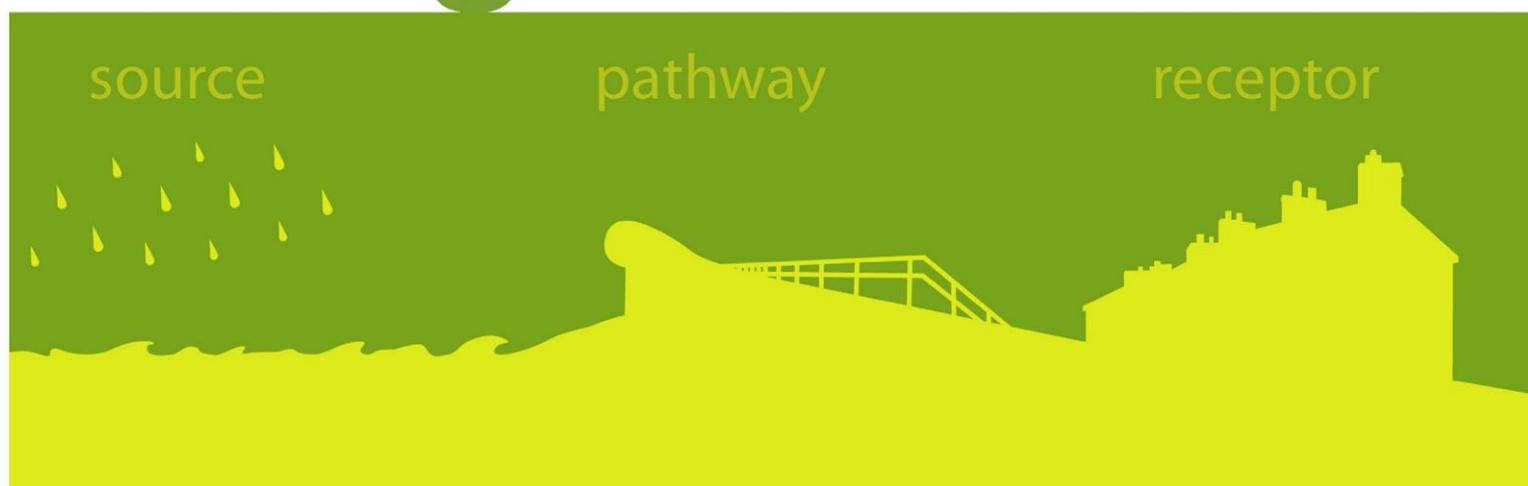


# delivering benefits through evidence



## Review of the Pilot Flood Protection Grant Scheme in a Recently Flooded Area

Project: FD2651/TR



Joint Defra/EA Flood and Coastal Erosion Risk  
Management R&D Programme

# Review of the Pilot Flood Protection Grant Scheme in a Recently Flooded Area

R&D Technical Report FD2651/TR

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## **Statement of use**

## **Dissemination status**

**Keywords: resilience; protection; resilience pilot; household; business; community**

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## **Publishing organisation**

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Published by the Department for Environment, Food and Rural Affairs  
(November 2010).

# Executive summary

In 2007, Defra launched a pilot grant scheme that provided funding for property-level flood protection surveys and measures in six locations in England. In November 2009, in what was probably the first flood event to affect any of these areas subsequent to the implementation of the pilot, the River Eden overtopped its banks and flooded one of the principal streets of Appleby-in-Westmorland.

Six months later, this research was commissioned by Defra to discover what difference the government-funded measures had made to the people of the town, what factors had affected the implementation and effectiveness of the grant scheme and how the experience of the flood had changed attitudes towards this approach to flood risk management.

This report details the findings of that research and is therefore of relevance to any local, regional or national bodies that are considering the introduction of similar schemes.

## ***Details of the scheme***

- Under the pilot scheme, homes and businesses were provided with a range of different *protection* measures (measures to prevent the ingress of flood-water). These included demountable flood barriers, pumps, a new drain, water-resistant external render and a flood wall. In two cases, action taken involved the participation of the Highways Agency.
- The scheme reinforced a culture of flood risk adaptation that already existed among some residents of Appleby. Prior to the pilot, however, residents had lacked confidence in their ability to choose between commercially available protection measures. Furthermore, protection tended to be home-made and piecemeal and was less common than *resilience* measures (measures designed to speed recovery, such as the raising of power sockets above the likely level of flooding).
- Administration and public consultation costs incurred by the local authority and Environment Agency in implementing the scheme amounted to an estimated £70,000 – almost as much as the original £80,000 Defra grant, most of which was used to pay for surveys and the protection measures.

## ***Benefits of the scheme***

- The protection measures installed in the pilot reduced anxiety about flooding.
- Wherever they were tested by the 2009 flood, the measures were successful in reducing disruption, damage and reinstatement costs.
- However, this was a routine local flooding event and was well within the design tolerances of the measures. Residents accept that a severe flood such as that of 2005 would overwhelm the pilot measures.
- The implementation of the scheme also reduced the need for flood risk management agencies to send emergency response resources to the town

during the flood and allowed them to use these resources in other flooded areas.

- Although the experience of the 2009 flood boosted confidence in the reliability of the protection measures, pilot participants still did not fully trust them and continued to rely on supplementary protection from sandbags.
- There was little evidence of a *demonstration effect*. It was too early to judge whether the example set by the scheme would inspire people to implement protection measures of their own accord. However, at the time of the research only one Appleby resident had been prompted by the scheme to buy his own protection measure and people in flood risk locations around the town showed little awareness of the scheme and had not changed their behaviour because of it.
- Pilot participants did not believe that their insurance terms would be affected by the protection measures and so had not informed their insurers of the reduction in risk brought about by the scheme.

### ***Advantages of collective implementation***

- Implementation of the grant scheme at the level of the community encouraged collaboration between residents and therefore facilitated the more effective protection of mansion blocks and homes with party walls.
- Collective implementation also fostered a greater sense of local solidarity; as did the inclusion in the scheme of local businesses as well as householders.
- The introduction of the scheme acted as a catalyst for local collective organisation and the creation of a town flood plan. Local leaders are now treated by the Environment Agency as part of their emergency response network and the town is less dependent on external help during flooding.

### ***Factors influencing the success of the implementation of the pilot***

A number of factors affected the successful implementation of the Appleby pilot;

- local people's receptiveness to the idea of the pilot, which resulted from the history of frequent flooding in the area, the impetus provided by the particularly severe flood in 2005 and the community's pride in its ability to survive events such as floods;
- the dedication of Environment Agency and district council staff in the area and their perception of property-level protection not as a "last resort", as it sometimes seen in the flood risk management industry, but as an option with unique benefits;
- the ability of these staff to win the trust and respect of local people;
- the commitment and financial support given to the scheme by local flood risk management agencies;
- the presence in the community of suitable leaders and social structures.

### ***Other Findings***

- The evidence of this research suggests the possibility that confidence in choosing measures might, in some cases, be a more important determinant of behaviour than the cost of measures.
- Because it was supported and funded by the state, the pilot provided an extra 'stamp of approval' for the concept of flood protection as well as for particular protection products that were used.
- The protection products provided by the scheme had in some cases displaced home-made measures.
- It is possible that the future performance of the scheme measures will be undermined if they are not properly maintained.
- Additionally, the effectiveness of the scheme overall could be threatened if key actors withdraw or an absence of flood events causes participants to lose interest in flood protection.
- Local flood risk management agencies therefore anticipate that they will need to provide ongoing support to scheme participants and community leaders.

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# 1. Introduction

This report describes the findings of research conducted in the small Cumbrian town of Appleby-in-Westmorland that flooded shortly after residents and businesses were provided with grant-funded property-level flood protection measures. It looks at issues around the implementation of the grant scheme, its consequences for the impact of the flood and, in the longer term, for attitudes to flood protection and resilience. The lessons of this study are of relevance to any local, regional or national organisation that wishes to encourage individuals to take practical measures to reduce their exposure to flood risk.

Property-level measures offer an alternative approach to flood risk management. *Protection* can prevent or slow water ingress, winning time for goods and possessions to be moved to safety and reducing damage to the fabric of buildings. Examples of protection include barriers across gates, doors, windows and airbricks, and measures to increase the water-resistance of walls and floors. On the other hand, the use of *resilience* measures assumes that water will gain ingress and reduces the vulnerability of fittings, fixtures and possessions. Examples of resilience include the use of water-resistant wall plaster, the raising of wall sockets and consumer units and the substitution of fitted carpets with ceramic tiles.

For individual properties or small groups of properties in areas that flood frequently, property-level protection and resilience can be an appropriate and cost-effective means of reducing damage and disruption. Where the number of properties at risk is small, large-scale engineered solutions are unlikely to yield sufficient benefits to justify the funding of such measures by the state. At the same time, analysis by Entec and Greenstreet Berman (2008) suggests that the use of packages of protection / resilience measures can be cost-beneficial for households where the annual risk of flooding is approximately 2% or greater. Furthermore, property-level measures have the advantage of being less disruptive of the physical environment.

