a lack of a clear communication strategy has been identified as a major failing in the response to dealing with disasters such as the 1998 Easter floods and 2007 summer floods in Britain as well as Hurricane Katrina in 2005 (Pitt, 2007; Gheyntanhi et al., 2007; Horner and Walsh, 2000).

*“During the floods, people experienced the effects of the lack of joined-up communication.....The information available was at best inconsistent, and at times unavailable.....Many people were passed from organisation to organisation when seeking advice” (Pitt, 2007).*

Strategies for communicating risk are often underpinned by the information deficit model which is based on the assumption that providing more and better information will produce more ‘rational’ responses. However, the presence of interpretive uncertainty causes the information deficit model to be inappropriate in some situations. Interpretive uncertainty is defined as the differences in how people interpret information (Brugnach et al., 2008) and results in the public at risk reacting in different ways when presented with the same information. A knowledge systems approach on the other hand, takes into account how knowledge is used in processing information. It represents an advance of the information deficit model, by ensuring that the manner in which flood information is processed and interpreted is represented in a communication strategy. In addition to the use of the information deficit model, communication strategies tend to follow a ‘top-down approach’ which does not take into account the public at risk as the end user (Faulkner et al., 2007; Basher, 2006). People-centred approaches are therefore becoming increasingly recognised, where communities have input into the flood management system (United Nations, 2006; Basher, 2006). This paper challenges the information deficit model by proposing the use of a knowledge systems and people-centred approach to improving flood communication strategies. The results of extensive quantitative analysis of the public at risk to various flood types across Ireland are presented. The objective of the paper is to identify obstacles existing in current communication strategies and from this, develop a framework for improving flood risk communication plans. Improving risk communication in this way has the potential to increase community resilience and public capacity to deal with flooding.

## 2. Methodology

As part of the ERA-Net CRUE project *URflood* (Understanding Uncertainty and Risk in Communicating about Floods), extensive quantitative research of at-risk communities across Europe was carried out. This paper presents results from the Irish case study areas. Various sites for study were proposed and discussed during consultation with the Office of Public Works (OPW), the national body with responsibility for flood risk management in Ireland. Four sites were chosen to encompass the major types of flood risk in Ireland: fluvial, pluvial, coastal,

residual as well as ‘new’ risks. Ballinasloe, County Galway was the first site chosen as it represents a ‘new’ fluvial risk. The town of Ballinasloe had little history of flood events until November 2009 when the River Suck (a tributary of the River Shannon) burst its banks. Ballinasloe is the largest town in County Galway, after Galway City, with a population of over 6,000 (CSO Ireland, 2006). Wexford Town, County Wexford was chosen as a coastal risk. The most recent major flood event occurred in October 2004, caused by high tides and strong south-easterly winds. Rainfall had an insignificant role in the flooding. Wexford Town is situated at the mouth of the River Slaney and has a population of approximately 8,850 (CSO Ireland, 2006). The third site chosen for study was Clonmel, County Tipperary. Clonmel was chosen as it has a long history of fluvial flooding from the River Suir, in addition to a new residual risk due to the Clonmel Flood Relief Scheme scheduled for completion in 2012. The town of Clonmel lies mainly on the north bank of the River Suir and has a population of over 16,000 (CSO Ireland, 2006). The final site chosen was an area within the flood contour of the River Dodder in Dublin. The River Dodder was chosen for study as it incorporates fluvial floods; pluvial floods, due to the urban nature of the catchment; coastal floods, as the mouth of the river is tidal; and residual risk as there are some flood defences along its course. The River Dodder is well known for its flashy characteristics and quick reaction to rainstorms and has flooded many times in the last century. Tidal flooding occurred on the 1<sup>st</sup> February 2002 causing major property damage. Severe flooding also occurred on the 25th August 1986, as a part of Hurricane Charley moved north-eastwards over Ireland. All four case study areas are shown in Figure 1.



