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Scotland's centre of expertise for waters

Assessing the effectiveness of Scotland's public flood warning service

FLOOD ALERT

FLOODING IS POSSIBLE. BE PREPARED.

Published by CREW – Scotland's Centre of Expertise for Waters. CREW connects research and policy, delivering objective and robust research and expert opinion to support the development and implementation of water policy in Scotland. CREW is a partnership between the James Hutton Institute and all Scottish Higher Education Institutes supported by MASTS. The Centre is funded by the Scottish Government.

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Please reference this report as follows: Geddes, A., Cranston, M., Ambler, A. and Black, A. R. (2017) Assessing the effectiveness of Scotland's public flood warning service: Full report CRW2016_12. Available online with Summary Report at crew.ac.uk/publications

Acknowledgements
This report draws on the experiences and views of more than 1300 individuals around Scotland, without whose generous assistance the research would have been impossible. We thank all respondents for their time and thoughts, particularly including community contacts in Aviemore, Menstrie and Nethy Bridge who arranged local meetings in those locations.

We also thank Cordelia Menmuir and colleagues at the Scottish Environment Protection Agency (SEPA) and Emily Hastings at Scotland's Centre for Expertise for Waters (CREW) and her project steering group colleagues for their roles in helping coordinate the work and for providing a range of information and comments throughout the course of the project. We also thank Anne Hutchison and Andy Jackson of the University of Dundee's Library & Learning Centre, for their guidance on the use of the Bristol Online Survey (BOS) platform. Likewise Emeritus Professor Alan Werritty also of the University of Dundee for providing valuable comments and practical assistance.

ISBN: 978-0-902701-50-2

Executive Summary

This report details the work of a project commissioned by the Scottish Environment Protection Agency (SEPA), through Scotland's Centre of Expertise for Waters (CREW), to assess the effectiveness of their public-facing flood warning service, Floodline. The objectives of the study are to:

- Identify whether Scotland's flood warning service is meeting the needs of its customers through damage mitigation actions;
- Identify whether customers value the current flood warning service as a vital tool in being more resilient to flooding;
- Understand whether all customers have identical requirements of the flood warning service or whether the service is used differently by separate and unique customer groups;
- Understand how customers respond to direct messaging received from Floodline in Scotland – identify what actions customers take as a result of receiving flood alert and/or warning messages, including actions to mitigate flooding;
- Present the benefits of the flood warning service in Scotland (both tangible and intangible).

The research centred on a major web-based survey of customers, unprecedented in scale and scope, supplemented by face to face meetings in three selected communities. Free-text responses were an important component of the on-line survey, allowing additional insights to be obtained beyond the quantitative analysis. Routing was used in order to capture responses which were appropriate to the experiences and characteristics of various elements within the survey sample. Respondents were asked to specify whether their interest in and use of Floodline, reflected flood risk concern relating to their home or another interest, e.g. business interests or the home of a family member.

The survey was conducted using three identical questionnaires designed using the Bristol online Surveys (BoS) platform, directed respectively at customers receiving Flood Warnings (focused on locally specific river or coastal locations), Flood Alerts (provided on a regional basis for customers not served by Flood Warnings) or both services (the latter group being applicable, for example, to someone who would like to receive early alerting of a potential flood situation developing in advance of a flood warning being issued). Respondents were surveyed 'blind' in the sense that they were not informed of their type of registration (Flood Warning/Flood Alert/both), and the results confirmed previous findings that there was a high level of misunderstanding about what type of service individual respondents were receiving.

Over 1,340 responses were received to the on-line survey, representing approximately a 7.5% response rate. This report presents detail on the characteristics of the sample of respondents in relation to the entire Floodline customer base, and indeed the entire population of people at risk of flooding throughout Scotland. By investigating these properties and the use of a clear sampling frame, it was possible to demonstrate that the survey results are broadly consistent with the entire Floodline customer base (and the national flood risk population), i.e. the results are representative of the target population.

To enable more detailed analysis of results and identify/eliminate possible geographical variations, respondents were asked to provide the postcode of their registration. A classification of Flood Warning Areas was developed in relation to the frequency of messages (High/Medium/Low) and the impacts of flooding (High/Medium/Low) in each Warning Area. This allowed responses to be assigned to one of nine frequency/impact groups. Survey responses were then explored in relation to these nine classes.

Key findings

The survey reveals that mitigation actions do follow from receipt of Floodline messages. Actions reported as being taken most frequently were ensuring mobile phones were charged, having a list of key telephone numbers, checking roads and availability of a safe exit and moving documents and vehicles. Among those for whom flooding of land was important, the majority moved livestock on receipt of a Floodline message. For those with property level protection, the majority reported deployment following a message.

The tendency to take action was found to be linked to experience of flooding, level of educational attainment, satisfaction with Floodline and satisfaction with and access to additional information provided on the Floodline website. There is a complex set of relations underpinning mitigation actions: causality is not clear, so it cannot be proven that actions arise purely as a result of receiving a message. Nevertheless, evidence suggests that message receipt is one of the drivers of action.

Most customers value Floodline as part of their preparedness for flooding, as evidenced by high levels of overall satisfaction. Nevertheless, a substantial number of the survey respondents noted aspects of the service which could be improved to enhance the benefit to them. Notably, there were a conspicuous number of Flood Alert customers seeking information which is more geographically specific to their individual situation. Many customers reported using additional sources of information, and a desire for better access to additional or improved real-time water level and forecast services.

Commonalities and differences in requirements and responses among Floodline customers were explored. Commonalities were established in relation to the timeliness required of Floodline messages, their geographical specificity and the frequency of messages: not too often; just often enough to cover all events specific to their own situations. Various areas of difference were identified: higher-educated respondents were more likely to have altered their property to provide direct flood defence and more likely to participate in a flood action group, while flood plans were more commonly found to have been prepared among less highly-educated respondents. **Past exposure to a flood was linked to a greater tendency to take preparedness steps.**

The majority of respondents reported that they had used the Floodline website, but percentages reporting they had accessed additional information via the Floodline phoneline were much

lower. **More than a quarter of respondents receiving a message had not used either the Floodline website or phoneline to seek further information in relation to forecasted flooding.**

The preparedness actions and post-message responses revealed by the survey point to widespread intangible benefits arising from the service. Additional benefits will accrue to individuals and businesses that use the Floodline website and phone service to obtain real-time information without having signed up to the service. Benefits such as the avoidance of damages to possessions which are moved, or even the avoidance of any property damage in the case of installing effective property level protection, point to major tangible benefits of the service. Intangible benefits will arise due to reductions in emotional distress and major inconvenience.

Key recommendations

Eight recommendations are summarised here and expanded upon more fully in Section 9 of the report:

1. Continue with provision of the Floodline Service in order to maintain delivery of the benefits identified by respondents.
2. Review the whole of the information landscape provided for Floodline online customers, in order to provide a more coherent, more informative and more effective portal relevant to present flooding concerns, seeking to combine information from disparate sources such as flood forecasting, monitoring and local authority feeds.
3. Maintain and continue to develop awareness raising activities – to promote a better understanding of the nature of flood risk, the availability of Floodline, how it works and how individuals can prepare for flooding and increase their resilience.
4. Review flood warning message content, to make messages as specific as possible (e.g. in relation to expected severity and extent), thereby increasing message utility and customer satisfaction.
5. The Flood Alert service requires fundamental review, given the high level of customer dissatisfaction with Alerts, and the extent of confusion about what the service does and does not provide.
6. Introduce a 'no warning' message type, as a means of reassuring customers when a warning is not expected to be issued, and ultimately also to raise overall satisfaction (given an apparent link between message frequency and customer satisfaction).
7. Review the potential for tailored content – while this may be technically challenging to deliver, customers were clear about the merit in warnings which are more geographically specific than at present, and spanning a range of needs chiefly dividing between domestic property and business needs.
8. Maintain the current phone/Interactive Voice Response service, which provides for the needs of customers who may not be able to access the internet, notwithstanding the limitations of service delivery via a voice platform.

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1 Introduction

Overview

The aim of this project has been to assess the effectiveness of Floodline, the public-facing element of the Scottish Environment Protection Agency's (SEPA) flood warning system. Floodline is a direct messaging service providing notifications of elevated levels of flood risk at times of extreme weather forecasts as well as rising river and coastal water levels. Introduced in 2011, and evolving from the earlier and more basic passive system of the same name, which simply published messages to a website and a recorded message service, Floodline is subscribed to by a growing number of customers. Customer surveys since 2013 have indicated high levels of satisfaction. Consequently, the context for this study is a generally positive one.

Nevertheless, satisfaction is not synonymous with effectiveness. The value of the Floodline messaging service, and the return on investment in it, could both be limited unless the recipients of the Floodline messages take appropriate follow-on actions to enhance their flood preparedness. Put another way, receiving a Floodline message can be considered as a low rung on a longer ladder of preparedness actions that members of the public may take (e.g. see Environment Agency, 2014). Currently however there is very limited knowledge regarding if and how Floodline messages are linking into this 'preparedness ladder'. Moreover, there is no single set of metrics for judging what form such additional actions may take or how they integrate with Floodline, although the timing, frequency, content and presentation of Floodline messages have clear importance in this regard.

This project was commissioned by SEPA via CREW, to explore in some detail such characteristics as well as the integration of the Floodline messages with other actions taken by the recipients of those messages. As such, seeking information from currently registered Floodline customers has been a core strand of this research, and efforts were also made to obtain the views of other members of the public not currently registered but nonetheless affected by flood risk.

The research was conducted over a six-month period between September 2016 and March 2017. This timing corresponded with wetter winter months, when flooding is more likely to occur, and consequently an element of 'real-time' study was proposed focussed on areas where flood warnings were triggered and where flooding was actually occurring. However, unlike the previous 2015/16 winter, conditions in winter 2016/17 were much drier with far fewer warning messages issued and no major flood events. Attempts to survey message recipients in areas which received Warning messages were made but unsuccessful.

Flood Alerts & Flood Warnings

The two types of notifications issued through Floodline – Flood Alerts and Flood Warnings – map to different levels of geographical organisation of the service; indeed a key issue for this contract was to assess how well customers understood this distinction and the specific tier or tiers they were registered for.

The differences between the geographically broader Flood Alerts, and more locally specific Flood Warnings is described by SEPA itself in the following terms:

Flood Alert:

- means flooding is possible;
- provides an early indication of potential flooding from coasts, rivers or surface water;
- raises awareness of flood risk;
- enables you and the emergency response services to prepare for possible flooding;
- issued as early as possible (up to a maximum of 36 hours ahead of potential flooding) and usually between 8am and 6pm.

Flood Warning:

- issued when flooding is expected for a defined local area;
- issued 3 to 6 hours in advance of expected flooding although in some areas rivers respond very quickly to rainfall so this time may be shorter;
- only available for some communities and stretches of coastline.

To add further clarification, it can be pointed out that the broader-scale Flood Alert regions cover all of Scotland and consequently are very large, ranging from around 1000 km2 (Orkney) to around 8000 km2 (Caithness and Sutherland). As the text above notes, when Flood Alerts are issued for a region, they are issued to all customers registered to receive Flood Alerts for a location within that region. This arrangement ensures that all persons in Scotland are provided with a basic level of flood warning. However, there remains the issue of the extent to which issued Alert messages correspond with conditions experienced within a region.

Flood Warning Areas are by contrast much smaller - as small as 0.1 km2 in several cases, ranging generally up to a few tens of square kilometres, and the largest being the Cromarty Firth (almost 100km2). As the above description notes, Flood Warnings are possible based on additional resources SEPA has invested in those areas in terms of instrumentation and forecasting capability. In this case flood risk maps calculated for 0.05 annual probability are used as an initial basis for defining the spatial extent of the at-risk local community, which is then refined using information on other relevant local characteristics (e.g. streets which may be cut off by flooding).

Flood Warnings consequently have a much higher degree of geographic specificity than Flood Alerts, although in large Warning Areas there remain issues of variability similar to those in Alert Regions. In addition another potential by-product of this approach to defining Warning Areas is a 'cliff edge' effect, in terms of the more detailed information provisions to registered customers within a Flood Warning Area compared to those located just outside.

Message Frequency & Flood Impact

For the purposes of this project, Flood Warning Areas have been allocated into a cross-classified set of message frequency and flood impact categories. In total there are nine categories, cross-relating low, medium and high frequency by low, medium and high impact. Appendix 1 provides further details.

The contract specification directed attention to customers in two such categories– namely those Warning Areas categorised as 'high frequency-low impact' and those categorised as 'low frequency-high impact'. Further discussion with SEPA staff served to elaborate reasons for these foci. Particular issues around the former group are twofold: to do with the costs of issuing messages, and whether high frequency leads to 'message fatigue' on the part of the respondents. For the latter group, a main concern is whether the messages issued in terms of timing and content are sufficient in conveying the magnitude of impacts, and in so doing galvanise respondents to take appropriate preparatory actions.

The availability of GIS boundaries for the Flood Warning Areas along with postcodes obtained from the survey responses made it possible to link the majority of respondents receiving Flood Warnings to a specific Flood Warning Area. Subsequently it was possible to investigate differences between respondents based on all of the aforementioned categories, including the two outlined here.

Regarding the flood warning customers categorised as 'low frequency – high impact', SEPA was also interested in exploring potential differences related to prior experience of flooding. There are multiple hypotheses to consider here around how far the experience of being or not being flooded may have been mitigated by the warning messages which were issued. In order to explore such hypotheses, questions on the number of times flooding had been experienced, when it had occurred, and on its magnitude were all included in the survey questionnaire.

Locations of Floodline customers

To register to receive Floodline messages, customers are required to indicate in which format they would prefer to receive messages, from a choice of phone (text or voice message) or email, and in addition an address (location) for which they would like to receive messages. This detail is central to the research undertaken here, given the importance outlined above of being able to match up survey respondents to particular locations.

As Floodline is viewed primarily as a service assisting home residents, in most cases the home address is the location which a customer has registered with Floodline. However, it is also possible for a single customer to register to receive messages for multiple different locations e.g. both a home and a business address, or a landlord having multiple properties, or even a location of a favourite river fishing spot. SEPA indicates that a smaller subset of customers had taken advantage of this multiple registration possibility, though was unable to provide precise numbers or to flag which particular customers were in this situation for data protection reasons. This had to be factored into the survey questionnaire, which channelled respondents to choose a primary registered location.

Aims of research

The objectives for the work undertaken are:

- Identify whether Scotland's flood warning service is meeting the needs of its customers through damage mitigation actions;
- Identify whether customers value the current flood warning service as a vital tool in being more resilient to flooding;
- Understand whether all customers have identical requirements of the flood warning service or whether the service is used differently by separate and unique customer groups;
- Understand how customers respond to direct messaging received from Floodline in Scotland – identify what actions customers take as a result of receiving flood alert and/or warning messages, including actions to mitigate flooding;
- Present the benefits of the flood warning service in Scotland (both tangible and intangible).

The key customer groups of interest are:

- Customers registered to receive Flood Alerts only who have not previously flooded;
- Customers registered to receive Flood Alerts only who have previously flooded;
- Customers signed up to receive both Flood Alerts and Flood Warnings;
- Customers registered to receive Flood Warnings which could be classed as 'high frequency-low impact';
- Customers registered to receive Flood Warnings which could be classed as 'low frequency- high impact who have flooded;
- Customers registered to receive Flood Warnings which could be classed as 'low frequency-high impact' who have not flooded;
- Customers who have deregistered from the service,

The focus of the surveys was on the following three broad questions:

1. Are customers happy with the service that they currently receive?
2. What information would customers like to receive in advance of/immediately prior to and during potential flooding?
3. What action, if any, do customers take on receipt of flood messages to reduce the impact of flooding?

This report has seven main sections following this introduction (Chapter 1) and a Literature Review (Chapter 2) corresponding with the main reporting requirements:

- General profile of Floodline customers and areas (Chapter 3)
- Assessing the representativeness of the research sample (Chapter 4)
- Customer survey respondents' characteristics (Chapter 5)
- Customer satisfaction with the Floodline service (Chapter 6)
- Customers' usage of Floodline messages (Chapter 7)
- Conclusions (Chapter 8)
- Recommendations (Chapter 9)

2 Literature Review

Introduction to flood warning

SEPA is the authority responsible for flood warning and informing in Scotland and operates the Floodline service. Prior to SEPA being established in 1996, flood warning was largely based on local need and established typically in response to significant flood events (Faichney, 2003). Such developments were established under the Local Government and Planning (Scotland) Act, 1982, which gave River Purification Boards (RPBs) powers to establish flood warning schemes.

The discretionary powers were adopted by some RPBs including the Tay Board which established flood warning schemes for the Tay and Earn following region-wide flooding in 1990 (Anderson, 1997). During this time warning and informing activities were traditionally performed by the police and in some instances local authorities. Whilst very few attempts had been made to determine public satisfaction with flood warning schemes in the United Kingdom at this time (Smith and Ward, 1998), analysis of local arrangements in England and Wales between 1986 and 1990 suggested low satisfaction with the flood warning service, with people indicating that warnings were received too late to take effective action and were critical about the limited information provided (Penning-Rowsell et al., 2000).

These discretionary flood warning powers in Scotland were passed from the RPBs to SEPA when it was formed in 1996 as a result of the Environment Act, 1995. SEPA in turn introduced the Floodline service in 2001. Although at this time the service was a passive system, meaning access was restricted to phoneline and/or internet, it heralded the start of a co-ordinated and national approach to flood warning in Scotland.

Scotland witnessed an increased frequency of flooding during the 1990s with a flood-rich period leading to major flooding in urban centres such as Edinburgh, Elgin, Glasgow and Hawick (Black, 1996). In response, the Scottish Parliament Rural Affairs and Environment Committee established a Flooding and Flood Management Inquiry to review options for improved flood risk management. Written evidence to the inquiry emphasised the need for continual development of flood warning, in addition suggesting a greater emphasis on effective dissemination of warnings. Noting the challenge of improving flood warnings, one response from the Association of Chief Police Officers of Scotland noted:

> *"public expectations around flood warning systems can never be fully met".*

Several recommendations for the improvement of flood warning were issued following the enquiry, (Scottish Parliament, 2008) including:

- The development of a national flood warning strategy;
- Giving SEPA the ability to disseminate flood warnings directly to end users;
- Upgrading existing flood warning systems and expansion into uncovered areas;
- Filling the void that exists regarding pluvial flood warnings; and
- The development of flood warning systems in other areas of Scotland at risk of coastal flooding.

The inquiry subsequently led to the establishment of the Flood Risk Management (Scotland) Act, 2009. Under the Act, SEPA's flood warning responsibilities were formalised and strengthened, giving it, for the first time, a statutory basis for all flood warning activities. As stated under Section 74 of the Act:

> *SEPA must, where it considers that a flood is occurring or likely to occur in the near future, make available warnings in relation to the flood. SEPA will assess the future need for the provision or alteration of flood warning; in particular, the provision of systems where earlier or more accurate flood warning will deliver a reduction in the potential adverse consequences of flooding for human health, environment, cultural heritage and economic activity. SEPA will consult with local authorities and Category 1 Responders with respect to any alteration to the provision of flood warnings.*

Flood warning dissemination in Scotland

The introduction of active dissemination of warnings was one of the primary developments following the 2009 Act with a new direct and targeted warning service through Floodline being established in 2011 – ten years after the introduction of the passive system. Immediately following the launch of this new service over 12,000 customers were registered to receive Flood Alerts and/or Warnings, introducing a significant new customer base for SEPA's flood risk management activities (SEPA, 2012).

As part of the new service and in response to the Pitt Report (Pitt, 2008), in 2011 a new suite of warning codes and symbols were launched across England, Scotland, and Wales to make them clearer to understand (Figure 1). These replaced the previous symbols and replacement of the term Flood Watch with Flood Alert. The main driver for this change around terminology followed consultation with members of the public which suggested that those that were engaged with flooding found it a useful pre-warning of potential flooding (Evans, pers. comm. 2017).

Figure 1 New flood warning codes and graphics were launched in 2011 in Scotland

SEPA's implementation of the new codes and what they mean to the public were:

- **Flood Alert.** Flooding is possible. Flood Alerts give an early indication of potential flooding. They prompt you to remain alert and vigilant and provide you with time to make early preparations for potential flooding. Flood Alerts are issued for larger geographical areas, usually matching local authority boundaries.
- **Flood Warning.** Flooding is imminent. Immediate action is required – take measures to protect yourself and your property.
- **Severe Flood Warning.** A Severe Flood Warning is likely to be issued when flooding has occurred to change the status of the flooding. It will generally be issued when flooding is creating potential impacts that require further action such as evacuation.

(www.sepa.org.uk)

Advances in operational flood forecasting

It was the Strathclyde floods of 1994 that led to a more sophisticated approach to flood forecasting and warning (Cranston et al., 2007). Prior to 2007, the investment and development of hydrometric data capture had not been matched by investment in flood forecasting infrastructure (Werner et al. 2009). However, with the introduction of the Flood Early Warning System (FEWS) Scotland by SEPA, this facilitated the rapid expansion of flood forecasts to catchments not previously supported by flood warning and a platform for the introduction of scientific advances in forecasting techniques (Figure 2).

Cranston and Tavendale (2012) detail the development of operational flood forecasting following support from the Scottish Government, which included:

- **The development of new approaches to coastal flood forecasting.** Prior to The Act, the Firth of Clyde was the only coastal flood warning scheme in Scotland (Kaya et al., 2005). New methods for wave height and wave overtopping forecasting for vulnerable communities were introduced (Cranston et al., 2015) alongside an extension of geographical coverage to include the Moray Firth (Kaye, 2016).
- **Improvements to the accuracy and prediction of fluvial flooding.** Significant developments have been invested into improving the science for flood prediction with the introduction of real time approaches to hydrological and hydraulic modelling (Cranston and Tavendale, 2012).
- **Coupled meteorological and meteorological forecasting.** In 2011, SEPA and the Met Office introduced a partnership service called the Scottish Flood Forecasting Service. Underpinning the service was a new countrywide hydrometeorological forecasting capability linking rainfall/precipitation forecasts with a gridded hydrological model, Grid-to-Grid, to provide a risk-based river flood forecast for the whole of the country (Cranston, et al., 2012).

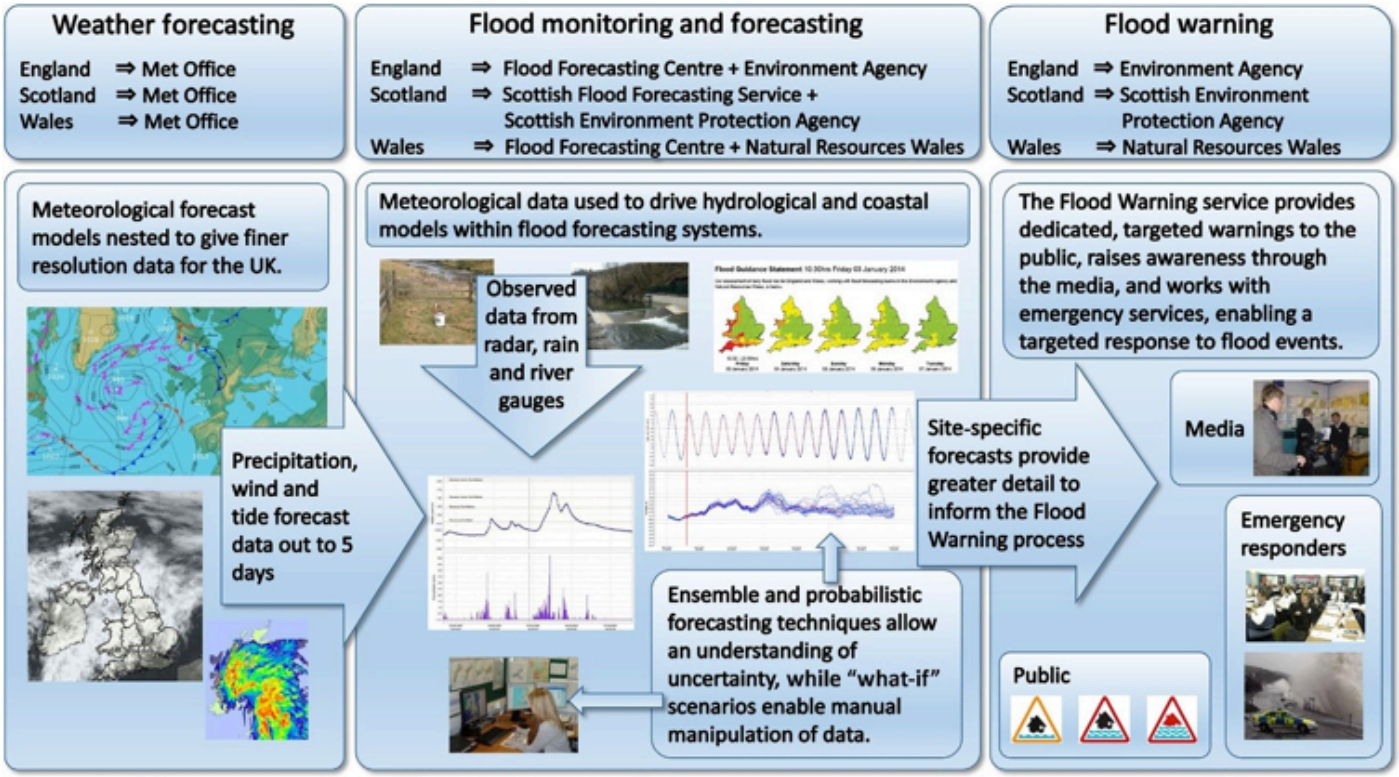


Figure 2 Organizational arrangements for weather and flood monitoring, forecasting, warning and response across England, Scotland and Wales (source: Pilling et al, 2016)

The benefits of flood warnings

The primary justification for implementing a flood warning system is in the mitigation of risks to life or serious injury. However, wider benefits include moving of property and personal possessions to safer locations, the implementation of property flood resilience measures and moving of livestock.

SEPA's new Flood Warning Framework (SEPA, 2017) states that:

> *"effective action based on accurate forecasts and timely warnings can result in a significant reduction in risk to life, social impacts, property damage, business and infrastructure disruption and timely removal of livestock" (SEPA, 2017).*

These potential losses associated with flooding may be reduced by flood warnings and can be categorised as tangible indirect and direct losses, and tangible human and other losses (Figure 3, Parker et al., 2005).