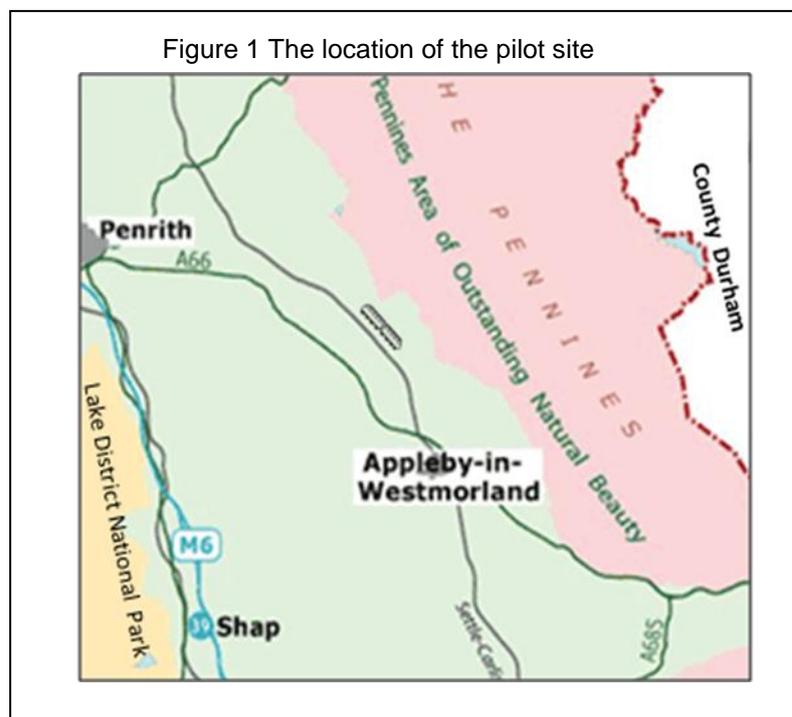
Having made a commitment in its Making Space for Water (MSW) programme to investigate the potential benefits of property-level adaptation measures, in 2007 Defra made £500,000 available for a pilot scheme that explored ways of delivering grants and assessed the likely take-up by property owners (Defra 2008a). The pilot involved six locations and provided grants for 199 properties, of which 89% were residential and the remainder commercial. Schemes were delivered by local authorities in partnership with local offices of the Environment Agency, with funding of £5,000 being provided by Defra for each property that participated in the scheme (including £1,000 for surveys and administration costs). Analysis of the scheme funding showed that the average cost of works was about £2,900 per property (Defra 2008b).

Two of these pilot areas have been the subject of independent, in-depth evaluation research. In 2008, interviews were conducted with householders involved in the Leeds pilot (Defra, 2008b - unpublished). This report focuses on data collected in a second pilot area, Appleby-in-Westmorland, which, at the

time of the research, was the only pilot area to have flooded subsequent to the implementation of the property-level adaptation measures.

## 2. The pilot scheme in Appleby-in-Westmorland

Appleby-in-Westmorland is a small market town that lies in the north of Cumbria between the Pennines and the Lake District (Figure 1). Appleby's dairy and gypsum-extraction industries having closed in recent years, its economy relies mainly on agriculture and tourism, with visitors being attracted to the area by the historic town centre (Figure 2), the surrounding countryside and the annual Horse Fair and harness race.



Appleby's significance as a town belies its relatively small population of 2,500. The nearest larger town, Penrith, is 20 minutes' drive and 14 miles to the northwest and the dearth of conurbations to the east, south and west, makes Appleby the nearest commercial hub for numerous hamlets and villages. The town boasts a castle and a grammar school of over 600 students that received its charter in the sixteenth century. Furthermore, until local government reorganisation in 1974 Appleby was the historic county town of Westmorland, a county with a population of over 70,000 that included towns such as Kendal, Grasmere, Windermere, Ambleside and Brough.

Figure 2 Appleby: a small market town surrounded by scenic countryside



The town is also well known for the flooding it experiences. Apart from November 2009, other severe floods mentioned by people in the town include those of 1968, 1995 and “The Great Flood” of 2005. Lesser floods occurred between these more dramatic events.

Figure 3 Illustration from a local newspaper, showing The Sands during the 1968 flood



Although surface water causes problems in some parts of the town, most flooding in Appleby originates from the River Eden. According to residents, the Eden overtops its banks approximately every second year. One participant in this research talked of there being two high-risk seasons in Appleby's year: the last two weeks in July, when heavy rainstorms can occur, and mid-October to March, when the Eden is swollen by snow-melt and rain falling onto the Pennines. Two parts of the town have been most vulnerable to flooding from the Eden (Figure 3): the area located within the river bend, which includes sports grounds, a swimming pool, a church and a residential street; and a road known as The Sands, which runs immediately north of the river and comprises houses, flats, shops, businesses, a bowling green and a church.

Figure 4 Map of Appleby, showing the River Eden and The Sands (top)



In 1995, the Environment Agency offered the town a package of flood defence measures. However, although the measures were accepted for that part of the town within the river bend, residents and property-owners in the north of the town rejected the proposals for their area – partly for aesthetic reasons and partly because of issues relating to access to land and property. As a result, while retractable barriers, heavy-duty flood gates, a bund and a flood wall now protect one part of the town, The Sands remains undefended and continues to flood regularly.

Figure 5 An Environment Agency flood barrier by playing fields in the south of Appleby



In 2007, two years after a particularly severe event had affected the town (as well as Carlisle and other parts of Cumbria), Appleby became one of the areas

in the Defra pilot scheme. Using a Defra grant of £80,000, Eden Borough Council and the local Environment Agency (both based in Penrith) proceeded to provide property-level flood protection for 34 residential and 12 commercial properties - mostly on The Sands, but also in the south of the town, where there was a problem with run-off flooding. Two years later, in November 2009, the River Eden overtopped its banks once again and floodwater threatened 25 of the 46 protected properties.

### 3. The research

This research was commissioned by Defra to investigate the impacts of the pilot measures on the consequences of the 2009 flood and to find out how the experience of using the protection measures had changed people’s attitudes and behaviours with regard to adaptation. It also aimed to learn about the role played in the implementation of the scheme by the relationships between key agencies and the residents and businesses of Appleby.

To address these questions, in-depth interviews were conducted with local people, with recruitment being conducted door-to-door and at various times of day in order to maximise the response rate and ensure diversity amongst the type of respondents.

To investigate factors influencing the implementation of the scheme as well as its impact on participants and non-participants, the research sample included those responsible for setting up the pilot and people from both inside and outside the pilot area (Table 1). The sample of people from within the pilot area was designed to reflect the composition of the population in the area and therefore included a mixture of businesses, tenants, owner-occupiers, landlords and community groups. Of these, thirteen had received full packages of protection, one had received partial protection and one had declined to participate in the scheme (Table 2).

Table 1 Key characteristics of the research participants

Interviewee characteristics							
	Householders		Landlords	Small businesses	Community group	Scheme organisers	Total
	Owners	Tenants					
Interviews	7	4	2	7	1	3	23
Respondents*	8	5	2	7	1	5	27

\* Four interviews involved two respondents

Table 2 Participants’ involvement in the pilot scheme

Extent of participation – respondents from within the pilot area		
Received full protection	Received partial protection	Refused to participate
13	1	2

To identify nearby at-risk properties that were not invited to participate in the pilot, the researcher relied on local information and the Environment Agency’s

flood maps. Of the four properties that were thus identified, one lay within the town and three were in villages and hamlets within a five mile radius of Appleby. Interviews were semi-structured. That is, although a similar range of topics was covered with all respondents, the interviewer did not adhere to any question order or format. Respondents' views and experiences were allowed to emerge in their own form and according to their own priorities, and respondents' comments were probed by the interviewer in order to achieve a deeper understanding of their perspectives and motivations.

Most research interactions were recorded and on the three occasions when this was not possible, hand-written notes were made immediately following the interviews. Recordings were professionally transcribed and the interviews were then analysed to produce the findings reported here.

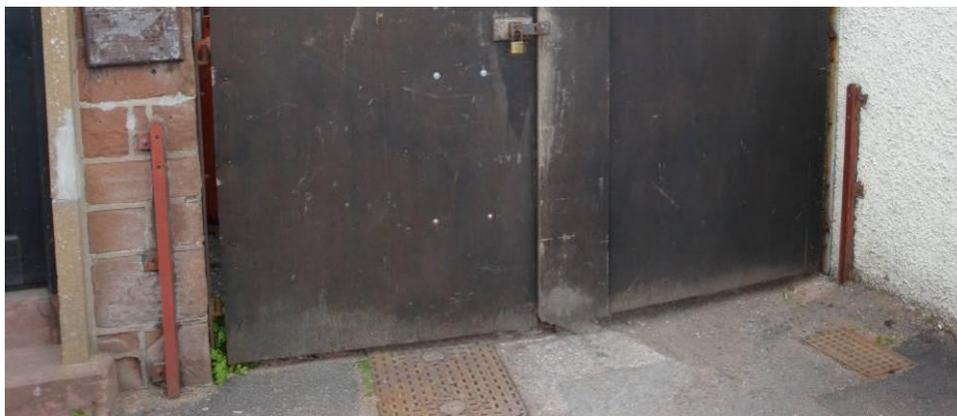
## **4. Flood risk adaptation before the pilot**

As described in the paragraphs below, many people in the pilot area had already adapted to the flood risk in some way before the scheme was launched. This suggests that local people were already aware of the notion of adaptation and indicates that they were probably more willing than other communities to welcome participation in the Defra grant scheme. It also means, however, that the economic benefits of the scheme were less than they would have been if, as is often assumed by models that estimate the benefits of such measures (Entec et al, 2008), no measures had previously been in place.

### **4.1. Flood action plans**

A number of businesses had flood action plans in place. These included plans for raising stock above flood levels or removing it to safer parts of the premises or even to other properties outside the floodplain. In some of the more well-established businesses, managers and staff were familiar with the procedure to be followed in a flood ("everybody knows the ropes; everybody knows what to do"), were apparently un-daunted by what it involved and were able to implement plans quickly and efficiently.

