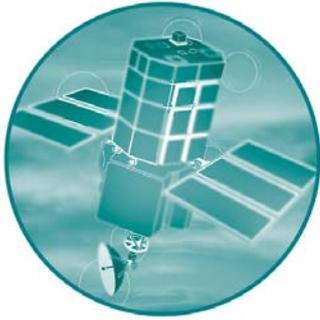


**Defra/Environment Agency
Flood and coastal erosion risk management
R&D Programme**



**Flood Warning for Vulnerable Groups
Secondary Analysis of Flood data**

R&D Technical Report W5C-018/2



**ENVIRONMENT
AGENCY**

Flood Warning for Vulnerable Groups Secondary Analysis of Flood data

R&D Technical Report W5C-018/2

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This report provides us with information about those groups most vulnerable to flooding. It considers their vulnerability in terms of their awareness of being at risk and their ability to respond to and recover from a flood event. The information helps us to target messages to these vulnerable groups to help them prepare for a flood event. It provides useful supporting information for planning communications with and flood warning services for the most vulnerable groups.

Keywords

flooding; flood warning; vulnerable; older people; parents; children; tenants; mapping; socio-economic; flood recovery

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EXECUTIVE SUMMARY

Background to the study

In 2001 researchers in the Department of Sociology and Centre for Environmental Strategy at the University of Surrey were commissioned by the Environment Agency to develop a detailed understanding of whether some groups within the population are particularly vulnerable to floods.

The aims of the project were threefold:

- To document the variance of awareness of flood risk within the populations in flood risk areas
- To document the variance in ability to respond to flood warnings within the population in flood risk areas.
- To document the social distribution of flood risk (are some social groups disproportionately likely to experience flooding?)

Phase one of the project involved analysis of existing literature and data on the social distribution of flood risk and reception of, and ability to respond to, warnings. It also involved some primary data collection in areas affected by the floods of October/November 2000 to explore whether certain groups appeared to be particularly vulnerable. This report concerns the secondary analysis of existing data.

Methodology

Surveys carried out by British Market Research Bureau (BMRB) for the Environment Agency provide the best available data on awareness of flood warnings and responses to flooding among the population. Secondary analysis of the At Risk Survey and Post Event Survey for 2001 was carried out. Unfortunately these surveys provide little data on the socio-economic characteristics of those who were flooded so it was not possible to analyse in any detail whether certain groups within the population are particularly vulnerable to flooding. Suggestions are made for improvements to these surveys to enable more comprehensive analysis. Analysis focused on the factors which affect reception of advice and warnings, awareness of flood risk and action taken.

Research Findings

Analysis of BMRB Data

As a result of the limitations of the BMRB data much of the analysis is descriptive and unsurprising. Some significant factors affecting reception of advice, levels of awareness of flood risk and propensity to take action to minimise the impact of flooding were, however, identified.

In terms of *reception of advice*:

- Those who received warnings and were subsequently flooded recalled more advice than those who were warned but whose premises did not flood, due to a combination of salience and necessity.
- Warned people recall more advice than not warned people (perhaps as they receive more advice as part of their 'warning package').
- Previously-flooded people were more likely to be older, retired and to have lived at their present address for more than 20 years compared to newly-flooded people.

- Previously flooded people were more likely to have received a warning than those who experienced flooding for the first time in 2000/2001.
- Newly flooded people seem to receive more advice, although recall factors may account for this difference.

The following factors were identified as significantly affecting *levels of awareness of flood risk*:

- Previous experience of flooding caused the biggest increase in awareness.
- Being in socio-economic group A or B.
- Being in an Environment Agency served area.
- Being an owner/occupier.
- Being in full time or part time work.
- Being aged 45-54.
- Being in a pre-1970s property increased awareness.
- Where flood severity was worse, awareness was higher.
- Those resident for less than 1 year showed markedly less awareness than longer term residents.

In terms of *action taken*:

- Those who received warnings and were subsequently flooded took more action than those who were warned but whose premises did not flood, due to a combination of salience and necessity
- Advice to take action that is disruptive or requires effort was more likely to be acted on by those who were flooded. This suggests people react to the flood event as it unfolds.
- Advice to take more passive actions is acted upon much more equally, regardless of flooding and warning status.
- Previously flooded people were generally more likely to act upon advice given.
- Households with more than two members resident took more action.
- Being in a pre-1970's property increased actions.
- Households that flooded above floor level had increased actions.
- Having been resident for less than one year decreased actions.

Recommendations and Implications

- There is a need for more socio-economic data to be collected within BMRB surveys to allow for more comprehensive analysis of factors influencing awareness of, and ability to respond to, flood warnings, as well as the social distribution of flood risk.
- Public perceptions of Environment Agency flood advice and warning artefacts would be better explored in a qualitative study than in the BMRB surveys.
- If lack of awareness of flood risk is treated as an indicator of vulnerability to flooding then the following groups are particularly vulnerable:
 - those who have recently moved into a flood plain;
 - people in newer buildings;
 - people renting;
 - people in socio-economic groups C2, D and E.
 - those under 35 and those over 55

In a previous report of the 'At Risk' 2001 survey (BMRB, 2001) it was shown that flood risk residents are slightly older than the national average. Coupled with the finding that older (and younger) people are significantly less aware of their flood risk, this may have major implications for future planning of flood warning dissemination.

1. INTRODUCTION

As part of the ‘flood warning for vulnerable groups’ project, a review and secondary analysis of existing flood data was conducted to help identify factors contributing to ‘vulnerability to flooding’. This report summarises the procedures undertaken, problems encountered, and recommendations made.

2. BACKGROUND

Since 1997 the Environment Agency has commissioned BMRB to conduct a programme of annual surveys of different target populations to establish the awareness of being at flood risk, the public’s understanding of the flood warnings operating in their area and awareness and understanding of precautions and preparations that can be made in the event of flooding. The BMRB programme consisted of three elements:

2.1 National Awareness Survey

This survey has been conducted every January from 1997 to 2001 among the general adult population in England and Wales, using BMRB’s Omnibus survey, ACCESS. The objectives of this survey are to investigate the awareness of the Agency’s responsibility for providing information about flooding, flood warnings, flood defence works and the existence of the flood warning system among the population at large.

2.2 Post Event surveys

These surveys are set up and carried out on an *ad hoc* basis as and when a flood event occurs. The objective of these surveys is to provide an assessment of the efficiency of the flood warnings service among people who are actually flooded. Post Event surveys were administered following flood events in January 1997, January, April and October/November 1998, December 1999, and in June and the Autumn 2000.

2.3 At Risk Survey

This survey aimed to assess among the target population - i.e. those who live in areas at risk from flooding - the awareness and understanding of the flood warnings system operating in their area. Five surveys have been conducted in April/May/June 1997, March/April 1998, March/April 1999, March/April 2000 and July/ August 2001.

3. METHODOLOGY AND DATASETS

3.1 Introduction to secondary analysis

Secondary analysis concerns a re-analysis of data, often addressing very different research questions than those for which the original survey was designed. In the normal research sequence, research questions are generated based on a conceptual framework. Indicators, in the form of survey questions are designed and then data is collected. The analysis that follows this process then sets out to answer the original research questions and develop the original

theory. However, in secondary analysis, the indicators are already set and may not be ideal in answering the secondary analysts' research questions. However, there are many advantages of secondary analysis, mainly to do with savings in the costly outlay of collecting survey data, but secondary analysis may also uncover social processes which were not explored by the original primary analysts. The following analysis attempts to address our research questions:

- < What is the variance of awareness of flood risk within the populations in flood risk areas?
- < What is the variance in ability to respond to flood warnings within the population in flood risk areas?
- < Are some social groups disproportionately likely to experience flooding?

3.2 Data sets for secondary analysis

3.2.1 BMRB data

To answer the first two research questions we mainly concentrated on the final surveys of the At Risk (At Risk 2001) and Post Event (Post Event 2001) surveys, both of whose reports were published by BMRB in 2001 (BMRB: 2001a, 2001b). The BMRB executive summaries of both surveys are to be found in Appendix 1. Both surveys had the advantage of providing the most recent data providing the most current picture of public awareness of the role of the Environment Agency and flood awareness and preparedness in general.

The Post Event 2001 dataset, however, was considered the most appropriate for more extended analysis for two reasons. Firstly, the Post Event questionnaire covers a wider range of issues related to flooding concerning flood awareness, advice received, severity of flooding, actions taken, and several demographic. In comparison, the other BMRB flood-related surveys – the At Risk and National Awareness surveys – cover fewer topics, and deal mostly with 'awareness'. The Post Event Questionnaire, however, is by no means ideal, and suggestions for improving it can be found in Section 5.

Secondly, the Post Event 2001 survey also sampled a large number of people. With 1395 cases in the sample, it has the biggest sample size of any Post Event survey yet conducted by the BMRB. Indeed, with the exception of the National Awareness surveys of 1998 and 2001 (which have fewer questions and are much shorter), the Post Event 2001 survey has the largest sample size of any flood-related survey carried out by the BMRB for the Environment Agency. Large sample sizes are always valued, as they tend to make the data more robust and suitable for detailed analysis.

3.3 Methodological problems with secondary analysis

3.3.1 Sampling strategy of the Post Event Survey

It must be recognised, however, that there were certain problems associated with using the Post Event 2001 data. The main problem was the matter of representation. Some BMRB studies have collected data proportionally from each of the Environment Agency's eight regions, according to the size of the regional 'at risk' database. Other BMRB studies have collected data from each of the eight regions, and then weighted the number of cases according to size of regional 'at risk' databases. For Post Event surveys, however, data is only gathered from areas where flooding actually occurred and so for some of the Environment Agency's eight regions there are no data in the Post Event 2001 study. There is also no attempt to proportionally sample from the actual towns and villages visited. Rather, 180

addresses from each settlement were selected, regardless of whether it was a rural village or a busy city. This all makes direct regional comparisons a difficult. Some things can be compared, such as ‘types of warning methods used’. However, even these comparisons may be inaccurate if there are warning method differences within areas as well as between areas. For example, larger settlements may have different warning methods in different locales. If the 180 addresses selected for the Post Event 2001 survey were all from one particular locale, a false picture may be painted of ‘the warning methods used in town X’.

In addition, very few demographic variables were included in the questionnaire and no questions were asked concerning the presence of children, ethnicity or family composition. This issue is addressed later in this report where recommendations are made about improvements to the questionnaire.

3.3.2 Size of subgroups in the Post Event sample

A number of issues arose during the early stages of data analysis. The first problem encountered, was that of looking at small groups. In some circumstances, selection of cases according to certain demographics and certain flood experiences, resulted in very small groups of people for analysis. For instance, about 40% of the sample, were aged 65 or more, whilst only just over 2% were aged under 25. This rendered age comparisons on certain items, or combinations of items (e.g. not warned and ‘flooding above floor level of property’) meaningless, as the experiences of a lot of older people were being compared with the experiences of literally a handful of young adults. With this in mind, two main strategies were adopted.

To respond to this problem, smaller groups were merged where possible and a policy of only drawing comparisons between groups with at least 50 people in was adopted. Whilst this meant some groups were overlooked (like the unemployed and under 25s) it meant that any relationships that were observed could be reported with a degree of validity.

3.3.3 Regional effects in the Post Event sample

Related to the ‘small groups’ problem, was the ‘regional effects’ problem. In looking at groups close to the minimum acceptable size ($n = 50$), any observed relationships might be heavily influenced by the situation in just one area.

The best example of the ‘regional effect’ concerns building age. In the sample, about 50% of buildings built before 1970 experienced some kind of flooding, whilst only 30% of buildings built after 1970 had some kind of flooding. However, it was also noticed that two of the areas with the most flooding (Maidstone and Woodford Green) also had a much higher proportion of older buildings than the other areas. Whilst older buildings may well be more prone to flooding, historical development and so on, it seems that in this sample, any kind of ‘building age effect’ is actually predominantly due to the degree of flooding in various regions.

3.3.4 Salience and memory in the Post Event sample

Finally, there are several items in the Post Event survey that require recall of information received or action taken. This introduces the whole matter of salience and memory. Salience is particularly key. The more affected by a flood event someone was, the more likely they are to remember things about it. Psychology suggests that people are better at remembering things they were actively involved in, than things they passively observed. People who were actually flooded should recall more advice received and action taken, than people who were not flooded, because they probably *got* more information, and *took* more action. However, as

not flooded people were by and large passive observers of the flood event, they are more likely to forget things they were told or things they did. Hence the observed recall differences between flooded and not flooded groups may have been artificially inflated by the nuances of memory.

It is also worth bearing in mind that memory tends to get worse with age. From psychological studies, it seems that this decay of memory is particularly pronounced for passive, observational memories, but less severe for memories of actions. That is, in general older people are less likely to recall advice received and action taken than younger people. However, this difference in recall will be greater amongst not flooded people than amongst flooded people. .

4. ANALYSIS

4.1 Initial Analysis of BMRB data

Despite the introduction of flood prevention and control policies, there still remains a considerable “residual flood risk”, as seen in the extensive and repeated floods in the UK over the last decade. In fact, the Environment Agency’s own message to people in “at risk” areas has been that you can’t stop flooding but you can prepare for it. Although being prepared may not stop the flooding it may mitigate the damage caused and speed up recovery after loss. So whether one is eventually flooded or not should not be a factor that would predict preparedness since flood warning and advice generally precedes the flood event. Therefore you would expect that people living in “at risk” areas should be equally warned and advised of flood risk. However, previous experience of flooding may temper ones acceptance of flood warnings or advice. It was therefore decided to look at these issues taken from two perspectives:

- < Types of warnings and advice received and action taken by flooded and not flooded people
- < Types of warnings and advice received and action taken by first-time flooded and previously-flooded people.

4.1.1 Flooded and not-flooded respondents

Characteristics of flooded and not flooded people

Exhibit 1 shows several characteristics of flooded and not-flooded respondents in the 2001 Post Event survey. This table shows that flooded people were more likely to receive flood warnings and advice. At first this may seem intuitive - that people who were actually flooded would be more likely to get a warning than people who were not flooded - and similarly that they would get more advice. This, and the greater awareness of Environment Agency artefacts and AVM, suggested that to some extent Environment Agency resources *were* getting to the right people. It was not immediately clear however, how this had happened. All of the 1395 cases in the sample had been chosen from the Environment Agency’s ‘at risk’ database so how did the ones that ultimately flooded manage to get more information and advice? At this stage in the analysis, a number of possibilities seemed plausible.

Exhibit 1. Characteristics of flooded and not-flooded respondents

	Flooded (608)	Not Flooded (784)	Sig.
Received flood warning	61%	41%	***
Satisfied with warning methods (if appropriate)	77%	87%	***
Dissatisfied with warning methods (if approp.)	23%	13%	
Given some kind of advice regardless if flooded	66%	53%	***
Have seen the red warning card	59%	41%	***
Have seen an Environment Agency leaflet	32%	22%	***
On AVM	17%	7%	***
Have had previous flood warning	33%	16%	***
Have been flooded before	50%	3%	***
Property built before 1970	77%	61%	***
Property built in 1990s	10%	19%	
Had enough advice	55%	70%	***

Source: Post Event 2001

*** p< 0.000 following Chi square test for independence

Firstly, salience and memory may mean that flooded people were more likely to recall warnings, advice, leaflets and so on, and this may account for the differences. Secondly, it may just be the luck of the sample, to get cases where the flooded people had the most information. Thirdly, the Environment Agency may have other information on their ‘at risk’ database, about *degree* of risk, or historical data about previous floods. This was confirmed by communication with Environment Agency personnel, suggested that there was a huge regional variation in the quality and quantity of ‘other information’ held about properties in flood risk areas.

The greater satisfaction with warning methods and advice amongst not flooded people could also be understood intuitively. Quite simply, not flooded people experienced less – or possibly no – disruption due to the flood, and so from their point of view, the warning methods and advice were satisfactory. Those flooded, on the other hand, may be angered by the whole flood experience and see warning methods and amounts of advice as needing improvement.