Attempts have been made to quantify the damage-reducing effects of flood warnings (Parker, 1991) where the benefits can be defined as the reduction in losses resulting from the provision of a warning when compared to the situation prior to the operation of the warning system. This approach was further refined in 2005 with a new framework for assessing the benefits (DEFRA, 2005). Some key findings from this work were summarised by Sniffer (2006) and include:

- Those warned tend to be, but are not always, more likely to take action and to save more;
- Many residents take action without a warning based on their own judgement or experience;
- The proportion attempting to make some savings and the proportion of damage avoided by the efforts of residents did not vary by social class;
- It confirmed previous studies highlighting the importance of flood experience in influencing savings; and
- Highlighted that warnings are most beneficial and needed in areas where there is little experience of flooding.

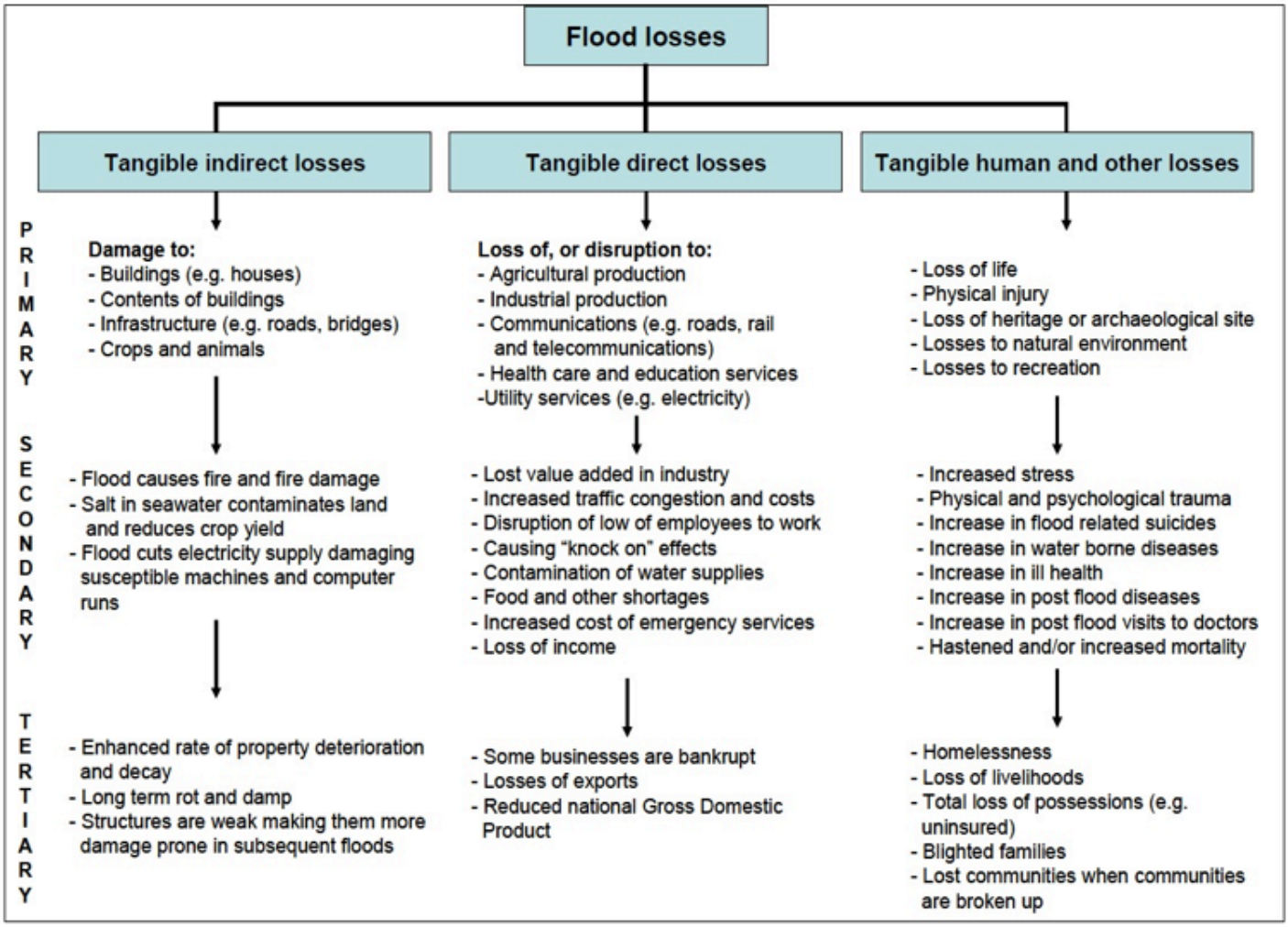


Figure 3 Categories of flood losses which may be reduced by flood warnings (source: Parker et al., 2005)

Social responses to flood warning communication

The Social Impacts of Flooding study assessed the impacts of flooding in Scotland and considered aspects of successful flood risk management including flood warning and dissemination systems (Werritty et al., 2007). The study found that a fifth of those surveyed living in flood risk areas used the Floodline service at the time, and considered it helpful, but overall the study found a complex picture of different information channels being used, and different levels of confidence in the information.

Mileti (2016) summarises various research on public response to warnings of natural hazards. One issue which Mileti raises is whether hazard communication can lead to a 'cry wolf' situation among recipients of the communication, in situations where warnings were issued but impacts did not actually materialise ('false positives'). On this point, Mileti contends that recipients do respond, but perhaps respond differently than in situations where impacts do materialise. As we will go on to discuss in later chapters, our own research, especially on Flood Alerts, paints a rather different picture than this, in suggesting that Mileti's argument might require more attention to differences in hazard communication types. Nevertheless, Mileti's argument that hazard communication needs to be supported by ongoing efforts to educate the public on the benefits on flood warning, and on how to utilise warning messages, carries weight. For example, he comments on how warning messages can have a profound effect on how people respond to messages, particularly around the content:

- Giving people guidance about exactly *what they should do*, using words to paint the picture.
- Warning messages should tell people about *the timing* of their actions, with warning having a higher probability of being followed by appropriate public response if they tell people when they should start and by when they should complete the recommended protective action.
- Warnings tend to work better when they tell people *who does and who does not have to take the protective action* and explain why.
- People are more apt to take protective actions if the warning informs them about the pending hazard's *consequence and how the protective action will cut their pending losses*. Protective action recommendations should be clear to the people being warned, for example 'the area of the town south of Red River will be hit by a wave of water higher than all the rooftops that will be moving at 40 miles per hour; relocating to areas that will not flood will keep you safe'.

Findings from this research were also echoed by Pitt (2007) who advised that warnings should say what they mean, with a reduced reliance on separate guidance, and should, as far as practicable, comprise the elements of an ideal warning:

- A brief description of the hazard – what is happening;
- The location – where the hazard is and where it is likely to go/impact;
- The severity of the impact – what is likely to happen and the consequences;
- What action should be taken and the time window in which to act; and
- When and how the next warning and other information will be available.

The World Meteorological Organization (WMO) summarised why in some instances flood warnings may fail (WMO, 2011). Possible reasons are classified according to whether a 'shared meaning' between the authority issuing the warning and the public has been reached, as follows:

1. *Shared meaning of the flood warnings exists but is of limited value (WMO, 2011):*

- Some people are not flood-risk averse and hence although the warnings are understood they are ignored, or even taken as a challenge;
- Other priorities may interfere with the immediate response to the warning message, for example people may be unlikely to respond until the whereabouts of their household members have been established;
- Inhabitants may be unwilling to leave their property, belongings and livestock, for fear of looting or vandalism;
- Other signals, such as actions of neighbours or the prevailing weather may contradict the official warning. People often seek confirmation of a flood event before they act;
- Some people have an aversion to following authority and may ignore official advice. In many cases people are disinclined to follow orders, preferring to make their own decisions based on the information in front of them;
- Some people cannot respond and hence warnings have no value to them, for example they may lack the physical or mental capacity to respond, or they may be absent;
- Some of those at risk may not be worried about flooding until they have suffered a loss.

2. *Shared meaning of the flood warning is difficult to achieve (WMO, 2011):*

- In many cases the population will be very diverse. This diversity may mean that there are different priorities, languages and levels of understanding of the flood warning;
- Some groups of people may not receive any warnings even when the system appears to function perfectly;
- Informal personal warning networks may reinforce, but can also undermine or deflect, official communications.

The Flood Risk Communications Public Dialogue research was intended to understand risk perception in relation to flooding and generate outputs for improved flood risk communication (Environment Agency, 2015). Some of the key findings from the work, in relation to social response to flood warning communication, include the following:

- **'Flood Literate' versus the 'Flood Unaware'.** The flood literate tend to use formal channels of communication and tools available from the Environment Agency and the Met Office, but also rely on their own experience and local knowledge. The flood unaware tend not to see the relevance of flood communication to them.
- **Message frequency.** There were mixed views over frequency of warnings, with some people who had more experience of flooding wanting more warnings than others with less experience.
- **Communicating likelihood.** Better to err on the side of caution and keep people informed regularly, for example, as alert changes to warning or even if the risk has lessened, with a clear idea of the level of certainty (for example, low, medium, high chance is preferable to probability or even percentages) – but warning too early sacrifices accuracy and increases the chance of false alarms.

- **Localising warning information.** Suggestions made by research participants included: listing location of safe places to go; which areas to stay away from, including road closures; indicating how the current state compares with historical flooding (for example, comparative river levels across different dates); providing information on whether one's house or postcode will actually be flooded (not just an unspecified 'local area'); and knowing what the local council is doing generally and specifically to help affected individuals.

Public surveys of customer satisfaction in Scotland

Previous attempts have been made to understand customer satisfaction with the Floodline service in Scotland (SEPA, 2013; SEPA, 2014; SEPA 2015). The studies focused on understanding how existing customers viewed Floodline and the various aspects of the service and whether customers valued the service provided. Key findings from these studies include:

- **Flood Alerts and Flood Warnings.** Customers do not understand the difference between flood warnings and alerts, using the terms interchangeably (SEPA, 2013 and 2014).
- **Customer Satisfaction.** There is a high level of satisfaction with the service with those finding the service helpful or really helpful at 76% in 2014 and 81% in 2015.

Finally, one study into enhancing flood resilience through improved risk communications involved qualitative and quantitative research with some communities in Finland, Ireland, Italy and Scotland (O'Sullivan, 2012). The study recognised that communities in flood-risk areas are not homogeneous and that social and demographic differences are likely to be reflected in the way people prefer flood-related warnings. It suggested the use of multiple channels of communication for disseminating warnings, stating that results indicate traditional methods are still required to cater to older residents in at-risk communities; however there is the potential for utilising new communication methods in social networking which are likely to be popular with younger members of society.

3 General profile of Floodline customers and areas

SEPA notes that the Floodline service currently supports over 25,000 customers, and that it saw some 300,000 individual messages being issued during the major flood events in December 2015-January 2016. However, the analysis here pushes beyond such headline figures, especially to consider how the customer base is distributed geographically across different kinds of Alert Regions and Warning Areas. As such it forms part of the 'geospatial' methodological thread noted above.

The anonymised data used in this case is sourced from SEPA's own system ('Horizon') which tracks uptake of Floodline by Alert Region and by Warning Area, based on numbers of registered customers (for both Alert Regions and Warning Areas, and numbers of at-risk properties (by Warning Area only)[1].

Distributions by Alert Region

Figure 4 illustrates the trend in numbers of customers registered for Flood Alerts since 2014, at roughly annual intervals, up until the most recent data supplied for the middle of 2016. These figures convey some idea of the scale of the Floodline service, in terms of the volume of message delivery. The large increase between 2015 and 2016 is thought to reflect an increase in registrations arising from the severe conditions of winter 2015-16.

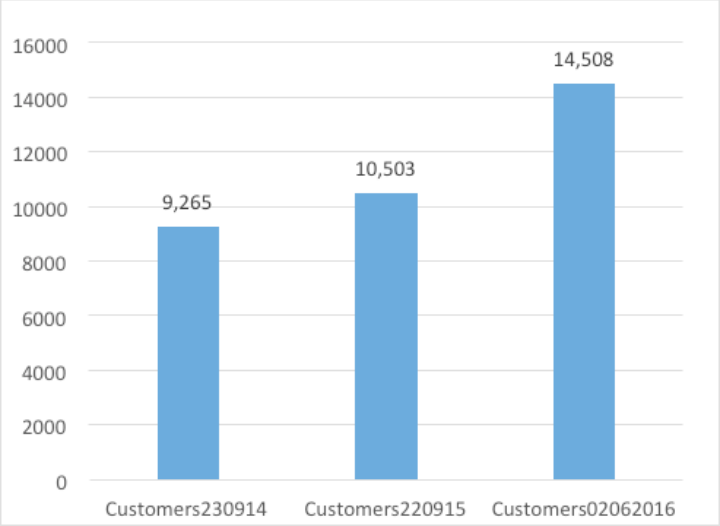


Figure 4 Numbers of customers registered for Flood Alerts (Source: SEPA Horizon system)

Going further, Figure 5 shows the most recent total (14,508 customers) broken down for each individual Alert Region (thus also showing differences in size and layout of these areas). To a degree these patterns mirror the underlying spatial distribution of the general population, with increasing levels of registrations moving from west and north to east and south. However, the north-east of Scotland including Aberdeenshire and Aberdeen stands some way apart with a much higher number of registered customers, in excess of 2,000, equating to

[1] The Horizon data were provided as separate sets of figures for Alert Regions and Warning Areas. It is assumed that there is no double-counting of customers and properties located in both types of area.

around 16% of the total number, compared to the two central belt regions (Western Central Scotland and Edinburgh and the Lothians) which both have around a 12% share.

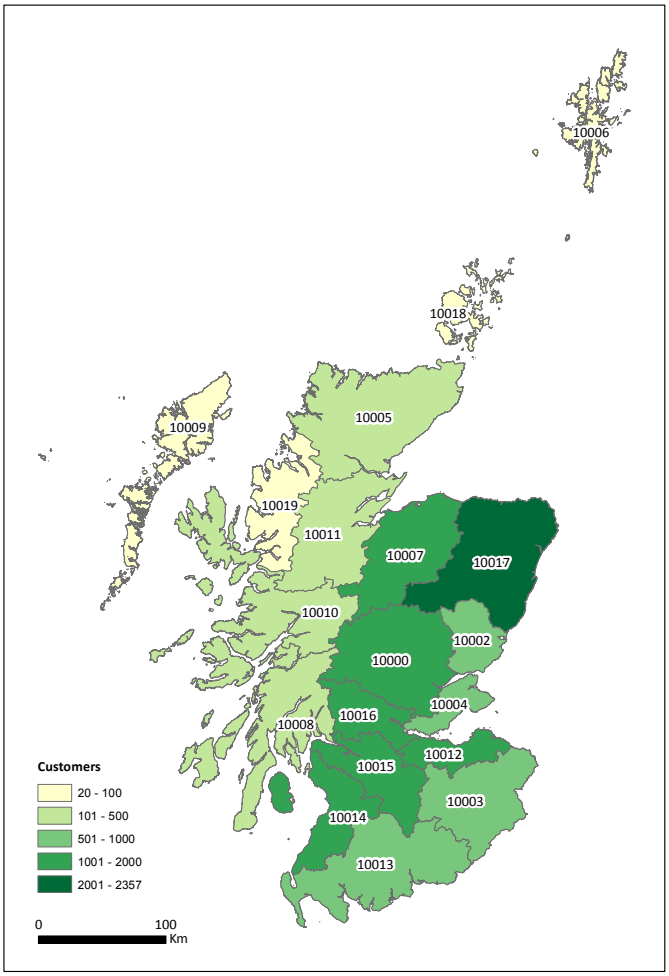


Figure 5 Customers by individual Alert Region

Alert Regions codes and names:

10000 – Tayside
10002 - Dundee and Angus
10003 - Scottish Borders
10004 – Fife
10005 - Caithness and Sutherland
10006 – Shetland
10007 - Findhorn, Nairn, Moray and Speyside
10008 - Argyll and Bute
10009 - Western Isles
10010 - Skye and Lochaber
10011 - Easter Ross and Great Glen
10012 - Edinburgh and Lothians
10013 - Dumfries and Galloway
10014 - Ayrshire and Arran
10015 - West Central Scotland
10016 – Central
10017 - Aberdeenshire and Aberdeen City
10018 – Orkney
10019 - Wester Ross.

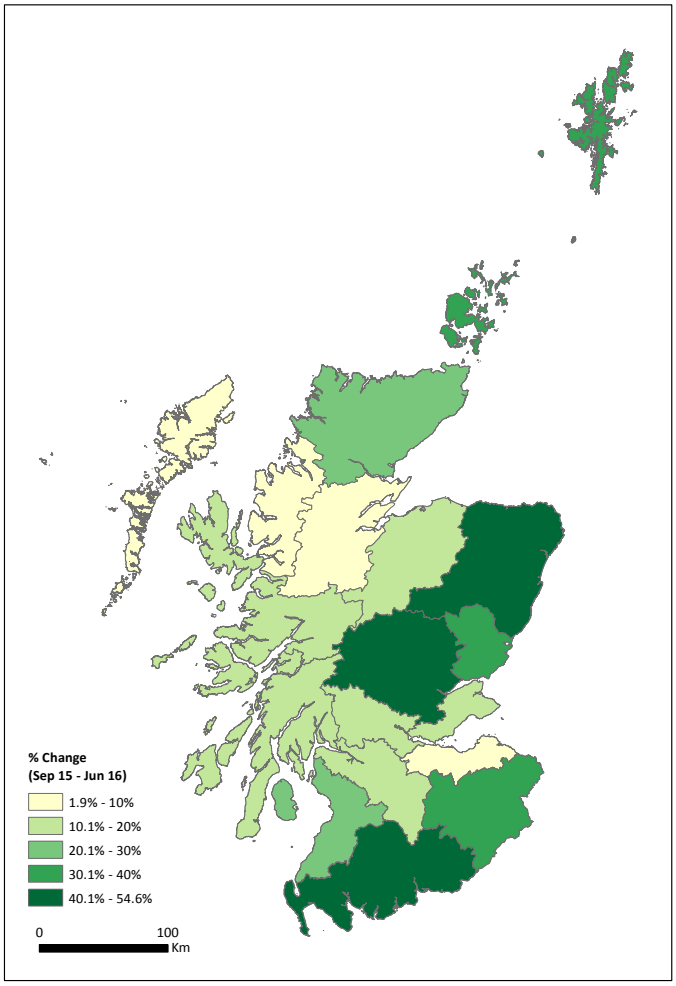


Figure 6 Percentage change in registrations by Alert Region, Sep 15 - Jun 16

Figure 6 also provides an interesting picture, breaking down the overall change shown in Figure 4 on a regional basis. In overall terms the total number of registered customers increased by 38% from 2015 to 2016, and to a large extent this was due to even higher percentage changes in the three regions which were most affected by flooding in the winter of 2015-16. In turn, this suggests that what drives people towards Floodline is the imminent threat or actual experience of flooding.

The low percentage change (on low absolute numbers of registrations) in the Western Isles and in Wester Ross is another notable feature from this map, to the extent that it points to a relative lack of penetration of the Floodline service in those areas, although it may similarly signal a lower degree of flood risk in.

Warning Areas

The anonymised SEPA-supplied data on Floodline registrations in Flood Warning Areas did not support assessment of trends in registrations over time as above. In any case, visualising Warning Areas on national maps is more difficult due to their generally small sizes. To give an indication of this size, the total 269 Warning Areas together occupy around just 1% of the overall Scottish land surface area.

Due to the numbers and sizes of Warning Areas, summary assessment of their characteristics is more feasible after aggregation into a smaller number of category groups. Three such groups are considered here:

- Warning Areas grouped by principal source of flood risk.
- Warning Areas grouped by SEPA Flood Warning Scheme.
- Warning Areas grouped by message frequency and flood impact categories.

Warning Area distributions by risk source

Table 1 shows the results from grouping the Warning Area level data by recorded source of flooding. Aggregating the data in this way yields interesting points concerning the distribution of coastal and fluvial risk. Whilst the numbers of Warning Areas at fluvial flood risk is more than double the number of Warning Areas at risk of coastal flooding, the actual numbers of properties at risk are much more similar across these two main flood sources, at around 30,900 properties each.

However, the number of Floodline-registered customers is more than double in Warning Areas at fluvial risk (over 11,300 compared to around 5,350 in areas at coastal flooding risk). To the extent that each individual registered customer can be linked to an individual property, this suggests that only around 17% of properties in Warning Areas at risk of coastal flooding are Floodline-registered, whereas in Warning Areas at fluvial risk, about 37% of properties are registered.

Thus it appears that awareness of, and/or concern about, fluvial flood risk has been the noticeably larger driver of Floodline registrations compared to coastal risk. The table also shows that the 'Activity' total, referring to Flood Warnings issued, is substantially higher for Warning Areas at fluvial risk than those at coastal flooding risk. However, other possible explanations for the discrepancy in levels of registration are (a) the more recent introduction of Flood Warnings for coastal areas (see Literature Review section) compared with fluvial warnings (1980s), and (b) perhaps a relative dearth of major flood events caused by coastal flooding.

Table 1 - Warning Area characteristics aggregated by recorded flood risk source

Source	Warning Areas	Horizon Properties	Customers	Customers÷ Properties	Flood Warning Activity	Severe Flood Warning Activity
Coastal / Fluvial	1	692	174	0.251	0	0
Coaster	87	30904	5359	0.173	720	0
Fluvial	181	30915	11337	0.367	6572	24

Warning Area distributions by Warning Scheme

Figure 7 sums up data for Warning Areas located with the same Warning Scheme. For each Scheme the graph bars show the summed total number of properties (as identified by SEPA) and the total number of registered customers. The graph is sorted in decreasing order of total number of properties by Scheme. The graph illustrates marked differences in numbers of properties and customers between Schemes. These numbers reflect the geography of the flood Warning Areas and history of developing each Scheme. The Schemes covering the Firths of (a) Forth and Tay and (b) Clyde cover respectively the highest two total numbers of properties, in excess of 10,000 each, and are eclipsed only by the Moray Firth in terms of numbers of registered customers. Customer registrations as a proportion of total properties vary widely also: the Firth schemes register among the lowest values of all registrations rates at around 15% each, while the Eye Water in the Borders achieves a 100% rate based on only 13 properties at risk.

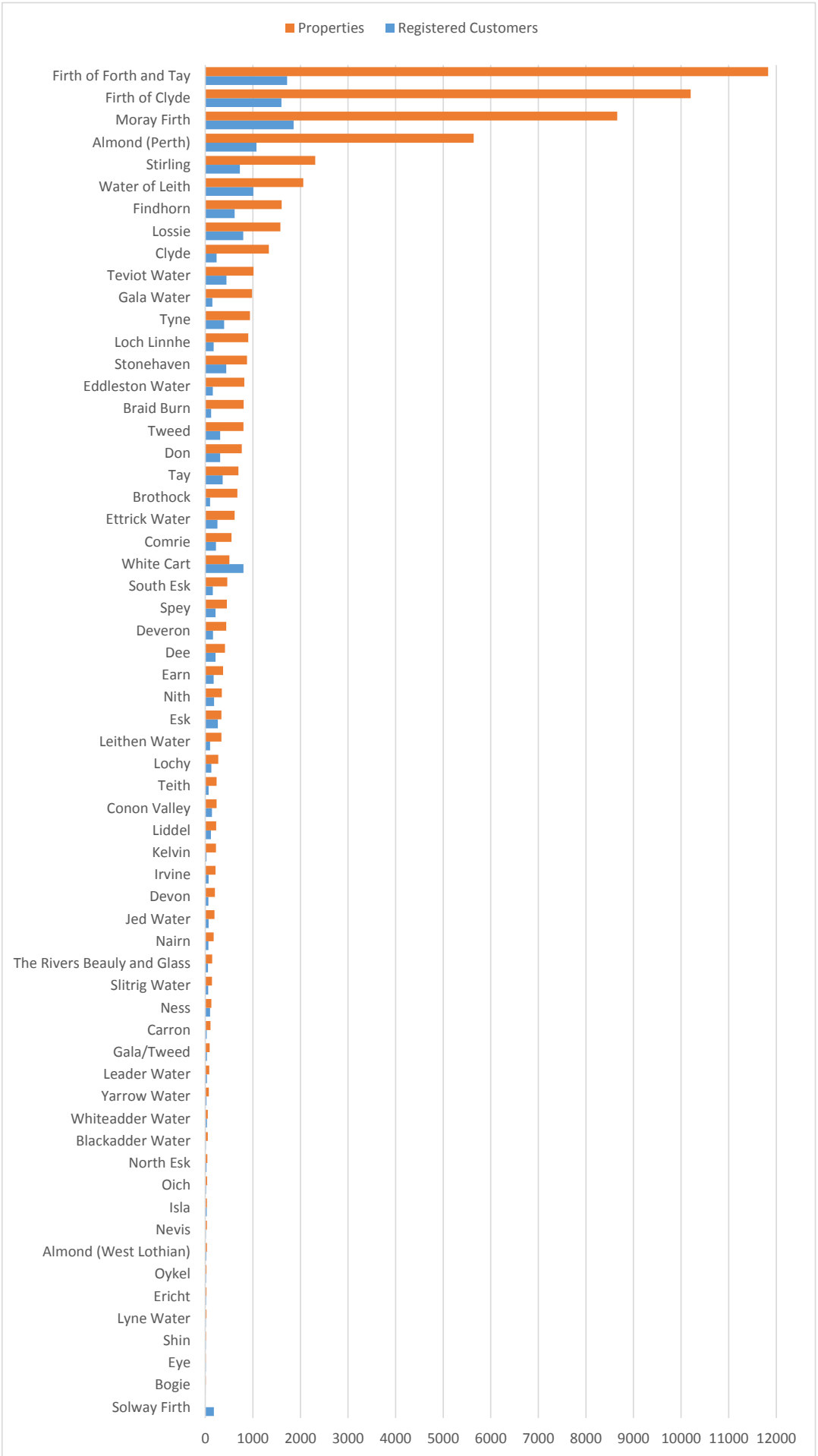


Figure 7 Distribution of properties and customers in Warning Areas, aggregated by Flood Warning Scheme

Warning Area distributions by 'Frequency-Impact' categories

The final two plots in this section aggregate the data from individual Warning Areas by the 'Frequency-Impact' categories created specifically for this research.