Figure 6 Stanchions for home-made flood barriers – seen here either side of the entrance to a goods yard



## 4.2. Deployable protection measures

In addition, some people had taken rudimentary protection measures (figures 6 and 7). Most of these relied on plywood door-boards and sandbags, but one business had used a more sophisticated technique, blocking access to its yard by placing wooden boards between two permanent stanchions and inserting a damp-proof membrane before adding a layer of sandbags.

Figure 7 A home-made plywood door-barrier



## 4.3. Sandbags

In spite of their not forming very effective barriers against floodwater, sandbags were relied on heavily in the town and this reliance seemed to be based on more than a presumption of their effectiveness. Respondents frequently represented their town as a place in which people pulled together in response to external threats. This representation of the town's collective identity appeared to be rooted not only in the response to the floods but also to historic raids mounted on Appleby by the Scots; to the influx of tourists, gypsies and "criminals" during the annual horse fair, and to the usurpation of Appleby by Penrith, when the latter became the administrative capital of the area in 1974. The association between flooding and other threats is signified by the sounding of a claxon when there is a raised danger of flooding – a clear echo of the World War II, when the same claxon was intended to warn residents of attacks of a different kind. The use of sandbags during a flood, and their distribution amongst fellow residents by those with suitable vehicles seemed to represent an expression of this spirit of independence and resistance.

It could be argued, therefore, that sandbags play an important role in the facilitation of social solidarity in response to flood risk. People in Appleby are proud of their community-led system to distribute sandbags and of the way in which they pull together to ensure that they are delivered to those that need them. The delivery of this system provides a *raison d'être* for the flood action group, which, in turn, makes the town relatively self-sufficient during minor floods and reduces the need for intervention by the geographically distant local agencies. The provision of sandbags also helped maintain good relations

between the town and the local flood risk management agencies, for the continued provision of sandbags countered the suspicion that they were neglecting the needs of Appleby people. In fact, it was said that town leaders only agreed to participate in the pilot scheme because it was presented alongside a proposal to devise a more organised and systematic system for storing and distributing sandbags – something that the town could do for itself, without the need for external aid.

Figure 8 Residents deploying sandbags - The Sands, 1995



In addition, unlike many other protection measures, sandbags need no previously-installed fittings and are equally appropriate in almost any circumstance. As a result, the equitable provision of sandbags can be represented as favouring no-one and helping everyone – a characteristic that reinforces the sense of unified struggle in the face of flood risk, which itself has widespread social benefits.

#### **4.4. Intrinsic protection measures and resilience**

As well as the deployable flood barriers just described, a range of resilience and intrinsic protection measures had also been implemented prior to the pilot, mostly as part of the reinstatement of properties following previous floods – particularly the more severe events of 1995 and 2005 – or as part of planned refurbishments or extensions.

Figure 9 An example of an intrinsic protection measure: a raised building extension



One property owner had installed water-resistant flooring and a drainage point in the most vulnerable room of his house and raised the thresholds of all adjoining rooms in order to contain and drain the flood water. Another had raised all the floors and airbricks, replaced wooden floors with concrete and bricked-up the river-facing door, replacing it with a new entrance at the back of the building. Others had moved electric sockets higher up walls, used water-resistant render on walls and, in one case, taken care to purchase items that could easily be moved away from the floodwater (e.g. laptops instead of PCs). When owners of one building near Appleby built an extension onto their property, they raised the level of the floor to put it beyond the reach of floodwater (Figure 9).

#### **4.5. Reasons for implementing measures**

The adaptive actions taken before the pilot appear to have been motivated and facilitated by three factors: people's awareness of the risk when they decided to move to, or remain in, the area; their recognition and acceptance of the risk from flooding, and the availability of the skills and understanding needed to select and implement the measures.

In keeping with the findings of previous research (Harries 2008a), analysis of the interviews in Appleby suggests that one reason for adaptive action was people's acceptance of the existence of an ongoing risk. Research in areas less well-known for flooding reveals that people sometimes choose to deny the existence of the risk, characterising floods as 'freak events' and refusing to represent their localities as permanently at risk (Harries 2008a). Respondents in this research, in contrast, represented flooding and flood risk as normal characteristics of their town and accepted that their properties would continue to be at risk. This enabled them to act to reduce their exposure to that risk:

Well, we'd had the property since the 1950s and we knew how much it used to flood – and it was getting worse, so [after the 1995 flood] we just decided that we'd take what precautions we could at the time.

Acceptance appears to be driven by two factors: familiarity with flooding and the extent to which exposure to the risk is voluntary. Many residents of the pilot area had lived in or around Appleby for most of their lives and were therefore familiar with the issue of flooding. Even those who had only recently moved onto the floodplain had been aware of the floods before they did so and, in many cases, had witnessed them personally. As a result, people accepted that floods would occur regularly and there was little evidence of psychological denial:

Interviewer	When you decided to move here, did the flooding come into your consideration?
Respondent	Yes, it did. And one of the first things we actually did was, like, [ask the landlord] and he said it will flood. And [we knew about] the devastation from [name of friend] being here at the 2005 floods. And I also actually...I'd not long started flat-sharing with [name of other friend] when he'd only just moved back into his house after that being refitted as well, so it never bothered me because I mean like, as a teenager I went out and helped do sandbagging on [name of street]. I mean I've lived on [name of a street that floods] as well.

Most residents and businesses had made a conscious choice to locate in the flood risk area. Attracted by a combination of lower housing costs, the attractive location, proximity to the town centre and access to passing trade, respondents often argued that the advantages of The Sands outweighed the disadvantages of the flooding. Furthermore, it was well-known that local people were themselves partially responsible for the existence of the risk because they had rejected the structural solution offered them by the Environment Agency in 1985.

Alongside acceptance, a second important factor determining behaviour is confidence about the right way of adapting to a flood risk. Respondents in this research had relatively high levels of confidence in planning and implementing their approach to adaptation. In part, this was due to an accumulation of experience from the floods they had lived through. With each flood, people become more aware of the most productive ways of reducing their risk exposure. The following passage shows, for example, how the experience of one flood can furnish householders with the knowledge they need to reinstate homes with minimal disruption and increased resilience:

I don't think what my insurance company did was correct in certain areas. They took the plaster off to three foot all around the house and everywhere – we didn't get contaminated water in here, we only got clean water in here! So I would take all the kick boards off, rip the floor up, dry everything out and then I would replace them bits myself because I think that's all that would be required. Probably renew the skirting boards and things like that, but make sure everything is properly dried out. I would concrete the floor in there.

Furthermore, when it comes to resilience, advice is easily available in Appleby. The Sands itself boasts a building firm and a builders merchant and numerous

respondents were either builders or had professional backgrounds that enabled them to understand flood damage mitigation issues. Due to the social dynamics of life in the town, these skills were accessible to residents from less practical backgrounds:

[...] anybody [who] owns a shop in Appleby drinks in [the same two] pubs and everybody gets to know each other and that's where a lot of, you know, like business is sought for like, you know, if you need a plumbing job done. You go to the [name of pub] and you'll find [name], who's an electrician. You go to the [name of second pub] and there's a guy called [name] who's the man for plumbing, and so on. So that, I think, creates...that is the main cement of Appleby community for me.

In summary, respondents accepted that their area flooded frequently, felt certain that no large-scale defence was forthcoming and were familiar with the manner of flooding and the kind of damage it was likely to cause. As a result, they were relatively willing and able to implement adaptation measures and to plan how to respond to future floods.

#### 4.6. Limitations of the measures in place

However, the protection and resilience measures in place prior to the pilot had generally developed in a piecemeal fashion and often provided incomplete adaptation to the risk. One respondent described how he first installed a flood board and only learned when it next flooded that he also needed anti-backflow valves to prevent water coming up through the drains. Another property-owner had a home that was resilient to flooding but had not considered buying door- and gate-barriers to enable him to retain use of his home and garden during a flood. Similarly, businesses with action plans in place for the evacuation of stock had no means of protecting the show-rooms themselves. Notably, none of the respondents had purchased any of the manufactured protection products available on the market, such as airbrick covers or engineered barriers.

Figure 10 Flood protection measures in action in Appleby before the pilot scheme



## 5. The implementation of the pilot scheme

As a result of their repeated experiences over many years, people in the town had assimilated the notion of flooding into their collective identities, representing Appleby as ‘the town that floods’ and the people of Appleby as ‘the people who resist and survive floods’. Although flooding was disruptive and sometimes frightening, respondents demonstrated pride in their ability to deal with it. One of the challenges faced by the authorities was to find a way of harnessing that pride and not undermine it.

To make the most of this sense of pride and avoid offending it, staff from the Environment Agency and the local authority ensured that townspeople were able to feel that they themselves were choosing how to manage their flood risk rather than having solutions imposed on them. This, it was said, took patience and tact. Both these organisations were sometimes viewed with suspicion by people from Appleby – both are based in Penrith, a town considered alien because of its distance and because it lies outside historic Westmorland, and the Environment Agency was blamed for the flooding because of its failure to dredge the river. Beginning from a position of assumed opposition, these two agencies therefore had to work hard to win the trust and support of the town.