The previous experience of flood warnings and actual flooding, also makes for interesting reading. Coupled with their knowledge of Environment Agency artefacts, and the greater amount of information they received, flooded people clearly had a lot more ‘flood experience’ than not flooded people. Indeed, this prompted some further analysis of the differences between first time floodees and repeat floodees, which shall be addressed in the next section.

As discussed earlier in this report, the differences observed in likelihood of flooding by building age turned out to be predominantly a regional effect.

Types of warning received by flooded and not-flooded respondents

The most common warning method, and for many the first indication that their property was at risk, was the Environment Agency’s recorded telephone message, which was first received by 34% of those people who were flooded, and 25% of those people who were not flooded.

For flooded people, friends or neighbours were the second most common warning method (15%), whilst for not flooded people, the first indication that their property was at risk was through an Environment Agency leaflet (15%).

Of those people who were warned of the flood, 78% also received some sort of advice. Of those who were not warned, 39% received some kind of advice.

Considering different types of flooding, those who experienced the *worst* flooding (above floor level of property), were the most likely to receive a warning (65.9%), and most likely to have 6 or more hours warning (78.7%).

The fact that the respondents who experienced the worst flooding also got the best warnings, again raised the question as to *how* this came about. Once again, it seemed at this point in the analysis that this could be due to salience, memory, luck, or information already held by the Environment Agency – or indeed a combination of these possibilities. The fact that warned people were more likely to get advice than not warned people, was also relevant to this issue. That is, people who were not warned, and so also tended to get less advice, ultimately ended up being less likely to suffer flooding. But, was this due to luck, or were these people known to be in less danger, and hence not given as much information?

Advice and action received

These two areas were inextricably linked, since the ‘advice’ was of types of mitigating ‘action’ that could be taken in the event of flooding. Comparisons of types of advice received, and whether it was acted upon, focused mainly on the differences between the groups of people who were flooded or not flooded, and warned or not warned.

When comparing people who were flooded with people who were not flooded, it was not surprising that the flooded people were more likely to recall pieces of advice than the not flooded people. Not only were flooded people more likely to get advice, it was also much more salient to them. However, the differences in recall varied depending on the *type* of advice. Advice to take disruptive precautionary or preventative measures (such as evacuating), was much more likely to be recalled by flooded people. Advice to take more passive actions (like listening to local radio) was fairly evenly recalled by both flooded and not flooded people. These results are summarised in the Exhibit 2

Exhibit 2 Advice received by flooded and not-flooded respondents

Type of advice recalled	Flooded (n = 608)	Not flooded (n = 784)
Listen to local radio	35.4% (215)	31.3% (245)
Call Floodline	38.8% (236)	27.8% (218)
Warn your neighbours	23.0% (140)	13.5% (106)
Move valuables upstairs / to safety	41.8% (254)	25.1% (197)
Move yourself / others to safety [evacuate]	29.6% (180)	13.3% (104)
Take warm clothes / medication to safe place	19.2% (117)	8.7% (68)
Prepare for loss of power (e.g. get torch)	26.0% (158)	14.9% (117)
Use sandbags	27.1% (165)	16.3% (128)
Use floodboards / flood gates	3.5%* (21)	3.6%* (28)
Switch off gas / electricity	24.2% (147)	9.9% (78)
Check gas / electricity before re-use	16.9% (103)	5.7%* (45)
Boil tap water if flooded	13.8% (84)	5.2%* (41)
Move cars to safe place	17.8% (108)	7.4% (58)
Listen out for warnings	22.9% (139)	20.7% (162)
Check Environment Agency website	4.8%* (29)	4.8%* (38)

[* n < 50]

Source: Post Event 2001

This trend was also seen when looking at how likely these two groups were to act on advice given. Exhibit 3 shows how likely flooded and not flooded people were to act on the pieces of advice they received.

[NB: a value of 76.7% for 'listen to local radio' does not mean that 76.7% of all flooded people 'listened to local radio' but rather that 76.7% of flooded people who were advised to 'listen to local radio', did so.]

Exhibit 3 Types of advice acted upon by flooded and not-flooded respondents

Type of advice acted upon	Flooded people	Not flooded people
Listen to local radio	76.7% (165)	77.6% (190)
Call Floodline	61.9% (146)	50.9% (111)
Warn your neighbours	85.0% (119)	80.2% (85)
Move valuables upstairs / to safety	83.5% (212)	54.3% (107)
Move yourself / others to safety [evacuate]	65.6% (118)	20.2%* (21)
Take warm clothes / medication to safe place	74.4% (87)	32.4%* (22)
Prepare for loss of power (e.g. get torch)	87.3% (138)	72.6% (85)
Use sandbags	75.6% (125)	59.4% (76)
Use floodboards / flood gates	42.9%* (9)	25.0%* (7)
Switch off gas / electricity	57.1% (84)	28.2%* (22)
Check gas / electricity before re-use	62.1% (64)	17.8%* (8)
Boil tap water if flooded	35.7%* (30)	26.8%* (11)
Move cars to safe place	81.3% (88)	39.7%* (23)
Listen out for warnings	92.1% (128)	90.7% (147)
Check Environment Agency website	31.0%* (9)	42.1%* (16)

[* n < 50]

Source: Post Event 2001

Again, the differences may be interpreted intuitively. Flooded people were much more likely to need to undertake various actions and thus more likely to act on advice. Having to move furniture around for instance, would be more memorable than just listening to the radio. The differences between the two groups however, are smaller for less disruptive actions. For passive actions, such as ‘listen to local radio’ or ‘listen out for warnings’, flooded and not flooded people were equally likely to comply. This suggested that even those people who ended up not being flooded were likely to monitor the situation during the flood event.

This exploration was then taken further, to see what difference it made if respondents had had a warning. As far as advice recall was concerned, a kind of ‘recall hierarchy’ was evident. For the majority of advice types, people who were warned and flooded were most likely to recall a piece of advice. Next most likely were people who were warned but not flooded. Then people who were not warned, but were flooded; and finally people who were not

warned, but did not flood. This concurs with the earlier observation that people who got a warning were much more likely to get advice.

Exhibit 4 Advice recalled by warned/not warned, flooded/not flooded respondents

Type of advice recalled	Warned & flooded (n = 369)	Warned & not flooded (n = 323)	Not warned, but flooded (n = 225)	Not warned, not flooded (n = 437)
Listen to local radio	44.2% (163)	42.4% (137)	22.2% (50)	23.1% (101)
Telephone Floodline	47.4% (175)	44.3% (143)	26.2% (59)	15.6% (68)
Warn your neighbours	32.2% (119)	23.2% (75)	8.9%* (20)	6.9%* (30)
Move valuables upstairs / to a safe place	55.3% (204)	46.4% (150)	21.8%* (49)	9.4%* (41)
Move yourself / others to a safe place	39.6% (146)	25.7% (83)	14.7%* (33)	4.1%* (18)
Take warm clothes / medication to a safe place	27.1% (100)	15.2%* (49)	6.7%* (15)	3.7%* (16)
Be prepared for loss of power	35.2% (130)	23.5% (76)	12.4%* (28)	7.8%* (34)
Use sandbags	35.0% (129)	31.3% (101)	16.0%* (36)	5.7%* (25)
Use floodboards / flood gates	5.4%* (20)	7.1%* (23)	0.4%* (1)	0.9%* (4)
Switch off gas / electricity	32.0% (118)	18.9% (61)	12.4%* (28)	3.7%* (16)
Check gas / electricity before re-use	22.8% (84)	10.5%* (34)	8.4%* (19)	2.5%* (11)
Boil tap water if flooded	19.2% (71)	8.7%* (28)	5.8%* (13)	3.0%* (13)
Move cars to safe place	25.2% (93)	12.7%* (41)	6.7%* (15)	3.4%* (15)
Listen out for warnings	31.4% (116)	30.3% (98)	9.8%* (22)	14.0% (61)
Check Environment Agency website	5.7%* (21)	9.0%* (29)	3.6%* (8)	2.1%* (9)

[* n > 50]

Source: Post Event 2001

The pattern, or hierarchy, was slightly different for actions. Exhibit 5 shows how likely people were to act on pieces of advice they were given. Once again these percentages represent the proportion of people who went on to act on a piece of advice they had previously been given.

Exhibit 5 Types of actions taken after advice given to flooded/warned respondents[§]

Type of advice acted upon	Warned and flooded	Warned and not flooded	Not warned, but flooded	Not warned, not flooded
Listen to local radio	80.4% (131)	77.4% (106)	64.0%* (32)	77.2% (78)
Telephone Floodline	60.6% (106)	51.0% (73)	66.1%* (39)	51.5%* (35)
Warn your neighbours	83.2% (99)	80.0% (60)	95.0%* (19)	80.0%* (24)
Move valuables upstairs / to a safe place	85.8% (175)	56.0% (84)	75.5%* (37)	51.2%* (21)
Move yourself / others to a safe place	67.1% (98)	22.9%* (19)	60.6%* (20)	11.1%* (2)
Take warm clothes / medication to a safe place	76.0% (76)	30.6%* (15)	73.3%* (11)	43.8%* (7)
Be prepared for loss of power	87.7% (114)	73.7% (56)	85.7%* (24)	73.5%* (25)
Use sandbags	76.6% (99)	57.4% (58)	72.2%* (26)	72.0%* (18)
Use floodboards / flood gates	45.0%* (9)	21.7%* (5)	0.0%* (0)	50.0%* (2)
Switch off gas / electricity	56.8% (67)	26.2%* (16)	57.1%* (16)	37.5%* (6)
Check gas / electricity before re-use	58.3%* (49)	14.7%* (5)	78.9%* (15)	27.3%* (3)
Boil tap water if flooded	39.4%* (28)	25.0%* (7)	15.4%* (2)	30.8%* (4)
Move cars to safe place	83.7% (78)	34.1%* (14)	66.7%* (10)	60.0%* (9)
Listen out for warnings	93.1% (108)	92.9% (91)	86.4%* (19)	88.5% (54)
Check Environment Agency website	33.3%* (7)	44.8%* (13)	25.0%* (2)	33.3%* (3)

[* n > 50] [[§] Note that the numbers in brackets represent the number acting upon advice received thus the percentages represent the percentage of those receiving advice who actually acted]

Source: Post Event 2001

The trend that existed for recall of *advice*, that those warned were more likely to recall advice, was not the same for the trend in actions taken. Rather, the key determinant here whether flooding had occurred or not. So, while the more passive actions did not vary much between groups, the most disruptive actions were still undertaken more by flooded people, regardless of their warned / not warned status.

Summary of findings for flooded and not flooded respondents

< **Flooded** people recall more advice, and take more action, due to a combination of salience and necessity

- < **Warned** people recall more advice than **not warned** people (perhaps as part of their ‘warning package’).
- < Advice to take action that is disruptive or requires effort, is more likely to be acted on by those who were **flooded** – this suggests reacting *to* the flood event as it unfolds.
- < Advice to take more passive actions is acted upon much more equally, regardless of flooding and warning status.

4.1.2 First-time flooded and previously-flooded respondents

From earlier comparison of flooded and not flooded people, it was clear that many flooded people had greater flood experience than not flooded people, through direct personal experience of flooding and knowledge of Environment Agency artefacts. Not all the flooded people however, had been flooded before, and so it was decided to investigate any differences between repeat floodees and first time floodees. The intention here was to look at the demographic characteristics of these two groups, and to see how having previous experience of flooding may affect how people react to a flood event.

Characteristics of newly-flooded and previously-flooded respondents

First-time and repeat floodees were compared across several demographic variables, including age, sex, number in household, work status, illness and length of residence. Significant differences include:

- < Repeat floodees tend to be older than first time floodees (59.5% of repeat floodees aged 55 or over, compared to 44% of first time floodees).
- < First time floodees were more likely to be in households of 3 or more persons, than repeat floodees (38.8% of first time floodees compared to 25.2% of repeat floodees).
- < Repeat floodees were most likely to be retired, followed by working full time. The reverse is the case for first time floodees.
- < Repeat floodees tend to have been at their property for longer than first time floodees (39.8% of repeat floodees have been resident for 20+ years, compared to 26.8% of first time floodees. 26.1% of first time floodees have been resident for less than 3 years, compared to 10.5% of repeat floodees).

Looking at these observations, it seem that most of the differences can be attributed to the fact that repeat floodees were simply just older than first time floodees. Not only was this evident from the comparison of ages, but also because repeat floodees were more likely to be retired, less likely to be living in ‘family size’ households, and more likely to have been in residence a long time. It is not surprising that such people were repeat floodees, as they had simply been around longer and hence had more opportunities to experience flooding in the past.

Warnings received by newly-flooded and previously-flooded respondents

Exhibit 6 compares the warnings received by newly-flooded and previously flooded respondents.

Here we see that repeat floodees were slightly more likely to get a warning, and the warnings they received often came earlier than those received by first time floodees. This may suggest that regional ‘other information’ (i.e. information other than the ‘at risk’ databases) includes historical information on properties that have been flooded in the past. Meanwhile, there may be less regional information about the properties of first time floodees, as they have not been affected in the past.

Exhibit 6 Warnings received by previous flood experience

Type of warning	Repeat Floodees	First Time Floodees
Received a warning	63.5%	57.9%
Warned less than half an hour before flooding	3.1%	8.1%
Warned between half an hour and an hour before flooding	0.5%	2.3%
Warned 1 – 2 hours before flooding	1.0%	2.3%
Warned 2 – 3 hours before flooding	3.1%	5.8%
Warned 3 – 4 hours before flooding	5.2%	8.1%
Warned 4 – 6 hours before flooding	10.4%	8.7%
Warned 6 or more hours before flooding	69.4%	57.2%

Source: Post Event 2001

Related to this, it may well be that repeat floodees have actively sought out more information about flooding, or made requests to be included in Environment Agency warning schemes. First time floodees, being generally newer to their area and with no previous experience of flooding and its consequences, may be less likely to make such requests. This notion is perhaps borne out by the earlier observation that people with previous flooding experience were more likely to be on the AVM system, and to own or recognise Environment Agency artefacts.

Advice and actions received

Repeat floodees and first time floodees were then compared on their recollection of advice, and their acting on advice received. Exhibit 7 below shows the types of advice recalled by each group.

Exhibit 7. Type of advice received by previous flood experience

Type of advice recalled	Repeat floodees (n = 304)	First time floodees (n = 299)
Listen to local radio	36.5% (111)	34.4% (103)
Call Floodline	35.5% (108)	42.5% (127)
Warn your neighbours	21.7% (66)	24.4% (73)
Move valuables upstairs / to safety	40.1% (122)	43.1% (129)
Move yourself / others to safety [evacuate]	28.3% (86)	31.1% (93)
Take warm clothes / medication to safe place	17.4% (53)	21.1% (63)
Prepare for loss of power (e.g. get torch)	22.4% (68)	29.8% (89)
Use sandbags	26.0% (79)	28.4% (85)
Use floodboards / flood gates	4.9%* (15)	1.7%* (5)
Switch off gas / electricity	21.7% (66)	26.4% (79)
Check gas / electricity before re-use	16.8% (51)	17.1% (51)
Boil tap water if flooded	13.8%* (42)	13.4%* (40)
Move cars to safe place	16.8% (51)	18.4% (55)
Listen out for warnings	20.7% (63)	24.7% (74)
Check Environment Agency website	3.6%* (11)	6.0%* (18)

[* n < 50]

Source: Post Event 2001

These results suggests that it is first time floodees who have received slightly more advice. When earlier comparing flooded people with not flooded people, it seemed that the people who got warnings also recalled the most amount of advice. However, when comparing these two groups of flooded people, this is not the case. Rather, whilst repeat floodees were more likely to get some kind of warning, it was the first time floodees who recalled more advice.

There are a couple of plausible explanations for this. Firstly, these two groups may have differing perceptions of what constitutes 'advice'. Repeat floodees are likely to have heard pieces of advice in the past, and so consider many pieces of 'advice' to actually be already held 'knowledge'. That is, if a 'repeat floodee' was advised during the Autumn 2000 floods to move valuables, they may not recall this as advice per se, as they already *knew* this was something they ought to do. First time floodees on the other hand, are more likely to consider

any piece of advice as precisely that, having had no previous experience of what to do in a flood.