**Figure 1. Case study locations**

Within each case study area, self-completion postal questionnaires were disseminated in the period between August and October 2010. Questionnaires were based around key themes that were also studied in three other UR*flood* partner countries (Finland, Italy and Scotland). These key themes included previous flood experience, risk perception, preparedness levels, flood information and communication methods, interaction with authorities, trust and reliability of responsible agencies, flood risk terminology, understanding the concepts of uncertainty, probability and risk as well as various demographic factors. Questionnaires were developed using the main principles of questionnaire design and as such, the majority of questions were short, simple and of a pre-coded nature. Both closed and open-ended questions were employed

with precise unambiguous wording formulated to minimise misunderstanding. Respondents were targeted in each case study area using the 100 and 200 year flood extent envelope for fluvial and coastal risks respectively. In areas where these flood extents were not available, a previous flood extent envelope was used. Extent envelopes were combined with a spatial database of addresses on a GIS platform, and questionnaires were sent to addresses within the flood contour as shown in Figure 2. In total, 2200 questionnaires were disseminated to homes and small businesses, along with a letter of support from the OPW explaining the research, as well as a prepaid return envelope. Awareness of the study was created through advertisements in local media in addition to official OPW press releases. Reminder letters were sent after approximately 10 days in order to increase return rates. Of the 2200 questionnaires disseminated, 436 completed questionnaires were returned; a response rate of circa 20%. Data was analysed using SPSS predictive analytics software package (SPSS, 2009) using chi-square tests, independent samples t-tests, as well as one-way analysis of variance (Anova). The critical significance value (p-value) was set at 0.05. This follows the usual convention that if there is less than a 5% probability that an observed pattern occurred due only to chance variation in the data, it is accepted that the observed pattern is not due to chance.

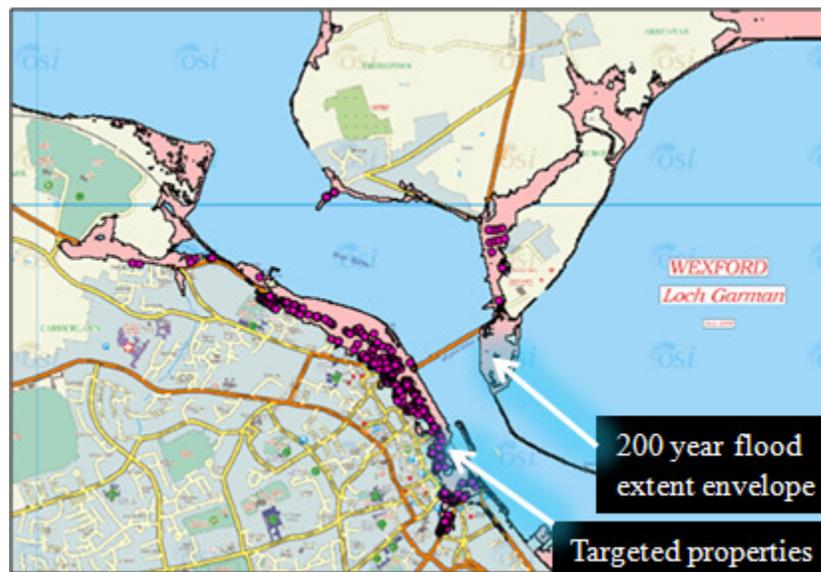


Figure 2. Targeting respondents in case study areas

### 3. Results

Data was analysed in terms of respondents' flood experience and awareness as well as pre-flood and during-flood communications.

#### *Description of sample:*

Analysed data were compared to Irish census data ensuring the sample was representative of the Irish population in terms of gender, age, employment status, education level and ownership of residence (CSO Ireland, 2006). The gender balance was approximately even with 53% males and 47% females. The age distribution showed a slight bias towards older people with a quarter of the sample being 65 years and over. However, a wide range of ages was represented. The

majority of homes and businesses were owner-occupied (68%) with 30% being rented. This is consistent with 2006 census data which shows 71% of properties were owner-occupied and 28% rented across Ireland (CSO Ireland, 2006). The majority of respondents had been living in their current home for 14 years or more. In terms of employment status, 63% of the sample were employed in some form, 21% were retired, while 6% were unemployed. The average unemployment rate in Ireland ranged from 6% in 2008 to almost 12% in 2009 (CSO Ireland, 2011). Only a very small percentage of respondents did not speak English as their first language (less than 6%); the majority of these being somewhat or very fluent in English (65%). 50% of the sample reached third level education or higher, 40% reached secondary school level, while just 10% received a primary level education. The European Commission showed that approximately 32% of the Irish population had reached third level education in 2009 (European Commission, 2011). This shows a slight bias towards more educated people taking part in the survey.