Accordingly, it was reported that rather than trying to impose their ideas on the town, the local authority and the Environment Agency asked people for their own proposals and supported their efforts to implement them. This was described by one local flood risk professional as follows:

What we did is, we got those people, effectively through the town council, to come and sit down with us and say, ‘accept the fact that there are going to be times when Eden District Council cannot be coming here [to help deal with a flood]. In such a situation, what do you think would be of benefit to you?’ And the first and most obvious one they come up with is, ‘we want to be able to have more control over sandbagging’.

Rather than creating a situation of dependence (*it’s their job to protect us*) and resentment (*they don’t care about Appleby*), this tapped into the sense of pride and resistance associated with the town. People in the town remembered how, in the past, residents had worked together to supply each other with sandbags – and they wanted to reinstate that source of pride. Despite doubts over the effectiveness of sandbagging, the Environment Agency helped the town achieve that aim; providing administrative support, expertise and encouragement for the setting up of a highly organised system that mobilises large numbers of Appleby’s residents in the distribution of sandbags and the provision of hot food and drink for flood victims and emergency workers. As a result, rather than being offered the role of ‘victim’, people from Appleby were able to be active participants in the response to the floods. Rather than waiting for others to solve the flood risk problem, the attitude now was, “Let’s show them [the borough council] what we can do!” This is revealed by the enthusiasm with which they spoke of the role they play and the impact they perceive it to have on the perception of their town:

You can’t have your hand held all the time. You’ve got to do things for yourself. [...] I think we cooked about five kilos of bacon that day [for emergency workers and flood victims].

Yeah, we went to the local butchers – he gave it to us at cost. We bought bread. And I've now got under the stairs a big plastic box with sugar, tea, coffee.

One of the workmen that came in on [the day of the flood], he said, “well, I'd like to tell you that this town is the best organised town of any of these floods locally!”

The establishment of a sense of partnership was not easy for the flood risk management authorities. Described as “a very time-consuming process”, it took a great deal of resource and considerable personal commitment by the relevant personnel to generate understanding of the issues and enthusiasm for the pilot scheme. As the professional flood risk managers additionally reported, a further difficulty was that it required them to trust residents and small businesses with the responsibility of deploying the various measures correctly, whilst knowing that the agencies, and not the public, were likely to be blamed if things went wrong. This necessitated a strong working relationship between the two agencies as well as commitment to the scheme by the local authority, which had to bear the risk of the scheme being deemed a failure and also the opportunity costs of having staff taken away from other work.

In practice, however, both the town and the two agencies benefitted from this approach. By bolstering the town's pride and sense of independence, the local authority and the local Environment Agency became seen by Appleby people as partners in their fight against flood risk. Although the up-front investment of time was great, volunteer leaders of the town's team now form part of the Environment Agency's emergency response network. It was argued by the professional flood risk managers that Appleby was now largely self-sufficient during floods; that this made a valuable contribution to the resources available to the authorities during a flood, and that this was a very significant benefit of the scheme:

As it is, [for] the kind of flooding that it's designed to protect, it works very well. But I personally think that the bigger benefit really, which wasn't what it was designed to do, has been the development of the community [...] As a result of this, a lot more people got [involved]. It's just been an inroad for [the Environment Agency] to do all sorts of sterling work with the community groups [...]

As the above quote implies, a second potential barrier to the successful implementation of the scheme was the fragmented social structure within the town. Life in any small community breeds resentments and difficult relationships and respondents suggested that Appleby was no exception to this. There were areas of friction between established families who had lived and worked in the town for generations and as well as between these same families and newer arrivals whose priorities conflicted with the customary approach taken by Appleby people. These differences and difficulties had hindered efforts to manage the flood risk – past meetings on the subject were described as fractious and attempts at dialogue as having ended with key actors pulling out due to personal grievances. As a result, although the town had in the past organised the coordinated distribution of sandbags and other assistance, efforts to resuscitate this tradition were said to have ended in acrimony and disaffection.

These divisions were said to have been overcome as a result of the presence of strong, motivated leadership and the existence of two external catalysts for change: the 2005 flood and the galvanising affect of the possibility of participating in the pilot scheme.

Interest in flood risk adaptation will always be greatest immediately after a flood, so it is little surprise that the experience of 2005 motivated people to work to address the flood risk in Appleby. The more vivid a risk is, the harder it is to deny it (Nisbett and Ross 1980), so it is understandable that the experience of the 2005 flood was a strong motivator for action. In that event, floodwaters rose to a depth of four feet in The Sands; two people had to be rescued by the emergency services from one of the shops and at 3am a decision was taken to evacuate even the defended areas in the centre of the town (Robertson and Koronka 2005). The impact of these events on the behaviour of the townspeople was compounded by the fact that it came on top of a history of frequent, less severe floods. When an event begins to retreat into the past it can seem better to allow the memory to fade rather than to risk high levels of anxiety (Harries 2008b). However, the frequency of flooding and the prominence of the risk make this difficult in Appleby, where the River Eden overtops its banks every two or so years and flood defence measures in the centre of the town are a constant reminder of the seriousness of the rarer events. As a result, these experiences gave people in the town the determination to fight harder than ever to create a collective response to the risk, prompted both by the suffering they had seen amongst their neighbours and by their desire to be “public spirited”. As one resident put it, 2005 was “so bad that we really [had to] do something about it”.

The invitation to participate in the grant scheme gave an extra impetus to this desire, for it promised a tangible reward to those who committed themselves to collaborative action. This is explained by one of the professional flood risk managers:

Because suddenly, they've got a reason that they're working together. You got sixty people who are all talking to each other about the fact that they can get [protection] products; this is what's going to happen. And they're beginning to see that if you're part of a terrace and I'm part of a terrace, and you don't do something and I do, you've not achieved anything, [and that] therefore you need a collective response to make something work.

As suggested in the above quote, in addition to needing joint working amongst the leadership of the town, this also required cooperation between immediate neighbours. In terraced houses and mansion blocks a failure to protect one home from flooding can easily lead to water passing into neighbouring properties through party walls or foundations. Even where homes are not physically linked, the best available solution might be to construct bunds or walls that impact on several properties at once, or to install a new drain in one garden that benefits several neighbours.

The need to work together also has other advantages. In Appleby it reinforced the notion of community solidarity in the face of the flood risk and built a stronger overall resilience than would have been achieved if individuals had

worked alone. Furthermore, the possibility that protection measures will not be implemented if a householder is away or on holiday is a frequently cited reason for not wanting to use barriers that require deployment; and some people might be too frail to deploy them by themselves anyway. Where neighbours work together on the implementation of a scheme they are more likely and more able to help each other out in such circumstances. In the Leeds pilot, people held keys for the cupboards in which their neighbours stored their barriers and a system was in place to help elderly people set up their protection.

Figure 11 Front view of a group of three homes involved in the pilot scheme



Respondents claimed that all this collaboration was only possible because of the type of people who took up leadership on the issue of managing the flood risk. They argued that successful leadership requires someone who can win the involvement and collaboration of a sufficient body of people who are in a position to help; someone who knows “the people that matter” and is able to enlist them in the task of motivating the wider population behind a scheme.

In Appleby, a core group of local people led the implementation from the town side. This team of four had footholds in most of the institutions whose contributions to the organisation of the town’s flood preparedness were essential – the borough council, the town council, the fire service, the Rotary Club and the Inner Wheel (an organisation for female relatives of Rotary Club members) – as well as other important institutions such as the grammar school and the scout group. The support of these institutions gave the initiative access to a wide range of resources, including equipment, storage, organisational skills, professional contacts, technical expertise and catering facilities. As these organisations intersect with the lives of a wide range of Appleby people, their support also gave the initiative credibility with a wide cross-section of residents and businesses.

Despite the overall success of the scheme in winning the support of local people, not all residents were convinced to participate and not all of those who accepted a grant were willing to pay for additional measures to supplement those provided. It seems likely that historical grudges against local agencies played their part in this. Some residents had a history of disagreements with these agencies and the good feeling generated by the scheme and by the approach taken by the Environment Agency and local authority officers seems to have been insufficient to overcome these memories. A sense of fatalism might also have played a role – a familiarity with the disruption and distress caused by flooding, the knowledge that flooding can be survived, and a resignation to its recurrence (“you have to put up with it, don’t you”). For these residents, the costs of participating in the scheme seem not to have been outweighed by the promised savings promised.

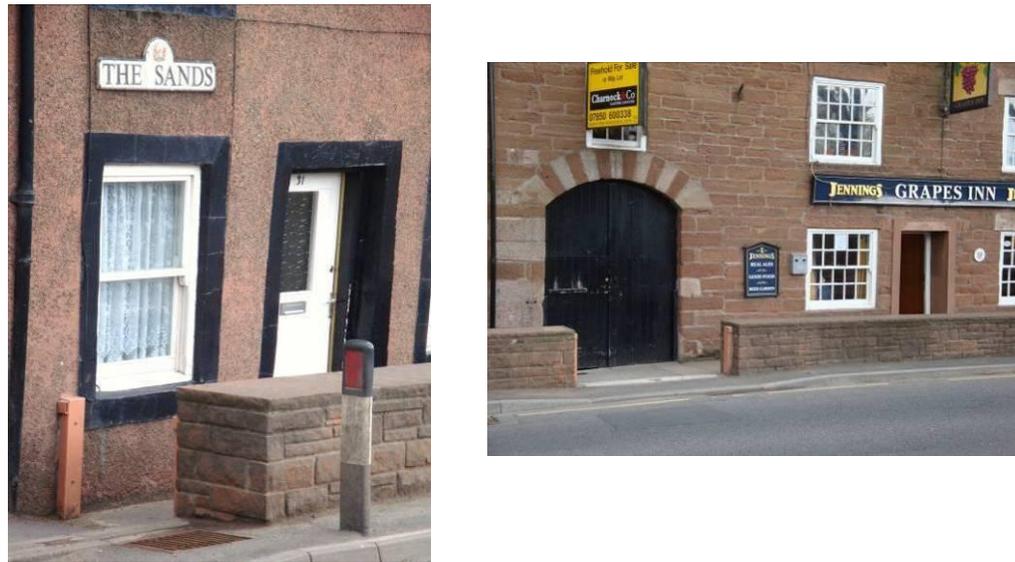
## **6. The measures provided by the scheme**

Participants in the Appleby pilot benefitted from a range of different flood protection measures. Unlike pilot areas such as Leeds, where the standard design of the houses allowed a standard product to be used, measures were tailored to the needs of individual properties. Furthermore, in two cases it was decided that collective solutions were more appropriate than measures that protected only one property.