Related to this, is the notion of salience. Whereas repeat floodees have been through flood Event before, the whole process is new to first time floodees. Such a disruptive ‘new’ experience may aid first time floodees to recall the whole episode – including the advice they received. Conversely, repeat floodees may be more ‘used to’ (though by no means blasé about) flooding, and find it harder to recall the specific details of their most recent specific experience – perhaps confusing elements of their most recent experience with those of earlier experiences.

Receiving advice is all very well, but it is also interesting to see the extent to which it is acted upon. Exhibit 8 compares the actions taken upon received advice by repeat floodees and first time floodees. As before, the percentages refer to the ‘percentage of people who were advised to take action X and actually went on to do so’. Absolute figures are also included for reference purposes.

Exhibit 8 Type of action acted upon by previous flood experience

Type of advice acted upon	Repeat floodees	First time floodees
Listen to local radio	85.6% (95)	67.0% (69)
Call Floodline	60.2% (65)	63.0% (80)
Warn your neighbours	90.9% (60)	79.5% (58)
Move valuables upstairs / to safety	88.5% (108)	78.3% (101)
Move yourself / others to safety [evacuate]	73.3% (63)	59.1% (55)
Take warm clothes / medication to safe place	81.1%* (43)	68.3%* (43)
Prepare for loss of power (e.g. get torch)	91.2% (62)	84.3% (75)
Use sandbags	79.5% (63)	71.8% (61)
Use floodboards / flood gates	53.3%* (8)	80.0%* (4)
Switch off gas / electricity	60.6%* (40)	54.4%* (43)
Check gas / electricity before re-use	70.6%* (36)	54.9%* (28)
Boil tap water if flooded	35.7%* (15)	32.5%* (13)
Move cars to safe place	84.3%* (43)	81.5%* (45)
Listen out for warnings	98.4% (62)	86.5% (64)
Check Environment Agency website	45.5%* (5)	22.2%* (4)

[* n < 50]

Source: Post Event 2001

This Exhibit shows that – despite recalling less advice – repeat floodees were generally more likely to *act* on advice that they were given. This may again be related to their previous experience. Repeat floodees would feel more confident that what they were doing was appropriate, or might in some way lessen the damage to property and possessions. First time floodees on the other hand, may feel more trepidation about taking action in case they ‘do it wrong’.

Alternatively, first time floodees may take less action as they have less experience of judging what is - and what is not – appropriate action to take. This may also relate back to the earlier observation that people take action in response to the unfolding events of a flood, rather than taking precautions before the flooding is upon them. If this is the case, people may not actually be directly acting upon advice they have just received. Rather, in the chaos and disruption of trying to limit flood damage, people may well just do whatever seems correct at the time. In such a scenario, the previous experience of repeat floodees is obviously

invaluable, and will give them more ideas about what to do now. This line of argument also suggests that ‘acting upon advice’ may not be a conscious decision taken during a flood event, but rather, something that is noticed upon later reflection of what occurred during the flood. Thus, first time floodees may not be ignoring advice they are given, but simply forgetting some of it during the actual flood. Repeat floodees who forget event-specific advice at least have previous flood experience to fall back on to inform their actions, whereas first time floodees do not.

Satisfaction of Warning methods

Earlier observations suggested that not flooded people tended to be more satisfied with warning methods and advice than flooded people. Exhibit 9 compares the satisfaction with warnings and advice of repeat floodees and first time floodees.

Exhibit 9 Satisfaction with warning methods by previous experience

	Repeat floodees	First time floodees
Satisfied with warning methods	82.0%	70.7%
Dissatisfied with warning methods	17.5%	28.1%
Had enough advice	65.1%	44.8%

Source: Post Event 2001

Perhaps unsurprisingly, it is the first time floodees who display most dissatisfaction. Being flooded is both traumatic, and likely to elicit anger. First time floodees may be more likely to think that the whole system of combating floods – including warning methods and advice - ‘could be better’. Repeat floodees on the other hand – whilst still angry – might be more likely recognise that it is not the warning methods or advice per se that are at fault, but perhaps their implementation or organisation. However, it is important to note that for both groups, satisfaction with warning methods is high.

Summary of key findings for newly -flooded and previously flooded respondents

- < Previously-flooded people were more likely to be older, retired and to have lived at their present address for more than 20 years compared to newly-flooded people
- < Previously flooded people were more likely to have received a warning than newly flooded people
- < Newly flooded people seem to receive more advice, although recall factors may account for this difference
- < Previously flooded people were generally more likely to act upon advice given.

4.2 Multivariate analysis of BMRB data

4.2.1 Awareness and action scales

The initial analyses of the data suggested a number of factors that may influence how someone experiences a flood event. A recurring theme that linked all these observations though, was the notion of ‘previous experience’. Actually having experienced a flood will be more memorable than simply observing previous flood events, and this previous experience will have a dramatic effect on an individual’s overall flood ‘awareness’. This notion of ‘awareness’ is very important. Literature (see Flood Warning for Vulnerable Groups: Literature Review) suggests that people are often unaware of the risk that flooding poses to

their property. Alternatively, people may be vaguely aware of the risk, but because they do not want to be flooded, do not seek information about their situation. Similarly, the Environment Agency recognises that people living in flood risk areas can be categorised as either ‘engaged’ or ‘complacent’ with respect to their awareness of flood risk and desire for information about flooding. There is plenty of information about flooding available, the real problem is getting people to look at it. Awareness is important because it is likely to lead to better preparedness for a flood event and more effective responses should property actually be flooded.

With this in mind, further consideration of ‘awareness’ seemed appropriate. An ‘awareness’ scale was constructed, where each respondent had an ordinal ‘awareness’ score. As well as allowing direct comparison of the range and distribution of awareness scores across different groups, this data would also allow for analyses to be run which compare competing influences on awareness of flooding.

Scale construction

Three scales were created in order to further explore people’s knowledge of, and responses to, flooding:

- < Using the At Risk 2001 survey, an ‘awareness’ scale was created, to allow the quantification of people’s general knowledge about flood warning methods, types of defensive action that could be taken and sources of information about flooding
- < Another ‘awareness’ scale was created using the Post Event 2001 survey. This scale quantified people’s awareness of specific flood events as they actually unfolded. That is, whilst the At Risk 2001 ‘awareness’ scale essentially measured ‘general knowledge’ about flooding, the Post Event 2001 ‘awareness’ scale measured the extent to which people seemed informed about flooding *during an actual flood event*
- < Finally, also using the Post Event 2001 survey, an ‘action’ scale was created, which quantified how much, and what type, of mitigating actions people took to combat the flood event.

Full details of the items selected for these scales are in Appendix 2.

Reliability analysis was carried out on each of the three scales to confirm satisfactory internal consistency, based on the average inter-item correlation. Cronbach’s α scores of 0.79 for the At Risk 2001 ‘awareness’ scale, 0.66 for the Post Event 2001 ‘awareness’ scale and 0.76 for the Post Event 2001 ‘actions’ scale were calculated to confirm a satisfactory level of inter-item correlation.

4.2.2 Analysis of Awareness and Action scales

Observations from each of the three scales will be considered in turn.

At Risk 2001 ‘awareness’ scale.

The mean ‘awareness’ score (range: 0-83) for the whole sample was 26.78. Exhibit 10 shows the mean scores comparing subgroups by tenure, working status, gender and whether been flooded before while exhibits 11, 12 and 13 chart the levels of awareness by respondents by age group, length of residence and by class.

Exhibit 10 Mean awareness scores for various subgroups

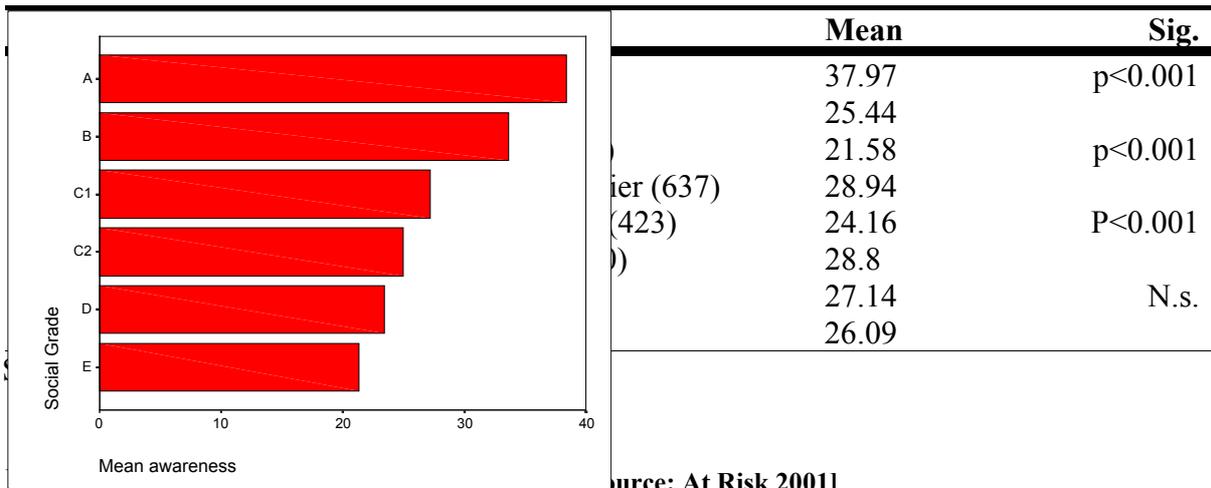
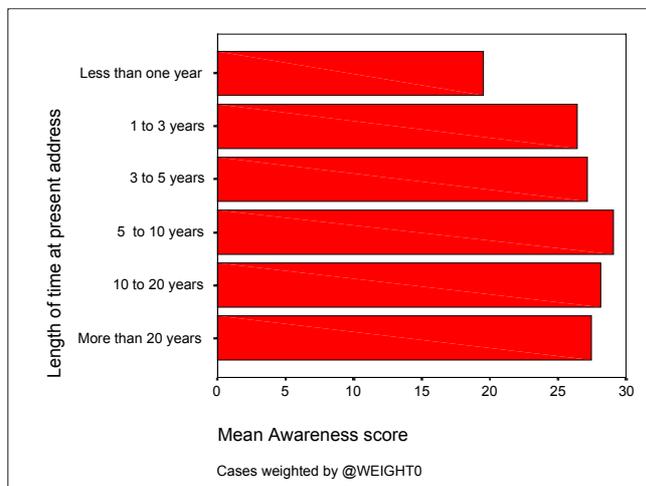
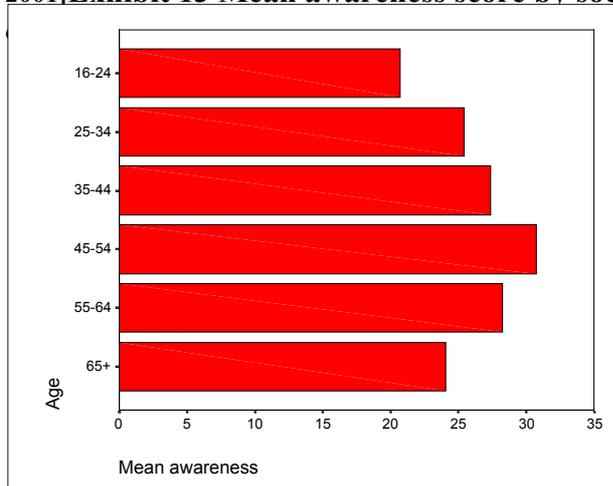


Exhibit 12 Mean awareness by length of time at present address [Source: At Risk 2001] Exhibit 13 Mean awareness score by social grade [Source: At Risk 2001] Previous flood



It should be no surprise that people with previous experience of flooding, tend to have more flood 'awareness' than people who have never been flooded before.

Tenure

Owner / occupiers may exhibit greater 'awareness' than people who rent accommodation as they have much more at stake and may wish to be as informed as possible about measures they can take in the event of a flood. Whilst renters have only to worry about their possessions, owner / occupiers risk suffering damage to both their possessions and the actual property itself.

Work status

There are a number of reasons why working people may display more 'awareness' than those who are not working. Working people are more likely to be owner / occupiers than people not working (Exhibit 13). Age may also be a factor. As can be seen from Exhibit 14 the majority of the 'not working' group are actually retirees, whilst most working people may be in the 25-64 age range. As can be seen in Exhibit 11 'awareness' was generally lower than average among the over 65s, whilst 'awareness' was higher for those of 'working age'.

Exhibit 14 Distribution of work status by age groups [Source: At Risk 2001]

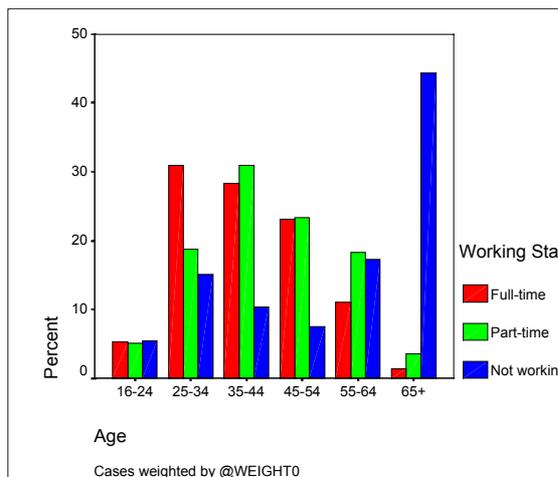
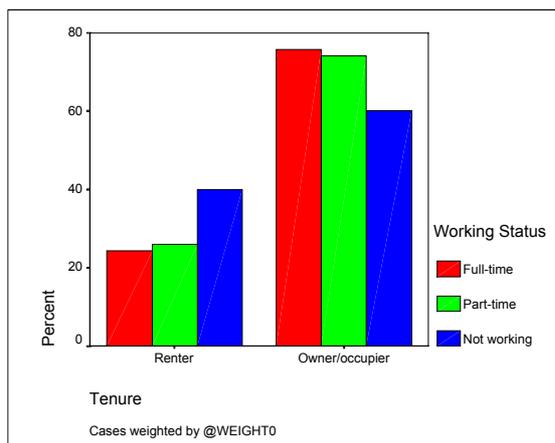


Exhibit 15 Distribution of work status by tenancy [Source: At Risk 2001]



Age

Age also seemed to have some effect on ‘awareness’. The youngest and oldest age groups had the lowest ‘awareness’ scores, whilst the ‘middle-aged’ scored higher. Those at the younger end of the scale may have less experience of flooding simply through having not been alive as long as other respondents. They may have fewer ideas about what *can* be done in the event of a flood; what agencies they can contact for flood information; what methods of flood warning might be used; and so on.

At the other end of the age scale, one cannot estimate the effects of memory (see Section 3.3.4). As memory deteriorates with age, some of the knowledge contributing to this ‘awareness’ may be harder to recall, and may only be evidenced in the face of an actual flood event. This is particularly relevant considering that some items on the questionnaire required respondents to recall events from months or even years ago.

However, age may be very relevant since previous reporting of this data has shown that:

'Over one third of respondents (36%) were aged 55 or over and over a quarter (27%) were under 35. Compared with the national average, flood risk residents are slightly older (nationally 23% of the population being 55+ c.f. 36% of the sample)'. (BMRB, 2001:10)

Length of residence

As far as length of residence is concerned, the main point of interest is that people new to an area (resident for less than 1 year) displayed markedly lower 'awareness' than people who had been in residence longer. This is perhaps not surprising as one is bound to learn progressively more about an area, the longer one lives there. That said, a lot of information about a new locale, will be picked up fairly quickly, with decreasing amounts of 'new' information amassed year by year. This could explain the sudden leap in 'awareness' amongst respondents who had been resident in their areas for more than a year.

Social Class

Finally, social class seems to have an important effect on 'awareness'. This may be due to people in groups A and B having: greater access to flood information sources; better recall of information; and more ability to think of plausible answers to spontaneous-response type questions in an interview situation. This may be the result of better education and being more used to using the type of cognitive skills necessary to recall information and think of responses, even when the subject may not be particularly salient

Equally however, the observed differences may be tied to other variables. People in social economic groups D and E are less likely to own their own home (Exhibit 16), and are less likely to be in employment (Exhibit 17).