Figure 8 firstly shows the distribution of properties and customers by the nine individual groups included in the categorisation. The stand-out point from this graph relates to the large share of total properties in the three 'Low Frequency' (LF) categories, especially Low Frequency – Medium Impact (LFMI) and Low Frequency – High Impact (LFHI). Together these categories include around 60% of all properties in Warning Areas, and a similar share of total registered customers.

The blue bars indicate the numbers of registered customers in these categories, and show that customers generally represent a small or modest fraction of the total properties per category.

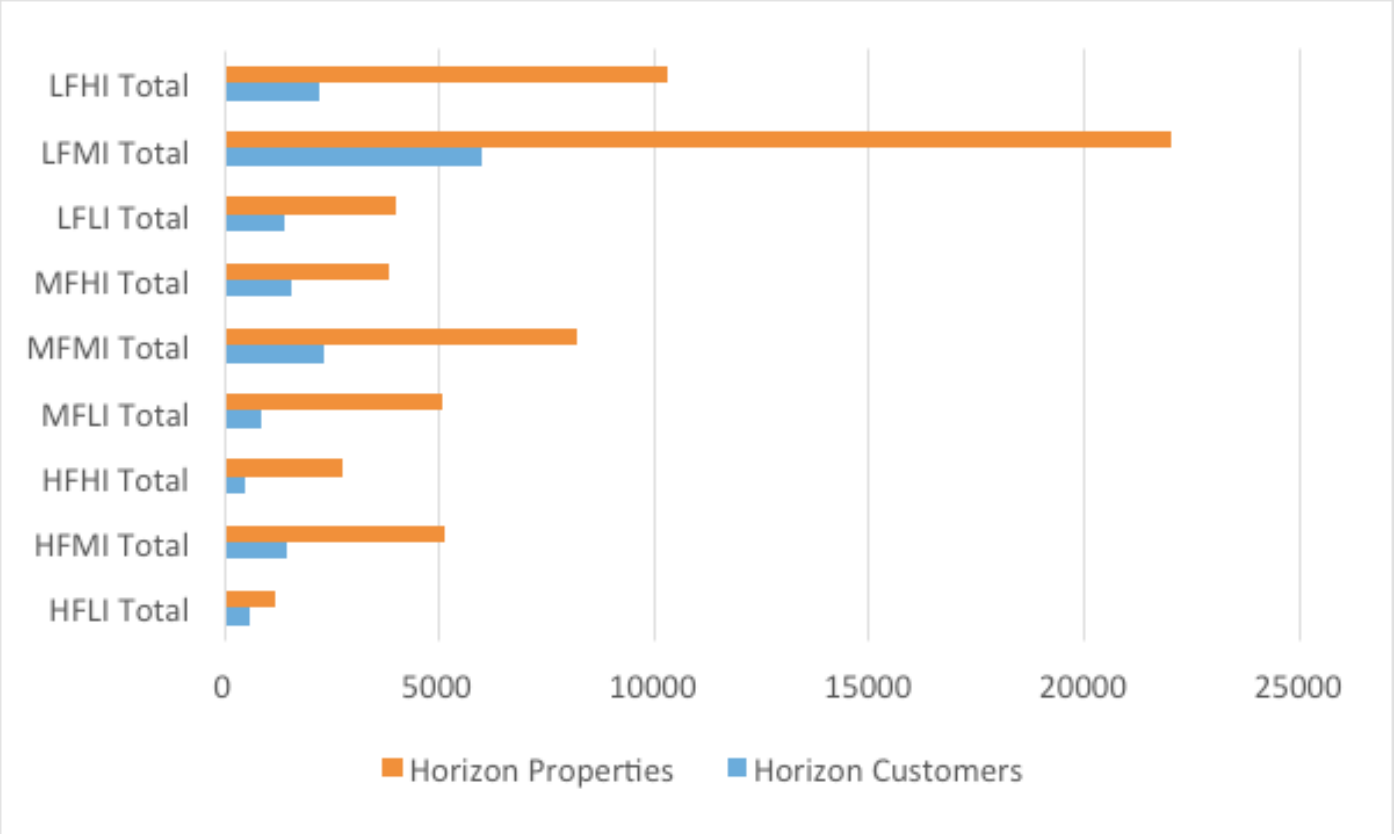


Figure 8 Distribution of properties and customers in Warning Areas, aggregated by Frequency-Impact categories

Secondly, Figure 9 highlights the stark differences between the nine categories, based on the 'Activity' totals, taken as before as representing the number of Flood Warnings issued.

Message frequency can be seen to be very much higher in Warnings Areas in two of the 'high frequency' categories than others, namely in the High Frequency-Low Impact (HFLI) category, and in the High Frequency-Medium Impact (HFMI) category . In other words, the category labels for these two Warning Areas appear to be appropriate. Flood Warnings issued to Warning Areas in these two categories are likely to have been smaller scale flood events (likely to have been local flooding of functional floodplain, with impacts limited, for example, to isolated properties, minor roads or agricultural land), rather than major flooding episodes.

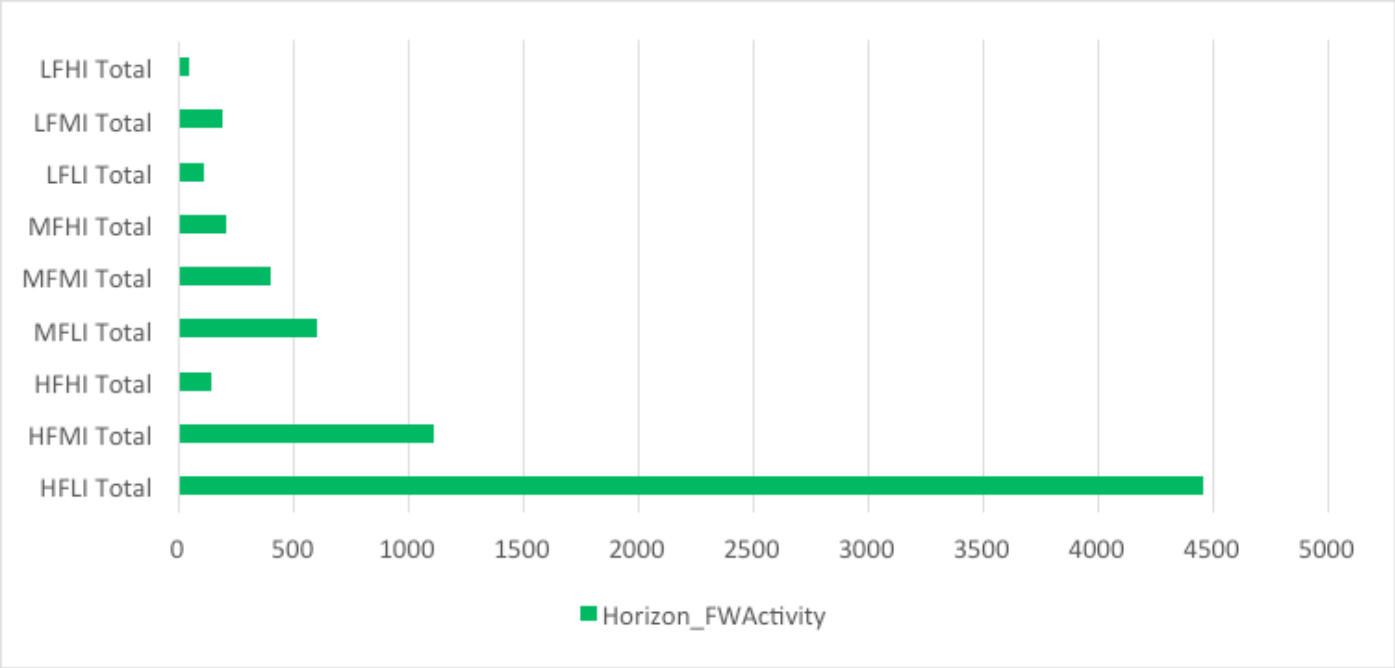


Figure 9 Flood Warning 'Activity' totals aggregated by Frequency-Impact categories

[2] By comparison to these two categories, the 'Activity' total for the third 'high frequency' category, High Frequency-High impact is much smaller. Indeed, the total is also smaller than another 'high impact' category, namely MFHI. This may indicate an anomaly in the coverage of this category, although this has not been investigated further.

Social composition of Warning Areas

It is also possible to provide some brief insights into the social composition of Flood Warning Areas, based on a straightforward GIS approach integrating Warning Areas with the Scottish Index of Multiple Deprivation 2016 (SIMD16).

The latter is a convenient means of spatially assessing social differences - although its usage also carries some important caveats:

- First, the SIMD is designed to measure concentrations in deprivation at small area level rather than individual-level deprivation. Consequently, we must remember not all 'deprived individuals' live in 'deprived areas' (and equally, not everyone living in a 'deprived area' should be expected to be a 'deprived individual').
- Second, while deprivation overlaps conceptually with notions of 'vulnerability', 'flood vulnerability' and 'flood resilience', it is not completely synonymous with any such concept. However it may also be noted the recent work on 'flood disadvantage' has drawn on SIMD data as one key form of input (Kazmierczak et al., 2015).

The SIMD is produced for the standard small-area geography of Data Zones. In GIS parlance, a simple 'point-in-polygon' operation was used to link Data Zones and hence the SIMD16 to Warning Areas, further refined by using a distance threshold in an attempt to include Data Zones which overlapped partially with Warning Areas.

In addition, a 'distance threshold' was also employed, in an attempt to capture the complex and varying overlaps between Warning Areas and Data Zones. Specifically a cut-off distance of <= 200m from a Data Zone centroid to the edge of the nearest Data Zone was used to identify the subset of Data Zones located within or close to Warning Areas (see also Appendix 2).

Based on these methods, 538 Data Zones or around 8% of the total 6,707 2011 Data Zones in Scotland were judged to be within 200m of the nearest Warning Area, including a similar percentage of the overall Scottish population. Because there are so many Data Zones across Scotland, it is common to use summary groupings to analyse them. Here Data Zones are grouped into deciles of the SIMD16. In other words, with Data Zones first sorted in rank order of the SIMD, Data Zones are then grouped into 10 equal-sized classes, with each class including 10% of the Scottish population. On this basis decile 1 represents the 10% of the population living in the most deprived Data Zones, decile 2 represents the 10% of the population living in the next most deprived Data Zones, and so on.

These national population-weighted SIMD deciles were used here, as a means to assess the distribution of the population within the subset of Data Zones located within 200m of the nearest Warning Area. The graph in Figure 10 shows the results. Each bar in the graph represents the percentage of the population of Data Zones which are within 200m of a Warning Area within each SIMD16 national decile. The horizontal line provides a comparison against the overall population profile for Scotland as a whole (the line being flat as each SIMD decile contains 10% of the national population). Thus any departure from that flat profile signifies a degree of disparity in the make-up of the sub-population living within 200m of Warning Areas compared to the distribution of the Scottish population as a whole.

The graph shows considerable variations in the percentages within each decile, forming an inverted u-shaped distribution. The percentage of population in Data Zones falling into the most deprived deciles 1, 2 and 3 is smaller than in other deciles and is also under-represented relative to the corresponding national 10% level. This is also the case with Data Zones in the two least deprived deciles, 9 and 10. Conversely, there is a disproportionately high percentage of population in the other deciles, in deciles 4-8. Overall the distribution shown by this graph suggests that people in deprived Data Zones tend not to live within or as close to Warning Areas as people in other less deprived Data Zones. In turn this reflects the linear arrangement of Warning Areas, along river courses and stretches of the Scottish coastline. In contrast, area deprivation as measured by the SIMD is primarily a concentrated urban phenomenon, focussed in particular in parts of Glasgow, Edinburgh and Dundee and in sections of several smaller towns.

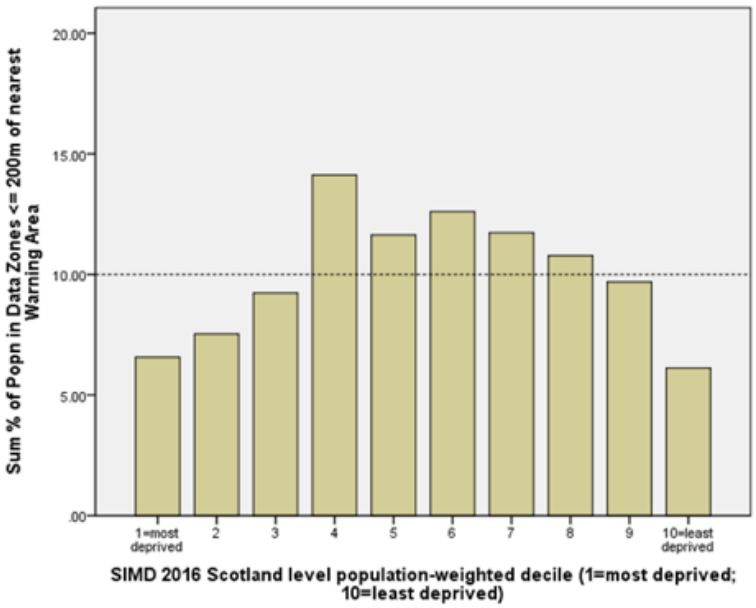


Figure 10 Population profile of Data Zones within 200m of a Warning Area, by SIMD16 national deciles

This subset of selected Data Zones in Warning Areas can be further sub-divided in different ways. Here we confine attention to just two such sub-divisions.

- A first subset of Data Zones <= 200m distance of Warning Areas which are also classed as High Frequency-Low Impact (HFLI), or High Frequency-Medium Impact (HFMI) – i.e. the two types of Warning Area with highest flood warning activity levels. Of the total 269 Warning Areas defined at the time of this research, 56 of them (21%) are in these two classes.
- A second subset of Data Zones <= 200m distance of Warning Areas and classed as High Impact areas (i.e. in LFHI, MFHI, or HFHI Frequency-Impact classes). Of the total 269 Warning Areas, 29 of them (11%) are included in these three classes.

The first subset contains 64 Data Zones with an aggregate population of 47600, equating to 11% of all the Data Zones <= 200m distance of any Warning Area, and 12% of their population. The distribution of Data Zones across the national SIMD deciles is shown in Figure 11 (left graph). The shape of distribution formed by the graph bars is reasonably similar to that in Figure 10, although there are some key differences:

- There are no Data Zones, hence no population, in the most deprived decile of all (decile 1).
- The population of decile 4 is now relatively under-represented compared to the 10% national shares of population in each decile, while that of decile 9 is slightly over-represented.
- Population percentages in deciles 6, 7 and 8 are relatively over-represented compared to the national profile, and are also higher than the corresponding percentages in Figure 10.

Reasons for these characteristics are that Warnings Areas classed as HFLI or HFMI are predominantly areas at risk of fluvial flooding, and are arranged linearly along river courses, especially in rural areas, in the south-east, east-central area, north-east and north of the mainland. According to the SIMD, none of those areas have concentrations of high levels of deprivation.

The second subset contains 125 of the 538 Data Zones within 200m of a Warning Area (24% of the latter) with a summed population of 98300 (23% of the population across all 538 Data Zones). In other words, the number of Data Zones and the associated population in this subset is roughly twice as large as for the first subset, even though it includes around only half as many Warning Areas.

Graphing the population percentages for the second subset produces a strikingly different profile (Figure 11, right side). Notably:

- There is a left-biased distribution shape, with highest population percentages in deciles 1 to 6, with the exception of decile 3, above the national share indicated by the horizontal 10% level.
- In contrast, the percentages of population in decile 3 and in the least deprived deciles 7-10 are low compared to the national 10% shares.

These profile characteristics for the second subset reflect the location of High Impact Warning Areas at or near river mouths in urban areas, such as in Renfrew, Granton and Leith, Grangemouth, Inverness Harbour, and North Muirton / North Inch in Perth. The potential damage to industrial and/or port facilities concentrated in these areas may be an important factor explaining why they are classed as high impact. Similarly, the industrial character of these areas is associated with high relative levels of multiple area deprivation. In addition Data Zones in these locations are geographically small due to having high population densities, and as a result they are more numerous than in other areas. In turn, the small size of Data Zones means that more of them are likely to intersect with Warning Areas compared to the situation in other locations. This helps to explain why 23% of population of the total 538 Data Zones located in or within 200m of a Warning Area is associated with this subset.

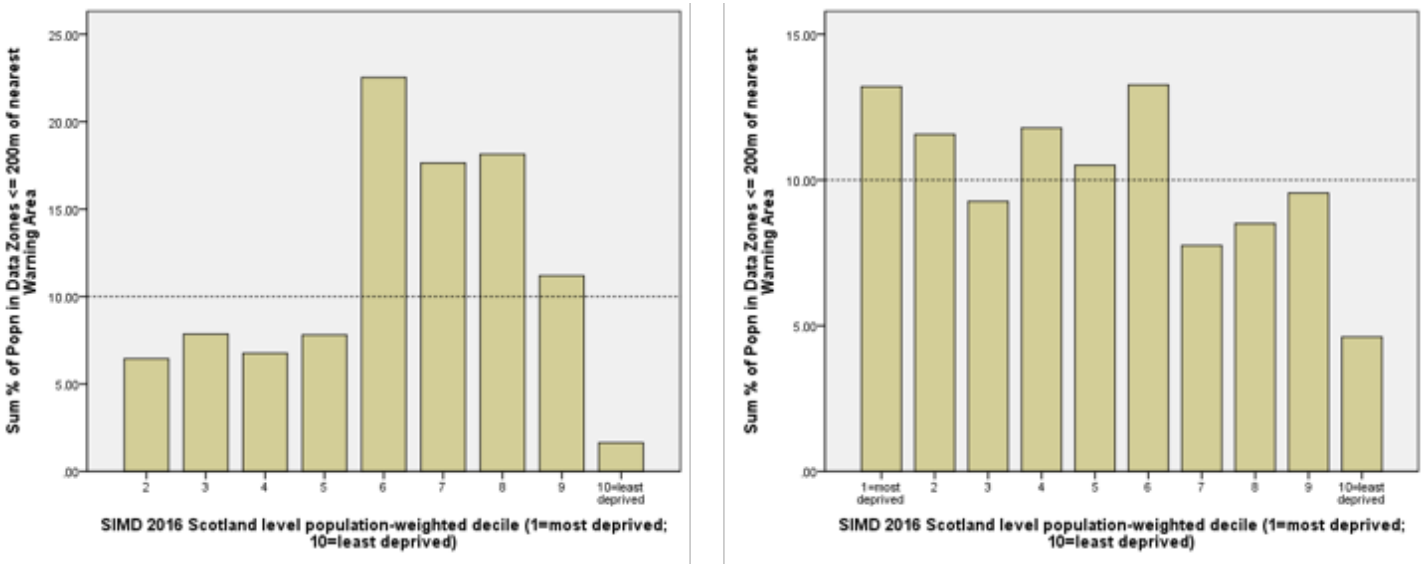


Figure 11 Population profile of Data Zones within 200m of nearest Warning Areas: (left) Warning Areas classed as HFLI or HFMI; (right) Warning Areas classed as LFHI, MFHI or HFHI

It must be acknowledged that the interpretations drawn from these graphed profiles require caution. Other studies that have used similar data and methods to estimate populations exposed to environmental hazards have shown that results crucially depend upon which spatial representations of population distribution are used, definitions of deprivation, and the size and shape of proximity thresholds (e.g. Higgs and Langford, 2009).

Section summary

Given the array of issues touched on in this section, here we attempt to synthesise the main points:

- The section has shown that both properties at risk of flooding, and registrations for Floodline, are distributed unevenly, socially and spatially.
- There are strong suggestions that Floodline registrations are driven by experience or threat of major flooding, although registration data were not available to allow a formal investigation.
- There are similarities in numbers of at-risk properties in Warning Areas deemed to be exposed to coastal and fluvial flood risk, yet customer registrations in fluvial risk areas are roughly double the numbers in coastal flood risk areas.
- Both at-risk properties and current customer registrations are also concentrated in Warning Areas classed as Low Frequency and Medium Impact or High Impact. However, most Floodline messages have been issued to much smaller numbers of customers in High Frequency-Low Impact and High Frequency-Medium Impact Warning Areas (where at-risk property numbers are also much lower).
- A relatively crude geospatial analysis helps characterise the socio-economic profile of population living in Data Zones located within 200m of Warning Areas, specifically in terms of the SIMD16 area deprivation measure. A main concern here is the percentage of this population living in Data Zones which are also classed as being deprived, according to the SIMD. Results from the analysis indicate that the percentage of population in the most deprived Data Zones, in SIMD deciles 1 to 3, is relatively small, and lower than the 10% of the national population share within each of these deciles. This is also the case for the narrower subset of communities living in Data Zones <=200m of Warning Areas classed as HFLI and HFMI. However, a relatively large percentage of population associated with Warning Areas live in Data Zones in SIMD decile 4, which may be a concern.
- Finally, when attention is confined to profiling the subset of Warning Areas classed as High Impact, a contrasting profile is produced. For that subset the percentages of the population living in more deprived Data Zones are larger than the percentages living in less/non-deprived Data Zones.

4 Assessing the representativeness of the research sample

This section focusses on assessing, so far as is possible, the representativeness of the sample of almost 1,400 research participants who took part in this study.

The main focus is on the representativeness of the sample obtained from the three parallel customer surveys. Taken together these surveys were intended to provide a high-quality sample of all currently registered Floodline customers.

In addition, an overview is given of the local community meetings and their participants, and of the attempts to survey those who have never been Floodline-registered and previously registered Floodline customers who subsequently deregistered.

Representativeness of survey sample

An important question concerns whether or not this sample, mostly composed of respondents from all three customer surveys, is representative of the broader Floodline customer population base in a statistical sense. Inferential statistical techniques for making estimates about, and assessing differences in, a population, should only be applied if probability sampling procedures are used. Probability sampling means that each person in the sample frame has a known chance of being included in the sample, determined by the specific selection procedure used.

The best way to evaluate the representativeness of a sample is by considering the processes by which it was selected. Evaluating the process requires consideration of a number of criteria including the sample frame, the sample size and the design of the sample selection procedures (Fowler, 2009).

In regard to these criteria, we can make the following points with some certainty:

- *Sampling frame* – the sampling frame used for this study consisted of the list (or rather separate lists) of email addresses for each of three customer types. This includes some 18,000 of the approximately 25,000 currently registered customers. It is therefore reasonably comprehensive, although we must also make an assumption that the email addresses are currently used ones. The 7,000 or so customers who are not included are those for whom an email address is not available. This exclusion may introduce a degree of bias into the sample, if those for whom an email address is not available are systematically different from the rest.
  However, the degree of any resultant bias is likely to be relatively small, given that the customers with email addresses form by far a majority, and it is also likely to affect responses to some questions more than others – e.g. questions asking for ratings of the Floodline website or phone line.

Probabilities of selection

It is not possible to establish definitely the probability of selecting specific individuals from the sampling frame (which is often a more generic issue of web-based surveys). To establish this would require at a minimum, more information on how customers are clustered into other key groupings, including properties, families and households. Such clustering, where it exists, alters the probabilities of selecting a specific individual.

For example, it is quite likely that there are situations where more than one registered customer lives in the same property, as part of a single household and family. However, we do not know how such customers will have chosen to respond (or not respond) to the survey – e.g. whether they all responded separately, whether they decided to submit a collective response, or whether they decided to have only one person respond.

In addition, the likelihood of such clustering of respondents ties to the fact that several survey questions ask about experiences and measures at the property. In effect this means that some properties would also have increased selection probabilities compared to others.

If there was other information with which to assess these probability differences, then weights could be applied to correct for such differences. However, no such information was available here, as there were no survey questions asking respondents if there were other Floodline customers in their properties.

Sample size

Size is one of the most frequently asked questions about a sample, yet it is also often emphasised unduly, compared to the other aspects of the sampling design discussed above.

In reality it is possible, and indeed commonplace, for reliable estimates to be made from samples constituting very small fractions of a given target population, provided that there is an adequate sampling frame and probabilistic sampling has been implemented. For example, standard estimates of sampling error take no account of the fraction of the population included in the sample.

In the present study, the achieved sample sizes here are shown below in Table 2. Overall the number of respondents constitutes around 7.5% of the 18,000 or so to whom a link to the survey had been issued. Most responses were received from customers registered for Flood Alerts, this being the largest group of Floodline customers. The numbers of responses from those registered to receive Warnings, or both Alerts and Warnings, were lower and more similar. While these are small percentages, they are by no means atypical of sample sizes used for other social surveys.

Table 2 - Survey response by type of survey

	All surveys	Survey of Alert-registered customers	Survey of Warning-registered customers
Respondents by registration category	Alerts only: 603 Warnings only: 377 Both: 361 Total: 1,341	Alerts only: 603 Both: 361 Total: 964	Warnings only: 377 Both: 361 Total: 737
Approximate total customers	18,000	14,500	16,900
Approximate response rate	7%	7%	4%

Other potential survey errors

The above characteristics all affect 'sampling error', namely the random (chance) degree of error resulting from sampling. However, sampling error is itself only one component of total survey error. 'Non-sampling errors' relate to other aspects of the survey process, such as the ways in which questions are worded and sequenced.

For this study, there is some reassurance to be gained from the fact that the survey questionnaire was drafted carefully through a process involving multiple revisions and refinements, and additionally because the questionnaire and processes used to survey each of the three customer groups were identical. The coding frame showing the questions included in the questionnaire is included in Appendix 3. Additional information on survey conduct is also given in Appendix 4.

Summary of the statistical representativeness of the survey sample

Overall this discussion should make clear the intention of achieving a good quality probabilistic sample of the overall population of current Floodline customers. However, it is problematic to conclude definitively that the sample obtained fulfils that intention, in particular because of the issues around the sampling process and lack of information on probabilities of selection. Consequently, when it comes to using statistical analysis techniques beyond descriptive statistics, we proceeded cautiously, applying such techniques selectively, where appropriate.

Comparisons of survey respondents against general Floodline population characteristics

It is also possible to argue for the credibility of a sample on grounds other than the sampling process. In other words, even though a sample may not be representative in the statistical sense, it may nonetheless capture the main axes of difference in the population under study.