One of these collective solutions regarded four terraced properties on The Sands. These properties – a pub and three houses – flooded both from the river and also from run-off that flows down the hill onto The Sands. With the cooperation and financial support of the Highways Agency, a wall was erected at the front of the properties between the pavement and the road; a series of deployable aluminium flood barriers were installed to block access points for pedestrians and delivery vehicles, and a pump was provided for the extrusion of water (Figure 12). Responsibility for the gates and pump is shared by the residents and the pub licensee and the equipment is stored in an open alleyway where it is easily accessed.

This most permanently visible feature of the scheme caused concern amongst residents, who feared it might damage the aesthetic integrity of the river-front area. However, participants in the research indicated that the wall had now been accepted and those living or working behind the wall were pleased with its effectiveness both at holding back floodwater and also at shielding the properties from vehicles on the road.

Figure 12 The flood wall that was constructed in front of four properties on The Sands



A second example of collective protective action concerns a cluster of three conjoined properties in the south of Appleby that flood with surface water from the front and overland water from behind (see Figures 11 and 13). In this case, the scheme provided deployable barriers for gates and doors and an outside drain and drainage point and the scheme organisers also worked with the Highways Agency to reduce the flooding from the road.

Figure 13 The field behind the properties in Figure 11 and the entrance to the drain (fenced area)



It was reported that the negotiation of the aforementioned package of measures took a considerable amount of Environment Agency and local authority time. The property owners had strong ideas about what the problems were and what work needed to be done to address them. They were, indeed, experts on their own flooding and their knowledge was necessary to the creation of a solution.

Professional flood risk managers described how it took several on-site meetings to obtain the necessary information, reassure the owners that they were taking it on board and help reach a joint decision about which measures to use:

It was quite an intense level of attention. And at certain points these householders would ring me up or they'd text me and say, "It's raining now, do you want to come out and have a look at the field." And you'd kind of go, well you know, 'yeah, better had go'. I think it was that level of service that they'd been provided with [that enabled us to have such a good relationship with them].

Winning the support of local people for the scheme and reaching agreement on the choice of options took a great deal of time on the part of the scheme's administrators. They spoke of the importance of being seen to listen to residents and reaching decisions on the basis of an agreed evaluation of the situation. In cases such as the above, this meant learning from those who had experienced the flooding and who sometimes, therefore, had better knowledge of its provenance. In other cases it meant facilitating learning within the community by bringing together different local perspectives and guiding groups towards a more evidence-based notion of what caused the flooding and how to protect against it. The professional flood risk managers stressed the importance of allowing local people to take ownership of the problem and its solution rather than obliging them to accept the explanations offered by external experts. Taking this approach allowed owners to feel proud of the measures that had been implemented and to assimilate them into that aspect of their social identity that was based on the notion of resilience.

In a third case of collective action, the attempt to protect a block of flats almost faltered over the hesitation of one landlord. In this example, the challenge was to ensure the integrity of the protection by convincing the owners of all eight flats to implement the measures. Only after numerous attempts did the scheme organisers manage to contact the landlord of the eighth flat and convince him that, for the good of the other residents, it was necessary to participate in the pilot.

The measures provided for these flats were the most common feature of the scheme in Appleby: steel-boxed frames that expand telescopically and are covered by a waterproof neoprene jacket.

Figure 14 An expandable barrier seen from behind



Figure 15 The equipment used to deploy the barriers



These barriers require no permanent fittings. Once placed in position, a spanner is used to expand each guard horizontally and vertically and respondents explained that they need to be edged with sealant. The lack of permanent fixings was an advantage in Appleby, where many of the properties are listed and planning permission for permanent changes can be difficult to acquire. On the other hand, it was reported that the deployment of these barriers required a certain amount of mechanical adeptness and confidence and a few respondents claimed that this had caused them some difficulties and that barriers had sometimes been fitted incorrectly.

As illustrated in Figure 15, readiness to deploy these barriers necessitates the storage of appropriate tools and materials such as spanners and sealant, as well as of the barriers themselves. It also requires communally accessible storage space away from direct sunlight, such as the under-stair cupboard purpose built by one landlord in Appleby (Figure 16). Where openings are of different sizes, the labelling of each gate facilitates easier deployment. Although respondents expressed no doubts over their ability to fulfil these needs, there was some evidence that not all were complying with the manufacturer's recommendation that the products are washed after each use.

Figure 16 Barriers and associated equipment – as stored under the communal stairs in one block of flats



Deployable barriers were supplied to commercial properties as well as domestic ones. Figure 17 shows them being used to protect a fish-and-chip shop. In this example, permanent stanchions had been fitted to link four barriers together.

In many cases, the provision of these barriers was complemented by more general improvements to the water resistance of buildings, such as the provision of water-resistance rendering and the installation of non-return valves in main sewers or household sewers.

## 7. Direct impacts of the pilot measures

The system put in place by the Defra pilot scheme received its first test in November 2009, when the River Eden burst its banks<sup>1</sup> and flood water reached 25 of the properties protected in the scheme. With a maximum depth of about 450mm, this was a far smaller flood than that in 2005 and was therefore within the performance specification of the products provided in the pilot. Respondents reported that the measures were generally successful and that they kept out far more water than sandbags alone had done in the past. What leakage there was through the barriers was dealt with using pumps, so properties were kept substantially dry and no evacuations were necessary.

Figure 17 Deployment of barriers in front of a food outlet on The Sands



The experience of the 2009 flood gave an important boost to confidence in the measures introduced by the pilot. The assurances of suppliers and scheme organisers had not been taken on trust and none of the respondents mentioned the BSI Kitemark, let alone said that it had given them confidence in the products that bore it. Rather, people asserted that they needed to witness the effectiveness of the measures at first hand before they would believe in them:

I suppose I reserved judgment because I didn't know... You know, when you see this thing in a box and then that is supposed to stop the floodwater from getting into your property. It's sort of hard to, you know, like the...if that makes any sense. I just couldn't see how it was going to work until it was actually jacked out into the doorframe.

We just stacked [the sandbags] up in front of the blue boards just to sort of like reinforce the water. And because we'd never seen them getting wet, we had no idea what was going to happen with it or what would happen with the silicone if it was just going to rot and fall away from the sandstone, stuff like that. So it was a case of, just let's have [the sandbags].

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<sup>1</sup> For video footage of the event, see <http://www.youtube.com/watch?v=acEa46ezSsw>

Figure 18 Flooding in The Sands – November 2009



The experience of the 2009 flood did not eliminate all doubts about the pilot measures. Although the demonstration of the effectiveness of the barriers in the worst-hit properties convinced some that they could be trusted, others felt that they needed to experience their effectiveness more fully and more personally before they would drop their reliance on previous tactics:

The [door-boards] haven't been fully tested to the limit yet. And I think people are still a little bit wary as to how [they] are going to work. [...] I mean it came up to a level where it was just soaking lightly but it wasn't the full force of the river hitting that blue board. So we've that yet... got that yet to come.

As a result, some residents continue to claim that sandbags constitute an essential aspect of household protection (see Figure 19). The local authority is now trying to persuade the town's flood forum that it needs fewer sandbags in future floods, but the success of this attempt has yet to be proven and evidence from the interviews suggests that residents will continue to require sandbags with which to 'reinforce' flood barriers.

Neither could the pilot measures solve all the challenges faced by the dozen or so micro businesses in the area. In some of the larger premises the size of the at-risk area was too large to be easily protected and the amount of money available from the grant would only have made a small contribution to the costs of full protection. As a result, flooding continued to necessitate large-scale evacuation of stock and equipment and in November 2009 these businesses exercised their flood action plans as usual – though at the cost of just one or two days' of lost business.

Figure 19 Residents and businesses used sandbags to supplement the measures supplied by the pilot scheme



Although several businesses on The Sands experienced reduced flood damage and disruption thanks to the demountable barriers provided, this was not always the case. Some reported that lack of confidence in the barriers had caused them to dismantle more equipment and move more stock than was necessary. In these cases, the full benefits of the protection measures will only be realised when experience of the measures has generated an increased confidence in their capacity to prevent water ingress. In another case, the problem was less with the floodwater than with the associated levels of humidity, which would spoil much of the stock even if the barriers were fully effective.

Figure 20 A garage on The Sands during the 2009 flood - a barrier provided by the pilot scheme is visible on the showroom door



Apart from the reduction in disruption and damage, a further benefit of the pilot scheme was that it reduced anxiety amongst the householders and businesses

involved. As the following quotes from different respondents illustrate, people living and working in the pilot area were able to feel less worried and anxious and more secure than they would otherwise have done. Such benefits are difficult to measure and reflect in traditional benefit-cost analyses, but they are of great importance to residents and small businesses in at-risk areas.