Exhibit 16 Distribution of Social Grade by tenancy [Source: At Risk 2001]

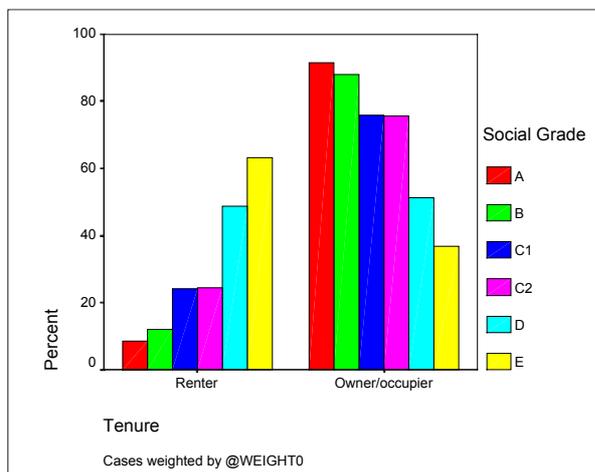
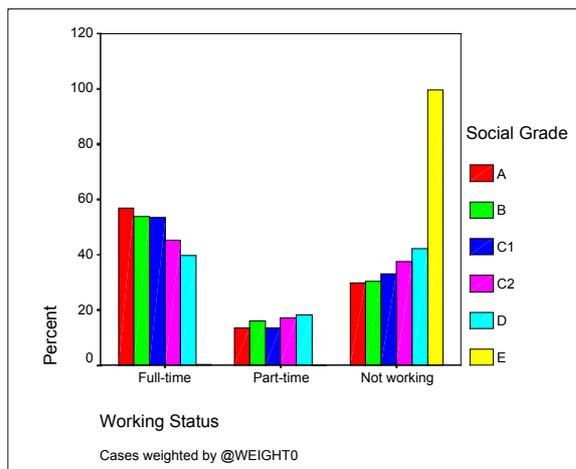


Exhibit 17 Distribution of social grade by work status [Source: At Risk 2001]



Post Event 2001 'awareness' scale.

Experience of flooding

Analysis of the 'awareness' scale (Mean =14.43 and range 0-50) revealed that people who were flooded in Autumn 2000 had higher 'awareness' scores on this scale, than people who were not flooded (Exhibit 18). Going through an actual flood event would certainly have been a learning experience for these people, and hence they showed greater 'awareness' when giving their responses to the Post Event 2001 questionnaire (which translates to a greater score on the 'awareness'

scale derived from this questionnaire). Flooded people were more likely to have received warnings and advice (see Section 4.1.1) were the main items contributing to this 'awareness' scale.

The issue of salience is also relevant here. When questioned about Autumn 2000 flooding a few months *after* the event, those people who were actually flooded might recall the information, warnings and advice they received, better than those people who were not flooded.

Similarly, it is no surprise that people who are repeat floodees score higher on 'awareness' than first time floodees. Repeat floodees can draw on more past experience than first time floodees, and may also have talked about flooding more often, and so be more used to recalling types of warning and advice.

Building age

The scale suggests that 'awareness' is also higher amongst people living in pre-1970s buildings, than those living in newer buildings. However, as previously mentioned (see Section 3.3.3), the 'building age' effect seems to be a regional effect. Two of the places with predominantly pre-1970s buildings (Maidstone and Woodford Green) were also two of the most flooded places in the survey. This means the fact that 'awareness' seems higher in pre-1970s properties is actually because in the Post Event 2001 sample these properties suffered more flooding (due to the 'regional effects' of Maidstone and Woodford Green). As mentioned above, 'awareness' is higher amongst people who *were* flooded in Autumn 2000, and so the 'awareness' scores of people in pre-1970s properties are observed to be greater than those of people in other properties.

Exhibit 18 Mean Post Event awareness scores for various subgroups

		Mean	Sig.
Whether property flooded	Yes (608)	18.2	p<0.001
	No (784)	11.6	
Whether property ever been flooded	Yes (304)	12.1	p<0.05
	No (299)	11.4	
When property built	Newer buildings (430)	11.7	p<0.001
	Pre 1970's (944)	15.8	
Gender	Male (575)	12.1	N.s.
	Female (682)	11.8	
If had enough advice	Yes (882)	12.1	p<0.001
	No (419)	10.8	
Where flooded	Above floor level	20.5	p<0.01
	Below floor level	17.1	

Source: Post Event 2001

Amount of advice

Another interesting observation is that people who felt they had had enough advice about flooding, tended to have higher ‘awareness’ scores than people who felt they had not had enough advice. It seems plausible that this lack of ‘awareness’ may have caused these respondents to feel they did not have enough advice. In other words, ‘awareness’ is higher amongst ‘satisfied’ people, and that is why they are satisfied.

Age and length of residence

The two Post Event 2001 ‘awareness’ scale graphs (Exhibit 19 and 20), show a similar story to the equivalent graphs associated with the At Risk 2001 ‘awareness’ scale. Once again the oldest and youngest age groups seem to have the lower ‘awareness’ scores; and people new to their area have low ‘awareness’ scores. For this scale however, it is worth bearing in mind that scores are liable to be largely influenced by whether or not a respondent was actually flooded in Autumn 2000.

Exhibit 19 Mean ‘awareness’ by length of time at present address [Source: Post Event 2001]

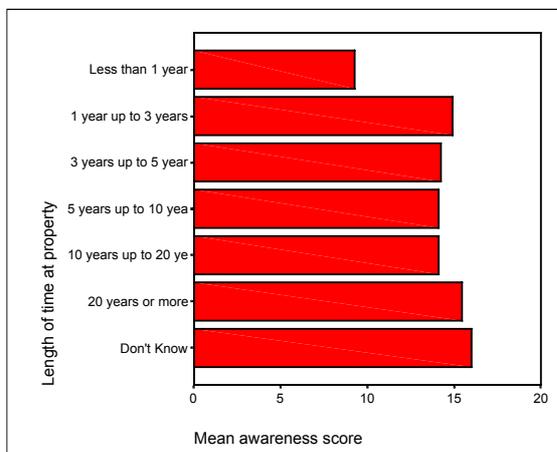
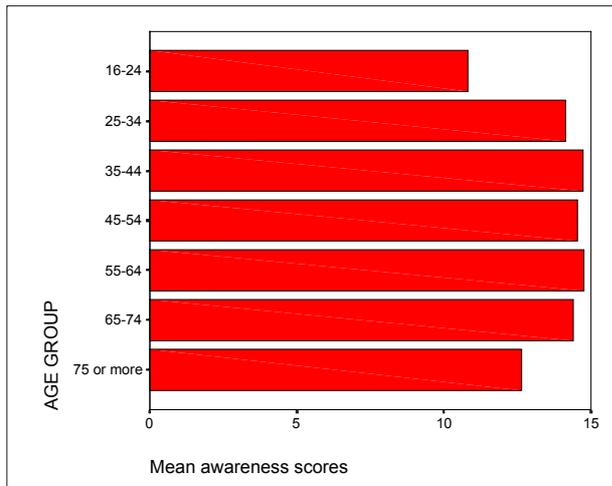


Exhibit 20 Mean ‘awareness’ by age group [Source: Post Event 2001]



Whilst all the previous suggestions (from observations of the At Risk 2001 ‘awareness’ scale scores) about how age and length of residence might affect ‘awareness’ are still plausible, one must also bear in mind the particulars of the Post Event 2001 sample. That is, the oldest and youngest age groups also happened to be the least flooded age groups (Exhibit 21), and new residents also experienced less flooding (Exhibit 22). In the latter case though, it is not clear if the large difference between the ‘awareness’ of new and longer term residents is entirely explained by the difference in amount of flooding experienced in Autumn 2000 (34.9% of people who had been resident for up to 1 year were flooded in Autumn 2000, compared to 44.1% of longer term respondents). Once again, further analysis through multiple regression may help to clarify matters such as this.

Exhibit 21 If property flooded by age group [Source: Post Event 2001]

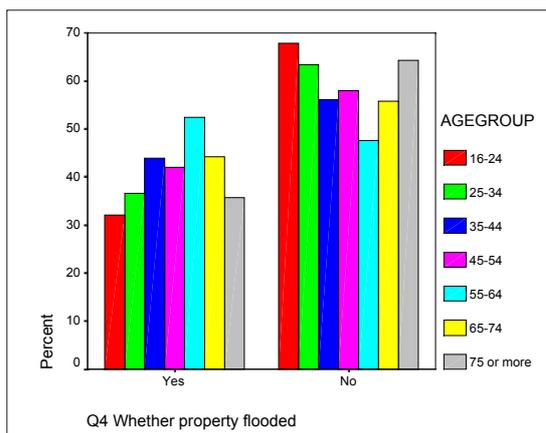
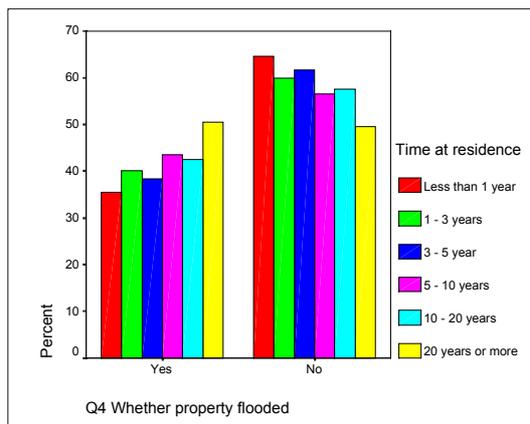


Exhibit 22 If property flooded by time in residence [Source: Post Event 2001]



Post Event 2001 ‘action’ scale.

Analysis of the weighted ‘action’ scales (Mean 7.8: range 0-37) for several subgroups of the sample is displayed in Exhibit 23. This table shows that those who experienced flooding, especially above floor level, those not living alone, and in pre-1970's houses were likely to score significantly more on the action scale. Curiously, those who maintained they did not have enough information also scored significantly more on the action scale.

Exhibit 23 Mean Post Event weighted action scores for various subgroups

		Mean	Sig.
Whether property flooded	Yes (608)	9.5	p<0.001
	No (784)	5.7	
Whether property ever been flooded	Yes (304)	12.7	N.s.
	No (299)	12.3	
Number in household	More than 1 (913)	8.3	p<0.001
	One (333)	5.9	
When property built	Newer buildings (430)	5.4	p<0.001
	Pre 1970's (944)	8.9	
Gender	Male (575)	7.2	N.s.
	Female (682)	8.2	
If had enough advice	Yes (882)	7.4	p<0.001
	No (419)	9.5	
Where flooded	Above floor level	17.6	p<0.01
	Below floor level	10.2	

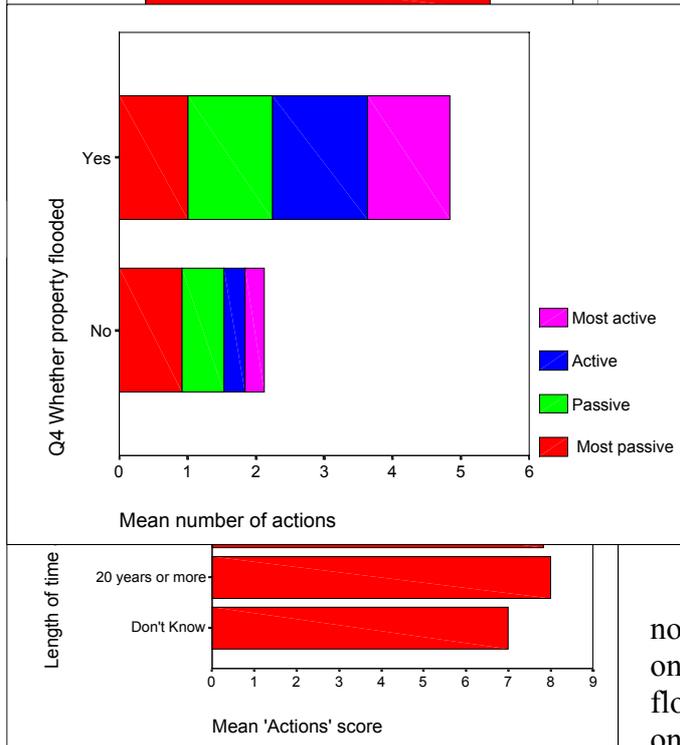
Source: Post Event 2001

As with the ‘awareness’ score, Exhibits 24 and 25 show the youngest and oldest score lowest on the ‘actions’ scale, as do those living at their present address for less than one year.

Exhibit 24 Mean weighted ‘action’ score by age group [Source: Post Event 2001]



Exhibit 25 Mean weighted ‘action’ score by length of residence [Source: Post Event 2001]

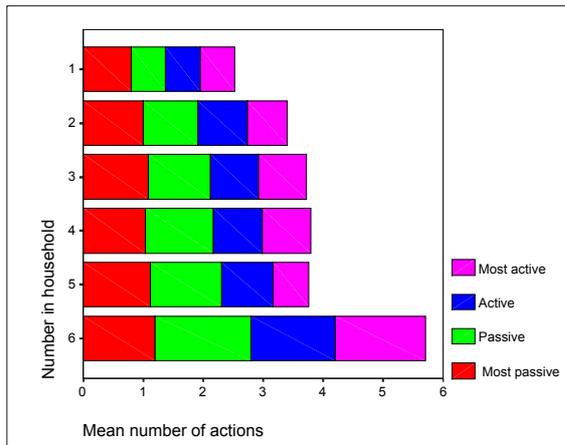


Previous flood experience

For scores on the Post Event 2001 ‘action’ scale, one can not only compare the mean weighted scores of different groups, but also compare the numbers of different types of actions taken (actions ranging from “most passive”, “passive”, “active” and “most active”, according to their disruptiveness). This is interesting when one looks – for instance – at the flooded and not flooded groups. It is no surprise that flooded people took more action than not flooded people. Flooded people obviously had to actually deal with floodwater, whilst not flooded people did not. If one then goes on to compare the types of actions taken by flooded and not flooded people (Exhibit 26), one can see that the groups do not differ greatly where the most passive actions are

concerned. Rather, the higher mean ‘action’ score for flooded people comes from the fact that they were much more likely to take the most active types of action. This again makes sense intuitively, as being directly affected by a flood event would necessitate major actions such as the moving of valuables, the switching off of electricity, or perhaps even evacuation. This also concurs with earlier suggestions (see Section 4.1.1) that all people in the proximity of a flood event like to be kept abreast of the situation – through taking ‘passive’ actions – but more disruptive actions tend to be taken only when required. To some extent this implies that many people in proximity to a flood event, take a reactive approach to events as they unfold (i.e. only taking major actions if flooded) rather than a preventative approach (i.e. taking major actions as precautions, even if ultimately not flooded).

Exhibit 26 Mean number of actions by whether property flooded [Source: Post Event 2001]



Number in household

The ‘action’ scale scores suggest that the amount of action taken in the face of a flood event increases with the number of people in the household. Looking at the weights of actions taken by people living alone; people in two person households; and people in households of three or more people, it can be

seen in Exhibit 27 that the increase in ‘action’ is spread across all four weights of action types. That is, as the number of people in a household increases, so does the number of all types of actions. One explanation is that a lot of actions become easier with more people around. Indeed, some actions would be extremely difficult to undertake alone, such as moving larger pieces of furniture. With more people in a household there is also a greater chance of someone having picked up some kind of advice about action that can be taken, and more people to think of ways to defend and protect property and possessions.

Exhibit 27 Mean number of actions taken by number in household [Source: Post Event 2001]

Once again the groups differ the least in their undertaking of the most passive actions, with bigger differences observed for more disruptive actions. It is worth bearing in mind however, that if people are adopting a reactive action strategy, it may be that the lower ‘action’ score of people living alone is because these people were less likely to actually be flooded. Looking at percentages, 40.8% of people living alone were flooded, compared to 43.1% of people in two person households, and 44.5% of people in households of three or more people.