### ***Flood experience and awareness:***

76% of the sample had experienced flooding previously. The method of sampling used ensured that all respondents were at risk to flooding, though may not have necessarily experienced flooding in their current residence. Despite this, 24% of respondents did not feel at risk. Previous experience was found to have a direct impact on awareness levels (Chi-square=41, df=1,  $p < 0.001$ ). However, there were those within the sample that did not feel at risk despite having been previously flooded in that same residence ( $n=12$ ). 10 of these 12 respondents lived in the same housing estate in Dublin, which was flooded last in February 2002. Flood protection works have since been completed in this area. Results therefore indicate a level of residual risk within communities. This is reflected in the following quotes by respondents living in this area:

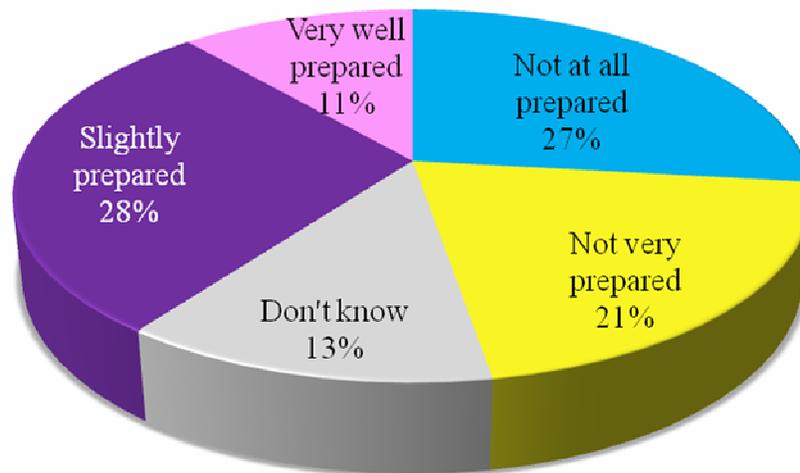
*“Following the disastrous flooding in 2002 we now have in place a very effective flood barrier wall (newly built) which I personally feel will exempt us from any more flooding of a similar nature.”*

*“With the flood defences now in operation I could not imagine being flooded again”*

Perception of the causes of flooding were explored in all case studies with results indicating that the public at risk may not perceive all potential sources of flooding including groundwater flooding or flood defence breaches. This lack of awareness is a potential barrier to communicating and building capacity to cope with flooding.

### ***Pre-flood communication and preparedness:***

Respondents were asked to self-assess their levels of preparedness for future floods. Results in Figure 3 show that just 39% of the sample had confidence in their preparedness levels. This was found to be directly related to previous flood experience ( $t=7$ ,  $df=180$ ,  $p < 0.001$ ). Respondents who had been flooded multiple times also tended to be more prepared for future floods than those who had only been flooded once (1-way Anova,  $F=3.6$ ,  $p=0.028$ ). Small business owners were found to be slightly more resilient than residents, with 60% of business owners feeling prepared, compared to just 36% of residents. Low levels of preparedness in at-risk communities represent a failing of current communication strategies.