I do feel that (*pauses*)...I'm not worried every time it starts raining in sort of January, February, which at one time we were. You know, if you had a storm coming in, if you saw a depression, and you were sort of looking at the weather forecast and where's it going to hit.

To think that we would be left with just sandbags is quite frightening now that we've seen what [the door-boards] can do.

From what I saw of the [door-boards] and how they worked, I was kind of quite impressed with them. And I would actually put quite a lot of faith in them. If I didn't have them then I think I would have been a lot more tense. I'd be a lot more unhappy about having to live here. I do draw quite a lot of security knowing that they're just out there.

Before I had the drain in [...] I would be listening most of the night for the gurgle of my pump going because I knew if my pump stopped we could get water in again. So we did have anxious times. But that's what I'm saying: that drain has relieved that anxiousness and I can go to sleep now knowing that that drain will cope.

## 8. Indirect impacts of the scheme

As well as the direct benefits of the grant schemes in the pilot, Defra hoped that they would promote greater use of protection and resilience both within the pilot areas and in other high-risk localities, encouraging people in these areas to take such measures of their own accord. To explore the significance of this *demonstration effect*, participants in the scheme were asked how the scheme had changed their attitudes towards flood protection. In addition, residents and businesses from properties in nearby at-risk areas were asked whether knowledge of the scheme in Appleby had changed their views and behaviours.

### 8.1 Impact of the demonstration effect inside the pilot area

A key issue in this regard is awareness of the options and confidence in their effectiveness. Before November 2009, the residents and business people of Appleby had not witnessed the performance of commercially manufactured protection products and so had no reason to believe in their effectiveness and would not have purchased them for themselves. Two things changed this situation: the practical demonstration of their effectiveness in November 2009 and the expression of confidence in the measures implied by their inclusion in a state-sponsored scheme:

Interviewer Would you have bought the gates yourself had they not been provided?  
Respondent1 Yes, definitely. Because now I know they work, then yes I mean I might even invest in one for the front door [...]  
Interviewer Is it only now you've seen them work?  
Respondent1 Oh yeah.  
Interviewer Because partly what I'm interested in is, whether people would do it anyway without any of this happening.

Respondent1 I don't think they would until they've experienced a flood. I don't think people would think... They have to see them, they have to actually go to an exhibition of something where they see them in action and working and seeing how much water can be held back and how much water doesn't get through, to convince people to buy them really.

Interviewer Would you have done it anyway, do you think?

Respondent2 Oh probably not. I think it was because...because it [was] a government scheme and there was government grants there, and they recommended a company to start with. If you got the Yellow Pages out, starting inside to look at flood defences, you probably wouldn't have pursued it quite the same.

Interviewer How come?

Respondent2 Well, you don't know what you're buying, do you?

Interviewer And how happy are you with what [the scheme organisers] decided you should have?

Respondent3 Very, because if we'd gone on our own to do it, we wouldn't have had a clue where to go.

As illustrated in the three quotes above, people in Appleby hesitated to select protection products themselves because of uncertainty over what was appropriate to their circumstances and what would be effective. Without either seeing products in action or receiving expert advice such as that provided in the scheme, they argued that they "wouldn't have had a clue" what to buy.

In fact, the evidence suggests that confidence in choosing measures might be a more important determinant of behaviour than the cost of the measures. With the exception of the more expensive measures such as the flood wall on The Sands, this indicates that people might have been willing to spend their own money on flood protection if they had been able to feel confident in the effectiveness of what they were buying.

This argument does not, however, eliminate the need for the grants altogether. The availability of funding was probably itself one of the factors that persuaded people to feel confident in the measures. Furthermore, the fact that one resident refused to top-up the grant with his own money reveals that cost can be a determining factor for some residents of high-risk areas.

Nonetheless, there is some indication that grant funding may not have been critical in all cases and that the more fundamental barrier to action might sometimes have been a lack of confidence about what action to take. Two participants in the scheme reported that they had been intent on taking action prior to the pilot and had only been prevented from doing so by a lack of confidence about which measures to purchase. Similarly, respondents from outside the pilot area claimed that they would be willing to pay for protection measures if they were sure that they would be effective and one participant in the scheme who did purchase his own door-board explained that he would not have done so without the facilitating framework provided by the scheme:

Respondent These floodgates were just so simple to use and we had thought of buying them before [...] [The scheme] was just an easy way of getting it because they ordered it all for us and we just paid the extra money. [...] Whether we

would have got round to it is another thing because it was that thing that it was easy to order. [...] I think it was the thing that somebody came to the door and said, "What do you want?" and you say, "Well, I'd like this, this and this, and they say, "Well, your grant money stops here but you can, this is how much this, this and this costs and you can, if it's fine we'll just send you a bill." "Okay then!" So, it was just made, I mean it sounds terrible doesn't it, but just life's so busy isn't it that you never get around to doing it, it's not that you don't want to do it you just... And it was just made so easy to just put your plans into action. Yeah. And they sorted it out with a local builder who took off the old sort of wooden slats where the old floodgates went and everything was sorted for you. They made sure that it fitted properly and they showed you how to fit it and it was real spoon-fed stuff really but it worked. Everybody took advantage of it.

Interviewer What do you think is the key difficulty that would have stopped you? Is it busyness or is it...?

Respondent It's getting round to it; finding the time to do it.

## **8.2 Impact of the demonstration effect outside the pilot area**

As might be expected, the demonstration effect was weaker outside the pilot area than within it. People living outside Appleby knew that residents of the town had been given some kind of protection, but were often unsure of what had been provided, its effectiveness in the 2009 flood and, more importantly, the appropriateness of the particular measures to their own circumstances.

Uncertainty over what had been provided was due, in part, to the low visibility of many of the measures in the scheme. The protection measures implemented in the pilot were more visually obscure than the flood defences previously introduced in other areas of the town (see Figure 5) and therefore less noticeable to passersby. One respondent from a nearby village explained that he had noticed the new flood wall on The Sands (Figure 11) but had not known about the deployable barriers, even though he was friends with someone who had been provided with some. This illustrates the disadvantages of protection measures that have no permanent, visible fixings. Although such measures are often favoured by homeowners because they are seen as less stigmatising, they are also less likely to promote a demonstration effect.

Another issue affecting the power of the demonstration effect was doubt over the effectiveness of the scheme measures. Even scheme participants who experienced the 2009 flood themselves remained unconvinced of their effectiveness, so it is unsurprising that those outside the pilot area also remained uncertain. The closure of roads and bridges makes Appleby relatively inaccessible during flood events, so people from surrounding villages are unlikely witness the impact of the measures at first-hand. When Appleby reopened after the 2009 flood and people from outside were once more able to visit The Sands for their shopping and other service needs, doubts over the performance of the new flood protection measures were reinforced by the presence of sandbags, which remained visible in the town for several months after other protection measures had been put away. As indicated by one respondent, the fact that they had still needed sandbags suggested that the other measures had been less than fully effective by themselves. Media coverage might have addressed some of these doubts and uncertainties, but because the media tend to look for dramatic news, they emphasised the

damage and inconvenience that was caused by the flood and tended to give little emphasis to the benefits of the new flood protection measures<sup>2</sup>.

Figure 21 Sandstone walls typical of those found in older buildings in and around Appleby



Probably the most important constraint on the influence of the demonstration effect outside the pilot area was, however, doubt over the transferability of the measures to other circumstances. Not being intimately familiar with the circumstances in Appleby, people from the surrounding areas were unable to compare these circumstances their own. As a result, even if they had been convinced of the effectiveness of the measures in the pilot area, this would not have translated into a confidence that they could be effective in their own homes and businesses.

One area of doubt, for example, regarded the suitability of door-barriers for buildings made of sandstone, whose walls might be particularly permeable to water (see Figure 21). Although this was a feature of buildings on The Sands as well as of the homes outside Appleby, it was difficult for people not from Appleby to know whether and how this difficulty had been overcome in the pilot.

Figure 22 Fixings for deployable barriers (left) and water-resistant render (right)



In contrast to the distinctive blue barriers that were highly visible in media coverage of the floods themselves and the fittings of other flood-boards that

<sup>2</sup>See, for example, the piece broadcast by BBC Look North on 19 Nov 2009 - [http://news.bbc.co.uk/local/cumbria/hi/front\\_page/newsid\\_8367000/8367951.stm](http://news.bbc.co.uk/local/cumbria/hi/front_page/newsid_8367000/8367951.stm)

were noticeable at all times, measures to waterproof walls and floors are less noticeable and more ambiguous (see Figure 22).

## 9. Flood insurance

Questions on insurance were included in this research in order to explore the interrelationship between property-level adaptation and the availability and cost of contents and buildings cover. If the implementation of resilience and protection measures makes it easier for businesses and householders to obtain insurance, or makes it more affordable, this could act as an extra incentive to take such measures and would also be an additional benefit of schemes of this nature. On the other hand, it is also possible that those with effective and affordable insurance against flood losses will be less inclined to take practical adaptation measures because they know they can rely on the cover provided by their insurers<sup>3</sup>.

Amongst the people interviewed for this research, there was some inconsistency in insurance-related experiences. While some complained of high premiums, others said that they had been able to obtain insurance at rates comparable to those for properties not at risk of flooding.