Amount of advice

Another interesting observation from the ‘action’ scores, is the difference between people who felt they had had enough advice, and people who felt they should have had more advice. Section 4.2.2.2 showed that those who felt they had received enough advice displayed more ‘awareness’ than those who felt they had not received enough. For ‘action’ however, the reverse is true (Exhibit 28). The two groups differ least on the most passive actions again,

with the 'not enough advice' group taking more 'active' actions. This is similar to the pattern of differences between flooded and not flooded people (Exhibit 29). Looking at the percentages, 38% of the 'enough advice' group were flooded, compared to 59% of the 'not enough advice' group.

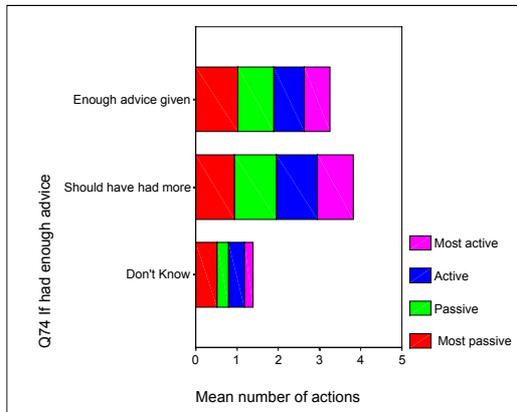


Exhibit 28 Mean number of actions by if received enough advice [Source: Post Event 2001]

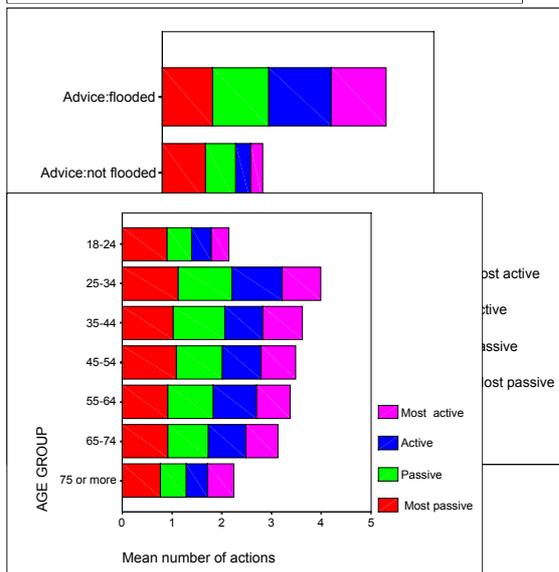


Exhibit 29 Mean number of actions by whether advised and/or flooded [Source: Post Event 2001]

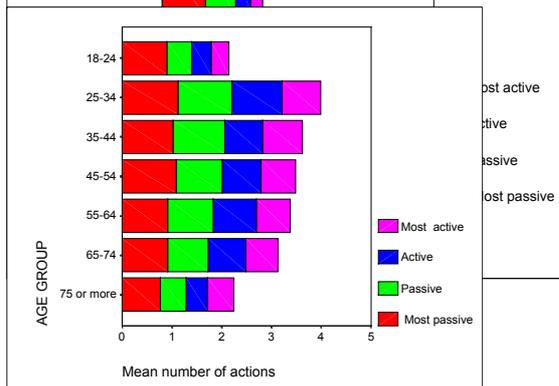


Exhibit 30 Mean number of actions by age group [Source: Post Event 2001]

Exhibit 31 Mean number of actions by length of time in residence [Source: Post Event 2001]

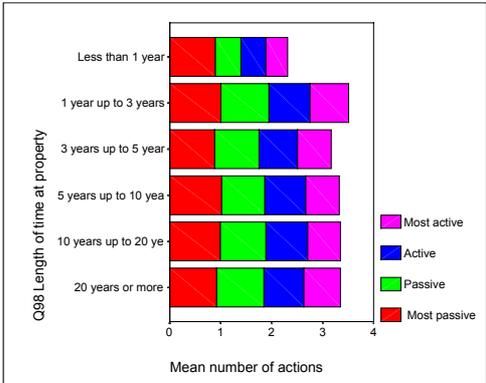
Finally, looking at the graphs showing the effect of age (Exhibit 30) and length of residence (Exhibit 31) on ‘action’, there are marked similarities to the equivalent graphs derived from the ‘awareness’ scale. The ‘awareness’ and ‘action’ graphs (Post Event 2001 scales) for age groups differ only due to the differences on the ‘action’ graph for the mean action score of 25-34 year olds. Meanwhile, the ‘awareness’ and ‘action’ graphs for length of residence appear almost identical.

This suggests a number of possibilities. Firstly, ‘awareness’ and ‘action’ may be very closely related where matters of age and length of residence are concerned. Alternatively (or perhaps, in addition) there may be some other variable dictating the similar shapes of these graphs. Intuitively, one might suppose this to be the extent to which various age groups and length of time in residence groups were actually flooded.

Building age and Region

The matter of region is somewhat difficult to address. Because the sample used in the Post Event 2001 survey is *not* representative at the regional level and was not designed to be, it is not wise to read too much into regional comparisons from this data. On the other hand, as region does seem to affect a number of the observations and relationships in the data, it would seem foolish to ignore it entirely. Rather than to extensively deconstruct the particular make-up of each regional sample, it is simpler to just compare the regions across flood severity and event specific ‘awareness’. For this analysis, a new indicator was created, as a measure of ‘flood severity’. Whilst ‘being flooded’ could simply be dichotomised into ‘yes’ and ‘no’, it is likely that having one’s lounge flooded several times by several feet of water, would have

more of an effect on ‘awareness’ (and later, ‘action’) than simply having one’s drive flooded once. Each respondent therefore had a ‘flood severity’ score based on *where* their property flooded; how *deep* any internal flooding was; and how many *times* they were flooded in the Autumn 2000 floods. This resulted in ‘flood severity’ scores from 0 (people not flooded at all) to 22.



The mean ‘flood severity’, ‘awareness’ and ‘actions’ scores were calculated for the twelve regions in the Post Event 2001 sample. These are presented in Exhibit 32 with each column running

from highest scoring region to lowest (see Exhibits 33, 34, and 35 for graphical charts of the same data).

Exhibit 32 Flood severity, awareness and action scores for the sample areas

Flood Severity (Sample mean = 3.07)	Awareness (Sample mean = 14.43)	Action (Sample mean = 7.79)
Malton (8.11)	Maidstone (21.31)	Malton (15.69)
Woodford Green (6.36)	Woodford Green (21.03)	Woodford Green (13.75)
Maidstone (5.60)	Malton (19.07)	Maidstone (11.56)
Shrewsbury (3.88)	Arundel (18.18)	Nottingham (9.60)
Newark (2.37)	Tenbury Wells (16.16)	Newark (8.32)
Worcester (2.08)	Nottingham (14.80)	Bridgnorth (6.73)
Gloucester (1.87)	Bridgnorth (14.52)	Shrewsbury (5.83)
Tewkesbury (1.85)	Gloucester (13.60)	Tenbury Wells (5.35)
Nottingham (1.61)	Worcester (9.53)	Arundel (5.03)
Bridgnorth (1.48)	Tewkesbury (8.74)	Gloucester (4.68)
Arundel (0.98)	Shrewsbury (8.48)	Worcester (3.93)
Tenbury Wells (0.34)	Newark (8.25)	Tewkesbury (2.48)

Source: Post Event 2001

The table begins by making intuitive sense. The three worst hit areas – Malton, Woodford Green and Maidstone – also display the best ‘awareness’ and ‘action’ scores. Thereafter, the ‘awareness’ and ‘action’ scores of the other nine regions seem to deviate somewhat from what one would expect based on the severity of flooding in these areas. There is something of a split between these nine regions. Shrewsbury, Newark, Worcester, Gloucester and Tewkesbury seem to have lower mean ‘awareness’ and / or ‘action’ scores than one may expect from their mean flood severity scores. Conversely, Nottingham, Bridgnorth, Arundel and Tenbury Wells have higher mean ‘awareness’ and / or ‘action’ scores than might be expected.

Investigating one of these areas further – Shrewsbury – it transpires that low ‘awareness’ totals for respondents from this area arise from less advice recall (a major contributor to the Post Event 2001 ‘awareness’ scale) than in other areas. Other ‘awareness’ and ‘action’ score discrepancies are similarly explained by scoring particularly well or badly on items key to the scale in question. This leads to two conclusions. Firstly, there may well be regional differences in the level of ‘flood warning service’ offered – and this manifests through the differing regional performances on ‘awareness’ and ‘action’.

Exhibit 34 Mean flood severity score by area [Source: Post Event 2001]

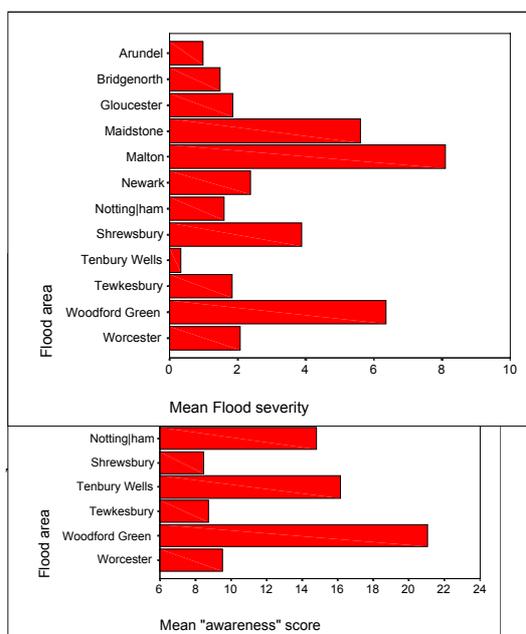
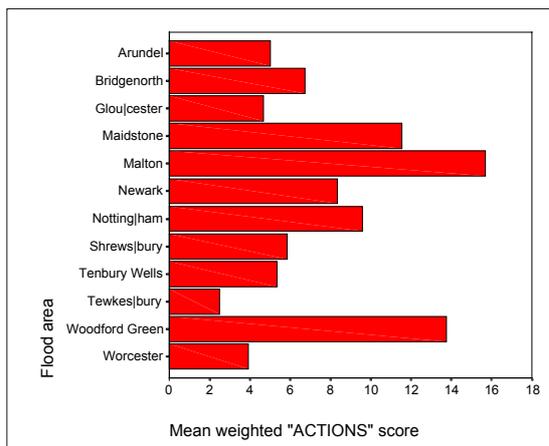


Exhibit 33 Mean ‘awareness’ score by area [Source: Post Event 2001]

Exhibit 35 Mean weighted ‘actions’ by area
 [Source: Post Event 2001]



However, the second conclusion is something of a caveat to the first. That is, because the regional samples in the Post Event 2001 sample are in no way representative of the areas they were drawn from, any comparison of regional ‘performance’ must be interpreted with caution. However, these regional variations may suggest that further regional exploration would be worthwhile.

4.2.3 Regression Analysis using the ‘awareness’ scales

Early analyses, and comparison of mean scale scores for various groups, had suggested a number of variables that may be affecting ‘awareness’. That analysis however, could not indicate which are the most significant variables, nor how variables may be inter-related. Using the ‘awareness’ scores from both the At Risk 2001 and the Post Event 2001 surveys as dependent variables, we modelling the competing effects of several independent variables to ‘explain’ the variation in levels of ‘awareness’. The following section presents the regression models for both awareness scales. From this analysis we hope to be able to indicate which of the independent variables have most explanatory power in relation to ‘awareness’ to flooding. In this way we hope to identify those social factors which are most likely to discriminate between groups of the ‘at risk’ population, at least on their ‘awareness’ to flood hazard.

At Risk 2001 – Awareness

Clearly previous flood experience has an impact on “awareness”. Model 1 in Exhibit 36 demonstrates that previous flood experience has more impact on increasing ‘awareness’, (beta value =0.27), than the effect of being in an Environment Agency-serviced area (beta value =0.12). While both these variables are significant factors in predicting ‘awareness’, they only

account for 9% of the variance in “awareness”. The addition of length of time in residence and tenure, both of which have been shown individually to have a significant effect on ‘awareness’(see previous section 4.2.2.1), improved the fit of the model in Model 2, now accounting for 14% of the variance. Model 3 included the individual characteristics: work; status; social class and age and accounts for 18% of the variance in ‘awareness’. This model also showed however, that introducing these individual variables reduces the effects of tenure evident in the previous model, suggesting that being in work and in social class A or B could explain some of the effect of increased ‘awareness’ by owner/occupiers who, are also more likely to be working (see Section 4.2.2.1).

This final model accounted for only 18% of the variance in ‘awareness’ scores – suggesting that there were other significant effects on general ‘awareness’ that were not covered by the At Risk 2001 ‘awareness’ scale.

To summarise the final model for the At Risk 2001 sample at least – ‘awareness’ was affected in the following ways;

- < (0.22) previous experience of flooding caused the biggest increase in ‘awareness’
- < (0.16) being in social economic group A or B increased ‘awareness’
- < (0.11) being in an Environment Agency served area increased ‘awareness’
- < (0.11) being an owner/occupier increased ‘awareness’
- < (0.10) being in full time or part time work increased ‘awareness’
- < (0.07) being aged 45-54 increased ‘awareness’
- < (-0.13) having been resident for up to 1 year *decreased* ‘awareness’.

Several variables proved not to be significant in ‘explaining’ the variance in the ‘awareness’ score. These included gender and whether the respondent had a telephone.

Exhibit 36 The impacts of household and individual variables on ‘awareness’

		Model 1		Model 2		Model 3	
Variable		Beta	Sig	Beta	Sig	Beta	Sig
<i>Household/Area Variables</i>							
Flood status	Not flooded before ^{\$}	-	-	-	-	-	-
	Had been flooded before	0.27	***	0.24	***	0.22	***
If EA serviced	Not serviced by the EA ^{\$}	-	-	-	-	-	-
	Serviced by the EA	0.12	***	0.15	***	0.11	***
Length of residence	Resident over 1 year ^{\$}			-	-	-	-
	Resident under a year			-0.12	***	-0.1	***
Tenure	Renter ^{\$}			-	-	-	-
	Owner/Occupier			0.18	***	0.11	**
<i>Individual Variables</i>							
Work status	Not working ^{\$}					-	-
	Working					0.1	**
Age	Age below 44 or above 55 ^{\$}					-	-
	Middle aged (45-54)					0.1	*
Social Class	Social class C, D and E ^{\$}					-	-
	Social Class A or B					0.16	***
Adjusted R ²		0.09		0.14		0.18	

Source: At Risk 2001

^{\$} Reference category

Post Event 2001 – Awareness

For the Post Event Survey it was also important to control for the area and so Model 1 in Exhibit 37 compares the awareness scores of all areas compared to the reference category ‘Malton’ which was chosen as the most severely affected area. Here we see as far as ‘awareness’ is concerned there were no significant differences between Arundel, Maidstone and Woodford Green compared to Malton. However all the other sample sites had significantly lower awareness compared to Malton, especially Newark with the highest negative beta value of -0.27 followed by Shrewsbury at -0.26.

However, adding flood severity to the model as an explanatory variable in Model 2 ‘explained’ some of these differences. The standardised beta coefficient is reduced for all areas except Arundel, Maidstone and Woodford Green. Clearly flood severity had an effect on ‘awareness’. Model 3 however, explores the effect of previous flood experience and we see the same impact on ‘awareness’ as we did with flood severity. The introduction of building age in Model 4 and length of residence in Model 5 slightly reduces the area impact on ‘awareness’ only in Woodford Green and Maidstone (areas shown to have a high proportion (over 90%) of older houses build prior to the 1970’s). However, both building age and length of residence had significant impacts on “awareness” scores.

To summarise the Post Event 2001 final model controlling for area, the following variables had significant impact on “awareness”(beta values in brackets).

- < (0.17) where flood severity was worse, ‘awareness’ was higher
- < (0.13) previous experience of flooding increased ‘awareness’
- < (0.07) being in a pre-1970s property increased ‘awareness’
- < (-0.09) having been resident for up to 1 year decreased ‘awareness’

Several variables were introduced into the model and had no significant impact on predicting ‘awareness’. These included age, gender, number in household, working status, first language and long term illness.

The final model explained only 21.7% of the variance in ‘awareness’ scores. Again, this suggests that there were other influences on event specific ‘awareness’, which were not measured which may have an impact on the Post Event 2001 ‘awareness’ scale.