The customer sample can be assessed in this latter non-statistical sense by deriving similar information as for the general profile of Floodline customers discussed in Section 3. Comparison of the former with the latter then informs understanding of the broader representativeness of the sample.

The comparisons reported on here were thus also enabled through the ability to geocode survey respondents, in order to GIS-match them to other data. Survey Question 34 requested the customer postcode and subsequently it was possible to obtain the corresponding spatial coordinates of the postcode.

Numbers of respondents with geocoded locations are shown in the final column of Table 2 above. As this shows, a pleasing aspect of the results is the large number of customers for whom locations could be geocoded, some 96% of all respondents. The full geocoding process is explained in detail in Appendix 5, and there the reader will also find further sets of results matching geocoded respondent data to Flood Alert regions and Flood Warning Areas.

Following below are a number of comparisons between the sample and the general Floodline customer profile from Section 2 taking account of the following dimensions:

- For Flood Alert customers – the distribution across Flood Alert regions.
- For customers receiving Flood Warnings:
  - Distribution by flood risk source;
  - Distribution by Flood Warning Scheme;
  - Distribution by Message Frequency – Flood Impact categories;
  - Distribution by multiple social deprivation (using the SIMD16).

Distribution of Flood Alert survey respondents vs all Flood Alert customers

Figure 12 below re-expresses the data from Figure 5, in this case with the blue bars showing the percentages of all Alert customers in each different Alert Region as extracted from the SEPA Horizon records. The orange bars show the corresponding breakdown for respondents to the Alert survey.

For most Alert Regions these percentages are consistently similar, within a fraction of a single percent of one another. However, for each of the three regions containing most customers (at the head of the graph), the percentage of survey respondents is around 2% less than the corresponding total from the Horizon system; this may also reflect a tendency for lower responses among more urban populations. The largest difference is in the Findhorn, Nairn, Moray and Speyside Alert Region, where the percentage of respondents from the survey is less than half the percentage from the Horizon records.

Conversely, the percentage of survey respondents is noticeably higher than the corresponding Horizon percentages for several regions, particularly Ayrshire and Arran, and Dumfries and Galloway.

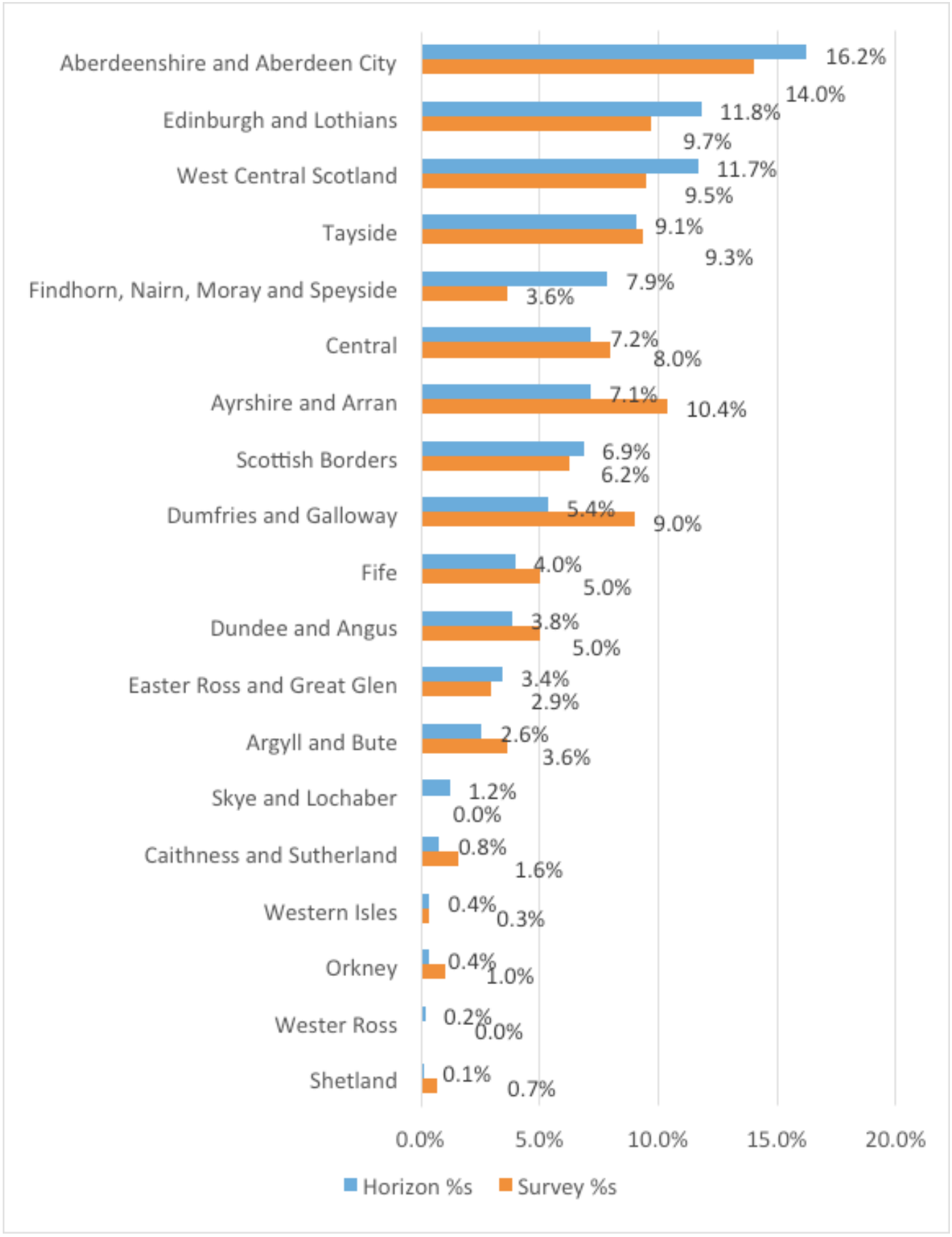


Figure 12 Distribution of Flood Alert customers and Flood Alert survey respondents by Alert Region

Respondents to Flood Warning and 'Both' surveys vs all Flood Warning customers

We now turn focus to analysing the characteristics of respondents in Warning Areas only. Because of this focus, only respondents to two of the three surveys are considered below – namely those responding to the Warning-only survey, and those responding to the survey of customers receiving both Warning and Alerts (the 'Both' survey). No Alert-only respondents should be located in Warning Areas, and consequently such respondents are excluded from this part of the analysis.

Comparisons by flood risk source

Figure 13 provides a comparison between the combined numbers of 'Warning' and 'Both' survey respondents and total numbers of Flood Warning customers, the latter extracted from the Horizon records (see Section 3). Information on the source of flood risk for each Flood Warning Area was also obtained from the Horizon records.

The graph makes clear that the profile of survey respondents across the different source risk categories is very similar to the profile for all Flood Warning customers.

Comparisons by Flood Warning Scheme

Figure 14 continues the comparison from above, but in this case the more detailed profiles by Flood Warning Scheme are compared.

For the majority of Schemes the differences in percentages are very slight. Largest differences are evident for the Don, Dee, Solway Firth and Carron, where the percentages of respondents are between 2 and 4% higher than the percentages derived from the Horizon data. Conversely, the Horizon-derived percentages are greater than the survey percentages by around 2 to 3% in the Schemes at the head of the graph containing the largest percentages of Flood Warning customers, including the Moray Firth, Firth of Clyde, Water of Leith, White Cart and Lossie Schemes.

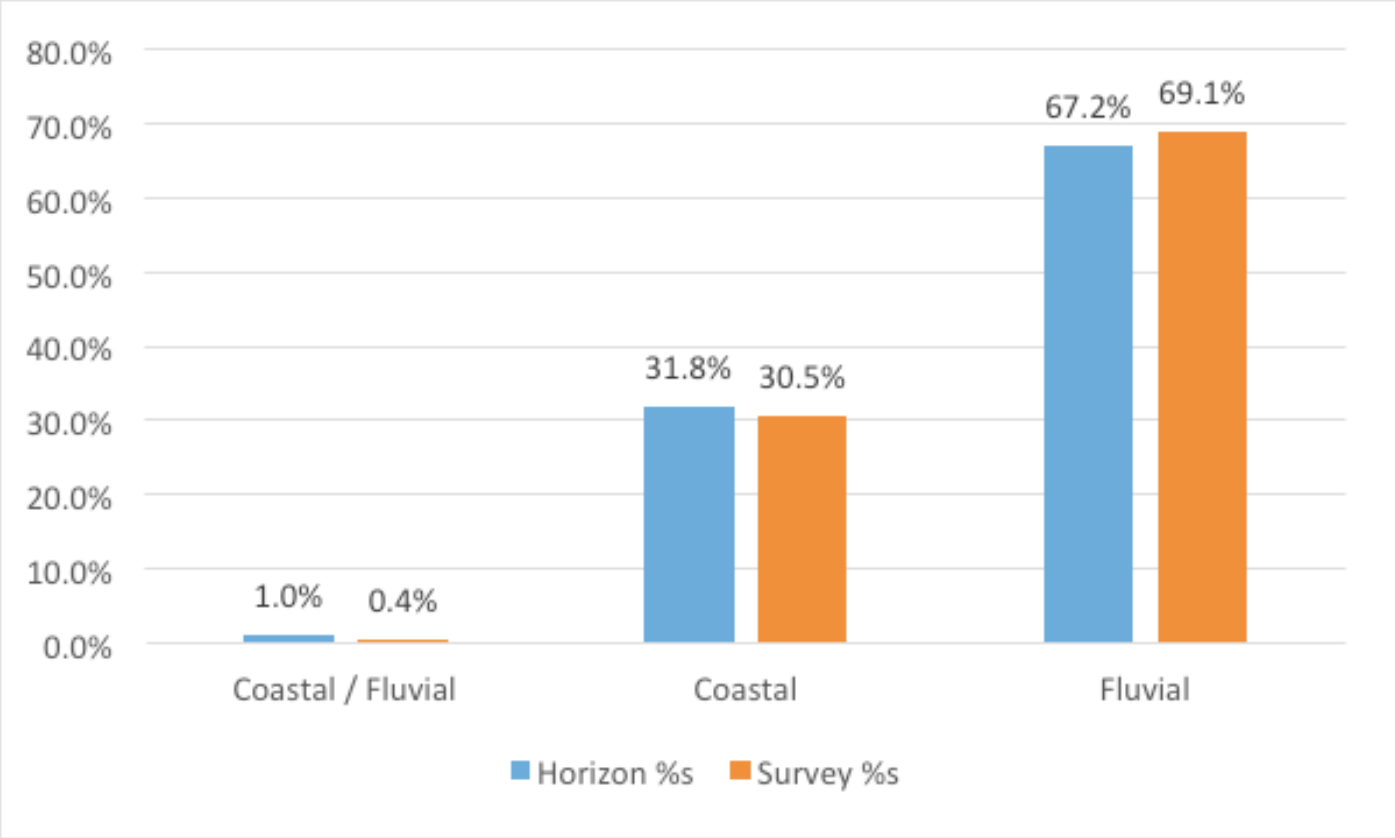


Figure 13 Percentages of Flood Warnings customers and respondents to Flooding Warning and 'Both' surveys by flood risk source

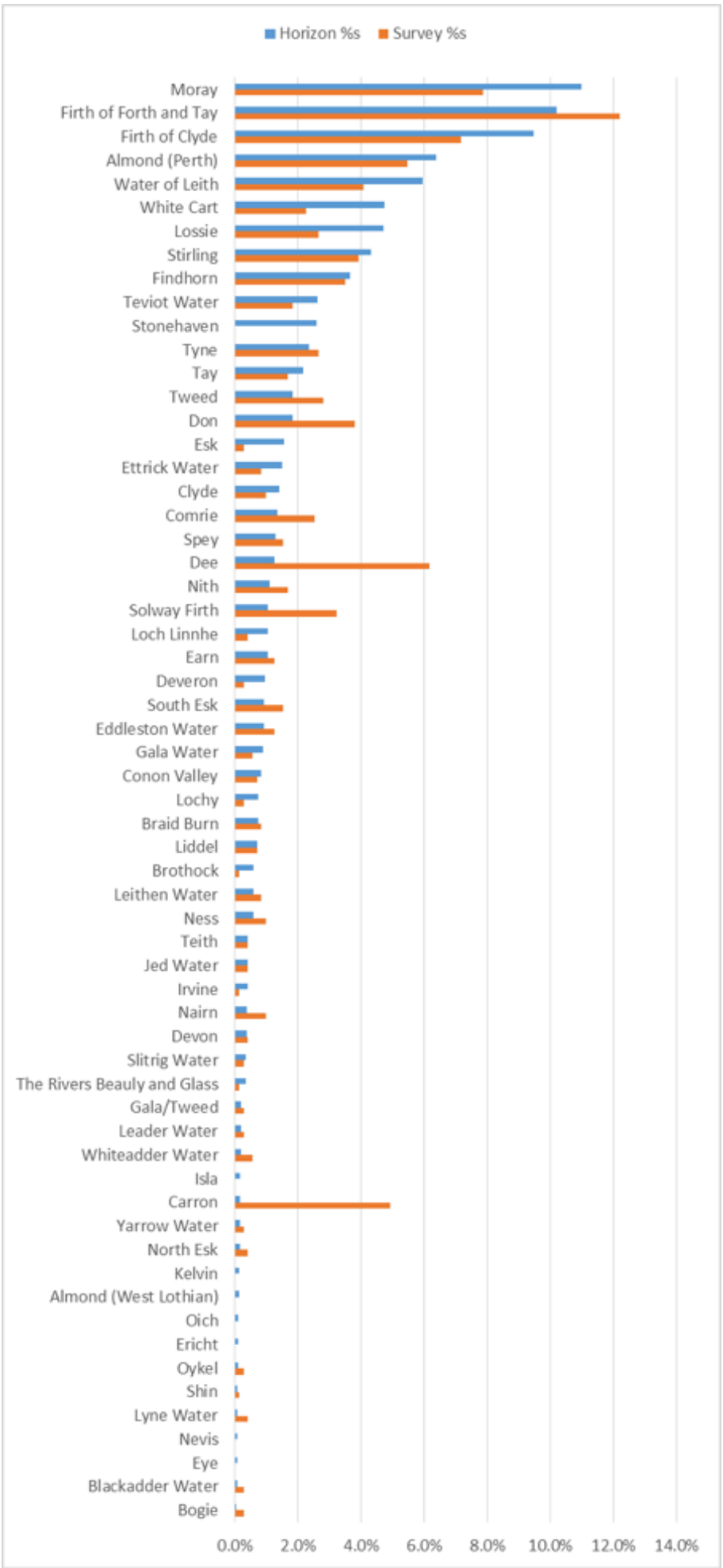


Figure 14 Percentages of Flood Warning customers and respondents to Flooding Warning and 'Both' surveys by Flood Warning Scheme

Comparisons by Frequency-Impact

The next graph compares survey respondents and all Flood Warning customers grouped in the Message Frequency – Flood Impact categories (Figure 15).

As above there is clear consistency between the two distributions across the different Warning Area categories. Four categories are slightly under-represented in the survey data, while five are slightly over-represented. It is perhaps slightly concerning that, for one of the particular categories of interest to SEPA, namely Low Frequency – High Impact, the difference reaches close to 5%.

Nonetheless, across all nine categories the average difference in percentages is zero, providing weight to the view that the survey data are broadly representative of the distribution of the overall Floodline customer population over the different Warning Area categories.

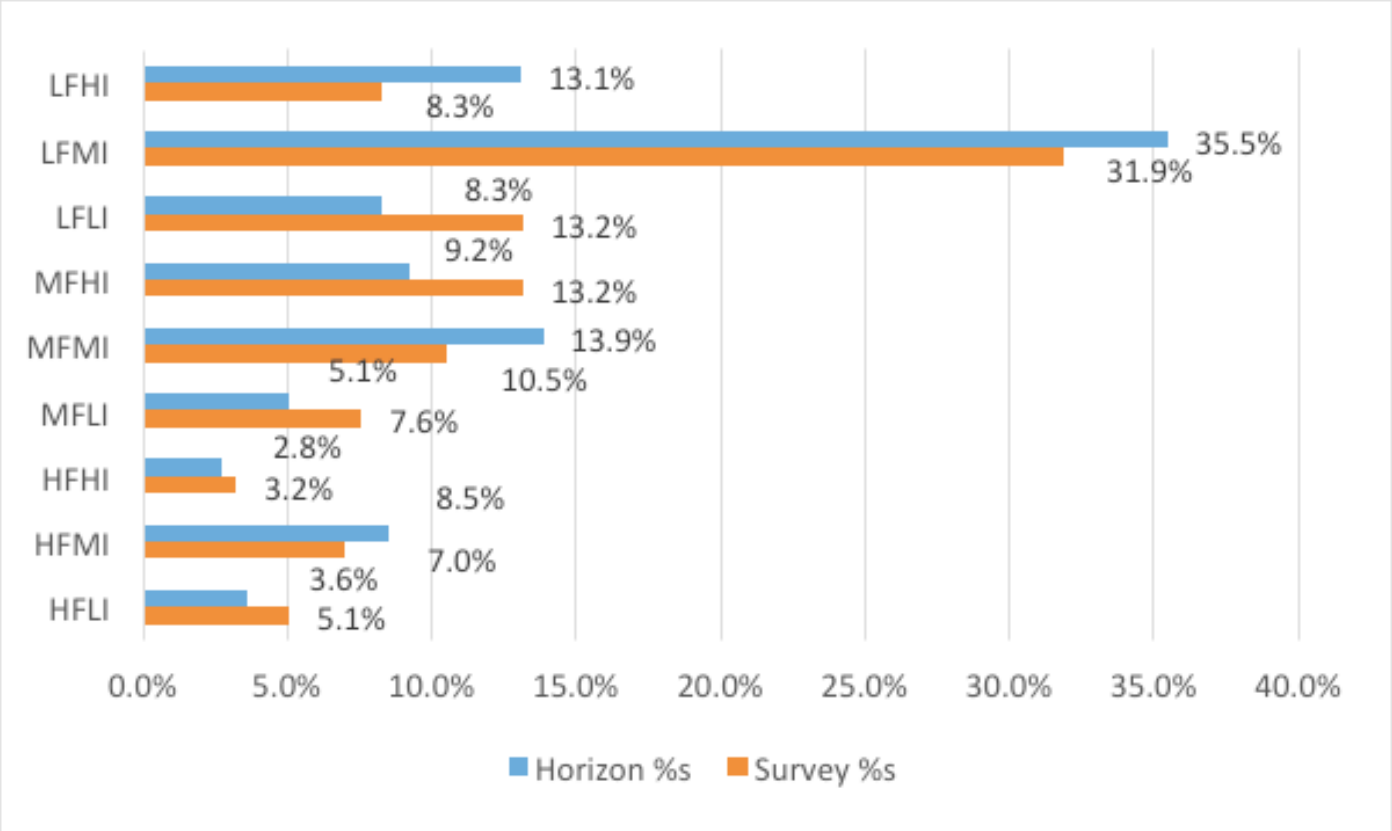


Figure 15 Distribution of survey respondents and all Floodline customers in Warning Areas, by Frequency-Impact category

Comparisons by multiple social deprivation decile

Finally, the same subset of survey respondents was also matched to Data Zones, and subsequently, to the SIMD16 deprivation deciles. In this case, the resultant distribution for respondents (Figure 16) can be compared against the general distribution of Data Zones shown earlier (Figure 10).

This comparison shows some similarities, in particular around the low percentages in Data Zones in the most deprived SIMD deciles 1, 2 and 3, and also with the percentages in deciles 4 to 8 being above the national 10% shares represented by the horizontal line shown on the graph. However, differences are also evident, with most respondents in deciles 7 and 8. The percentage of survey respondents in SIMD decile 4 is also rather lower than the corresponding percentage of the overall Warning Area population in that decile, whereas the percentages in the less deprived deciles 5 to 8 are comparatively higher – i.e. indicating that respondents tend to be somewhat more concentrated in areas where relative deprivation levels are lower.

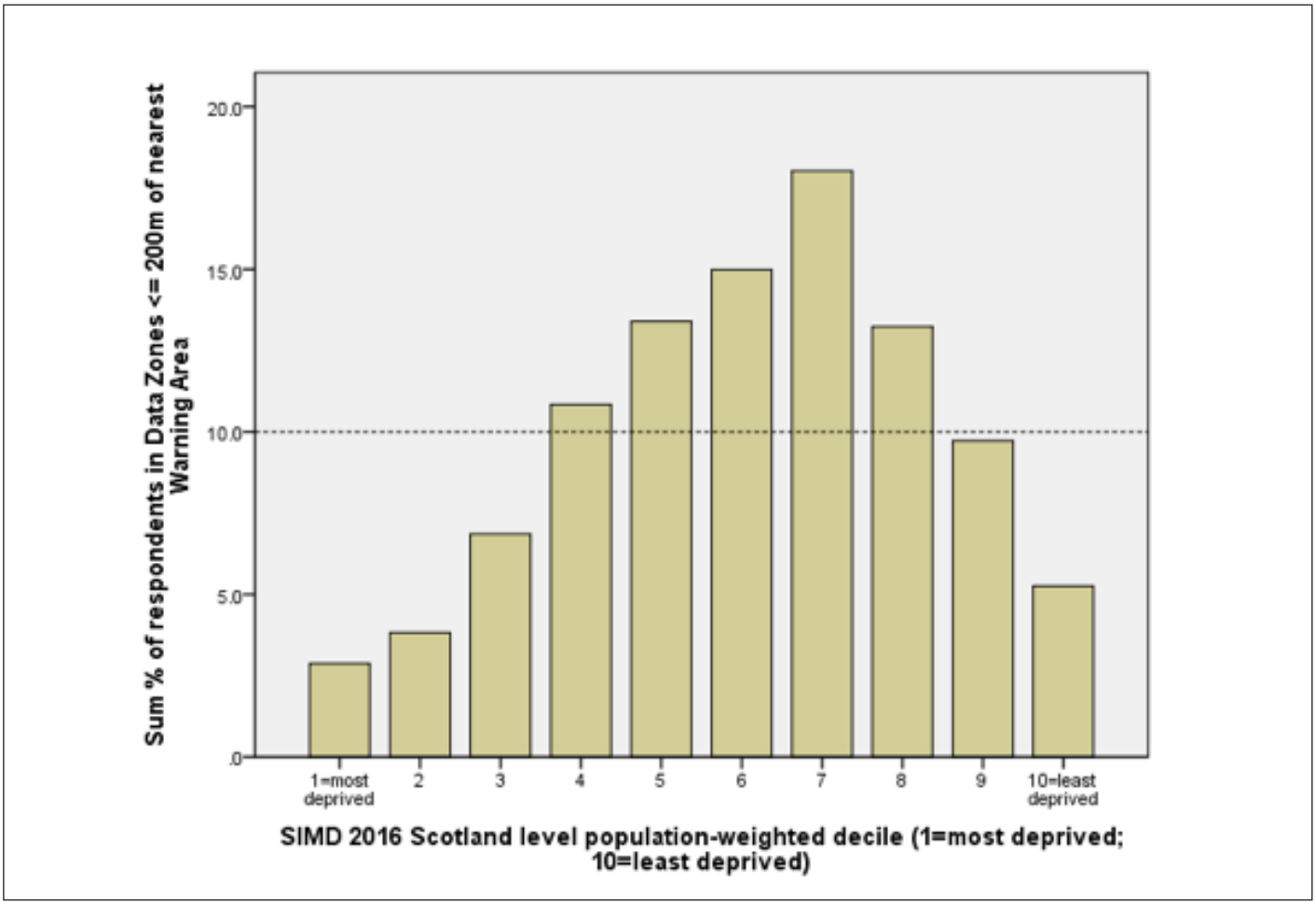


Figure 16 Distribution of survey respondents in Warning Areas, by Frequency-Impact category

Participants in local community meetings

While the customer surveys described above formed a primary focus for this study, a series of local community meetings was conducted, in parallel with the survey. An intention of these meetings was to target local communities having different exposures and experiences of flooding, as well as covering the key groups identified by SEPA.

Furthermore, an additional concern governing the selection of local communities in which the meetings were held was to avoid those which had already been approached for other flooding research projects, where 'response fatigue' may be an issue. In the interests of time, personal contacts within the communities were the primary means used to publicise the meetings and to draw attendees.

As these meetings were conducted as the surveys were themselves still in progress, it was not possible to draw on the results from the latter to inform the themes which were explored during these meetings.

Despite the low numbers of meetings held and attendees, this element of the research nevertheless enabled an important vein of discussion about the Floodline service, primarily among current service users. This discussion supplemented the results from the surveys.

Table 3 overleaf provides a summary of the areas in which the meetings were held together with a summary of types of attendees and the range of issues raised. More detail on the findings is provided in subsequent sections of this report.

Table 3 - Summary of local community meetings held

Location	Broad characteristics of area	Number attending	Characteristics	Broad findings from meeting
Menstrie, Clackmannan-shire	Alert messages generally for flood risk on the River Devon. One nearby Warning Area, Menstrie Industrial Site (LFLI), but this was not a concern for meeting attendees	7	• People interested in their homes and the community (none were Floodline customers) • No one had been badly affected by flooding	• Alerts do not apply to Menstrie • Minimal awareness of SEPA and Floodline • Floodline not advertised enough • Lack of trust in SEPA
Nethy Bridge, Highland	Covered by the Aviemore/ Dalfaber to Grantown Flood Warning area: a rural area dominated by agricultural flooding interests.	8	• Two farmers (one a Floodline customer). Both affected by flooding • Other six concerned about their homes and the community	• Messages should be more personalised • Demand for improved messaging • Demand for additional flood warning system on the River Nethy
Aviemore, Highland	Within River Spey catchment. Two local Flood Warning Areas: Aviemore/ Dalfaber to Grantown (HFLI); Aviemore and Dalfaber (MFLI), covering domestic, business and agricultural customers.	7	• A Catchment Initiative Project Officer – lives in village • A village resident – affected by flooding for over 40 years • A resident working in fisheries • Manager of Aviemore Holiday Park • Another resident had experienced regular flooding • Three are registered with Floodline	• Demand for better information from SEPA river levels website: needs to be updated more regularly • Flood Alert messages are too broad-scale – too many false alarms • Flood Warning messages aren't provided early enough and are not localised enough

Surveys of others not registered for Floodline

Although the main objective for this study was to investigate the effectiveness of Floodline among its current customer base, an attempt was also made to survey a wider section of the public who could make use of the service, but who are not currently doing so.