However, few respondents had yet informed their insurers of the measures introduced by the scheme. This might be because most respondents believed their premiums to be determined either by their postcode or according to the claims history of their property. As a result, there was little evidence that people expected insurance terms to be directly related to their efforts to reduce the risk exposure. Only one respondent reported that his premiums had remained lower because of an adaptation and this was a resilience measure implemented prior to the scheme. In all other cases, people either did not expect any impact on their insurance terms or else expected them to be indirect – i.e. as a result of reduced future claims.

The one case where there was a direct impact was characterised by what seemed a particularly pragmatic and direct relationship between the insurer and the insured. After the 2005 event, the insurer had not only recommended and paid for adaptation measures to the premises of this business, but had also given an interim payment to replace lost stock and reduce business interruption. Furthermore, the owners reported that when they had objected to the insurer's view that reinstatement necessitated stripping the plaster off the walls, the owners' opinion had prevailed<sup>4</sup>. This suggests that the insurer and the business conducted a genuine dialogue about how to deal with the issue and that the two worked in partnership to reduce the impacts and potential impacts of flooding.

In contrast to the one example of direct impacts on insurance terms, others emphasised the indirect impacts of putting flood plans in place or taking

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<sup>3</sup> For more on this phenomenon, known as *moral hazard*, see for example Baker (2002)

<sup>4</sup> The respondent argued that the way in which the building had been constructed rendered this unnecessary.

protection / resilience measures. For example, several businesses felt that the only way to reduce insurance costs was to make fewer claims in order to convince the insurers that the risk really had been lowered:

- Respondent I've already taken precautions and because we've had no claims on the two floods since, I eventually got some recognition that I'm not as bad a risk [...] and it has improved slightly.
- Interviewer Just through not claiming? Or through you saying, 'look I've got this and I've got this and I've got this'?
- Respondent Effectively from not claiming when there has been a flood. So they know that it's, you know, it has to be...You know, you can tell the insurance company that we are now only a one-in-fifty year risk rather than a one-in-ten, but they say well, you know, 'So what? Prove it!' And the only way you can prove it is by not claiming when there's a flood.

For some businesses, this meant refraining from making claims for smaller floods even if they had incurred damage. This, in turn, encouraged them to reduce the costs of these lesser floods by implementing protection, resilience and flood plans. As illustrated in the following quote, this not only reduced the damage and disruption caused by the smaller floods. It also meant that loss adjusters were more disposed to be generous when the more serious floods occurred, because they could see that the businesses had made every effort to minimise the damage and were fulfilling their part of the moral contract with the insurance company:

- Respondent That was the great thing when the insurance assessor came. He walked in and he obviously thought [at first], "Oh, we're having to pay out [lots of] money here." He said, "Where are the damaged [type of stock]?" and we said, "What do you mean?" He said, "Obviously you're going to have [type of stock] damaged." We said, "No, we've moved them." He said, "Right." He said...next thing he looked on his list, he said, "What about the [other type of stock]" and we said that [the floodwater had been kept away from it]. It's all been checked and there's not a problem with it. So his attitude was then "Right, what can I help you with?" So because we'd made an effort, when he realised that he'd saved somewhere around [sum of money] in stock that hadn't been damaged, he was more than happy to...
- Interviewer He was kind of on your side with...
- Respondent Yeah, yeah.

A number of the tenants in the research had no insurance at all against flood damage. They explained this by arguing that they did not consider the value of their possessions to be worth the cost of insurance; that they would be able to move the most precious items out of reach of flood-waters, and that they could easily and cheaply replace items that could not be moved, such as cookers and fridges. For these respondents, the key to avoiding excess flood damage was the timeliness of their actions to remove vulnerable goods away from endangered areas. In this respect, the barriers provided by the pilot scheme were of significant help. Even though they did not yet trust them to prevent water ingress, these tenants believed that they would win them more time to evacuate their possessions to safety.

## 10. Conclusions

The experience of the Appleby pilot scheme both demonstrates the benefits of property-level flood protection at reducing flood damage and suggests that the implementation of such measures at the communal level has distinct advantages over their promotion to households and businesses individually. It also suggests that this success, and the appropriateness of such schemes to other areas, might depend on the coincidence of a number of different factors.

### 10.1 Benefits of the scheme

In the November 2009 flood the measures were deployed successfully, and were effective in reducing damage, disruption and reinstatement costs.

Furthermore, as a result of the impetus given by the scheme to the setting up of a local flood action group, Appleby became less dependent on the support of external agencies during floods. This gives relief to emergency response resources, which can now be deployed elsewhere during widespread flooding.

A further important benefit of the pilot scheme is that participants became less anxious about living in a flood risk area. Residents accept that a “big flood” like that of 2005 will still cause widespread disruption, but the presence of the protection afforded by the Defra scheme is allowing them to feel that they are resilient to the kind of flooding that occurs in Appleby almost every two years.

The scheme also helped convince people of the advantages of flood protection. By showing that the national government was willing to pay for such measures, the scheme encouraged people to consider protection more seriously. This message was reinforced by the events of November 2009, when Appleby became the first of the Defra pilot areas to experience a flood and all twenty-five participating properties that were reached by the floodwaters were successfully protected. Although the flooding was only shallow and the test, therefore, a mild one, confidence in the measures was boosted by this experience.

In spite of the fact that there was already a culture of adaptation in the town and the surrounding area, the hoped-for demonstration effect was only partially in evidence. A small number of Appleby residents were persuaded to spend their own money on protection measures, arguing that if the state were willing to invest in them, then they must be worthwhile. However, people from the surrounding areas were only vaguely aware of the scheme and even some pilot participants were not yet entirely convinced of the value of the measures that had been introduced and argued that it would take a more severe flood to convince them of their worth.

The benefits of the protection measures for the insurability of local properties had yet to materialise. It seemed not to have occurred to residents to inform their insurers of their participation in the scheme and few, if any, had done so. Although reduced claims may in some cases lead to improved insurance terms, insufficient time had passed for this phenomenon to become evident.

## **10.2 Advantages of collective implementation of property-level measures**

Although the full benefits of the scheme had yet to be realised, it seems likely that a less collective approach to the problem in Appleby would have met with less success. Although individuals could, in theory, be allowed to select and finance their own property-level protection measures, few in Appleby had done so and those that had were unable to design packages of measures that provided complete protection. Furthermore, residents who did want to protect their homes and businesses hesitated over buying commercially available protection because of worries about spending large sums of money for uncertain benefits. The pilot scheme not only provided advice on what to buy; by contributing towards the costs of products it also, in effect, vouched for their effectiveness; and by introducing them on a large scale, it made them seem more normal and reduced the perceived risk involved in purchasing them.

The collective nature of the scheme also had a number of other advantages. Effective resilience to flooding is by nature social. Floods often prompt people to provide each other with practical help and emotional support and they provide a shared experience that forms a bond between people living in the affected area. Concerns expressed by respondents in previous research suggest that the use of differing standards of protection can weaken that bond, but this research indicates that the introduction of protection measures across an entire locality can actually strengthen the cohesion between members of a community. Introducing protection for a whole neighbourhood helps build the relationships and interdependencies that are an essential part of local level resilience. This is especially important for areas with semi-detached homes, terraces and flats, for in such cases it is often impossible to achieve affective protection without collaboration between neighbours.

Furthermore, as demonstrated in Appleby, locality-wide action can have wider benefits. By facilitating greater internal organisation and self-sufficiency amongst communities, it releases central resources for deployment elsewhere. Volunteer leaders of the team set up to implement the scheme in the town now form part of the Environment Agency's emergency response network. It could also be argued that there are wider benefits for the local community itself, for in Appleby the involvement of so many different sectors of the community in a common project added to the overall store of social capital.

It was striking how central local businesses were to the management of the impacts of flooding in Appleby. Business-people in Appleby played a key part in setting up the pilot scheme and in November 2009, as in previous flood events, provided the means to distribute sandbags to different points in the town and the resources that allowed local teams to look after both victims and rescuers. The government grant scheme that was introduced subsequent to the pilot excluded businesses and focussed on providing protection for householders (Defra 2009). It is possible that this might compromise the relationship between the commercial and residential parts of a community and undermine overall solidarity and resilience. This issue should be considered in the evaluation of the scheme.

On the other hand, the needs of commercial enterprises are very different to those of most households. For some businesses on The Sands, complete protection was impossible or would have been very expensive. In such cases, although the grant made a symbolic contribution to flood risk management, the residual risk was high and, in some cases, business continuity remained a serious challenge. If businesses are to be included in protection schemes, consideration needs to be given to the distinctive nature of their needs.

### **10.3 Factors determining the successful implementation of a scheme**

This research suggests a number of important factors that might determine the success of a scheme to provide flood protection to properties in a single area.

The first of these is acceptance of the flood risk by the population of the area concerned. In Appleby, the historic frequency of the flooding made it impossible for local people to deny the risk. Furthermore, the distinctive self-identity of the town, the myth of past solidarity and resistance and the recent history of a more organised response to flooding all allowed the townspeople to feel some sense of pride in their collective resilience to the threat. Although some local people continued to blame the Environment Agency for not dealing with the risk at source (e.g. by not dredging the river), the self-presentation of local authority and Environment Agency staff ensured that locals were less able to shift responsibility onto outsiders and were able to accept that responsibility themselves. As a result, people in Appleby were particularly receptive to the notion of property-level adaptation.

This was reinforced by memories of the severe flooding in 2005. Extreme events leave particularly vivid impressions and often, therefore, catalyse attempts to prevent or ameliorate any future such occurrences. The 2005 event was a significant catalyst for action.