Exhibit 37 The impact of household and individual variables on event specific ‘awareness’

		Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
		Beta	Sig.										
<i>Area Variables</i>													
Malton	RefCat												
Arundel		-0.02	NS	0.08	*	0.05	NS	-0.02	NS	-0.02	NS	0.09	**
Bridgnorth		-0.11	**	-0.01	NS	-0.04	NS	-0.12	**	-0.11	**	-0.01	NS
Gloucester		-0.13	***	-0.04	NS	-0.07	*	-0.14	***	-0.14	***	-0.04	NS
Maidstone		0.06	NS	0.1	**	0.09	**	0.03	NS	0.05	NS	0.08	*
Newark		-0.27	***	-0.18	***	-0.19	***	-0.28	***	-0.27	***	-0.17	***
Nottingham		-0.1	**	0	NS	-0.03	NS	-0.11	**	-0.1	**	0	NS
Shrewsbury		-0.26	***	-0.19	***	-0.23	***	-0.27	***	-0.26	***	-0.2	***
Tenbury Wells		-0.07	*	0.05	NS	0.002	NS	-0.07	*	-0.07	NS	0.05	NS
Tewksbury		-0.22	***	-0.14	***	-0.18	***	-0.22	***	-0.23	***	-0.14	***
Woodford Green		0.04	NS	0.07	*	0.09	**	0.01	NS	0.04	NS	0.07	*
Worcester		-0.22	***	-0.13	***	-0.17	***	-0.23	***	-0.22	***	-0.14	***
Flood severity				0.25	***							0.17	***
Previous flooding	No ^s											-	
	Yes					.205	***					0.13	***
Building age	1979's-1990's ^s											-	
	pre-1970's							0.11	***			0.07	***
Length of residence	More than 1 year ^s											-	
	Less than 1 year									-0.1	***	-0.09	***
Adjusted R ²		0.15		0.193		0.185		0.16		0.158		0.217	

Source: Post Event 2001 \$ Reference category Sig * <0.05; **<0.01; ***<0.001

5. SUGGESTIONS FOR FUTURE DATA COLLECTION.

This section makes recommendations for improvements to the BMRB surveys currently used to collect data on flood knowledge and experience. These suggestions are informed by problems encountered in the secondary analysis. Suggestions are made for alterations to both the 'At Risk' questionnaire and the 'Post Events' questionnaire. These two questionnaires offer insight into the two key aspects of 'flood knowledge'; awareness prior to a flood event (from the 'At Risk' survey) and preparedness and action during an actual flood event (from the 'Post Events' survey).

One recommendation for both surveys is to ensure that all interviews are conducted individually, or that some indication is made where this is not the case. Some of the verbatim responses from the Post Events 2001 survey imply that respondents may have sat in on each other's interviews, or that two or more interviews were run concurrently. For instance, a respondent may give a verbatim reason for some action, and the respondent who has the next sequential ID number may give the response 'same reason' to the same question. It may be that interviews *are* all separate, and that the interviewers or transcribers are simply entering 'same reason' to avoid having to type out essentially identical answers twice in a row. Even if several respondents *are* interviewed together, or are from the same household, there should be few problems except where a question asks 'does anyone in the household.....'. For example, the Post Events survey asks if anyone in the household has any long-standing illness, disability or infirmity, whilst the At Risk survey asks if anyone in the household has a mobile phone. Where interviews are *not* conducted separately, this may lead to over-reporting of these household characteristics.

5.1 Post Events 2001 Questionnaire.

The recommendations for alterations to the Post Events 2001 Questionnaire are split into three types; extra items that could be included; items that could be left out; and items that could be re-worded, re-ordered, or put to more of the sample.

5.1.1 Extra Items

Demographic variables

The most significant omissions are measures of a number of demographic variables. While the survey does contain some demographics, such as age, sex and work status, there are many other equally important population characteristics which are not recorded. No data are gathered on type of housing tenure; social class; income; car ownership; ethnicity; specifics of any long-standing illness or disability or household composition (number of children, adults, elderly etc).

Some other BMRB surveys on flooding contain more demographics than the Post Events 2001 survey. For example, the At Risk 2001 survey codes respondents' social class and housing tenure. These items could easily be imported into future Post Events surveys. Measures of other demographics such as ethnicity and household composition should also be included.

It is particularly important that the lack of data on the ethnicity of respondents is redressed. While the importance of giving out flood information in different languages is recognised cultural differences extend much further simply than language. For example the roles of

women and typical family structure may differ between cultures and impact upon how individuals respond to flood warnings.

Actions taken

The section of the questionnaire that asks about actions taken by respondents to prepare for or react to the flood event also requires improvement. At present the questionnaire asks for spontaneous recall of actions respondents were advised to take; prompted recall of advised actions; and prompted recall of actions taken on own initiative. An extra item could be included asking for spontaneous recall of any action taken. This item would precede the existing three and be an open question. The question should be put to the whole sample as the actions of people who ultimately were not flooded are still of interest. This question would reveal the types of 'common sense' actions people take and may provide ideas which the Environment Agency could then advise other people to employ. The question would also help to clarify such matters as which people recall most action, which people seem most likely to act on Environment Agency advice and regional variation in types of action taken.

5.1.2 Items that could be left out

Asking about Environment Agency artefacts

There is one part of the Post Events Questionnaire which could be removed entirely. Towards the end of the schedule respondents are asked to look at an Environment Agency leaflet comment on its usefulness, and make suggestions on how to improve it. For many respondents this is the first time they have seen such a leaflet and they have only a few moments to familiarise themselves with it. Even those respondents who have seen the leaflet before may be unfamiliar with it as it may have never been salient to them (e.g. if not flooded) or its relevance may have diminished as floodwaters subsided.

In addition situational factors may inhibit respondents' ability to give valuable feedback on the leaflet. The interview has already been progressing for some time when the leaflet questions are asked. Respondents may wish to get the interview over with as soon as possible. There may also be an element of interviewees seeking to please the interviewer by rating the leaflet as useful. Respondents may also find it difficult to think of the right terms and expressions to describe their impressions of the leaflet in the few minutes they have to consider it.

There is some evidence of such effects in the Post Events 2001 data. While only about a quarter of the sample (26.4%) have ever seen the leaflet before, over four-fifths (83.7%) then go on to rate it as useful. About two thirds of the sample (65.4%) also say that they cannot think of any way to improve the leaflet. This may indicate attempts to please the interviewer, or respondents' assessment that if they express satisfaction with the leaflet further questioning about how it could be improved will be avoided bringing the interview to a speedy close. Those respondents who do offer some kind of opinion on how to improve the leaflet tend to give one of two types of answer. First there are very general comments such as 'better print' or 'better layout' without clarification of ways in which these aspects need to be improved. Secondly, there are comments that are not really to do with the leaflet itself, but more to do with the 'flood event' in general, such as 'easier to get sandbags' and 'have 24-hour phone lines'. This kind of answer contains some useful information but does not help the Environment Agency understand public perception of its leaflets.

In order to receive more detailed and valuable data on public perception of the leaflet and other Environment Agency artefacts (such as the red warning card) a separate piece of research should be conducted.

Removing exploration of people's opinions of artefacts from the Post Events survey would have the benefit of leaving space which could be filled with more questions of demographics. Respondents can answer demographic items more quickly and easily than opinion items which is important for items near the end of a schedule.

Whilst a thorough investigation of people's thoughts on Environment Agency artefacts is not appropriate for the Post Events survey it *is* useful to retain the very simple 'have you ever seen this leaflet / card?' items. These allow for a rudimentary grasp of 'who gets what' and can be used as part of an investigation of awareness.

5.1.3 Items to modify

The Post Events Questionnaire contains a number of items that would benefit from minor alterations. First there are a number of questions that could be phrased better or are open to ambiguous interpretation.

Q6 - Thinking now about the most recent occasion, where did your property flood?

This question on the schedule asks respondents who were flooded where they were flooded. Respondents are shown a list of possible answers and asked to indicate all that apply. One possible answer is 'below floor level of property'. This could be interpreted in a number of ways. As one of the other answers is 'above floor level of property' respondents may assume that if they did not actually have water in their property, but there was floodwater around (e.g. the garden was submerged), then they must have had a flood 'below floor level of property'. Alternatively, properties with cellars or basements, may interpret 'below floor level of property' as referring to these subterranean areas. Another interpretation could be any kind of backflow through drains or toilets. Some respondents might consider that if the road outside their property was flooded, then *that* constitutes flooding 'below floor level of property'. It is not just respondents who might have these varied interpretations; interviewers and coders may also have different concepts of the phrase.

What this item needs is a simple clarification of what 'below floor level of property' means, *or* for this particular option to be omitted, and the list to simply contain obvious domestic places that may have been flooded such as – house, garden, drive, greenhouse etc.

Q41 – ...Listen out for warnings...

One of 'the types of advice which households may be offered in the event of a flood warning' is to 'listen out for warnings'. It is not entirely clear what this means, however; warnings from what source; warnings about what in particular; warnings via which media? This lack of clarity may lead to inconsistencies in respondents' recall of advice received. For example, some respondents who were advised to listen to local radio for information, may cite 'listen to local radio' as advice given, whilst others may cite 'listen to local radio' *and* 'listen out for warnings'. 'Listen out for warnings' is another ambiguous term. Some respondents may interpret it as advice to listen out for the status of the flood according to the Environment Agency's four categories. Other respondents may interpret it as advice to keep in touch with friends and neighbours to see what they know. Clarifying exactly what is meant by the phrase would be useful

Q44,46,48,50,52,54,56,58,60,62,64,66,68,70,72,- *Why did you not manage to do this?*
Several questions ask why respondents did not act on pieces of advice they were offered. The most common response to these questions seems to be ‘no need / not necessary’. It is unclear whether this means that the respondents perceived there to be no need or whether they were told by some official source that there was no need. Another popular reason given for not acting on advice is ‘water not high enough’. This response could also easily be subsumed under the ‘no need / not necessary’ answer; i.e. there was ‘no need’ because the ‘water not high enough’. This leads to the suspicion that when asked why they did not act on pieces of advice, respondents gave all manner of reasons which were too varied to code separately. Instead, the most popular response – ‘water not high enough’ – was coded separately with all other reasons grouped together as ‘no need / not necessary’. Whilst this is not a major problem it would be useful to more reasons coded separately in the data. It would also be useful to have response codes for ‘I thought there was no need / it wasn’t necessary’, and ‘I was told there was no need / it wasn’t necessary’. This would show which respondents were using their own judgements instead of, or as well as, official advice, and how these people ultimately fared.

Q90 -How would you prefer the flood warnings to be organised in this area?

An item towards the end of the Post Events schedule asks this question. The interviewer then reads out the possible answers; ‘by an external agency such as the Environment Agency’; ‘by the local community’; ‘don’t know’; and ‘other’. An improvement would be to give respondents more options to pick from aside from the ‘don’t know’ and ‘other’ responses. It would also be preferable to show the respondents a list of possible responses (as is done for many other questions in the survey) so there are no primacy and recency effects to contend with as respondents try to remember what the possible response options were. Respondents could also be given choices such as ‘emergency services’, ‘local authority’, ‘Flood Warden’ or ‘the media’. This would lessen the likelihood that they are being led into answering that they want an external agency or the local community to organise flood warnings, and give these answers more validity if they still prove to be the most popular.

Q94 & Q96 - Can I check, (before this last occasion) [has this address] ever received a flood warning, even if you were not actually flooded? – And has this address ever been flooded (before this last occasion) [since you have lived here]

These questions ask respondents if their property has received a flood warning before or actually been flooded before. There are a couple of modifications that would improve this ‘previous experience’ section.

First, it would be interesting to know when previous warnings and floodings occurred. That is, is a respondent’s ‘prior flood experience’ recent – and hence maybe easier to recall - or is it from decades ago? Secondly, the questions are very property-centred; they only ask respondents about their previous flood experiences in the current property. It seems that previous experience is one of the biggest influences on flood awareness (see section 4.2.2.), so it would be useful to know if respondents have *ever* received flood warnings or actually been flooded in *any* property they have lived in (and how long ago).

5.1.4 Putting questions to more of the sample

There are a number of questions in the Post Events schedule that could be put to more respondents than is currently the case.

Q19 - *Apart from the warning you have already told me about, in which of these further ways were you given prior warning of the flood or further flooding information?*

This question about what kinds of warnings were received other than the first warning is currently only put to warned people who were also flooded. It would be interesting to also put this question to warned people who were not flooded to see if there were any differences in the array of warning types reported by each group.

Q32 – *Was there anything about the warnings you received that you did not understand?*

The question ‘was there anything about the warnings you received that you did not understand?’ is also only asked of people who flooded. There is no reason to suppose that not flooded people are any more or less likely to understand warnings they receive, and so they should be asked this question too.

Q34 & Q35

The first of these items asks respondents if they were at any point told whether the flood warning status was all clear, flood watch, flood warning or severe flood warning. However, the accompanying probe in Q35 of ‘what did you understand this to mean?’ is only asked of those who reply in the affirmative to question 34. Asking this of the entire sample would allow the Environment Agency to get some idea of how well known its new warning system was becoming. That is, is knowledge of the codes confined to those who end up flooding, or those in certain areas, or those who are retired or is knowledge spread evenly across demographics? This approach would also raise consistency as the At Risk survey asks everyone if they know of the new code system.

Q37 – *Can you think of any better ways to warn people in the area when a flood is likely to happen?*

This question asks respondents if they can think of better ways to warn people when a flood is likely to happen and is only asked of those who received warnings and experienced flooding. Asking this of the entire sample may result in additional novel suggestions.

5.2 At Risk 2001 Questionnaire

The recommendations for the At Risk survey are less numerous than those for the Post Events survey and in many cases replicate suggestions made for the Post Events survey.

Q4 - *Firstly, were you aware before now that your address is in an area which may be at risk from flooding?*

It is not clear in the schedule whether the list of possible answers to this question is read to the respondents or not. It can be assumed from an earlier interviewer instruction to not show the screen to the respondent, that respondents themselves cannot see the screen. However, other ‘list – type’ items usually have ‘DO NOT PROMPT’ or ‘DO NOT READ’ instructions to the interviewer, whereas this is not the case for this item. Whilst this item probably *is* an open-ended question – and should be – it would be as well to include another reminder to the interviewer not to read out any of the possible answers.

Q25 - *Suppose that you heard that your [household] was in danger of being flooded. Can you think of any special precautions or preparations which you or other members of your [household] should take in this event?*

About mid-way through the At Risk schedule, respondents are asked if they can think of any preparations or precautions they could take if they were in danger of being flooded. Those who answer ‘yes’, are then asked what they can think of, and if they have ever had to actually take any such actions. It would be better simply to ask the whole sample two questions; ‘can you think of any special preparations or precautions you could take if your property was in danger of flooding?’ and ‘have you ever taken any special precautions in the event of the flood?’. Both these questions could then have ‘no’ as one of the coded answers.

Q31-36 - Asking about the Environment Agency red card

As with the Post Events survey, the At Risk survey asks respondents to comment on an Environment Agency artefact this time the red card. As discussed earlier in this document, this section is perhaps best removed and done as a separate piece of research. Again, the extra ‘space’ this would create could be used to ask for more demographic information.

Q39 - How would you prefer the flood warnings to be organised in this area?

Another recommendation duplicated from the Post Events survey concerns asking how respondents would prefer flood warnings to be organised. As with the Post Events survey respondents are given a limited choice of responses and may be led into answering ‘external agency’ or ‘local community’. The suggestions made above concerning this matter in the Post Events survey are equally valid for the At Risk survey. That is, more choice of responses, and allowing respondents to *see* the list of options. The At Risk survey could also include items asking about *personal* flood experience (regardless of abode) as suggested for the Post Events survey.

6. CONCLUSIONS

It is important to reiterate that the limited nature of the BMRB data has not allowed a comprehensive analysis of vulnerability to flooding. Some significant factors affecting reception of advice, levels of awareness of flood risk and propensity to take action to minimise the impact of flooding were, however, identified.