To give some sense of the size of this latter group, SEPA currently estimates there are around 109,000 properties in Scotland at risk of flooding , while in addition, population data included in the SIMD2016 suggests that that around 409,300 people live in or within 200m of a Flood Warning Area (equating to around 7% of the total 5.3 million Scottish population recorded in 2011). Both these figures put the 25,000 currently registered Floodline customers into perspective.

Consequently, after the customer surveys were underway, separate surveys were planned using two different versions of a similar questionnaire. One version of this questionnaire was for those who had *de-registered* from Floodline, on grounds that they had had some experience of the service, which they would be able to relate.

The other version of the questionnaire was for those who had never registered previously for Floodline. Arguably this was the more complex group to survey, in that it includes both those unaware of Floodline and those who are aware of it but who have chosen not to register. The size of the latter category is not known, yet informal evidence, such as the number of 'hits' on the Floodline website and its social media channels at the time of the 2015/2016 winter floods, suggests that numbers are likely to be substantial.

Both 'de-registered' and 'never registered' surveys were prepared on the Bristol Online System (BOS) – the same web-based platform that was used for the customer surveys. Covering notices containing a link to the surveys were then emailed to a large list compiled of contacts in local community councils, and were also disseminated via SEPA social media.

However, without a clear sampling frame of potential individual respondents, a low response was anticipated for both surveys. This was borne out with only 30 respondents to the 'never registered' survey, and only 1 respondent to the 'de-registered' survey. Neither of these is sufficient for statistical testing, and instead results from these surveys are referred to in only a cursory way in later sections of this report.

Section summary

The main focus for this section has been on assessing the sample of current Floodline customers who responded to the customer surveys.

The section discusses the intent of obtaining a survey sample which could then be used to make statistical generalisations about the Floodline customer population as a whole. It is not possible to declare with certainty that the sample meets this criterion, primarily because of the nature of the sampling frame provided for the survey.

Nevertheless, the distribution of sample characteristics is generally reasonably close to the distributions discussed in the previous section. This gives confidence that the sample captures a typical cross-section of the customer population.

The sample will contain some degree of bias if those not contacted for the survey are different in systematic ways from those who were contacted. In addition, the deprivation analysis suggest that respondents are somewhat more likely to be in areas in lower deprivation levels, i.e. less spread across a range of higher to low deprivation areas than the customer population as a whole.

[3] **For example as published on the Floodline webpage http://www.sepa.org.uk/environment/water/flooding/floodline/ (last accessed 03/05/17).**

5 Customer survey respondents characteristics

Having considered issues of sample representativeness in the previous section, here we describe the make-up of the sample in more detail. As previously, the focus here is on the sample of respondents to the three customer surveys.

The section covers an array of respondent characteristics, starting with the reasons chosen for registering for Floodline. Demographic characteristics of the sample are considered next, before attention turns to describe some basic variations in respondents' prior experience of being flooded, this being a potentially important influence on people's experience of and response to the Floodine service.

Latterly the section reports results from those survey questions which were designed to explore customers' own assessment of their flood risk, and also if they understand which tier of the service they are subscribed for. One premise for these questions was that the distinction between Flood Alerts and Flood Warnings may not be well understood, and confusion around this, coupled with self-assessment of risk, could be a source of confusion and of mismatched expectations around what the service offers.

Many such characteristics have not been incorporated into previous customer feedback surveys. Thus, although results provided here are descriptive, they nevertheless add novel insights into who is using the Floodline message service.

Reason for registering for Floodline

The first question in the customer surveys asked respondents to choose a reason that best described the reason for signing up to Floodline. Two choices were given; concern to their current home or 'other reason'.

Reponses to this question were heavily skewed towards the former:

- Approx. 950 (71%) of respondents said concern about flood risk to their current home was the reason for signing up for Floodline
- 385 respondents (29%) said that an 'other reason' was the reason they had signed up.

Those who indicated that risk to their home was their main reason were also asked to provide details on their current residence. Almost 90% of such respondents indicated that they owned their home either outright or with a mortgage, while the remainder were roughly evenly split between those renting privately and renting from a housing association (Figure 17).

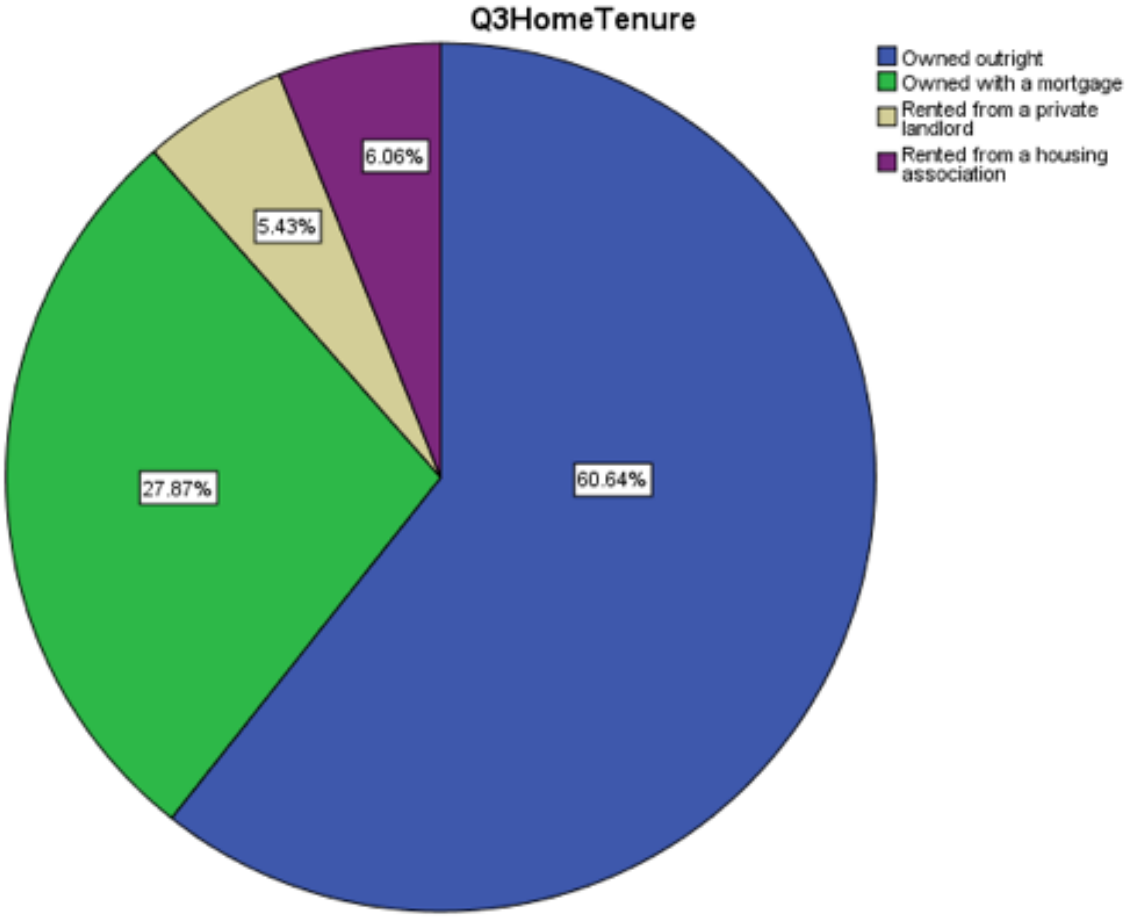


Figure 17 Breakdown of tenure status among respondents who indicated their current home was the main reason for registering for Floodline

The most common type of residences were houses, totalling 82% of the 'residential' respondents. Those in flatted properties were broadly evenly divided at roughly 7% each between those at ground floor or lower and those at first floor or above (Figure 18).

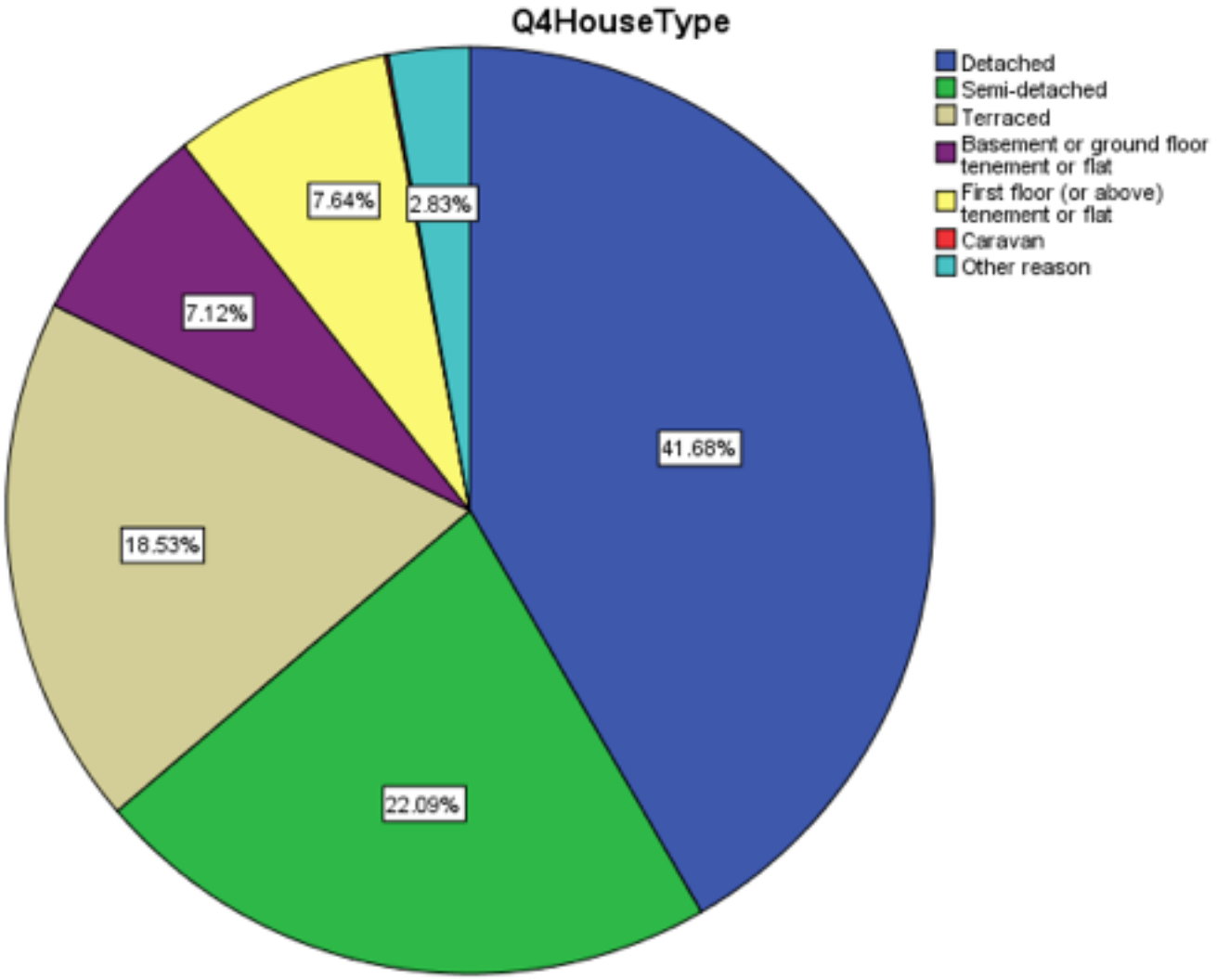


Figure 18 Breakdown of housing type among respondents who indicated their current home was the main reason for registering for Floodline

Furthermore, the majority may be described as long-term residents, with around two-thirds having lived in their current homes for 10 years or longer, and a further 20% living in their current homes for one to five years or five to 10 years (Table 4). In contrast, the numbers of respondents who had lived in their homes for a much shorter period of time, up to a year, was far smaller, only 18 in total.

Table 4 - Length of occupancy in current home, among respondents who indicated their current home was the main reason for registering for Floodline

	Q5LengthOfTime				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under 1 year	18	1.9	1.9	1.9
	Over a year but less than 5 years	178	18.6	18.6	20.5
	Over 5 years but less than 10 years	163	17.1	17.1	37.6
	10 years or more	597	62.4	62.4	100.0
	Total	956	100.0	100.0	

The subset of respondents who gave 'other reason' as the reason they had registered for Floodline were routed to a different survey question (Question 6). This question presented a range of more specific possible reasons, and respondents were asked to choose which were important to them.

The response chosen most often was 'risk to journeys you make' (68% – see Table 5), despite the service not being promoted specifically for travel purposes. The next most common responses were 'risk to services and amenities you use' and 'risk to other people you are concerned for, but who do not usually live with you'.

Other responses which were more likely to be about respondents' specific locations, included 'risk to another residential property (owned or responsible for)', 'risk to business premises (worked at or responsible for)' and 'risk to land (owned or rented)'. All of these were less commonly selected, although percentages are still relatively large, chosen by upwards of one-fifth of all the respondents who indicated that they had an 'other reason' than concern over the home for registering with Floodline.

Table 5 - Percentages of 'Other' respondents reporting different reasons for signing up for Floodline

Importance:	Another property	Business premises	Land owned or rented	Journeys made	Services & amenities	Other people	Other
Important	25.5	32.5	21.0	68.1	54.3	46.5	
Not important	70.6	64.7	72.7	30.4	40.8	48.3	
Missing	3.9	2.9	6.2	1.6	4.9	5.2	
Total	100	100	100	100	100	100	0

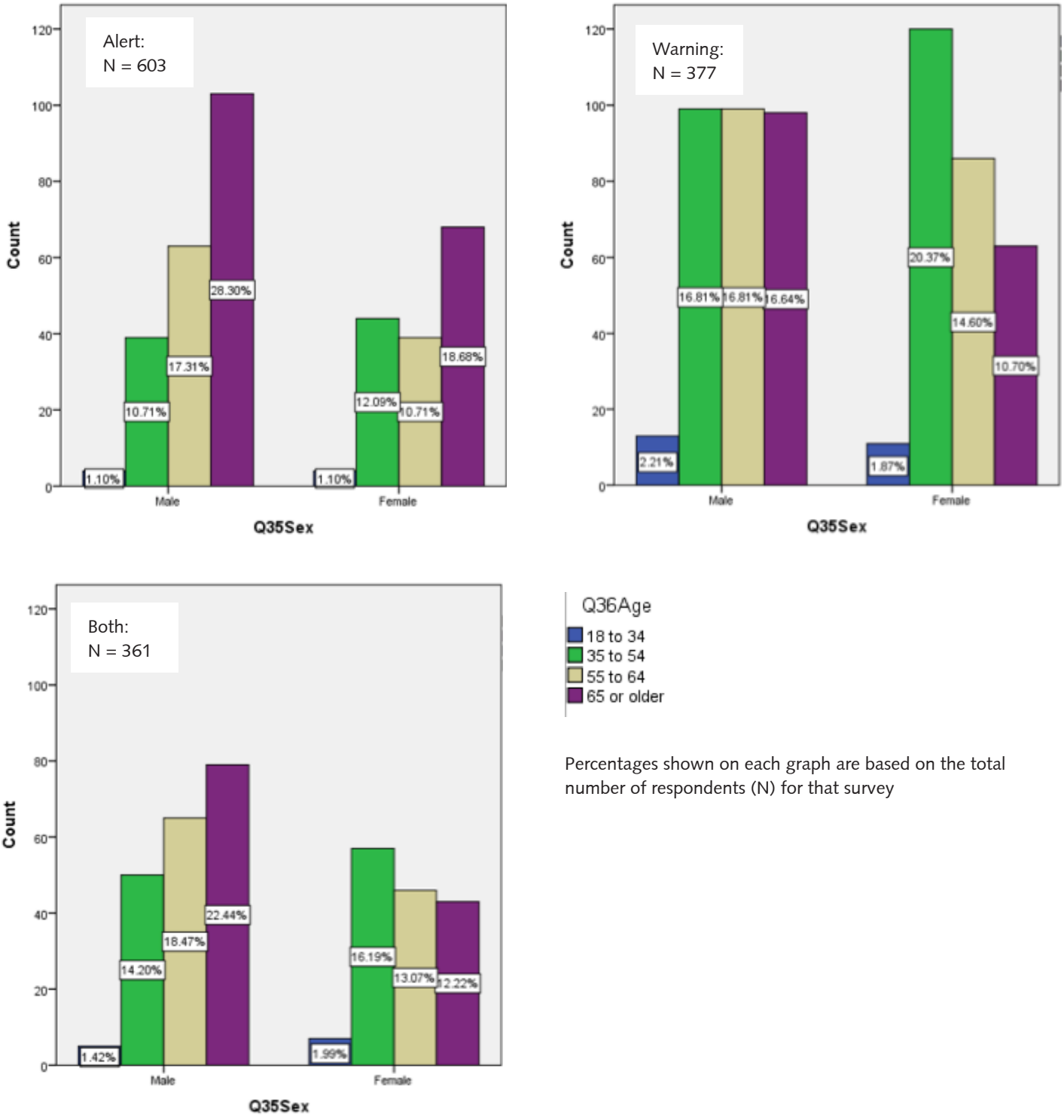
N = 385 for all columns

Demographic characteristics

Questions towards the end of the survey covered basic information on respondent sex, age, education and occupation. The questions covered all respondents irrespective of reason for signing up for Floodline.

Sex and age

Questions 35 and 36 asked respondents to give their sex and age group. Responses to those questions show that, in general, men were slightly more likely to have responded than women. However, when further broken out by age group, other interesting messages emerge (Figure 19).



Percentages shown on each graph are based on the total number of respondents (N) for that survey

Figure 19 Survey respondents by respondent sex and age group, and by survey type

First, these graphs show that by the far the lowest percentage of respondents is in the youngest age group (18-34). On the one hand, this may be because younger groups are less likely to be in a 'settled' life stage, more likely to be mobile, and less likely to be long-term owners or occupiers of properties – in all, having less motivation to register for Floodline. In addition, customers in this group are also likely to be relatively 'hard to reach', as other research has discovered (Environment Agency, 2014).

Second, an interesting reversal of gender differences is evident across the three older age groups. In the 35-54 age group, the percentage of female respondents was similar to if not greater than the corresponding percentage of males, which is an encouraging sign of the reach of the service. In contrast, however, among the 55 to 64 and 65 or older groups, there were clearly more male than female respondents.

Reasons for such a reversal may reflect a stronger tendency for older respondents to live in conventional household formations consisting of two primary adults, with decisions on signing up for Floodline having been decided by, or delegated to, the male heads of the household. However, further information on household composition is required to confirm this hypothesis.

Education and employment

Questions 37 and 38 asked respondents about their educational qualifications and employment status respectively. Both questions used standard classifications, similar to those used in the population census.

Regarding education, the majority of the respondents had qualifications at university degree level or higher (26.5% of all respondents), or professional qualifications (29% of all respondents), with the next largest groups being those with HNC or equivalent (11%), other unspecified qualifications (8%) and O/Standard Grades or equivalent (7%).

These results indicate that most respondents (55%) had high levels of educational attainment, including university degrees or professional qualifications – more so than the population in general. By way of comparison, according the 2011 population census, 26% of the Scottish population had qualifications at these levels.

In terms of occupational status, the sample respondents were dominated by two almost evenly-sized groups: those in full-time or part-time work (41% of all respondents) and retirees (41.5%), followed by self-employed (12%). Again using the national census as a yardstick shows that the percentages of respondents working and self-employed are broadly consistent with their national shares, but that the percentage of retirees is much higher (national share of 15% of all persons 16 to 74: 2011 Census).

On cross-referencing these two characteristics, it becomes apparent that the most frequent respondents across all three customer surveys were retirees who had attained professional qualifications, followed by people working full- or part-time with university degree or equivalent levels of educational qualification (Figure 20).

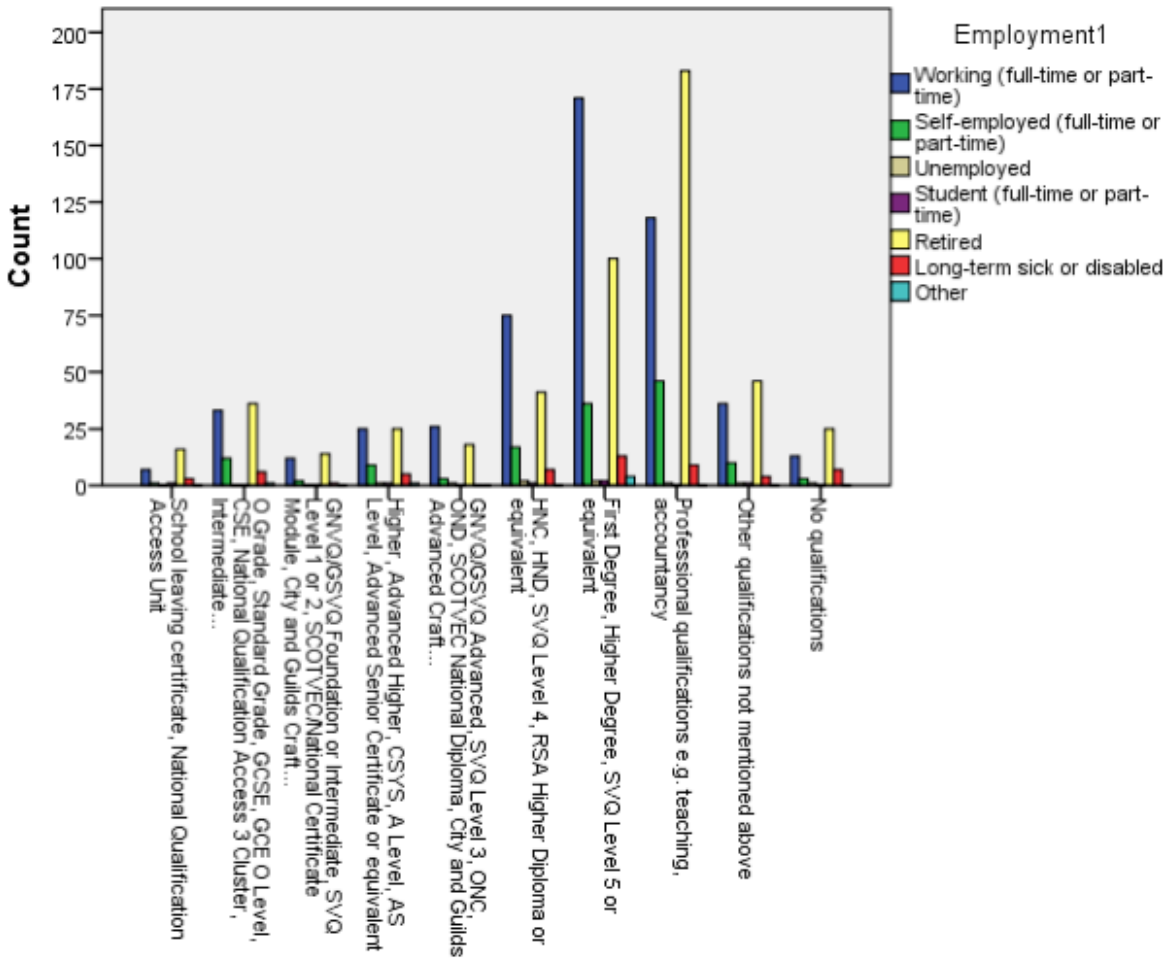


Figure 20 Breakdown of respondents across all three surveys, by educational qualifications and employment status

The 'retirees' group featured especially prominently in the Flood Alerts and Flood Warnings surveys, and the 'working' group shows strongly in the Alerts survey and the survey of those registered for both Alerts and Warnings (Figure 21).

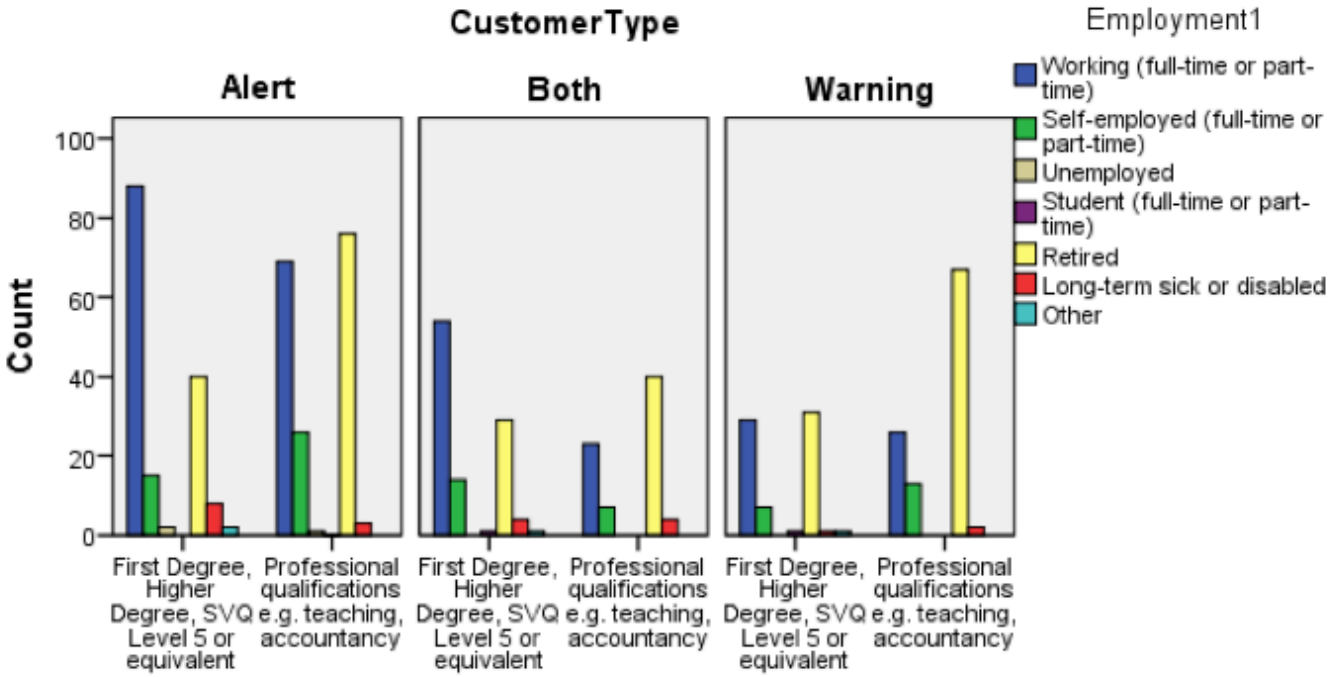


Figure 21 Counts of respondents by survey type and occupational status - limited to those with degree-level or professional qualifications

Experience of flooding among respondents

All respondents were asked about their flood experience at the location for which they had registered to receive Floodline messages (Question 7).