**Figure 3. Preparedness levels of respondents (n=414)**

Current information sources regarding flooding and preparing for floods include a flood information website ([www.flooding.ie](http://www.flooding.ie)), a flood hazard mapping website ([www.floodmaps.ie](http://www.floodmaps.ie)) as well as an awareness campaign entitled ‘Plan, Prepare, Protect’. The awareness campaign was launched by the OPW in December 2005 across the country. 70,000 copies of an information booklet were distributed to local public libraries, citizens’ information centres and local authority offices. In addition to this, 150,000 information leaflets were distributed to properties in areas most prone to flooding. There was subsequently a booster media campaign in October 2006. Within this survey, carried out in 2009, respondents’ awareness levels of the campaign were investigated. Just 18% of the public at risk within this sample were aware of the campaign. However, 73% of those who were aware found it to be helpful. Results indicate poor penetration of once-off campaigns into the future. Awareness of the two websites was subsequently investigated. The information website ([www.flooding.ie](http://www.flooding.ie)) is intended to enhance public access to information about flooding and contains information about preparation, protection, what to do during and after a flood, who can help in a flood, as well as specific information for farmers and business owners. Using the Flood Hazard Mapping website ([www.floodmaps.ie](http://www.floodmaps.ie)), members of the public can search for flood information in any locality and view reports, photographs, newspaper articles and other information about reported floods. As with the awareness campaign, familiarity with these websites was extremely low, with just 11% of respondents having visited either of the websites. Again, the majority of those who had visited (62%), found the information available to be helpful.

*“Was not aware that this web site existed as there was no communication or information posts or otherwise”*

When asked to rate the amount of information about floods that is currently available in Ireland, the majority of respondents (almost 60%) found the amount of information available to be ‘too little’. From all of these results, a facilitator to effective flood risk management can be identified as the helpfulness of information that is available. However, the public’s lack of awareness of such sources of information is a barrier to effective communication. Respondents may be

unaware of the information available if it is not communicated through methods that the public at risk prefer. Results in Table 1 show that websites were the least accepted method of communication for receiving information on preparing for floods. Direct contact in the form of an in-person visit was the most popular. Given that this may not always be possible due to resource constraints, delivering brochures to properties as well as radio announcements were also favoured. However, it is important to keep in mind that preferences will always vary between groups within communities as well as between cultures and countries, so it is not possible generalise a single ‘best’ method for communicating about floods. The use of unwanted communication methods and over reliance on a particular method are identified as further obstacles to well-designed communication strategies.

**Table 1. Preferred communication methods for receiving information on preparing for floods**

<b>Communication method</b>	<b>% respondents</b>
Door-to-door communication	49.5
Brochures/leaflets delivered	38.5
Radio	38.3
Phone call	31.7
SMS	31.2
Email	24.1
Scrolling warning on TV screen	17.9
Website	16.1