6.1 Awareness

- The analyses of flood ‘awareness’, suggested the following significant effects;
- previous flood experience increases **general** ‘awareness’
- being in social economic group A or B increases **general** ‘awareness’
- being in an Environment Agency served area increases **general** ‘awareness’
- being an owner / occupier increases **general** ‘awareness’
- being in full or part time employment increases **general** ‘awareness’
- being aged 45-54 increases **general** ‘awareness’
- having been resident for up to 1 year decreases **general** ‘awareness’
- worse flooding increases **event specific** ‘awareness’
- previous flood experience increases **event specific** ‘awareness’
- having been resident for up to 1 year decreases **event specific** ‘awareness’
- living in a pre-1970s property increases **event specific** ‘awareness’

(all effects are relative to *not* being in these groups / scenarios e.g. previous flood experience significantly increases ‘awareness’ compared to *not* having previous flood experience)

These data do not however provide a complete picture. Some of the significant effects are only very small. For example, the effect on general ‘awareness’ of being aged 45 - 54 is significant, but it does not actually have a very large influence on ‘awareness’ scores especially compared to the effect that something like ‘previous flooding’ has. Considering the fairly small r-squared statistics from the regressions, it may be more worthwhile to look for other influences on ‘awareness’, not covered by the BMRB data.

The notion of previous experience appeared several times. It is clear that having been through a flood event before, makes a huge difference to flood ‘awareness’, and one’s ability to cope with future flooding. People with previous flood experience have more knowledge to hand about ‘what to do’, when any future flooding occurs. However, the ‘extra knowledge’ associated with repeat floodees is not confined to their own personal experiences. Rather, it is likely that the regional Environment Agency flood warning service, the local authority, or some other local organisation, will also add to their records that ‘property X is at risk from flooding’. Thus, in many respects, previous flooding experience increases the knowledge of both the residents in the flood-hit property, *and* whatever local organisations are charged with issuing flood warnings and distributing information about flooding.

Previous flooding also has an interesting effect on ‘advice’. Repeat floodees recall less advice than first time floodees. However, repeat floodees will have heard a lot of the pieces of ‘advice’ before, and so may consider this information as already held ‘knowledge’ rather than new pieces of ‘advice’. Conversely, first time floodees will probably have very little knowledge about flooding, and so consider almost every piece of ‘advice’ as precisely that. With this in mind, it may be interesting to see which of these two groups is most receptive to brand new pieces of flood advice, and which group displays a greater need and / or expectation of help from outside agencies. That is, do people with previous flood experience feel better equipped to tackle a flood event with minimal outside help, than first time floodees; and how do they feel about this?

Finally, we come to the issue of flooding itself. Throughout this investigation it has become increasingly clear that many of the observed relationships are simply created by who got flooded, or has been flooded before. Flooding (or previous flooding) was the most significant variable in the regressions run on both ‘awareness’ scales (i.e. it causes the biggest increase in ‘awareness’). Flooding also has an interesting effect on satisfaction with warning methods and advice. Those who were flooded were less satisfied with the warnings and advice. However, exploring satisfaction further, it was discovered that people who reported that they got *no* advice but ended up not flooding, were almost as happy with the amount of advice they got, as people who got lots of advice, but also got flooded. This suggests that ‘satisfaction’ is as dependent on whether one ultimately floods or not, as the amount and quality of actual information received.

6.2 Actions taken

In terms of *action taken*:

- Those who received warnings and were subsequently flooded took more action than those who were warned but whose premises did not flood, due to a combination of salience and necessity
- Advice to take action that is disruptive or requires effort was more likely to be acted on by those who were flooded. This suggests people react to the flood event as it unfolds.

- Advice to take more passive actions is acted upon much more equally, regardless of flooding and warning status.
- Previously flooded people were generally more likely to act upon advice given.
- Households with more than two members resident took more action.
- Being in a pre-1970's property increased actions.
- Households that flooded above floor level had increased actions.
- Having been resident for less than one year decreased actions.

6.3 Suggestions for future data collection

- All future BMRB surveys should include questions on housing tenure, social class, car ownership, ethnicity, and household composition
- The precise effects of age and region could be further investigated through the collection of more representative data.
- Public perceptions of Environment Agency flood advice and warning artefacts would be better explored in a qualitative study than in the BMRB surveys.

6.4 Implications

- There is a need for more socio-economic data to be collected within BMRB surveys to allow for more comprehensive analysis of factors influencing awareness of, and ability to respond to, flood warnings, as well as the social distribution of flood risk.
- If lack of awareness of flood risk is treated as an indicator of vulnerability to flooding then the following groups are particularly vulnerable:
 - those who have recently moved into a flood plain;
 - people in newer buildings;
 - people renting;
 - people in socio-economic groups C2, D and E.
 - those under 35 and older than 55
- In a previous report of the 'At Risk' 2001 survey (BMRB, 2001) it was shown that flood risk residents are slightly older than the national average. Coupled with the finding that older (and younger) people are significantly less aware of their flood risk, this may have major implications for future planning of flood warning dissemination.

REFERENCES

BMRB International (2001), *Floods - 2001 At Risk Survey Report (for Environment Agency)*.

BMRB International (2001), *Floods - 2001 Post Event Survey Report (for Environment Agency)*.

APPENDIX 1

BMRB Executive summary Post Events 2001

This survey was carried out in thirteen areas following the flood events in Autumn 2000. Twelve of these areas were affected by flooding and one (Burton) was warned about flooding but was not actually affected.

A total of 1,496 interviews were conducted. The average response rate was 72%.

This summary is based on results from the main survey only.

- More than two-fifths of respondents (44%) had experienced flooding to their property (which included their garden, out buildings or garage) during Autumn 2000.
- ! Of the respondents who were flooded, almost a third (30%) were flooded above the floor level of their property.
- ! Three fifths of respondents (60%) who were flooded received a flood warning prior to the event. Of those who did not receive a warning, 86% did not get any information and one in ten (12%) received a warning too late.
- ! The Agency's OPM1 (proportion of properties flooded above floor level receiving a prior warning) was 66%. Over a quarter (27%) did not receive any information.
- ! The Customer Charter figure (proportion of properties flooded above floor level *and* warned by the Environment Agency who received more than 2 hours notice) was 91%. Only 5% of these respondents got less than 2 hours notice.
- ! Of the respondents who received a warning, three quarters (76%) felt they received it in the right way and 94% understood everything about the flood warning they got.
- ! Four fifths of respondents (81%) were satisfied by the method by which their flood warning was delivered.
- ! The Agency's OPM2 (proportion of properties flooded about floor level who took action to mitigate damage and personal risk) was 91%. Respondents who received advice about the flooding almost universally (97%) took action as a result of the advice.
- ! A quarter of all respondents (26%) had previously seen the Environment Agency leaflet and of these, two thirds (67%) had a copy of at home.
- ! Half of all respondents (49%) had seen the Code Red Letter and of these, almost four out of five (79%) still had a copy of it.
- ! Half of respondents (49%) said they would prefer an external agency (such as the Environment Agency) to organise flood warnings in their area, a third said they would prefer for it to be organised by the local community.

- ! Three quarters of respondents (77%) had been flooded more than once and of the respondents who received a flood warning last year, a quarter of (23%) had at least one flood warning prior to this.

!

BMRB Key results AT Risk 2001

Sample profile

Nine in ten properties were residential (90%). The large majority of residents (70%) were owner-occupiers and more than two fifths (42%) had lived in their properties for at least 10 years. Most properties (63%) were built pre-1970.

Almost one in ten (9%) of respondents had prior experience of a flood warning. Only 7% had received a flood warning since September 1996. One in eight (12%) had prior experience of flooding at their address, although only 9% had since September 1996.

Awareness & knowledge of flood warnings and the Environment Agency

- ! Half of respondents (51%) were aware before the interview that they lived in an area that may be at risk from flooding.
- ! A quarter of respondents (26%) were spontaneously aware that the Environment Agency is the organisation responsible for providing information to people whose homes and businesses may be at risk from flooding. However, the most common answer given at this question was the local council or local authority, mentioned by 34% of respondents. 28% of respondents said they did not know which organisation was responsible for this.
- ! Over a fifth of respondents (22%) were spontaneously aware that the Environment Agency is the organisation responsible for issuing flood warnings. The Agency is the most commonly mentioned organisation in this respect, however the local council or local authority was mentioned by 21% of respondents. Over a third of respondents (35%) said they did not know which organisation was responsible for this.
- ! A fifth of respondents (20%) were spontaneously aware that the Environment Agency is the organisation that has powers to carry out flood defence works to reduce the risk of flooding. Again, the most common answer given here was local council or local authority, mentioned by 30% of respondents. 35% of respondents said they did not know which organisation had the power to carry out defence works.
- ! Three in ten respondents (30%) were spontaneously aware of the Environment Agency as being responsible for either providing information about flooding, issuing flood warnings and being responsible for flood defence works.
- ! After prompting, total awareness of the Agency rises to 77%.
- ! A quarter of respondents (26%) had heard of the Agency's new warning system, where people are told the status of the flood.

Awareness & knowledge of action to take in flood event

- ! 84% of respondents said that they were aware of special precautions which should be taken in a flood event.

- ! One in ten (10%) said they had made some special precautions in case of a flood event.
- ! When prompted, the precautions the most respondents were aware of were to move valuables/ personal belongings upstairs or to a safe place (78%), move yourself and others to a safe place (76%), block doorways/ airbricks with sandbags (72%) and to switch off electricity and/ or gas (70%). Telephoning Floodline for further information was less commonly recognised with half of respondents (50%) mentioning it.
- ! The longer-term preparations that the most respondents were aware of were to check contents insurance (69%) and to check buildings insurance (66%). The third most common preparation was to get the Floodline phone number, mentioned by 38% of respondents.

Opinions on Environment Agency Code Red Card

- ! A quarter of respondents (24.5%) had seen the Code Red Card prior to the interview. 70% said they had a copy on the premises while 17.5% said they owned one previously but no longer had it.
- ! Having read the Code Red Card, nine out of ten respondents (90%) thought that it was helpful with just over half (53%) saying it was *very helpful*.

Buildings and Content Insurance

- ! Just over three fifths of homeowners (61%) said they had buildings insurance that included cover for flood damage. 37% of homeowners said they did not know if their building insurance covered flood damage.
- ! When home owners were asked about their contents insurance covering flood damage, results were almost identical; 60% said they had contents insurance which included cover for flood damage and 37% said they did not know if their contents insurance included flood damage. 1 respondent out of the 22 with no cover had had difficulty obtaining contents insurance cover.
- ! Of the residents who rent their property, nearly half (49%) said they had contents insurance which included cover for flood damage. Almost half (45%) of respondents who rent their home said they did not have contents insurance at all and of these 127 respondents 3 had had difficulty obtaining contents insurance.

APPENDIX 2

Construction of awareness scales

Item selection

In order to create the scales, it was necessary to work through the surveys, selecting items that could be used as indicators of ‘awareness’. These selected items could then be recoded and weighted according to their relative importance in determining ‘awareness’. Items to be used in the construction of the two scales, had to fit two criteria. The item had to have been asked of the whole sample, and the item had to be relevant to the nature of the scale. Some relevant variables could not be included as questions were not asked of the whole sample. For example, there are no data on the *spontaneous* advice recall (*qadvi*) of people who did not get a flood warning, and hence this item cannot be used in the Post Events 2001 ‘awareness’ scale. However, before any items could be so manipulated, a number of issues arose over the *selection* of items.

That said, there were a few exceptions. For example, in the At Risk 2001 schedule, *all* respondents are asked if they are aware that they live in a flood risk area. Those that respond ‘yes’, are then asked *how* they became aware of this. Although this further probe question (how they became aware of the risk) is *not* put to the whole sample, it is still valid to include the item in an ‘awareness’ scale. The reasoning behind this, is that people who *are* aware of being in a flood risk area, can be made aware of this in a number of ways. By including the probe question (how they became aware of the risk), the scale not only differentiates between those who are aware of the flood risk, and those who are not; it also differentiates between those who have been made aware of the risk in many different ways (e.g. personal experience, Environment Agency artefacts, radio warning, Flood Warden, local authority and so on), and those who have only been made aware of the risk in one or two ways.

Both the At Risk 2001 schedule and the Post Events 2001 schedule contain a number of items structured in this way; a main question with further probes if the respondent answers the main question in a specific way. For *any* of these items to be included in scale construction, it was only necessary for the *main* question to be asked of the whole sample, as the subsequent probe questions merely served to further refine the basic differences between ‘yes’ and ‘no’ answers to the main question. The way in which such differences were quantified, is considered in the section on the ‘weighting’ of scale items.

For items like this, it is acceptable to have ‘missing’ information for the probe questions, as it is already known that people who answered ‘no’ to a main question (for instance), would simply answer ‘no’ or ‘not applicable’ (as appropriate) to all the subsequent probe questions as well. For instance, if a respondent says they are *not* aware that they are in a flood risk area, then it is obvious that they have not been told of the flood risk by any of the methods that form the subsequent probe question that is put to those respondents who *are* aware. This differs from the earlier example of the spontaneous advice item (*qadvi*) on the Post Events 2001 schedule, where the ‘missing responses’ (of people who did not get a flood warning) are *not* known and cannot be implied from previous responses (refer to the ‘Problems with item selection’ section).

Lists of the items chosen to build each of the three scales, are appended to this section (Exhibits A, B and C) .

Assigning weights to items.

Items were weighted in line with the conclusions of earlier analyses of the data. For example, the Post Events 2001 data suggested that the *most* mitigating action was taken by people with prior flood experience – implying greater flood ‘awareness’ through having directly experienced flooding. By the same token, people who had received an Environment Agency leaflet did not display a significantly greater propensity for action than those people who had *not* received such a leaflet. Hence, items that indicated experience of actually taking action against flooding, were weighted greater than items which simply indicated an awareness of Environment Agency artefacts.

The weighting process is also an intuitive undertaking. For instance it was assumed that actually having one’s property flooded raises flood ‘awareness’ more than just receiving a warning card through the post. Similarly, having to drag furniture upstairs is a more disruptive and involved ‘action’, than just listening out for news on the local radio.

Weighting the items for the At Risk 2001 ‘awareness’ scale

The hierarchy of weightings used were as follows:

- ! Previous experience of taking mitigating actions (*specpre* – ‘Has your [household?] made any special preparations in case of a flood event?’) was given the largest weighting (score=8).
- ! The next weighting (score=6) was assigned to indicators of awareness of being directly at risk (from previous warnings and so forth – e.g. *everwar* – ‘Can I check, [have you ever received a flood warning at this address]?’ and *aware* – ‘Firstly, were you aware before now that your address is in an area which may be at risk from flooding?’). People who *had* previous flood warnings (for instance) had clearly been made aware at some point in the recent past (since 1996) that flooding was an issue in their area – which ought to raise their awareness.
- ! The next weighting (score=4), was assigned to items indicating recognition and ownership of Environment Agency artefacts (e.g. *qcol* – ‘Have you heard of this new warning system?’ and *letter* – ‘Now I would like to show you a card provided by the Environment Agency containing flood warning code information. Can I check, have you ever seen this card before?’). Whilst these artefacts provide awareness-raising information about flooding, they do not directly inform people that flooding is an issue that will directly affect *them* – and so may not be salient to many people, and may not prompt further information gathering (with its associated raising of ‘awareness’). Information in a leaflet (say) is much more likely to contribute to overall flood ‘awareness’ if one also hears on the local radio that one’s own area may be at risk.
- ! The lowest weight in the At Risk 2001 ‘awareness’ scale (score=2), was assigned to general awareness that precautions can be taken (*danger* – ‘Suppose that you heard that your [household] was in danger of being flooded. Can you think of any special precautions or preparations which you or other members of your [household] should take in this event?’). Much like artefacts, this knowledge does not actually inform people of the degree of danger they *personally* are in, and on its own does not

represent much ‘awareness’. Once again, this limited flood awareness may become situationally salient, and prompt further information gathering.

The scale also made use of several ‘general knowledge’ type questions in the At Risk 2001 schedule, which further explored basic responses such as ‘yes, I know of flood warning methods’, by asking respondents to list such things as ‘the *types* of warning methods you are aware of’ (for instance). For items of this nature, a simple count was done for each valid response (each valid response weighted as ‘1’). Hence, someone who knew of seven flood warning methods, would score ‘7’.