Patterns are very similar across both those who registered their current home as their location, and those who registered for an 'other' reason (Table 6). In both cases, over half of respondents had not experienced actual flooding at their registered location. Thus while risk of flooding may impel people towards registration (see Figure 6 in Section 3), the evidence of the influence of actually having been flooded appears more mixed.

Table 6 - Percentages of respondents by experience of flooding

Experienced flooding affecting registered location?	'Home' respondents	'Other' respondents
Yes	44.6	40.0
Not important	54.5	57.7
Missing	0.9	2.3
Total	100	100
	N=956	N=385

For those who had been flooded, follow-up questions were asked about number of times flooded, most recent flooding experience, and the impacts of flooding.

A relatively small proportion of respondents completed the question on the number of times flooded, equating to around 40% of the 'Home' respondents and 35% of the 'Other' respondents who indicated they had experienced flooding.

Most of those who responded to the question on the number of times flooded indicated that they had been flooded infrequently: 75% of 'home respondents' indicated they had been flooded either just once or twice, compared to a smaller fraction (58%) of 'Other' respondents. Putting this another way, higher percentages of 'Other' respondents had experienced more than two floods compared to 'Home respondents'. Interestingly too, some respondents in both groups gave very high values, e.g. 10 times flooded, 25 times, and even three respondents who indicated they had been flooded as many as 50 times.

For most respondents, the experience of flooding is not that recent. Almost two-thirds indicated that the most recent flood they had experienced was over a year ago, compared to one-third who said their most recent flood experience was within the past year. This breakdown was very similar for both 'Home' and 'Other' groups of respondents.

Of the 190 respondents who had been flooded in the past year, 60% had received Flood Warnings. (This was established because those individuals had responded either to Flood Warnings only survey or to the survey of those receiving both Flood Warnings and Flood Alerts). By far the majority of this subset were in Warning Areas where fluvial rather than coastal flooding had been a concern, and most (just over 40%) were concentrated in the Dee or Don Flood Warning Schemes, while 30% were in Schemes in the Borders or Dumfries and Galloway areas.

Almost all of the respondents who had indicated they had been flooded replied to the further set of questions asking them to rate their experience of specific impacts. The following summary gives the responses to these 'flood impact' questions, comparing the two main 'Home' and 'Other' respondent groups (Table 7).

Table 7 –Breakdown of respondents with flood experience by type of flood impact

$FloodImpacts_MRS*Q2Reason Crosstabulation

			Q2Reason		
			Concern about flood risk to your current home (i.e. your current residence)	Other reason	Total
FloodImpacts_MRS[a]	House	Count	219	51	270
		% within Q2Reason	51.4%	33.6%	
	Land	Count	385	116	501
		% within Q2Reason	90.4%	76.3%	
	Property	Count	202	61	263
		% within Q2Reason	47.4%	40.1%	
	Power	Count	146	37	183
		% within Q2Reason	34.3%	24.3%	
	Water	Count	72	13	85
		% within Q2Reason	16.9%	8.6%	
	Communication	Count	124	28	152
		% within Q2Reason	29.1%	18.4%	
	Access	Count	314	117	431
		% within Q2Reason	73.7%	77.0%	
	Amenities	Count	174	62	236
		% within Q2Reason	40.8%	40.8%	
	Other	Count	43	26	69
		% within Q2Reason	10.1%	17.1%	
Total		Count	426	152	578

Percentages and totals are based on respondents.

a. Group

Note - The percentages in the table are for the number in each of those groups, who had been flooded, and who indicated that each specific impact was important.

There are broad similarities in distributions across both 'Home' and 'Other' groups. Most had experienced flood water on their land ('Land' row in table), including e.g. gardens and fields, and also had had their access routes cut-off by flood waters. Not surprisingly perhaps, a higher percentage of 'Home' respondents indicated that they had experienced flood waters inside their house.

Most of these questions were concerned with the extent of flood water ingress – however over 40% of both groups indicated they had experienced actual property damage ('Property' in above table - including e.g. damage to their car or property boundary walls). Most of these were respondents who had been flooded just once, a third of whom indicated they were flooded in the past 12 months, and 73% being registered to receive Flood Warnings. Highest numbers of these customers were geocoded to the following Flood Warning Schemes: the Dee, Don, the Almond (at Perth), the Carron and the Firth of Clyde.

Customers' own assessment of flood risk

Across all three surveys there are broad similarities in the percentages of customers who assessed themselves as being at low flood risk. The table below (Table 8) shows these percentages reported against the four response categories provided in the survey, ranging from 'Not at risk' to 'Low', 'Medium' and 'High' risk.

The further results reported below are based on collapsing the four risk categories from Table 8 into just two: 'Not at risk / Low risk' and 'Medium to High risk' respectively.

Using these collapsed categories shows some differences. About two thirds of all respondents to the Alert survey indicated they were in the 'Not at risk / Low risk' category, while a third rated themselves at 'Medium risk / High risk'. This compares to nearer half (53%) of respondents to the other two surveys (customers receiving Flood Alerts) who fell into the 'Not at risk / Low risk' category, and similarly around half in the 'Medium risk / High risk' category.

The respondents who rated their flood risk as being 'High' were also far more likely to be very worried about flood risk to the property they registered with Floodline (Information about worry about flood risk was sought via survey Question 15). Over half of those customers (54%) were 'Very worried' and over a quarter were 'Worried'. Almost 80% of these were home owners, and about two-thirds (66.5%) were registered to receive Flood Warnings, according to the version of the questionnaire survey completed.

Meanwhile, 84% of all those who deemed themselves 'Not at risk' indicated they were 'Not at all worried', and only 70% of those rating themselves at 'Low risk', and 61% rating themselves at 'Medium risk' were only 'Slightly worried'.

Survey Question 17 asked respondents to rate *how well informed* they felt about risk of flooding at the property or location they had registered with Floodline.

Table 8 - Breakdown of respondents' own assessment of flood risk

Q14RateRisk * CustomerType Crosstabulation

			CustomerType			
			Alert	Both	Warning	Total
Q14RateRisk	Not at risk	Count	101	22	35	158
		% within CustomerType	16.8%	6.1%	9.3%	11.8%
	Low risk	Count	297	154	175	626
		% within CustomerType	49.4%	43.0%	46.7%	46.9%
	Medium risk	Count	146	116	112	374
		% within CustomerType	24.3%	32.4%	29.9%	28.0%
	High risk	Count	57	66	53	176
		% within CustomerType	9.5%	18.4%	14.1%	13.2%
Total		Count	601	358	375	1334
		% within CustomerType	100.0%	100.0%	100.0%	100.0%

Customers who saw themselves as being at 'Medium / High risk' were somewhat less likely to indicate that they felt 'Very well informed' than those who saw themselves 'Not at risk / at Low risk' (20% of the former compared to almost 30% of the latter). The first group was also more likely to indicate that they felt 'Not very informed' (24% compared to 15%). Overall then, there appears to be a reasonably consistent logic to respondents' rating of their level of risk, the degree of worry they express and their ratings of how informed they feel. In addition, responses to survey Question 16 would suggest perceptions of changing flood risk are an important driver of self-assessment of risk. The question asked respondents how much they felt flood risk at their registered location or property *had changed recently*[4].

Around 23% of those who felt that their flood risk had increased recently rated their risk as 'High', and 35% rated their risk as 'Medium'. Only 9% of those who regarded their flood risk as having decreased recently see themselves as being at 'High risk', although 33% indicated they were at 'Medium' risk (Table 9).

Table 9 - Perceptions of recent change in risk against self-assessed risk level

		Q16ChangeInRisk			
		Increased	Stayed about the same	Decreased	Total
Q14Rate Risk	Not at risk	3.4%	18.2%	7.9%	158
	Low risk	38.5%	50.4%	50.8%	624
	Medium risk	35.4%	22.0%	32.7%	371
	High risk	22.7%	9.3%	8.7%	174
	Total	387	686	254	1327

Do customers know which part of Floodline they are registered for?

The final aspect considered here relates to survey Question 18, asking respondents to indicate *which type of Floodline message they were registered to receive.*

However, the question did not explicitly label messages as 'Flood Alerts' or 'Flood Warnings'. Rather, in place of these, and as a test to respondents, the terms 'Messages for a broad geographic region' and 'Messages for a local specific area' were used in place of formal labels. The former of these terms was used in place of Flood Alerts, and the latter in place of Flood Warnings. Nevertheless, the terms are open to interpretation, and hence caution is required when interpreting results.

Responses to this question indeed indicate that respondents interpreted the terms in multiple ways (Table 10).

One feature evident from this table concerns the high fractions of respondents who claimed not to know how the distinction between the terms applied to them, including around a fifth of respondents to the separate Alert and Warnings surveys, and around one-tenth of those responding to the survey of those registered to receive both Alerts and Warnings.

In addition, there is clear evidence of confusion among the Alert respondents, 35% of whom incorrectly indicated that they felt they were registered to receive 'Locally specific' messages, whereas less than a quarter correctly indicated that they were registered for messages for a 'Broad region'. Larger proportions of customers for the two other surveys made a correct association between the choice of terms and their actual message registration – almost 60% of respondents to the Warning survey indicating they were registered for 'Locally specific messages' and 40% of customers registered for both types of message indicating they were registered for 'Both' terms.

For the Alert respondents, it was then possible to focus in more depth on those who either gave an answer of 'Don't' know', or who made an incorrect association with the terms given, as a result of choosing 'Locally specific' messages or 'Both' messages. Around two-thirds of this latter group had not been flooded. However, in terms of their demographic characteristics or their assessment of flood risk, or how informed they felt, they did not form a distinctive subset compared to all the survey respondents.

Table 10 - Customer type against respondents' choice of Floodline message type

Q18TypeOfMessage * CustomerType Crosstabulation

			CustomerType			
			Alert	Both	Warning	Total
Q18TypeOfMessage	Messages for a broad geographic region	Count	141	30	16	187
		% within CustomerType	23.5%	8.3%	4.2%	14.0%
	Messages for a locally specific area	Count	210	146	222	578
		% within CustomerType	34.9%	40.4%	58.9%	43.2%
	Both	Count	136	143	56	335
		% within CustomerType	22.6%	39.6%	14.9%	25.0%
	Don't know	Count	114	42	83	239
		% within CustomerType	19.0%	11.6%	22.0%	17.8%
Total		Count	601	361	377	1339
		% within CustomerType	100.0%	100.0%	100.0%	100.0%

[4] 'Recently' was not defined and rather was left open to respondents' own interpretation..

Section summary

This section shows that most respondents included in this research via the customer surveys are customers most concerned about domestic flood risk to their current homes. They are more likely to be house owners, and long-term residents.

Among respondents who are registered with Floodline for other reasons, journeys made, services and amenities and concern about other people were the most commonly cited reasons for registering.

Only a small proportion (approximately 3%) of respondents were young adults 18 to 34 years old. The percentages of male respondents can be seen to increase with age, except in the case of those registered to receive only Flood Warnings, in which case there are more similar percentages of men in age range 35 to 54, 55 to 64 and 65 or older. In the 35-54 age group there are roughly similar percentages of male and female respondents.

Consistent with the age profile, the majority of respondents were working full-time or were retirees and possessed degree or professional qualifications. Compared to the overall Scottish population, they represented a more highly-educated professional grouping.

Of those who had been flooded, most were concerned about flood risk to their home and had been flooded just once. There are some indications that multiple experiences of flooding are slightly higher among those registering with Floodline for reasons other than risks to their current home. About 40% of those who gave responses to specific flood impacts indicated they had experienced damage to their property. However, over half of respondents had not experienced flooding at their registered home or location, giving mixed support to the idea that actual experience of flooding impels people to register for Floodline.

There are broad consistencies between customers' own rating of their flood risk, how worried and informed they feel about flood risk, and views of whether and how flood risk had changed recently.

There are relatively high percentages who appear not to be aware of the distinction between Flood Alerts and Flood Warnings. Signs of potential confusion are highest among respondents who are registered for Flood Alerts, a fairly large share of whom appear to think that the message for which they are registered will contain more geographically specific information than is actually correct.

6 Customer satisfaction with the Floodline service

Survey responses given by the sample of customers together with views aired at the local meetings allowed for exploration of overall levels of satisfaction levels with the Floodline service, and about the particular aspects of the service with which customers were satisfied and dissatisfied.

This material enables the focus in this section of the report to address two of main questions from the research brief:

- Are customers happy with the service they receive?
- What information would customers like in advance?

More specifically, the main points which form the focus for this section are as follows:

1. Issues around customer overall satisfaction and Floodline message frequency;
2. Dissatisfaction over the broad-scale nature of Flood Alerts;
3. Message content and whether this conveys flood impacts well enough in terms which recipients relate to and understand.

Customer satisfaction levels

Survey Question 31 asked customers to *self-rate their satisfaction level*, while survey Question 32 was an open-ended question probing for *more information on the self-rating given* (see Appendix 3).

Results from the former paint a similar picture to that from SEPA's own previous customer feedback surveys – i.e. the starting point for the present analysis being with a generally positive message on satisfaction levels.

Overall most survey respondents indicate that they had either 'High' or 'Very High' satisfaction levels (Figure 22), equating to two-thirds of the overall sample. A quarter gave a 'Neutral' rating, while less than a tenth rated their satisfaction as 'Low' or 'Very Low'.

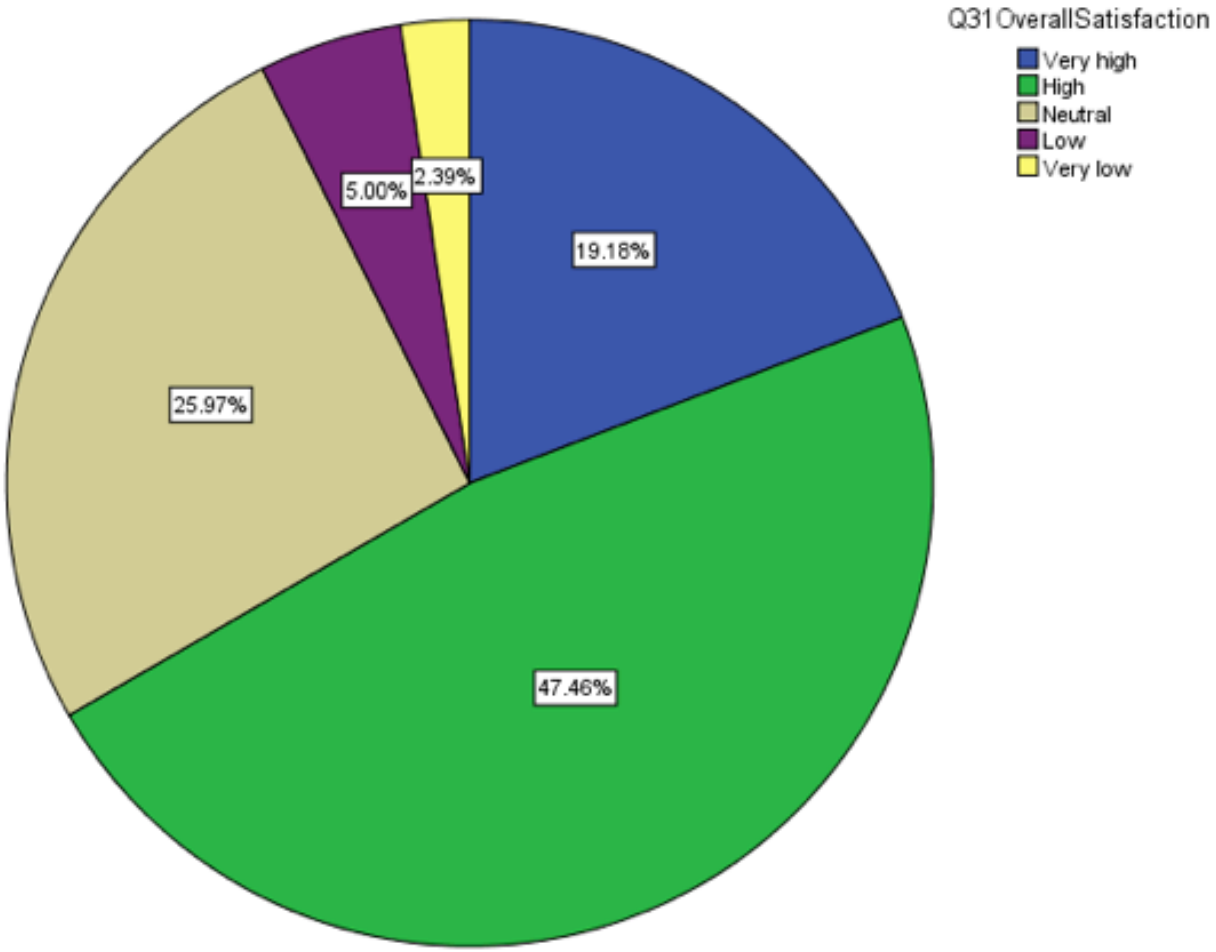


Figure 22 Customer survey respondents by overall satisfaction rating

However, there is also some evidence of differences in overall satisfaction level by customer registration type (Table 11).

Table 11 - Overall satisfaction by customer type

Q31OverallSatisfaction * CustomerType Crosstabulation

			CustomerType			Total
			Alert	Both	Warning	
Q31OverallSatisfaction	Very high	Count	130	72	55	257
		% within CustomerType	21.6%	19.9%	14.6%	19.2%
	High	Count	264	190	182	636
		% within CustomerType	43.8%	52.6%	48.4%	47.5%
	Neutral	Count	160	68	120	348
		% within CustomerType	26.5%	18.8%	31.9%	26.0%
	Low	Count	34	18	15	67
		% within CustomerType	5.6%	5.0%	4.0%	5.0%
	Very low	Count	15	13	4	32
		% within CustomerType	2.5%	3.6%	1.1%	2.4%
Total		Count	603	361	376	1340
		% within CustomerType	100.0%	100.0%	100.0%	100.0%

Note: Satisfaction ratings were available from 1340 of 1341 respondents (excluding one customer registered to receive Flood Warnings only.)

For all three customer types, only a small percentage of respondents gave an overall satisfaction rating of 'Low' or 'Very Low', with small differences between the groups. Conversely, for the next highest 'Neutral' rating category, much larger differences are evident, ranging from 19% of customers registered to receive both Alerts and Warnings, to 32% of Warning-only respondents, with 27% of Alert-only respondents giving this rating.

In addition, there was a 9% range in percentages of respondents giving a 'High' rating (44% of Alert-only respondents, compared to 53% of customers registered for both Alerts and Warnings, and 49% of Warning-only customers). There was a similar range among the percentages giving a 'Very High' rating, although the patterning of percentages in this case was different, with only 15% of Warning-only respondents giving this rating, compared to 22% of Alert-only respondents and 20% of respondents registered for both types of messages.

Warning-only respondents were somewhat more guarded in expressing their satisfaction with the Floodline service. Four-fifths in that group chose a 'High' or 'Neutral' rating, compared to around 70% of those in the two other groups. In contrast, respondents registered to receive both types of message appeared to be more satisfied, with 73% indicating their satisfaction was 'High' or 'Very High'. This is perhaps because such respondents are assured they are well covered by the Floodline service.

It should also be noted that 65% of Alert-only customers also gave a rating of 'High' or 'Very High'. Thus while some customers expressed specific complaints with the broad nature of Alerts, as discussed further below, the majority indicated they were satisfied overall with what the service provides. This level of satisfaction was confirmed in the community meetings: business owners pointed to the reassurance derived from warnings, and their particular usefulness in situations when staff may be absent from the at-risk location. Specific comments from some respondents about the need for Alerts to be more specific need to be seen in the context of these overall findings.

Satisfaction by Frequency-Impact category

Differences also emerged when the focus was narrowed to only customers registered for Flood Warnings, matched to the different categories of Warning Areas.

For the results table in this case, the overall satisfaction rating levels have been collapsed to just two, to ensure adequate minimum base totals (see Table 12 below).

Reading across Table 12 from left to right shows that the percentages of respondents in the 'High' satisfaction category taper downwards as one moves from Warning Areas classed as 'High Frequency', to those classed as 'Medium Frequency', with the lowest percentages for Warning Areas classed as 'Low Frequency'.

Taking together the three 'High Frequency' and three 'Low Frequency' categories there is an almost 20-point difference in percentages of respondents giving a 'High rating' between the 'High Frequency' and 'Low Frequency' categories (80% compared to 61%). Correspondingly, a difference of similar magnitude is also reflected in the percentages giving a rating of 'Neutral or Low' (20% of respondents in 'High Frequency' categories, compared to 39% of respondents in the 'Low Frequency' categories.

Similar grouping was also carried out on the Impact categories (i.e. comparing respondents in 'High Impact' to those in 'Low Impact' categories. However, differences in this case are much lower, with 70% of those in the 'High Impact' categories giving a 'High' rating, compared to 68% of those in the 'Low Impact' categories. For both of these category groups, 30% of respondents gave a 'Neutral or Low' rating.

Satisfaction levels in categories of Warning Areas of specific interest to SEPA are compared below (Table 13).

Given that these categories are at either end of the 'Message Frequency' spectrum, gradients in percentages similar to those above are also evident. In this case lowest percentages for 'High' satisfaction are associated with the combination of a lack of experience of being flooded at the registered home or other location, and being in a Low Frequency – High Impact Warning Area.

Table 13 - Overall satisfaction rating in priority types of Warning Areas

% indicating satisfaction level	SEPA priority categories:		
	HFLI	LFHI-Flooded	LFHI-Not Flooded
High	80.6	75	61.9
Neutral or Low	19.4	25	38.1
	N=36	N=16	N=42

Note: Satisfaction ratings were available from 58 of 59 individuals georeferenced to LFHI Warning Areas.

Table 12 - Overall satisfaction rating by Message Frequency-Flood Impact categories of Flood Warning Areas

OverallSatisfcation_2Cats * Category Crosstabulation

			Category									Total
			HFHI	HFMI	HFLI	MFHI	MFMI	MFLI	LFHI	LFMI	LFLI	
OverallSatisfcation_2Cats	High	Count	18	40	29	66	57	41	39	133	59	482
		% within Category	78.3%	80.0%	80.6%	70.2%	76.0%	75.9%	66.1%	58.6%	62.8%	67.7%
	Neutral or Low	Count	5	10	7	28	18	13	20	94	35	230
		% within Category	21.7%	20.0%	19.4%	29.8%	24.0%	24.1%	33.9%	41.4%	37.2%	32.3%
Total		Count	23	50	36	94	75	54	59	227	94	712
		% within Category	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: 'High' category includes original ratings of 'High' or 'Very High'; 'Neutral or Low' includes original ratings of 'Low' or 'Very Low'

The responses given below, help to illustrate the reasons for the relatively low satisfaction of respondents in the 'LFHI-Not Flooded' sub-group. They indicate the effect of a 'lack of practice' using the service, plus a desire for more information:

It's been too long since I used the service to give either a positive or negative response. I found the website slow to use on occasion but the summary information was helpful. I am not sure if I signed up correctly for the telephone message service, it may have been my mistake not to give my mobile number.

This service is new to me, know little about it but prevention through knowledge is priority.

However, for the entire group of respondents registered for Flood Warnings, prior experience of flooding does not appear more generally to contour differences in numbers giving a 'High' satisfaction.

Satisfaction and message frequency

More broadly it might be said that not all respondents were in the same position when it comes to judging satisfaction, because not all of them had actually received a message from the Floodline service.

When this difference is factored into the results, a slightly different picture emerges (Table 14).

This table collapses the five original satisfaction levels (see Table 11) into just three, in order to maintain reasonably large base counts.

Among customers who had received a message, 69% gave a 'High' rating (encompassing the original 'High' and 'Very High' categories). Conversely, among the minority of respondents (roughly 5%) who had yet to receive a Floodline message, around half gave a 'Neutral' or 'Low' rating. Using a simple test shows that these differences are statistically significant (Chi-Square = 11.8, $p < .01$).

Taking a closer look at the latter group of respondents shows that most (80%) were registered to receive Flood Warning messages only, and most (70%) were also in Warning Areas where message frequency had been categorised as 'Low'.

As noted, Q32 gave the opportunity to add further comment on the overall satisfaction rating. Several comments given by respondents yet to receive a message, and who gave a 'Neutral' or 'Low' satisfaction rating, indicated a rather guarded view, that judging satisfaction was impossible without having received a message, and also that messages had not been received because the respondents concerned were relatively new Floodline registrants.

However, one or two others indicated that they had been registered for much longer periods of time, and that their expectations of receiving a message at particular times had not been met. The following response exemplifies this view:

I have been registered with floodline since it began. I have not once received any message despite having to take preventative action myself to prevent water entering the veterinary surgery. I do not think that Sepa has anywhere near enough local knowledge to be of any use to us in Rothesay at all.

The issue raised here of 'enough local knowledge' is also one returned to later in this section.

The views of customers yet to receive a message might be discounted on the basis of their small numbers and lack of experience of the service. However, doing so would be to miss important information, particularly given broader evidence supporting the idea that overall satisfaction ratings are contoured by experience with the Floodline service.

As well as the question on overall satisfaction levels, a separate survey question, Question 22, asked those who had received

Table 14 –Overall satisfaction rating by experience of receiving a Floodline message

OverallSatisfaction2 * Q19MessageReceived Crosstabulation

			Q19MessageReceived		
			Yes	No	Total
OverallSatisfaction2	High	Count	836	39	875
		% within Q19MessageReceived	68.8%	50.0%	67.6%
	Neutral	Count	294	30	324
		% within Q19MessageReceived	24.2%	38.5%	25.0%
	Low	Count	86	9	95
		% within Q19MessageReceived	7.1%	11.5%	7.3%
Total		Count	1216	78	1294
		% within Q19MessageReceived	100.0%	100.0%	100.0%

These responses may be broken out in similar ways as above, with similar patterns of results. When broken out by customer type, there are no strong contrasts after discounting those who either did not respond or said they had only received one message (Table 15). Percentages indicating message frequency was 'Good' are similar to percentages giving a 'High' overall satisfaction rating.