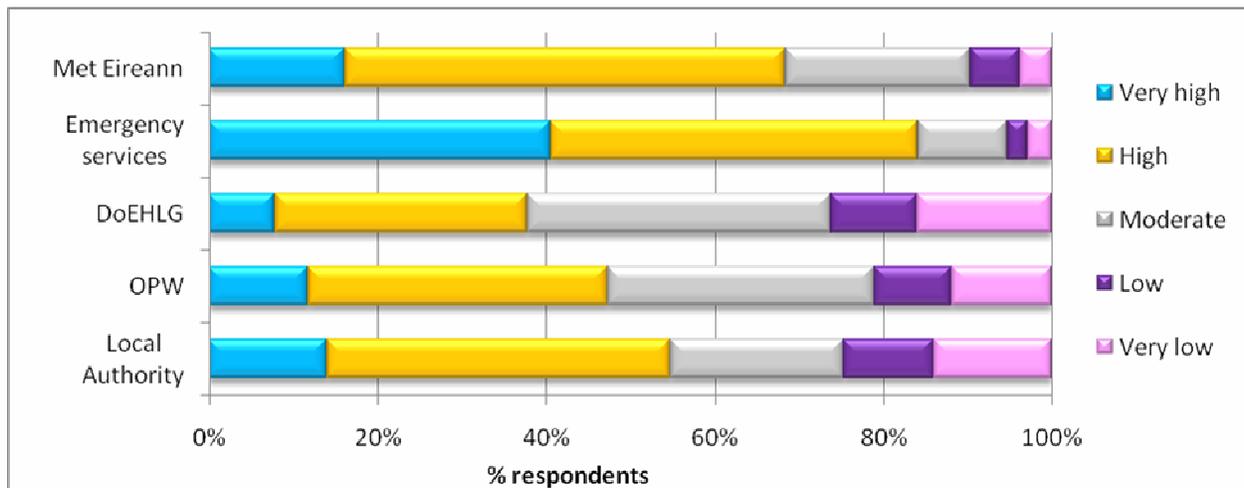
### ***During-flood communications:***

In order for the public at risk to process a warning effectively, they must trust the source of warning, find the source to be reliable and also comprehend the message. Communication without trust and credibility is likely to have very little impact (Renn and Levine, 1991; Williams and Noyes, 2007). For this reason, trust and reliability of agencies involved in flood risk management was investigated. Figure 4 shows that the public at risk hold the least amount of trust and reliability for national bodies such as the OPW and the Department of the Environment Heritage and Local Government (DoEHLG), followed by local authorities. Emergency services, on the other hand, are perceived to be the most trusted and reliable source. There was frustration with the perceived accessibility of agencies, with 40% of the sample feeling agencies are not open to listening to comments from the public. Approximately 55% of respondents had never spoken to their local authority. This increased to 77% and 84% who have never spoken to the OPW and the DoEHLG respectively. Of those that had attempted to contact these bodies, between 25% and 30% felt ignored by them, with one respondent quoting:

*“At previous flood warning conditions it was impossible to contact anyone in the council or OPW. Phones would not be answered.”*

Perceived accessibility was found to be directly related to trust and reliability ( $t=9$ ,  $df=287$ ,  $p<0.001$ ). Results suggest that if flood warnings are continued to be disseminated from national and local sources, trust and reliability as well as perceived accessibility of these bodies must be strengthened. Improving lines of communication between authorities and the public is

recommended to improve trust and reliability and therefore responses to flood warnings. Associating flood messages with agencies that are already perceived as trustworthy and reliable may also be useful.



**Figure 4. Perceived trust and reliability of agencies involved in flood risk management**

Once the message received is found to be reliable and trustworthy, it must be processed and comprehended. Terminology such as a ‘100 year flood’, ‘flood with a 1% annual exceedance probability (AEP)’, ‘1 in 100 flood’ as well as a ‘flood with a 1 in 100 chance of being equalled or exceeded every year’ are often used in flood communications with the public at risk. Respondents were therefore asked which of the four terms they preferred and to self-assess their understanding of each term. A ‘test’ was then presented to establish whether the terms were actually understood. Results in Table 2 show that although the ‘100 year flood’ term was the most preferred term, and had the highest rate of those claiming to understand it, a large percentage did not actually understand it. Results suggest that more information is needed in explaining these terms as a lack of confidence in understanding commonly used terms is a setback to successful communication.