Other items used to construct the scale – such as actual types of action previously taken, and how recently a flood warning had been received – were weighted intuitively, relative to the weightings already assigned to other items.

Weighting the items for the Post Events 2001 ‘awareness’ scale.

The weighting process for the Post Events 2001 ‘awareness’ scale followed a similar pattern to that above. As items on the Post Events 2001 schedule directly concerned with taking action were used for the ‘action’ scale, the Post Events 2001 ‘*awareness*’ scale was not constructed using any such items. The intention with the two Post Events 2001 scales, was to see how ‘awareness’ might inform ‘action’. This meant action items had to be limited to the ‘action’ scale only, as the ‘awareness’ scale was meant to represent respondents’ event-based awareness of what they *could* do – whilst the ‘action’ scale represented what they actually *did*. This meant there were no items relating to action taken used to build the ‘awareness’ scale, and hence no items received a weighting of 8.

Hierarchy of weightings were as follows:

- ! As with the At Risk 2001 ‘awareness’ scale, the Post Events 2001 ‘awareness’ scale gave the highest weighting (score=6) to items indicating that some kind of flood warning was received (e.g. *qwarn* – ‘So, on the most recent occasion, did you have any warning that your property might flood before it actually did?’ and *qwarns* – ‘[Did you] receive any warnings about possible flooding, even though you were not yourselves flooded?’).
- ! The next weighting (score=4) was assigned to receiving Environment Agency artefacts (e.g. *qcode* – ‘Here is a letter that was sent by the Environment Agency to properties that are at risk from flooding. Can you tell me if you recall receiving this letter?’ and *qleaf* – ‘Now I would like to show you a leaflet provided by the Environment Agency containing flood warning information for this area. Can I check, have you ever seen this leaflet?’).
- ! A weighting of 2 was given to items that indicated that respondents had some *knowledge* of Environment Agency artefacts (e.g. *qavm3* – ‘Have you ever received an offer to be put on the AVM?’).
- ! This scale also used one ‘list’ type indicator (*@qadn* – specific types of advice received) which again used a ‘count’ approach of ‘1’ per valid response.

The Post Events 2001 ‘awareness’ scale also used some other items that had to be weighted intuitively. Two such items are of particular note. Firstly, there was a question that asked if respondents were in any way involved in the Flood Warning service (*qinv* – ‘Can I check, do

you or anyone else in this [property] have any involvement with the flood warnings service?’). Answering ‘yes’ to this was given a weighting of 10, as such respondents were likely to have all manner of flood knowledge that was not necessarily covered by the other indicators used. Secondly, the item asking respondents how they first became aware of the flood risk (*qdis* – ‘How did [you] first discover that [your property] was at risk?’), had sixteen possible responses (different methods of being alerted). Each of these methods of being made aware, was then weighted 1, 2, 3 or 4, depending on how informative, accurate and attention-grabbing the method was. For instance, a siren may be quite attention-grabbing, but gives *no* information – so was weighted 1. A personal visit from a Flood Warden on the other hand, is likely to be a source of accurate information, and more memorable than getting the same information from the radio – so is weighted as 4.

Although both the At Risk 2001 ‘awareness’ scale and the Post Events 2001 ‘awareness’ scale used similar approaches to weighting items, it is worth pointing out this does not make them directly comparable. They are measuring different types of awareness, general awareness versus event-specific awareness. Also, the two surveys include different demographic variables. This means for instance, that whilst the effect of social economic group on general awareness can be looked at, one cannot examine the effect of social economic group on event-specific awareness. The intention of producing *two* awareness scales is to investigate what each one reveals individually and to see if there *are* any similarities across the few demographic variables that the two surveys share (such as length of residence, age and sex).

Exhibit A At Risk 2001 – Items Used To Construct ‘Awareness’ Scale.

Original Item(s)	New Variable	Scores / Weights
aware (of being in a flood risk area)	awaresc	(Yes = 6) (No = 0) (Don’t Know = 0) (Not Stated = 0)
@qhow2, @qhow3, @qhow4, @qhow5, @qhow6, @qhow7, @qhow8, @qhow9, @qhow10, @qhow11, @qhow12, @qhow13, @qhow15 (how became aware that in flood risk area)	qhowsc	sum (@qhow2, @qhow3, @qhow4, @qhow5, @qhow6, @qhow7, @qhow8, @qhow9, @qhow10, @qhow11, @qhow12, @qhow13, @qhow15) (0 – 13)
@agenc2, @agenc3, @agenc4, @agenc5, @agenc6, @agenc7, @agenc8, @agenc9, @agenc10, @agenc11, @agenc12, @agenc13, @agenc14, @agenc15, @agenc16, @agenc19 (knowledge of organisations)	agencysc	sum (@agenc2, @agenc3, @agenc4, @agenc5, @agenc6, @agenc7, @agenc8, @agenc9, @agenc10, @agenc11, @agenc12, @agenc13, @agenc14, @agenc15, @agenc16, @agenc19) (0 – 16)

providing flood information)		
@qwarn2, @qwarn3, @qwarn4, @qwarn5, @qwarn6, @qwarn7, @qwarn8, @qwarn9, @qwarn10, @qwarn11, @qwarn12, @qwarn13, @qwarn14, @qwarn15, @qwarn16, @qwarn19 (awareness of organisations that issue flood warnings)	qwarnsc	sum (@qwarn2, @qwarn3, @qwarn4, @qwarn5, @qwarn6, @qwarn7, @qwarn8, @qwarn9, @qwarn10, @qwarn11, @qwarn12, @qwarn13, @qwarn14, @qwarn15, @qwarn16, @qwarn19) (0 – 16)
@warn2, @warn3, @warn4, @warn5, @warn6, @warn7, @warn8, @warn9, @warn10, @warn11, @warn12, @warn13, @warn14, @warn15, @warn16, @warn17, @warn18, @warn19, @warn20, @warn21, @warn22, @warn25 (knowledge of flood warning methods)	awwarnsc	sum (@warn2, @warn3, @warn4, @warn5, @warn6, @warn7, @warn8, @warn9, @warn10, @warn11, @warn12, @warn13, @warn14, @warn15, @warn16, @warn17, @warn18, @warn19, @warn20, @warn21, @warn22, @warn25) (0 – 22)
@threa2, @threa3, @threa4, @threa5, @threa6, @threa7, @threa8, @threa9, @threa10, @threa13 (knowledge of sources of up to date flood information after a warning has been issued)	sourcesc	sum (@threa2, @threa3, @threa4, @threa5, @threa6, @threa7, @threa8, @threa9, @threa10, @threa13) (0 – 10)
@metho2, @metho3, @metho4, @metho5, @metho6, @metho7, @metho8, @metho9, @metho10, @metho11 (knowledge of local flood warning methods)	awmethsc	sum (@metho2, @metho3, @metho4, @metho5, @metho6, @metho7, @metho8, @metho9, @metho10, @metho11) (0 – 10)
qcol (knowledge of new warning codes)	newcosc	(Yes = 4) (No = 0) (Don't Know = 0) (Not Stated = 0)
@qwatc4, @qwatc5 (accurate understanding of 'Flood Watch')	watchsc	sum (@qwatc4, @qwatc5) (0 – 2)
@qcol22, @qcol24	flwarnsc	sum (@qcol22, @qcol24) (0 – 2)

(accurate understanding of 'Flood Warning')		
@qseve3, @qseve8 (accurate understanding of 'Severe Flood Warning')	flsevesc	sum (@qseve3, @qseve8) (0 – 2)
danger (know of any special precautions to take if flooded)	dangersc	(Yes = 2) (No = 0) (Don't Know = 0) (Not Stated = 0)
@speci2, @speci3, @speci4, @speci5, @speci6, @speci7, @speci8, @speci9, @speci10, @speci11, @speci12, @speci13, @speci16 (knowledge of types of special precautions that can be taken if flooded - spontaneous)	awprecsc	sum (@speci2, @speci3, @speci4, @speci5, @speci6, @speci7, @speci8, @speci9, @speci10, @speci11, @speci12, @speci13, @speci16) (0 – 13)
specpre (actually had to take special precautions against flooding)	precdone	(Yes = 8) (No = 0) (Don't Know = 0) (Not Stated = 0)
@yespr2 (used sandbags)	sanddone	(Yes = 6) (No = 0)
@yespr3 (have raised plugs above skirting level)	plugdone	(Yes = 6) (No = 0)
@yespr4 (moved valuables upstairs)	valsdone	(Yes = 8) (No = 0)
@yespr5 (sloped garden)	garddone	(Yes = 6) (No = 0)
@yespr6 (stocked up on food)	fooddone	(Yes = 4) (No = 0)
@yespr9 (other precautions taken)	othdone	(Yes = 4) (No = 0)

<p>@prepa2, @prepa3, @prepa4, @prepa5, @prepa6, @prepa7, @prepa8, @prepa9, @prepa10, @prepa11, @prepa12, @prepa13, @prepa16</p> <p>(knowledge of types of special precautions that can be taken if flooded – prompt list)</p>	<p>prepawar</p>	<p>sum (@prepa2, @prepa3, @prepa4, @prepa5, @prepa6, @prepa7, @prepa8, @prepa9, @prepa10, @prepa11, @prepa12, @prepa13, @prepa16) (0 – 13)</p>
<p>letter</p> <p>(ever seen EA red warning card)</p>	<p>cardsc</p>	<p>(Yes = 4) (No = 0) (Don't Know = 0) (Not Stated = 0)</p>
<p>owncopy</p> <p>(whether have own copy of EA red warning card)</p>	<p>owncard</p>	<p>(Yes, still have copy = 4) (Yes, had copy but not any more = 0) (No, never had copy = 0) (Don't Know = 0) (Not Stated = 0)</p>
<p>everwar</p> <p>(ever had a flood warning at current address)</p>	<p>prevwarn</p>	<p>(Yes = 6) (No = 0) (Don't Know = 0) (Not Stated = 0)</p>
<p>howmany</p> <p>(how many flood warnings received at current address)</p>	<p>manywarn</p>	<p>(Once only = 2) (2-3 times = 3) (4-6 times = 4) (7-10 times = 5) (11 times or more = 6) (Don't Know = 0)</p>
<p>sept95</p> <p>(whether received flood warning since September 96 (sic))</p>	<p>recwarn</p>	<p>(Yes = 4) (No = 0) (Don't Know = 0) (Not Stated = 0)</p>
<p>whenwar</p> <p>(when received last flood warning if not since September 96)</p>	<p>lastwarn</p>	<p>(5-10 years ago = 2) (10 or more years ago = 1) (Don't Know = 0) (Not Stated = 0)</p>

Exhibit B Post Events 2001 – Items Used To Construct ‘Awareness’ Scale.

Original Item(s)	New Variable	Scores / Weights
<p>qwarn (did you get a flood warning – flooded people)</p>	<p>warn1sc</p>	<p>(Yes = 6) (No = 0)</p>
<p>qwarns (did you get a flood warning – people not flooded)</p>	<p>warn2sc</p>	<p>(Yes = 6) (No = 0)</p>
<p>qdis (method by which first became aware of flood risk – all warned people)</p>	<p>disce</p>	<p>(from friend / neighbour = 1) (siren / loudspeaker = 1) (personal observation = 1) (letter / leaflet = 1) (telephoned Floodline = 2) (radio announcement = 2) (television announcement = 2) (teletext = 2) (fax machine = 2) (police = 3) (fire brigade = 3) (local authority = 3) (personal visit = 3) (recorded EA message = 4) (personal EA phone call = 4) (Flood Warden = 4)</p>
<p>@qad1, @qad2, @qad3, @qad4, @qad5, @qad6, @qad7, @qad8, @qad9, @qad10, @qad11, @qad12, @qad13, @qad14, @qad15, @qad16, @qad17, @qad18 (types of advice received – prompt list)</p>	<p>adscore</p>	<p>sum (@qad1, @qad2, @qad3, @qad4, @qad5, @qad6, @qad7, @qad8, @qad9, @qad10, @qad11, @qad12, @qad13, @qad14, @qad15, @qad16, @qad17, @qad18) (0 – 18)</p>

qcode (did you receive EA red warning card)	redcard	(Yes = 4) (No = 0)
qcode2 (do you still have EA red warning card)	ownredcd	(Yes = 4) (No = 0)
qleaf (ever seen EA leaflet)	leaflet	(Yes = 4) (No = 0)
qleaf2 (still have copy of EA leaflet)	ownleaf	(Yes, still got copy = 4) (Yes, had copy but not any more = 2) (No, never had copy = 0)
qavm1 (are you on AVM)	onavm	(Yes = 4) (No = 0)
qavm3 (ever received offer to be put on AVM)	avmoffer	(Yes = 2) (No = 0)
qcwar (ever received a flood warning at current address)	prevwarn	(Yes = 4) (No = 0)
qwars (how many times received flood warning at current address)	numwarns	(Once only = 1) (2-3 times = 2) (4-6 times = 3) (7-10 times = 4) (11 times or more = 5)
qinv (any involvement with the flood warning service)	involve	(Yes = 10) (No = 0)

Exhibit C Post Events 2001 – Items Used To Construct ‘Actions’ Scale.

Original Item	New Variable	Scores / Weights
qloc (acted on advice to listen to local radio)	radiow	(Yes = 1) (No = 0)
qflo (acted on advice to telephone Floodline)	floodw	(Yes = 2) (No = 0)
qwa (acted on advice to warn neighbours)	neighw	(Yes = 2) (No = 0)
qval (acted on advice to move valuables upstairs)	valuew	(Yes = 4) (No = 0)
qyou (acted on advice to move to safe place – evacuate)	safew	(Yes = 4) (No = 0)
qwarm (acted on advice to take warm clothes and supplies to a safe place)	warmw	(Yes = 4) (No = 0)
qpow (acted on advice to prepare for power cut – get a torch ready)	powerw	(Yes = 2) (No = 0)
qblo (acted on advice to use sandbags)	sandbagw	(Yes = 3) (No = 0)
qboa (acted on advice to use floodboards)	boardsw	(Yes = 3) (No = 0)
qswi (acted on advice to switch off gas / electricity)	elecoffw	(Yes = 3) (No = 0)
qchec	elchecw	(Yes = 3) (No = 0)

(acted on advice to check gas / electricity before re-using them)		
qtap (acted on advice to boil tap water)	boilw	(Yes = 2) (No = 0)
qcars (acted on advice to move car to safe place)	carw	(Yes = 3) (No = 0)
qlist (acted on advice to listen out for warnings)	liswarnw	(Yes = 1) (No = 0)
qweb (acted on advice to check EA website)	webw	(Yes = 1) (No = 0)
@qdid1 (listened to local radio – own initiative)	radiodid	(Yes = 1) (No = 0)
@qdid2 (telephoned Floodline – own initiative)	flooddid	(Yes = 2) (No = 0)
@qdid3 (warned neighbours – own initiative)	neighdid	(Yes = 2) (No = 0)
@qdid4 (moved valuables upstairs – own initiative)	valuedid	(Yes = 4) (No = 0)
@qdid5 (evacuated property – own initiative)	safedid	(Yes = 4) (No = 0)
@qdid6 (took warm clothes and supplies to safe place – own initiative)	warmdid	(Yes = 4) (No = 0)
@qdid7 (prepared for loss of power – own initiative)	powerdid	(Yes = 2) (No = 0)
@qdid8 (used sandbags – own initiative)	sanddid	(Yes = 3) (No = 0)

@qdid9 (used floodboards – own initiative)	boarddid	(Yes = 3) (No = 0)
@qdid10 (switched off gas / electricity – own initiative)	switdid	(Yes = 3) (No = 0)
@qdid11 (checked gas / electricity before re-use – own initiative)	checkdid	(Yes = 3) (No = 0)
@qdid12 (boiled tap water – own initiative)	boildid	(Yes = 2) (No = 0)
@qdid13 (moved car to safe place – own initiative)	carsdid	(Yes = 3) (No = 0)
@qdid14 (listened out for warnings – own initiative)	listdid	(Yes = 1) (No = 0)
@qdid15 (checked EA website – own initiative)	webdid	(Yes = 1) (No = 0)