A further success factor that emerges from this research is the skill and adaptability of flood risk management agencies and their staff. The dedication shown by these staff was underpinned by a belief that the type of scheme being implemented was the best way, if not the only way, of dealing with flood risk management amongst many of the communities in the area. Rather than being seen as a “last resort”, as it sometimes is in flood risk management, protection and resilience was viewed as an option that offered benefits unavailable from other strategies. The efforts of flood risk management professionals could not have been so successful without this personal commitment. It was the capacity of individuals and organisations to be flexible and to take risks that allowed them to win the trust of the local people – for example, by supporting their desire to set up a system for the deployment of sandbags, despite doubts over its practical benefits.

Nor could the scheme have been so successfully implemented without strong inter-agency relationships and the support of senior management and council members of the Environment Agency and the local authority. Without the support and commitment of these organisations the costs and opportunity costs involved could not have been incurred.

A final reason for the successful implementation of the scheme was the existence of suitable social structures and leaders and the ability of influential townspeople to work together. Where appropriate social structures do not already exist, their creation can be a lengthy and time-consuming process. Where they do already exist, implementation timescales can be shorter, but only if the different elements of that structure are able to collaborate with each other. In Appleby, although the structure existed, the component elements were in a state of disharmony and it took the offer of the grant, the occurrence of the 2005 flood and strong local leadership to bring them together.

#### **10.4 Relevance of the success factors to other areas**

Although it is impossible to determine from just one case-study whether the conditions of success identified in this study would also be pertinent outside Appleby, evidence from elsewhere suggests that they can probably be applied more widely than just this one case.

The general importance of the first factor, the frequency of experience, is well recognised in the academic literature on flood risk and also by policymakers. Numerous quantitative studies have shown experience of flooding to be a significant predictor of protective behaviour against natural hazards such as flooding (e.g. Laska, 1990; Grothmann and Reusswig, 2006; Siegrist and Gutscher, 2008) and unpublished survey analysis by the author of this report further indicates that this phenomenon increases dramatically once the number of experiences of household flooding rises above two or three. For these reasons, when it issued its guidance for the rolled out flood protection grant scheme, Defra (2009) stipulated that grants would only be awarded in areas that had been flooded at least once in the previous ten years.

Strong social structures, too, are recognised as being helpful for the establishment of community level flood adaptation. Respondents in this research reported that Appleby's sense of community stemmed from the presence of families that had lived there for generations. However, Coates (2008) found a similar sense of community in areas that lacked this characteristic and argues for the importance of physical locations in which people can meet and establish relationships – for example, shops and community centres. Even if there is no strong sense of pre-existing community, the existence of such locations allows one to develop when a flood or the offer of a government grant generates a common cause.

Furthermore, it is important to remember that the pre-existing social structures and sense of identity in Appleby were both an advantage and a disadvantage when it came to implementing the scheme. On the one hand, they provided an existing resource for the delivery of the scheme. On the other hand, established relationships can imply old enmities and staff involved in setting up the Appleby pilot argued that they struggled to help the town organise its response to the risk partly because of such issues.

## 10.5 Risks identified by the study

Neither the Appleby scheme nor any of the other pilot schemes have been in existence long enough for there to be any certainty regarding their longevity or unforeseen negative impacts. However, this research provides evidence regarding a number of risks, each of which is listed here before being described in more detail below:

- Although there was no evidence to suggest that the scheme had encouraged the growth of a culture of dependency on the state, by displacing existing efforts at flood protection, the grant scheme might have reduced the longer-term adaptive self-sufficiency of local people.
- Residents' need for the reassurance provided by sandbags shows that their confidence in the new protection measures remain tentative. This confidence could easily be damaged by any instance of the measures' perceived or actual failure.
- The emphasis placed on protection might undermine efforts at increasing resilience – i.e. measures to limit the damage caused when water enters a property.
- Residents were aware that a severe flood would overcome the pilot measures, so there seems little risk that such an event would lead to disaffection with the scheme.
- However, the effectiveness of the protection measures provided could be undermined if they are not properly maintained in the future
- And the effectiveness of the scheme overall could be threatened if key actors withdraw or if participants lose interest in it.

Rather than stimulating an increase in the use of protection and resilience, it is possible that grant schemes will stifle existing community initiatives and create a culture of dependency. Some people in Appleby were already using home-made protection measures before the pilot or had taken steps to increase the resilience of their properties. The pilot measures displaced many of the home-made barriers and in another pilot area, Leeds, rendered superfluous a locally organised project that had provided standard DIY door-boards and airbrick covers to a number of local people. Whilst there is no doubt that the barriers provided by the pilot schemes are technically superior to the home-made equivalents, it is possible that their introduction will undermine the growth in self-sufficiency and responsabilisation represented by the home-made measures.

Equally, although there was no evidence to suggest that the pilot scheme had made people any more dependent on government funding, neither was it clear whether this funding was always a necessary condition for the introduction of property-level protection. In some cases, financial support toward the cost of the measures may have been a less important determinant of behaviour than confidence in choosing measures.

Similarly, although the motivations for implementing resilience measures<sup>5</sup> are little understood, there must be a risk that the introduction of protection

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<sup>5</sup> I.e. measures designed to speed recover from a flood once water has achieved ingress

measures<sup>6</sup> will cause resilience to be seen as unnecessary or, at best, less important than protection.

A second risk is that confidence in the type of measures promoted by schemes such as the one in Appleby could be seriously damaged by any actual or perceived failure of these measures to protect residents from flooding. As demonstrated by the continued reliance on sandbags, commercially produced protection measures have yet to displace more traditional means in the confidence of the general public. Any example of failure could undermine the growing but delicate faith in the latter. Given the predilection of the media for examples of waste and error, protection measures might be reported as having 'failed' even if the real issue was faulty deployment or flood-levels that exceeded the design specifications of a particular measure.

It is possible, therefore, that attitudes towards the scheme in Appleby will change if there is another flood on the scale of the 2005 event. Such a flood would overtop the barriers supplied in the pilot, leaving residents and businesses with no option but to evacuate their properties. This might lead to a re-evaluation of the scheme, both by residents and the media, and even to the denigration of the very notion of property-level adaptation. On balance, however, this seems unlikely. Respondents in the research were aware that the measures would not be able to protect them from a more severe flood and did not give the impression that they would lose faith in the scheme or its organisers if this were to occur. In fact, the town had already seen the overtopping, in 2005, of defences in the south of Appleby that were built in the 1980s, and there was a widespread feeling that nothing could be done to preserve at-risk areas from a future event of the same magnitude.

A more serious threat to the overall effectiveness of the scheme might be the danger of gradual erosion of the quality of the products and the dissipation of the knowledge needed for their implementation. If flood protection products are to maintain their effectiveness they need appropriate maintenance and storage, and this is likely to be more often neglected during long periods without floods and when homes change hands. Maintenance contracts might be one solution to this problem. Some manufacturers are already beginning to offer deals that include maintenance as well as product supply, but this was not yet the case when the Appleby pilot was implemented.

This raises the issue of a further threat to the duration of the scheme benefits: the erosion of the organisational infrastructure set up to manage flood risk in the town. As indicated above, the creation and survival of the Appleby flood action group appeared to depend on a number of factors, including leadership, support from outside agencies and the enthusiasm of local people. Should any of these factors change (e.g. if key Environment Agency staff were to move on to new roles or if resourcing priorities were to change) then the survival of Appleby's flood action group might become less secure. Similarly, if there were a fall in the frequency of floods, the need for the group would become less immediately obvious and the commitment of leaders and the local population might wane. Some of these dangers can be anticipated, for example by holding practice

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<sup>6</sup> I.e. measures designed to prevent floodwater from achieving ingress into properties

flood alarms – as is, indeed, done in Appleby – or by taking steps to formalise the organisational structures of flood action groups and engage in succession planning. Nevertheless, the longer-term survival of the Appleby scheme, and others like it, has yet to be tested.

Figure 23 – flood barriers in storage in the garage of an Appleby resident



In the case of Appleby, the local flood risk management agencies predicted that to prevent a gradual decline in the effectiveness of the pilot scheme there would need to be continuous investment of time by the local authority and / or the Environment Agency. This would add to the time and effort needed for such initiatives. Local agencies estimate that they had already spent £70,000 administering the scheme and establishing the necessary relationships with participants and local leaders. This is roughly equivalent to the amount spent on the initial surveys and the measures themselves and almost equals the £80,000 awarded to them by Defra. Although the lessons learned in the pilot would reduce the cost of future schemes slightly, this evidence nevertheless suggests that the administrative and engagement costs of such initiatives are greater than had previously been assumed.

## 10.6 Conclusion

Although the pilot in Appleby-in-Westmorland demonstrates the challenges and costs of setting up schemes of this nature and the uncertainties of their long-term future, it also shows the potential value of an effort to simultaneously implement property-level protection across a whole at-risk community. The pilot eliminated or reduced flood damage, disruption and reinstatement costs; helped people feel less anxious; boosted confidence in the measures, and extended the resources available to flood risk management agencies during a flood. There is little evidence of an immediate demonstration effect, but by kick-starting the normalisation and popularisation of commercially available flood protection products, the pilot has made it more likely that they will be used by other individuals and communities in the future.

## **Acknowledgements**

The author owes his thanks to all the people of Appleby-in-Westmorland and the surrounding area who welcomed him to their part of Cumbria and made valuable contributions to this research. These include householders, business-people and staff at Eden District Council and the Environment Agency's Penrith office. Thanks are due, too, to those local photographers that allowed the use of their images to illustrate this report.

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