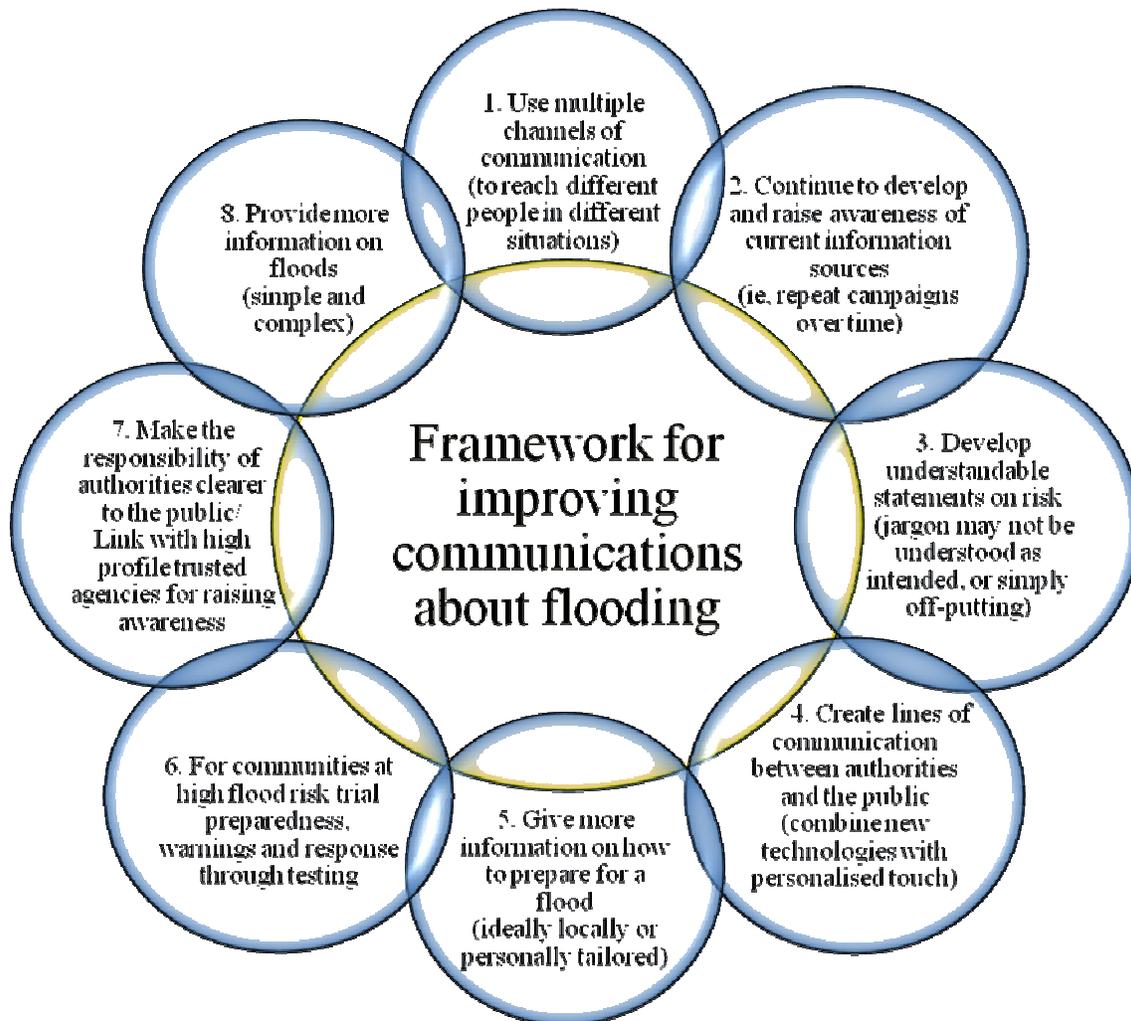
*“We were told it will be another 50 years before the floods in Wexford will be so bad again”*

**Table 2. Respondents' preference for, as well as perceived and actual understanding of, commonly used flood terminology**

Term	Preferred Term	Self-assessed understanding	Actual understanding
100 year flood	45.9 %	61.4 %	54.8 %
1 in 100 flood	21.3 %	52.2 %	82.5 %
1% AEP	5.5 %	29.8 %	90.3 %
1 in 100 chance	27.3 %	55.2 %	90.1 %

#### 4. Discussion

Effective communications strategies are recognised as essential components of flood risk management. However, current communication strategies are often based on the information deficit model and are commonly developed by authorities without input from the community. This paper follows a people-centred and knowledge systems approach utilising extensive quantitative data gathered from the public at risk as to how they understand flood information. From these results, facilitators and barriers to effective communication have been identified. Building on identified obstacles, a framework is developed to be used as an aid for agencies responsible for flood risk communication (Figure 5).



*Figure 5. Framework of 8 interrelated guidelines useful for those involved in developing flood risk communications*

The framework is presented as a series of eight guidelines for improving communication strategies. It is supported by work in three other European countries as part of the UR*flood* project and should therefore be applicable to any community in Ireland and beyond. The

guidelines have been tested using in-depth interviews with the public at risk. Recommendations for their implementation are discussed below.

**Guideline 1. Use multiple channels of communication:** With the rapidly developing world of communications, new methods can be used in addition to more traditional communication channels. Improving co-operation between authorities and the media will allow more efficient use of the media in disseminating information. Useful methods of communication include mass media, printed brochures, articles in local newspapers, through flood officers, information lines and daily points of access. An emphasis is put on more trusted communication sources such as residents associations and local councillors.