Table 15 - Rating of message frequency by type of survey respondent

Q22RateFrequencyCORRECTED * CustomerType Crosstabulation

			CustomerType			
			Alert	Both	Warning	Total
Q22RateFrequencyCORRECTED	Good	Count	374	216	157	747
		% within CustomerType	66.5%	67.1%	61.8%	65.6%
	Neither good nor poor	Count	130	67	70	267
		% within CustomerType	23.1%	20.8%	27.6%	23.5%
	Poor - too frequent	Count	42	29	7	78
		% within CustomerType	7.5%	9.0%	2.8%	6.9%
	Poor - not frequent enough	Count	16	10	20	46
		% within CustomerType	2.8%	3.1%	7.9%	4.0%
Total		Count	562	322	254	1138
		% within CustomerType	100.0%	100.0%	100.0%	100.0%

Note: table excludes those who had received no messages, only one message, or who did not provide a response for other reasons.

When focussing only on respondents registered to receive Flood Warnings, differences are apparent when grouping Warning Areas by category of message frequency (Table 16). Here percentages rating message frequency as 'Good' are lowest in the Flood Warning Areas categorised as LF (low message frequency), at 60%, compared to 72% among those in HF (High Frequency) Warning Areas and 68% of those in Medium Frequency areas.

Table 16 - Rating of message frequency across Flood Warning Areas

Crosstab

			CategoryByFreq			
			HF	MF	LF	Total
Q22RateFrequencyCORRECTED	Good	Count	72	130	158	360
		% within CategoryByFreq	72.0%	67.7%	59.8%	64.7%
	Neither good nor poor	Count	19	40	72	131
		% within CategoryByFreq	19.0%	20.8%	27.3%	23.6%
	Poor - too frequent	Count	3	15	18	36
		% within CategoryByFreq	3.0%	7.8%	6.8%	6.5%
	Poor - not frequent enough	Count	6	7	16	29
		% within CategoryByFreq	6.0%	3.6%	6.1%	5.2%
Total		Count	100	192	264	556
		% within CategoryByFreq	100.0%	100.0%	100.0%	100.0%

Notes: HF = High Frequency of messages; MF = Medium Frequency; LF = low frequency. Same exclusions as above table apply. In addition, only respondents who could be geocoded and matched to Warning Areas are included.

Interestingly, respondents in the 'Low Frequency' Warning Areas were low, at 6%, with a similar percentage of respondents in the 'High Frequency' areas. In fact, a slightly higher percentage (7%) of respondents in the 'Low Frequency' Warning Areas indicated that messages were 'Poor – too frequent'.

However, it should also be heeded that most of the respondents included in the 'Low Frequency' Warning Areas in the previous table were in Warning Areas classed as 'Low Frequency – Medium Impact'. In contrast, just 29 of them were in the SEPA priority category of 'Low Frequency – High Impact', and a low total of 31 respondents from the table were in the other priority category of 'High Frequency – Low Impact'. These small numbers prevent clear comparison, in this case.

Nevertheless, this part of the section provides some clear messages. There is evidence that most of the survey respondents had a high satisfaction level overall with the Floodline service, and likewise that most of those who had received more than one message rated the frequency of messages as being good.

At the same time, there may be some cause for concern regarding the differences evident among respondents registered to receive Flood Warnings, specifically the lower percentages giving good ratings in Warning Areas categorised as having 'Low Frequency' of messages.

While some in this group indicated that messages were not frequent enough, a more general impression is that respondents in this group did not feel they had the experience, or practice using Flood Warnings to know if or how they would help them. Separately from this, there is also concern – albeit more among those registered for Flood Alerts – that messages are being issued too frequently to be useful. This issue is taken up below in the next part of this section.

Finally here, it is worth noting a link between geographical specificity and message frequency. In the Aviemore area for example, there was agreement among those attending the community meeting that warnings did not map onto impacts for the majority of recipients (there had been 38 warnings in 5 years), but an acceptance that the warnings were useful and accurate in addressing low-lying flooding of farmland and a golf course. Less frequent warnings would be welcomed by those in more built-up locations at higher elevations, but to continue to meet the needs of land managers might require some separate provision.

(Dis)satisfaction with Flood Alerts

One of the strongest themes to emerge – and more in the free-text survey comments than in the quantitative data – concerned the broad-scale nature of Flood Alerts. This was also confirmed in all of the community meetings.

There were just over 300 survey respondents who gave a 'Neutral' or lower satisfaction rating and who were registered to receive Flood Alerts (including both Alert-only customers and those registered for both Alerts and Flood Warnings).

Of this group, three quarters chose to use the option to add further comments on their overall satisfaction rating. Many comments were along the lines that Alerts were very (too) broad to be useful for individual customers' needs, as the sample below shows:

Handy but not specific enough

Info is too broad and is either wholly inaccurate or too late

Information is non-specific to my location

Information is quite generalised

Information needs to be more specific to the area you live in

(all quotes from Alert-only customers)

As detailed before. I need information on my area only, I can't respond to lots of messages about other areas including mine - it's far too broad

Limited experience to give a proper answer here. Only received flood alerts for Aberdeenshire previously which haven't been that helpful as this is a big area with a number of rivers. Local area info will be more helpful. In future I will be interested to see how much notice I get of a flood warning to local area.

Messages are for too a large area, so you have to go to the website, which is very unuser friendly, and vague. Also not getting any warning re flood caused by storm Desmond for our area.

Messages not area specific. Aberdeenshire covers a wide area. Have to find out info elsewhere

Need for more geo-specific info

(all from customers registered for both Alerts and Warnings).

However, other types of messages are also embedded with these comments. First, tied to the impression that Flood Alerts are very broad, some customers had simply taken to ignoring their potential utility for their own purposes. On this point, a selection of comments given on 'Medium' or 'Low' satisfaction ratings are as follows:

Almost 100% false alarms leads to ignoring them

Because I receive a "Severe Flood Warning text before seemingly each wee rain shower.

Because they send you a message every time there is heavy rain forecast which is not necessarily a flood risk

Call every time it rains hard. This property has flooded once in 35 years so it can't be in danger of flooding every other week. We don't want to be reminded of the traumatic experience of being flooded when it is not really in danger. We DO want a warning when it is genuinely in danger

(all from Alert-only customers)

Messages too often when nothing really happens, last year i had had a message about every day for months, you begin to ignore them, i would rather have them when there is a very

danger that flooding may happen instead. Messages for a very broad area and not specific to the actual town.

Too many warnings, if I took action every time I got a warning in the winter time I would never be done shifting belongings.

(customers registered for both Alerts and Warnings).

In addition, and more worryingly, the view that Alerts were there to be largely ignored also appeared to have contributed to a building sense of distrust and other criticisms over the service:

Have very little confidence in SEPA methods of measurement

I have had flood warnings and there has been no heavy rain! If I prepared every time I got a flood warning I would be very busy and would have to take a lot of time off work. Floodline doesn't really work for me but I will keep on with it as we have nothing else. I weather watch which is more help to me.

I have received roughly 6 Floodline text alerts - on none of these occasions has the river level for my house ever been near a problem. Yet, recently, when the river level was at its highest since last year's floods, I did not receive an alert.

(Alert-only customers)

The phone number never works and the txt message is too non specific. I get a txt when anywhere in Aberdeenshire is at risk so if I am away it causes anxiety. If I have wifi I check the river level which is more helpful to me.

…on the one occasion it would have been useful, no message came, hence I have lost a bit of confidence in the service

(customers registered for both Alerts and Warnings).

Some comments included more constructive suggestions, in that they signalled not just an appetite for information that was more geographically specific, but also richer in content, specifically joining up different information sources.

Here is the view of one respondent registered for Alerts and who is clearly well-versed in different information sources, and seeking to use them together:

Alerts not geographically clear enough and requires you to go to the website to see if it's relevant to you. … Given SEPA now has responsibility for safety of reservoirs and holds information on flow rates of rivers, it should be possible to provide much better coverage and information through floodline rather than have the public needing to monitor numerous sources of information to predict flooding themselves: - I currently use rain radar and sepa's river flow data to estimate loch flood potential, but as the barrage outflow is not published this is far from reliable. Combining the information that SSE holds on loch levels, with river inflow (held by SEPA) and outflow (SSE) should be able to give reliable flood information to both the transport authorities (roads and rail) and property owners who's assets are affected by water levels

It is too broad needs to be localised and offer info on how to access sandbags and door gates more easily

There has to be more joining up of weather related warnings with SEPA and the Met office, especially when the warnings are then issued. I am aware that they do talk to each other, but ….why can't there be a joint warning issued to the public? Not many of the public know where to get this information, especially if it is coming from all directions. The local emergency co-ordinating group only issues a warning when the situation is serious, would it not be better for public preparation for safety to do this in a similar joined up way nationally.

Generally speaking the views towards Floodline evident from these comments were also manifest in other, quantitative, responses. Of the 300 or so in this group, slightly more than half (52%) indicated that they did not feel very well informed, or informed at all about flood risk to their registered home or location, and only 21% of the 270 who also responded to the question rating message frequency rated it 'Good'. For survey Question 34, asking for ratings *about the timing of messages*, 30% indicated that it was 'Good' but 55% gave a rating of 'Adequate – neither good nor poor' (c. 290 respondents from the group responded to the question).

In addition, 75% of the group (around 230) gave responses to Question 24 asking if messages received *had adequately conveyed the likely impact of flooding.* Of these respondents, 51% chose the negative response 'No – the impact was not as bad as conveyed' and 15% chose the response 'No – the impact was worse than conveyed'. These results tend to support the view that Flood Alerts may involve 'crying wolf' too often, causing respondents to ignore them (see also next section).

Finally, we can also see that this group of 300 or so Alert-registered respondents who gave a 'Neutral' or lower satisfaction rating was more likely than the group of Alert-registered respondents as a whole to indicate that they did not know what type of message they were registered for (Table 17; *cf* Table 10).

Table 17 – Survey respondents registered for Flood Alerts with 'Neutral' or 'Low' satisfaction, against respondents' choice of Floodline message type

Q18TypeOfMessage * CustomerType Crosstabulation

			CustomerType		
			Alert	Both	Total
Q18TypeOfMessage	Messages for a broad geographic region	Count	61	13	74
		% within CustomerType	29.3%	13.1%	24.1%
	Messages for a locally specific area	Count	51	30	81
		% within CustomerType	24.5%	30.3%	26.4%
	Both	Count	36	35	71
		% within CustomerType	17.3%	35.4%	23.1%
	Don't know	Count	60	21	81
		% within CustomerType	28.8%	21.2%	26.4%
Total		Count	208	99	307
		% within CustomerType	100.0%	100.0%	100.0%

Note: one respondent from the group under consideration is excluded as they did not answer Q18.

The following points were raised at community meetings regarding Flood Alerts:

- Participants at the Menstrie community meeting described alert messages as irrelevant, and described the specific processes responsible for flooding there: hillslope saturation, and high flows in the Menstrie Burn which is not covered by SEPA's forecasting system.
- At Nethy Bridge, a farmer stated his distrust of the Flood Alert system, citing inaccuracy and an insufficient relevance to his own farm.
- Business representatives and local residents at Aviemore criticised flood alerts which covered all of the Spey catchment, and requested a system which would be more relevant to smaller areas within the catchment.

There was little support for the benefits of the Flood Alert service.

Satisfaction and information and changes desired

A number of questions in the survey enabled the exploration of satisfaction levels to be taken on from above, into the wider context of what additional information and changes customers indicated they would like to have.

Three open-ended questions were particularly important to such exploration. The questions were optional, and as expected response rates were relatively low, in particular among respondents registered to receive only Warning messages (Table 18).

Despite the low rates of response, replies to these questions are not without some value.

For respondents registered to receive Flood Alerts, the responses to Question 25 were dominated by the view already made plain earlier – namely, the widely-shared appetite for Alerts to provide more geographically specific information for individual customers. The same view was echoed by some customers registered for Flood Warnings only. However, the Warning-only respondents who answered Q25 also gave other types of comments. Notably, a desire for more advance messaging, i.e. earlier notification of Flood Warnings, was expressed in one form or another by several Warning-registered respondents.

Table 18 - Response rates to questions about additional information and improvements to Floodline

	% Alert respondents	% Both respondents	% Warning respondents
Q25 What could be done to improve these messages in future?	43.4	41.8	27.3
Q26 Ins there any information you do not receive from Floodline messages, the Floodline website, or the Floodline phone service that you think could be helpful?	29.2	29.4	16.7
Q33 Here is an opportunity to provide any further comments on improvements	29.7	27.7	29.2
	N=603	N=361	N=377

Along similar lines, among the Warning-only customers who answered Q23 on ratings of timing of messages received, 43% rated the timing as 'Adequate' or 'Poor'. This compared to lower percentages giving 'Adequate' or 'Poor' ratings among the two other groups (Table 19).

A second, more limited, set of comments related to the mode of communication of Flood Warnings. Such comments tended to suggest that customers are not averse to receiving messages via different communication channels. In particular, the combination of text messages with a phone call or email appeared to be welcome. Text messages appear to have a particularly important role to play as the most convenient mode of communication when internet connections are not available and because of the chances of phone calls being missed.

Responses to Questions 25 and 26 together shed light on other changes to Floodline wished for by respondents. One of the major themes here was around increasing information content on current and anticipated water levels (be this river or tidal levels). The desire for this sort of information was expressed more frequently than the desire for information on likely flood extent, or flood duration by both respondents to the Flood Alert and Flood Warning survey, although such additional characteristics were also mentioned by some.

In addition, a smaller number of respondents suggested that the risk level could be communicated more clearly, e.g. through clearer, simpler and more consistent use of a 'Red-Amber-Green' colour scheme.

Another more common theme to emerge from responses to both Q25 and Q26 was around the 'visibility' of a joined-up approach during flood events. Many of the comments connected to this theme were around what to expect from other local and frontline service providers, including local authorities and the Police. For example, messages issued for Warning recipients in the Scottish Borders indicate Scottish Borders Council sandbag sources, but this is not widely replicated for other parts of Scotland. And, while emergency responders may know their own roles, duties and chains of communication in relation to flooding events, there is some evidence that such roles and lines are not clear to the public.

Two comments here illustrate this situation:

These [Warning] *messages should be sent to the police and the council so sandbags can be prepared and delivered*

to be more joined up with local emergency services. we received amber warning and police were also involved but when we got red warning from floodline no police around

(respondents to the Warnings survey), and:

Clear links to local authorities and groups that can offer help and assistance in preventing flooding

Details of the resources deployed, their locations and likely time those resources will be tied up

(respondents to the Alerts survey).

To a large extent the responses to the last of three open-ended questions (Question 33) simply re-stated the views already given. However, the question was also used by some, as a means to express a more cynical view that Floodline was merely 'window-dressing' intended to hide a lack of investment in the 'hard' flood defence infrastructure. In other words, some still saw that they had a right to be fully protected, 'water-free', contrary to the view of having to (re-)learn how to 'live with floods'.

A final theme can be mentioned, drawing across all three questions, relating to the dynamic 'information landscape' of which Floodline is part, and which is also increasingly digital and online. A number of respondents less satisfied with Floodline indicated that their needs for information were being met better elsewhere on the Internet – e.g. the BBC weather website, or others such as

the website www.raintoday.co.uk which shows the extreme rainfall and cloud density as it moves eastwards from the Clyde Estuary on an hourly basis. It is also highly accurate

(one respondent to the Alerts survey).

To take this slightly further, the few responses to the separate survey of those who had never registered for Floodline at all can be considered, bearing in mind an extremely modest total of 30 responses. Nevertheless, among those respondents, it is clear that TV and local radio remain more preferred sources of information on potential flooding. The BBC weather website, the Met Office website, and (encouragingly) the Floodline website were also cited as information sources by around half the respondents. In contrast, very few of those respondents used SEPA social media channels (which in fact were cited

Table 19 - Ratings of message timing among respondents who had received a Floodline message

Q23RateTiming * CustomerType Crosstabulation

			CustomerType			Total
			Alert	Both	Warning	
Q23RateTiming	Good - I received the message in good time	Count	394	215	168	777
		% within CustomerType	68.3%	62.9%	56.6%	63.9%
	Aqequate (neither good not poor)	Count	163	108	113	384
		% within CustomerType	28.2%	31.6%	38.0%	31.6%
	Poor - the timing was too late	Count	20	19	16	55
		% within CustomerType	3.5%	5.6%	5.4%	4.5%
Total		Count	577	342	297	1216
		% within CustomerType	100.0%	100.0%	100.0%	100.0%

less often than 'Friends or family' as a source of information). Indeed, more Floodline use of social media, such as Twitter or Facebook, barely received mention in the comments or suggestions in the three main customer surveys. However, some comments were made on the 'conventional' Floodline website, including the clarity of the information there and e.g. making greater use of map-based visualisations that would allow users to 'zoom' from a regional to a local view.

Section summary

This section has addressed two of the three main questions posed in the research brief, concerning customer satisfaction with the Floodline service and information which customers would like in advance.

The majority of respondents in all three main customer groups indicated a 'High' or 'Very High' level of satisfaction with the current service. This ranged from 63% of respondents registered for Warnings only, to 73% of customers registered for both Alerts and Warnings, with 65% of respondents registered for Alerts only also indicating this level of satisfaction.

Nevertheless, the section has indicated issues around message frequency and experience, among survey respondents registered for Flood Warnings, and in particular around the sense of lack of geographic specificity in Flood Alerts. Customers with low message frequency showed a greater propensity for dissatisfaction than other customers.

In terms of advance information deemed helpful, more specific information in Flood Alerts, and earlier timing of Flood Warnings are the main themes.

Other themes mentioned are to do with adding information on water levels, use of text messages, development and visibility of a more joined-up approach between the public and local and frontline service providers, and developing a strong and clearer digital presence, more to do with Web than social media developments.

7 Customers' usage of Floodline messages

It may be asserted that the ultimate test for Floodline is whether its messages, once issued, contribute to enhancing their recipients' resilience to the risks and impacts posed by flooding.

Taking forward this view, this section turns to the remaining key question asked in the research brief:

What action do customers take on receipt of flood warning messages?

The literature review (see Section 2) provides information on the linkage between receipt of flood warning messages and actions taken, making clear the complexities in this. Complexity is both in variations of messaging and in personal characteristics and broader social networks. Furthermore, there is no single set of actions that can be prescribed as necessary for all recipients, although an increasing volume of material on the SEPA Floodline website outlines a range of recommended actions that would be suitable for most[5]. Consequently, those actions were incorporated into questions included in the customer survey questionnaire.

These actions may be arranged conceptually as steps on a ladder, with some (lower steps) being easier to achieve than others. For example a recent report to the Environment Agency (Environment Agency 2014) outlines a range of 'key steps' as follows: checking if ones' property is at flood risk; subscribing to the flood warning system; making a flood plan; investing in flood protection equipment; and joining a local community flood group. While all these steps are open to all to take, the first two would generally involve less overhead than the others. Thus there are questions of 'how far up the ladder' people are willing, and able, to climb – and indeed if they get on the ladder at all[6].

This section thus examines customer attitudes in relation to the following general issues:

1. In general, the importance of links between use of, and ratings of, the additional information provided via the Floodline website and phoneline and the likelihood of actions being taken on receipt of a warning message, and on the likelihood of taking preparedness steps;
2. Issues with potential inaction - especially associated with the 'cry wolf' attitude among recipients of Flood Alerts (see previous section);
3. The effect of being flooded on the likelihood of taking preparedness steps.

Attitudes and actions

One of the strongest messages coming back from the customer surveys relates to the view, especially among a relatively large number of respondents registered for Flood Alerts, that the messages being issued are not geographically specific enough. In addition, some customers indicated that messages are being issued too frequently.

[5] For example, http://www.floodlinescotland.org.uk/your-home/ (last accessed 03/05/2017).

[6] The 2014 Environment Agency report found that around one third of survey respondents took no actions - almost the same as the number taking 2 to 3 actions.

In consequence, several respondents reported that they viewed the messages with a 'cry wolf' attitude and had taken to ignoring them. A range of responses to survey Questions 32 and 25 illustrate this position:

I have had flood warnings and there has been no heavy rain! If I prepared every time I got a flood warning I would be very busy and would have to take a lot of time off work. Floodline doesn't really work for me but I will keep on with it as we have nothing else. I weather watch, which is more help to me.

I have not followed up phone messages on the website. I must try to do this in future. Warnings since I have signed up to Floodline have not been considered serious to take any preventative actions

It's a bit like cry wolf. 99% of the time the river will get high but it does not affect. Us, if we ran around doing every flood prevention for every call we would be for ever moving sand bags. So now we just use common sense.

It's usually too wide reaching and we continue to receive flood warning but never see any change in river flow. Sometimes we don't even listen to a message as it's unfortunately unfounded and a waste of resources

I am not happy about just getting a 'flood' warning. One can develop the 'crying wolf' attitude to the warning and not act when it is a serious flood. I do find myself getting blasé about the calls now.

(all respondents registered to receive Flood Alerts only).

Further evidence arose from the community meetings. One farmer in lower Speyside reported checking river levels in person every time a warning is received, even at night, but having only had to move livestock once in 5 years (38 warnings). He also reported obtaining upstream water levels directly from a reservoir operator in order to obtain an indication of what to expect in the coming hours.

Insights such as these also point to the opportunity costs involved in following-up on messages, such as time involved in arranging time off work or in moving livestock – or even simply in looking for further information. Clearly a number of respondents were making judgements on such opportunity costs, many favouring taking no action.

Beyond these attitudes, the survey provides information from respondents collectively on actions taken in response to receiving a Floodline warning or alert:

- 42% of all respondents removed vehicles on receipt of a warning
- 71% of those that stated they had bought property level protection deployed it
- 62% of those who said flooding of land was important to them moved livestock

These are important illustrations of the impact and benefit of the Floodline service.

Follow-up uses of the Floodline website and phoneline

Other survey questions enabled a means to compare what respondents actually did. This gave a basis for assessing whether the negative perceptions especially towards Flood Alerts affected actual action(s) taken.

One key dimension here stems from the fact that the Floodline messages issued by text or phone call are intended to fulfil two key functions. One of these functions is to provide recipients with an initial notification of a risk situation, while the other is to direct recipients to more detailed information provided on the Floodline website and via the Floodline phoneline.

Survey Questions 21 and 27 were included to assess how far the initial messages were achieving the latter of these two functions. Question 21 asked if respondents *had ever used the website or phoneline, <u>after</u> receiving a Floodline message* (Table 20).

Table 20 - Respondent usage of the Floodline website and phoneline after receipt of a message

Q21FloodlineServices * CustomerType Crosstabulation

			CustomerType			
			Alert	Both	Warning	Total
Q21FloodlineServices	Yes, I have used the Floodline website	Count	366	195	160	721
		% within CustomerType	63.4%	57.0%	53.9%	59.3%
	Yes, I have used the Floodline phone line	Count	16	14	8	38
		% within CustomerType	2.8%	4.1%	2.7%	3.1%
	Yes, I have used both	Count	49	56	38	143
		% within CustomerType	8.5%	16.4%	12.8%	11.8%
	No, I have used neither	Count	146	77	91	314
		% within CustomerType	25.3%	22.5%	30.6%	25.8%
Total		Count	577	342	297	1216
		% within CustomerType	100.0%	100.0%	100.0%	100.0%

Notes: table excludes primarily respondents who had not received a message, plus a few others who did not answer survey Question 21.

Responses to this question show a statistically significant difference by customer type (Chi-Square = 20.7, p <.01), with intriguingly a clear majority (63%) of respondents registered for Alerts only saying they had used the website, compared to 54% of those registered for Warnings only and 57% of those registered for both types of messages.

Those percentages contrast with the much lower percentages of respondents indicating that they had used the phoneline (3% of Alert-only and Warning-only respondents, and 4% of respondents registered for both types of message). To some degree the low percentages here will reflect the exclusion from the survey of the customers who did not have a contact email address, for whom the preferred mode of contact was by phone.

The table also shows the percentages of each customer group indicating they had used *neither* the website nor the phoneline. The highest percentage of those indicating they had used neither was for the group of respondents registered for Warnings only (31%), compared to 25% of respondents registered for Alerts only, and 22.5% of respondents registered for both types of message.

In total, 26% of respondents indicated that they had not used either the website or phone - this itself is a potentially concerning statistic, in so far as it indicates a relatively large fraction of recipients who do not seek any further 'official' information after a message is issued.

Question 27 asked recipients of Floodline messages *to rate the additional information provided via the Floodline website and the phoneline*. Given the low numbers indicating that they had used the latter, the focus here is on ratings of the website only (Table 21).

Results here show a high overall level of satisfaction with the website (70%), with a slightly lower percentage of Alert-only customers being prepared to give a rating of 'Good/Very Good' compared to the two other groups, and with a higher percentage also giving a rating of 'Neutral' or lower.

Information from the Aviemore community meeting is relevant here, revealing that some message recipients refer to the SEPA river levels web pages to access more locally specific information. Some frustration was expressed in relation to one event in which that website was not updated for a number of hours – given that some participants use latest river levels from that source to decide on responses. Evidently there is good local knowledge about critical levels and typical travel times. SEPA's recently launched rainfall website providing near real-time data at http://beta.sepa.org.uk/rainfall is expected to be of value to savvy web users.

Wider spin-out of actions following from Floodline messages

The above analysis can be pursued further by drawing in responses to survey Question 28, which gave a list of actions that customers might take in response to a notification of flood risk. This list included, and was primarily based on, actions recommended on the SEPA website.

In total, the list included 14 differing actions plus one generic 'Other action' category. However, there are similarities between a number of actions, such as 'Made or checked you had a list of key phone numbers' and 'Made sure your mobile phone was charged', or similarly between 'Moved important documents to a safe place', and 'Moved valuable possessions' to a safe place.