**Guideline 2. Continue to develop and raise awareness of current information sources:** In order to improve current information in terms of quality, quantity and efficacy, relatively simple measures can be carried out. These include tailoring information to local needs and using more current 'up-to-the-minute' information. Providing simple URLs for information websites will facilitate easier access. Having links to and from other related websites such as weather forecasts, bus services and traffic information sites that people often visit during times of extreme weather will further promote current websites. Information available should include crisis information in an attention grabbing format as well as supplementary data such as river maintenance details. Using community flood groups, residents associations, emergency services and coast guards to promote current information sources can supplement mass media communication. Promoting information during wet weather, during news reports of large scale floods, or on anniversaries of previous floods is recommended.

**Guideline 3. Develop understandable statements on risk:** A balance needs to be achieved between using simple enough language to be understood by all and using over-simplified terms that may reduce topic salience. It is recommended that a 'layman' or non-technical person look at any planned information for public use, and simplify it to suit public needs. Statements need to be clear, direct, brief, focussed, contain simple language and relate to previous floods. Utilising audio, video and imaging will be a helpful supplement.

**Guideline 4. Create lines of communication between authorities and the public:** Trust and two-way communication can be built up through simple means, putting communities in a better position to further help themselves. Building self-help groups in at-risk communities or using existing local groups, holding public events and setting up an information line are some examples. Existing channels such as social media, radio, TV, weather forecasts as well as contact through local councillors and on-the-ground services can be utilised more effectively. Lines of communication need to be made visible to the public at risk.

**Guideline 5. Give more information on how to prepare for a flood:** In order for the public to prepare for floods, the benefits of doing so must be stressed. This includes financial benefits such as insurance and property prices, as well as the importance of protecting sentimental items. Working with insurance companies, emergency services, local flood groups, community centres, residents associations or local councillors to give personal advice on the benefits of preparatory measures represents a step towards achieving this. This approach also allows for tailored information to be given to specific groups such as the elderly, those with children, those living in one story accommodation, etc. Authorities or local groups can work with private companies to get special rates on bulk orders of personal flood protection devices for communities at risk.

**Guideline 6. For communities at high flood risk, trial preparedness, warnings and response through testing:** Implementation of this guideline will build up trust and communication between authorities and communities at risk as well as co-operation between the authorities themselves. It will illustrate where existing strengths and weaknesses occur by testing the entire process of preparedness, warning and action. A review of drills carried out elsewhere such as Exercise Watermark held in England and Wales in March 2011 will be useful here (Defra, 2011). Involving trained volunteers and local groups will engage the community. Evacuation drills and accessibility drills for sandbags are useful aspects. A tailored approach to the local area focussing on more vulnerable members of the community is important.

**Guideline 7. Make the responsibility of authorities clearer to the public/ Use emergency services in raising flood awareness:** Authorities discussing their work in the media and having planned communications will improve collaboration. The concept of using emergency services to raise awareness can be discussed between agencies and trialled in risk areas. Further suggestions include utilising local groups and focusing attention on specific groups such as the elderly, people with disabilities and new residents.

**Guideline 8. Provide more information on floods:** Information including the effects of climate change, descriptions of local flood history, stories of personal flood experiences, marks showing previous flood heights, details on current schemes, effects on property prices, as well as explanations of what current flood warnings are based on should be provided. Flood maps must have more user-friendly interfaces and be household specific. However, information needs to be prioritised and not all provided at once so that people do not feel overloaded with information. To further avoid overload, it is suggested that only information relevant to a particular stage of flooding be provided at any one time.

## 5. Conclusion

A comprehensive questionnaire study was carried out of the public at risk to various flood types in four case study areas across Ireland. Analysis focussed on flood experience and awareness, pre-flood communication and preparedness as well as during-flood communication. The research uses a people-centred and knowledge systems approach which represents an advance of the currently used information deficit model. From these results, facilitators and barriers to effective flood risk communications are identified and a framework for improving communication strategies is presented. The work is supported by case study research carried out across Europe as part of the ERA-Net CRUE *URflood* project. The framework will therefore be useful to those involved in developing or improving local flood risk management plans not only in Ireland, but across Europe.

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