Furthermore, not all of the actions on this list would apply to all types of Floodline customer. Differences between each of the three main customer types and also among each type are to be expected, with actions taken dependent very much on particular flood risk situation, as well as on customer attitudes. However, Question 28 did not specify whether the consideration of actions taken should be confined to any particular situation – it simply asked respondents if they had taken an action following any Floodline message they had received.

Responses across the list of actions included in Question 28 are compared between two different groups: those who had used the additional Floodline information (the Floodline website, phoneline or both of these) against those who had used neither (Table 22).

Table 21 - Rating of information on Floodline website by customers who had received a message

Q27_1RateWebsite_2Cats * CustomerType Crosstabulation

			CustomerType			Total
			Alert	Both	Warning	
Q27_1RateWebsite_2Cats	Good/Very good	Count	389	262	207	858
		% within CustomerType	67.3%	76.4%	69.7%	70.4%
	Neutral/Poor/Very poor	Count	115	41	40	196
		% within CustomerType	19.9%	12.0%	13.5%	16.1%
	Never used	Count	74	40	50	164
		% within CustomerType	12.8%	11.7%	16.8%	13.5%
Total		Count	578	343	297	1218
		% within CustomerType	100.0%	100.0%	100.0%	100.0%

Notes: table excludes primarily respondents who had not received a message

Table 22 - Actions taken by respondents after receiving a Floodline message based on use of the Floodline website and phoneline

$Q28_ActionsTake_Rcd_MRS*Q21FloodlineServices_2Cats Crosstabulation

			Q21FloodlineServices_2Cats_UsedNotUsed		
			Used neither	Used Floodline website/phoneline/both	Total
Q28_ActionsTake_Rcd_MRS[a]	Q28_1FloodKitRcd	Count	38	253	291
		% within Q21FloodlineServices_2Cats	17.8%	32.2%	
	Q28_2KeyPhoneNumbersRcd	Count	64	357	421
		% within Q21FloodlineServices_2Cats	29.9%	45.4%	
	Q28_3ChargedPhoneRcd	Count	139	582	721
		% within Q21FloodlineServices_2Cats	65.0%	74.0%	
	Q28_4PhonedForAssistanceRcd	Count	23	171	194
		% within Q21FloodlineServices_2Cats	10.7%	21.8%	
	Q28_5MovedDocumentsRcd	Count	66	331	397
		% within Q21FloodlineServices_2Cats	30.8%	42.1%	
	Q28_6ValuablePossessionsRcd	Count	53	290	343
		% within Q21FloodlineServices_2Cats	24.8%	36.9%	
	Q28_7MovedAnimalsRcd	Count	23	157	180
		% within Q21FloodlineServices_2Cats	10.7%	20.0%	
	Q28_8MovedVehicledRcd	Count	62	315	377
		% within Q21FloodlineServices_2Cats	29.0%	40.1%	
	Q28_9TurnedOffPowerRcd	Count	10	93	103
		% within Q21FloodlineServices_2Cats	4.7%	11.8%	
	Q28_10FloodProtectionRcd	Count	58	280	338
		% within Q21FloodlineServices_2Cats	27.1%	35.6%	
	Q28_11CheckedOnOthersRcd	Count	86	391	477
		% within Q21FloodlineServices_2Cats	40.2%	49.7%	
	Q28_12SafeExitRcd	Count	79	353	432
		% within Q21FloodlineServices_2Cats	36.9%	44.9%	
	Q28_13CheckedRoadsRcd	Count	133	533	666
		% within Q21FloodlineServices_2Cats	62.1%	67.8%	
	Q28_14VacatedPropertyRcd	Count	11	103	114
		% within Q21FloodlineServices_2Cats	5.1%	13.1%	
	Q28_15OtherRcd	Count	2	35	37
		% within Q21FloodlineServices_2Cats	0.9%	4.5%	
Total		Count	214	786	1000

Percentages and totals are based on respondents.

a. Dichotomy group tabulated at value 1.

Note: table includes only respondents who said that they had taken one or more of the stipulated actions.

On comparing percentages in the two main columns, this shows that the percentages of respondents indicating they had taken each action were higher among those using the Floodline website, phoneline or both than among those saying they had used neither the website nor the phoneline.

For some actions, the percentages of users of the Floodline website/phoneline are double or higher than the group using neither. This includes the actions of having prepared a flood kit, phoning for assistance, moving animals, turning off power supplies, vacating the property, and other actions taken. Meanwhile, greatest similarities between the groups were for actions including ensuring mobile phones were charged, checking roads, checking safe exits, and checking on other persons who might need assistance.

The actual percentage values (as opposed to differences) indicate which actions are taken most frequently, and which less frequently. Among website/phoneline users, the most frequent actions taken are: ensuring the mobile phone was charged (74%; *cf* 65% among non-users), checking if local roads and transport networks were affected (68%; non-users 62%), checking on others (50%; non-users 40%), making or checking a list of key phone numbers and checking if there was a safe exit (both 45%; non-users 30% and 27% respectively), moving documents (42%; non-users 31%) and moving vehicles (40%; non-users 29%). Use of flood protection on a respondent's property – including sandbags or other products – was an action cited by 36% of website/phoneline users, and 27% of non-users.

Conclusions from this comparison are first that there are similarities in the most common actions respondents said they had taken after they had received a Floodline message, whether or not they had used the Floodline website and/or phoneline. The patterning of percentages suggests that some actions are clearly deemed more important and/or are easier to take than are others. Secondly, greater percentages of the website/phoneline users have taken actions than non-users. This is a generally positive message.

However, a core issue here, which is more difficult to unravel, is whether it is the effect of the additional information provided by the website/phone, and/or consulting that information, which contributes to increasing the odds of taking action. Alternatively, it could be that the 'user' group is generally more concerned, and more likely to take action anyway. To try to answer this, another version of the previous table was prepared, comparing groups based on responses to Question 27 asking respondents *to rate the information on the Floodline website and phone service.*

In this case the original response categories were collapsed to just two - one category for respondents who rated both the website and phoneline as 'Very good' or 'Good', who may be thought of as including the group most likely to heed seriously the information provided via the website and phoneline, and more likely to be influenced by it. The second category contained all other respondents who provided lower ratings of both the website and phoneline. Those who had never used either the Floodline website or phone were omitted.

The new table resulting from this selection is provided below (Table 23).

Table 23 - Actions taken by respondents after receiving a Floodline message based on ratings of the Floodline website and phoneline

$Q28_ActionsTake_Rcd_MRS*Q271_2Combined Crosstabulation

			Q21FloodlineServices_Q27_WebsitePhonlineRatingsCombined		
			Lower rating combinations	Good/Very good rating of both Floodline website & phoneline	Total
Q28_ActionsTake_Rcd_MRS[a]	Q28_1FloodKitRcd	Count	126	127	253
		% within Q271_2Combined	27.9%	38.0%	
	Q28_2KeyPhoneNumbersRcd	Count	179	178	357
		% within Q271_2Combined	39.6%	53.3%	
	Q28_3ChargedPhoneRcd	Count	315	267	582
		% within Q271_2Combined	69.7%	79.9%	
	Q28_4PhonedForAssistanceRcd	Count	91	80	171
		% within Q271_2Combined	20.1%	24.0%	
	Q28_5MovedDocumentsRcd	Count	168	163	331
		% within Q271_2Combined	37.2%	48.8%	
	Q28_6ValuablePossessionsRcd	Count	149	141	290
		% within Q271_2Combined	33.0%	42.2%	
	Q28_7MovedAnimalsRcd	Count	73	84	157
		% within Q271_2Combined	16.2%	25.1%	
	Q28_8MovedVehicledRcd	Count	163	152	315
		% within Q271_2Combined	36.1%	45.5%	
	Q28_9TurnedOffPowerRcd	Count	38	55	93
		% within Q271_2Combined	8.4%	16.5%	
	Q28_10FloodProtectionRcd	Count	145	135	280
		% within Q271_2Combined	32.1%	40.4%	
	Q28_11CheckedOnOthersRcd	Count	211	180	391
		% within Q271_2Combined	46.7%	53.9%	
	Q28_12SafeExitRcd	Count	186	167	353
		% within Q271_2Combined	41.2%	50.0%	
	Q28_13CheckedRoadsRcd	Count	307	226	533
		% within Q271_2Combined	67.9%	67.7%	
	Q28_14VacatedPropertyRcd	Count	44	59	103
		% within Q271_2Combined	9.7%	17.7%	
	Q28_15OtherRcd	Count	21	14	35
		% within Q271_2Combined	4.6%	4.2%	
Total		Count	452	334	786

Percentages and totals are based on respondents.

a. Dichotomy group tabulated at value 1.

Note: table includes only those respondents who indicated they had used the Floodline website or phoneline, and those giving valid responses across all action categories

For almost all of the actions, percentages taking the action were higher among the group who had rated the Floodline website and phoneline as 'Good' or better, although the differences in percentages compared to the alternate group are much smaller in this case than for the previous table. In turn, this lends some weight to the idea that consulting the information on the Floodline phoneline and website has a positive effect on prompting people to take actions, after receiving a Floodline message. However, we cannot rule out other factors, such as general differences in levels of concern. In terms of frequency of taking actions, the ordering from most frequently taken to least is much the same as in the previous table.

To round out this part of the analysis, percentages taking actions are compared across the three main customer types – those registered for Flood Alerts only, those registered for Flood Warnings only, and those registered for both. Two tables are given, the first reporting the percentages of action taken by respondents within each customer group, irrespective of whether they had used either the Floodline website or phoneline, after receipt of a message (see Table 24 below).

Comparing percentages across columns illustrates slight differences in the propensity with which actions are taken by different types of customer. For each individual action, the percentage taking it is lowest for those registered to receive only Alerts, and is greatest among those registered to receive both Alerts and Warnings. Such a balance of differences is anticipated, given that Alerts and Warnings are designed to provide different levels of information, and at different levels of geographical specificity. However, it may also point to the corrosive influence of negative attitudes towards Flood Alerts feeding through to lowering the odds of actions being taken.

Greatest differences in percentages related to the action of having 'Vacated your property', having 'Turned off all power supplies' (also including water supplies), having taken 'Other' actions and 'Moving vehicles to a safer area'. Respondents registered for Flood Alerts only were much less likely to have taken those actions than other customers. There were also relatively large differences on other actions, including having used flood protection equipment, moved valued possessions, and phoned for assistance.

Table 24 - Actions taken by respondents after receiving a Floodline message, within each main customer type

$Q28_ActionsTake_Rcd_MRS*CustomerType_Cd Crosstabulation

			CustomerType using NumericCodes			
			Alert	Both	Warning	Total
Q28_ActionsTake_Rcd_MRS[a]	Q28_1FloodKitRcd	Count	119	91	81	291
		% within CustomerType_Cd	25.2%	32.6%	32.3%	
	Q28_2KeyPhoneNumbersRcd	Count	174	130	117	421
		% within CustomerType_Cd	36.9%	46.6%	46.6%	
	Q28_3ChargedPhoneRcd	Count	333	206	182	721
		% within CustomerType_Cd	70.6%	73.8%	72.5%	
	Q28_4PhonedForAssistanceRcd	Count	71	66	57	194
		% within CustomerType_Cd	15.0%	23.7%	22.7%	
	Q28_5MovedDocumentsRcd	Count	151	138	109	398
		% within CustomerType_Cd	32.0%	49.5%	43.4%	
	Q28_6ValuablePossessionsRcd	Count	127	119	98	344
		% within CustomerType_Cd	26.9%	42.7%	39.0%	
	Q28_7MovedAnimalsRcd	Count	79	55	46	180
		% within CustomerType_Cd	16.7%	19.7%	18.3%	
	Q28_8MovedVehicledRcd	Count	134	124	120	378
		% within CustomerType_Cd	28.4%	44.4%	47.8%	
	Q28_9TurnedOffPowerRcd	Count	29	44	31	104
		% within CustomerType_Cd	6.1%	15.8%	12.4%	
	Q28_10FloodProtectionRcd	Count	122	118	99	339
		% within CustomerType_Cd	25.8%	42.3%	39.4%	
	Q28_11CheckedOnOthersRcd	Count	208	135	135	478
		% within CustomerType_Cd	44.1%	48.4%	53.8%	
	Q28_12SafeExitRcd	Count	170	130	132	432
		% within CustomerType_Cd	36.0%	46.6%	52.6%	
	Q28_13CheckedRoadsRcd	Count	325	175	167	667
		% within CustomerType_Cd	68.9%	62.7%	66.5%	
	Q28_14VacatedPropertyRcd	Count	23	56	36	115
		% within CustomerType_Cd	4.9%	20.1%	14.3%	
	Q28_15OtherRcd	Count	13	15	9	37
		% within CustomerType_Cd	2.8%	5.4%	3.6%	
Total		Count	472	279	251	1002

Percentages and totals are based on respondents.

a. Dichotomy group tabulated at value 1.

Note: table includes only respondents giving valid responses across all action categories (table rows)

Second, the other table produced shows only the difference in percentages, between those reported in the body of the previous table, and those for a different version of the table, produced when the selection of respondents is narrowed to include only those who indicated in Questions 21 *that they had used the Floodline website/phoneline/both, after receiving a message* (Table 25).

Table 25 - Differences in percentages taking action by customer type (percentages across respondents saying they used the Floodline website and/or phoneline after receiving a message, less percentages across all respondents)

Action	Alert	Both	Warning
Q28_1FloodKitRcd	3%	3%	3%
Q28_2KeyPhoneNumbers	4%	1%	6%
Q28_3ChargedPhone	3%	1%	1%
Q28_4PhonedForAssistance	1%	2%	4%
Q28_5MovedDocuments	1%	1%	6%
Q28_6ValuablePossessions	1%	2%	7%
Q28_7MovedAnimals	2%	1%	4%
Q28_8MovedVehicled	0%	2%	6%
Q28_9TurnedOffPower	1%	2%	2%
Q28_10FloodProtection	2%	1%	3%
Q28_11CheckedOnOthers	2%	3%	1%
Q28_12SafeExit	1%	3%	2%
Q28_13CheckedRoads	2%	1%	1%
Q28_14VacatedProperty	1%	2%	3%
Q28_15Other	1%	1%	1%

All values in the body of this table are low positive values. In turn this shows that, across all three customer types, the percentages taking actions are slightly higher among the subset of respondents who said they had used the Floodline website, phoneline or both than among all respondents who indicated that they had taken some actions.

The largest differences are evident for customers receiving Warnings only. For example, in the subset using the website/phoneline/both, 50% indicated that they have moved documents, compared to 44% of all Warning-only customers taking actions. Similarly, 46% of the former subset had moved valuable possessions, compared to 39%.

Preparedness for flood risk

Survey questions 11 to 13 were included to find out about Floodline customers' *preparedness for dealing with flood risk*. Question 11 asked *whether they had taken each of a number of different preparedness steps*, while Question 12 and 13 asked about *awareness of, and participation in, local flood action groups*.

The range of preparedness steps in Question 11 again centred on those which SEPA recommends. However, we must be aware that customers may have taken any preparedness measures independent of whether or not they had consulted those recommendations.

Responses to these questions are compared first against a range of background characteristics (Table 26). The table shows that the most frequently reported steps are 'Know how to shut off gas, electricity or water supplies' and 'Ensured you had adequate insurance cover for flooding'.

Labelling the first of these as a deliberate preparatory step is somewhat questionable, and goes to explain why it was selected by most respondents, as knowing how to shut off supplies is more likely to be something they know anyway. Furthermore, the percentages taking this preparatory step can be contrasted with much lower percentages that indicated they actually turned off supplies after receiving a Floodline message (*cf* Tables 22-24).

The percentages reporting they had adequate insurance are also encouragingly high, although there are somewhat lower percentages for those in the youngest group (18-34), among those renting, and among those who indicated that a property or location other than their current home was their main reason for registering for Floodline.

Between one-third and 45% of respondents indicated that they had 'Prepared a Flood Plan', including a list of actions they would take on receipt of a flood warning message, and the percentages reporting they had 'Obtained and know how to install sandbags or flood protection products appropriate for your registered property' were also similar to this. Around one-third of respondents indicated that they had 'Prepared a special Flood Kit for your registered property (e.g. torch, medication, insurance details)'.

The step of having 'Provided information on flood risk to others at registered locations (e.g. employees, tenants, visitors)' was relatively high among those who said they were registered with Floodline for a reason other than their current home location (35%). Curiously this step was also reported to have been taken by a relatively high 39% of those aged 18-34.

Other actions involving making alterations to buildings or other parts of property were selected by smaller numbers of respondents. Not surprisingly, the percentages of home owners taking these steps were higher than those renting their homes, and percentages were also higher among those indicating they had registered with Floodline because of concern about their current home than those who had registered for other reasons.

Between 20 to 25% said that they were aware that a local flood action group existed in their local area. The smallest percentages of those aware were in areas of high multiple area deprivation, classed as being in Data Zones in the top four national deciles on the SIMD16. Of those respondents who were aware of a local flood action group, roughly between a quarter and a third participated. Those participating were more likely to be male than female, and possess a high level of qualifications. In contrast, only 10% of those in areas of high deprivation who were aware of a local action group participated.

Table 26 - Percentages of respondents taking flood preparedness steps by general background

% already done	Sex		Age				Qualifications		Deprivation		Customer type		Tenure	
	M	F	18-34	35-44	45-64	65+	High	Low	High	Low	Home	Other	Owned	Rented
Base counts	*687*	*553*	*39*	*394*	*385*	*441*	*677*	*544*	*238*	*919*	*929*	*340*	*811*	*115*
Prepared a plan	38.4	36.5	35.9	38.3	36.6	37.2	32.2	43.6	31.9	37.6	37.6	36.2	36.4	45.2
Obtained protection products	37.6	38.7	28.2	37.6	37.1	40.1	34	42.6	39.5	37.5	40.6	30.9	40.7	39.1
Prepared kit	33.6	30.9	23.1	31.2	31.9	35.1	27.9	37.3	33.2	32.3	34.1	27.4	33.8	36.5
Know supply shut-offs	86.5	78.8	66.7	82	84.9	84.1	82	84.9	82.4	84.3	85.3	77.6	85.9	80
Listed contact numbers	49.2	47.4	43.6	51.5	48.6	45.6	45.3	52.8	50.4	47.4	46.4	53.5	45	55.7
Adequate insurance	79	80.3	69.2	77.7	79	82.3	78	81.8	80.3	80.3	83.7	67.9	85.3	73
Altered buildings	11.8	11.6	7.7	12.7	11.7	11.3	13.4	9.9	8.4	13.1	12.2	10.6	12.9	7
Altered property	17.2	13.6	12.8	15.2	15.8	15.9	16.4	14.3	8.4	18.1	16.3	13.5	17.5	7.8
Provided others info	24.5	20.8	38.5	25.1	22.3	20.2	22.2	24.1	27.3	20.9	18.5	34.7	17.8	23.5
Other	6.8	5.2	2.6	5.1	6.8	7	7.2	5.3	5.9	6.6	5.1	9.4	5.3	3.5
Base counts	*712*	*586*	*43*	*414*	*404*	*459*	*714*	*565*	*250*	*958*	*948*	*384*	*824*	*122*
Awareness of local flood group	20.9	26.3	25.6	23.9	21.5	23.5	19.9	27.1	16	23.8	22.5	24.5	22.5	21.5
Base counts	*148*	*154*	*11*	*99*	*86*	*108*	*141*	*153*	*40*	*227*	*213*	*93*	*185*	*26*
Aware and participate in local flood group	37.2	24.7	18.2	35.4	33.7	26.9	36.9	27.5	10	35.2	31.5	32.3	31.9	26.9

Notes: Percentages in top segment of table include respondents without missing responses for any actions in that segment. Percentages in bottom segment included respondents without missing responses to either question.

Table 27 - Percentages of respondents taking flood preparedness steps by flood experience and categorised by Flood Warning Area

% already done	Been flooded?		When flooded?		Flood Warning Areas by Frequency			Flood Warning Areas by Impact			Flood Warning Areas: SEPA priority categories		
	Y	N	Past 12 mos	Older	High	Med	Low	High	Med	Low	HFLI	LFHI-Flooded	LFHI-Not Flooded
Base counts	*570*	*682*	*184*	*375*	*101*	*220*	*364*	*170*	*336*	*179*	*33*	*16*	*41*
Prepared a plan	53.2	24	56.5	52.3	49.5	43.2	34.3	40.6	37.2	42.5	48.5	37.5	17.1
Obtained protection products	57	22	55.4	58.4	38.6	49.5	39.6	41.2	39	50.8	33.3	37.5	12.2
Prepared kit	42.3	23.8	42.9	42.9	35.6	41.8	27.5	35.9	30.4	36.3	36.4	12.5	19.5
Know supply shut-offs	83.2	83.3	82.1	83.6	82.2	84.1	79.9	83.5	81.3	80.4	75.8	75	75.6
Listed contact numbers	57	40.8	60.3	55.2	55.4	58.2	41.2	48.2	45.2	55.9	60.6	43.8	26.8
Adequate insurance	80.5	78.9	79.9	81.2	73.3	88.2	77.5	82.4	79.8	79.3	75.8	81.3	78
Altered buildings	21.2	3.7	25	19.6	13.9	17.3	10.2	10	11.9	17.9	12.1	6.3	4.9
Altered property	25.4	7.5	25.5	26	20.8	16.4	13.5	9.4	13.7	24.6	27.3	12.5	2.4
Provided others info	32.6	14.7	28.3	34.3	33.7	27.7	18.7	19.4	21.7	31.8	36.4	31.3	9.8
Other	7.9	4.7	8.2	8	7.9	3.6	7.4	6.5	6	6.7	3	6.3	12.2
Base counts	*576*	*738*	*190*	*374*	*108*	*222*	*373*	*172*	*348*	*183*	*36*	*15*	*41*
Awareness of local flood group	34.4	14.4	41.1	31	25	27.9	24.4	31.4	19.3	32.2	13.9	20	9.8
Base counts	*197*	*106*	*78*	*115*	*27*	*62*	*90*	*54*	*67*	*58*	*5*	*3*	*4*
Participate in local flood group	38.6	18.9	37.2	40	29.6	22.6	36.7	22.2	28.4	41.1	20	33.3	50

Notes: see notes from previous table. In addition, Flood Warning Area columns including only respondents geocoded to those areas.

An additional table compares reporting of preparedness steps against *experiences of flooding*, and also across *those located in Flood Warning areas* (Table 27).

Comparing this to the previous tables shows there are comparably high numbers of respondents indicating they knew how to shut off supplies of electricity, gas and water, and who said they had adequate flood insurance. Regarding the percentages that had prepared a flood plan, had prepared a flood kit, and had flood protection products, clear differences can be seen in the higher percentages among those who had been flooded, compared to those who had not. Over half of flooded respondents said that they had prepared a plan, and obtained flood protection, while 42% said they had prepared a flood kit. These figures are more than twice the corresponding fractions of those not flooded who said they had taken these steps.

There were less clear differences in percentages indicating they had taken such steps among those flooded in the past 12 months compared to those who had experienced flooding less recently than this. Similarly, differences are smaller among the respondents in Flood Warning Areas categorised either by low, medium or high levels of Message Frequency, or by low, medium or high Flood Impacts. Some noticeably low percentages are evident across the SEPA-stipulated priority Warning Area categories. However, these are likely to be anomalies, due to the small base figures in those categories on which percentages are based.

Regarding the step of providing information to others, the highest percentages reporting this were among those who had been flooded (33% compared to 14% not flooded), and those in Flood Warning Areas classed as High Frequency, including those in Warning Areas in the specific category of High Frequency-Low Impact (HFLI).

Around 20-25% of respondents who had been flooded indicated they had made alterations to their properties, with roughly even splits between those who had been flooded in the

last 12 months and less recently. Across all the Warning Area categories, highest percentages were evident among those in areas categorised as having high message frequency and those where flood impacts were low (around 25% in both cases). Similarly 27% of those in the High Frequency-Low Impact category indicated they had altered their property.

Higher percentages of those who had experienced flooding than those who had not were aware of a local flood action group. The highest percentage was among those who had experienced flooding recently (41%). About 40% of those who had experienced flooding and who were aware of a local action group actually participated, against only 19% of those who had not been flooded, but who were aware of a local group.

One conclusion here relates to the apparent positive effect the experience of being flooding has on the likelihood of taking preparedness steps. The experience of having been flooded has a clearer effect in this regard, compared to the less clear association between experiencing flooding and registering for Floodline (*cf* section 5, Table 6). In addition, this table suggests that awareness of and participation in flood action groups is highest among those who have experienced flooding. However, in general, participation levels in such groups appear rather low and dominated by a qualified and well-educated male cohort. Two thirds of respondents who participated in such groups gave a 'High' overall rating for their satisfaction with Floodline.

This suggests that there is a positive association between such local action groups and satisfaction with the service Floodline provides. However, the overall evidence from the preceding tables tends to suggest that flood action groups may not be an ideal vehicle for further attempts to increase engagement with Floodline.

Preparedness and follow-through

Using responses to survey Questions 11 and 28 together, it is possible to make a fairly rudimentary assessment of whether respondents who said they had taken any of the preparatory measures had actually deployed those steps, after receiving a Floodline message.

To explain this further, Question 11 asked respondents to indicate *which recommended preparatory steps they had taken*, while Question 28 asked *which actions they had taken after receiving a Floodline message.* The analysis is possible because there is overlap between the list of preparatory steps and the list of actions which were asked about in these questions.

However, the lists of steps and actions are not identical (i.e. the lists of questions do not fully overlap). Comparisons are best possible for a subset of steps and actions as indicated below:

Q11 Preparatory Step:	→	**Q28 Action taken after receiving a Floodline message:**
Prepared a special Flood Kit	→	Prepared a flood kit or checked one was ready
Obtained and know how to install sandbags or flood	→	Deployed sandbags or other flood protection products
Prepared a list of useful contact numbers	→	Made or checked you had a list of key phone numbers
Provided information on flood risk to others	→	Checked on others who might need assistance
Know how to shut off gas, electricity or water supplies	→	Shut off all supplies of electricity, gas and water

Here, the focus is on the first four step/action combinations from this list above. Regarding the fifth, i.e. shutting off supplies of gas, electricity and water supplies, a distinct contrast has already been noted between the high percentages indicating they knew how to do this, and the percentages who actually took that step after receiving a Floodline message.

The analysis here is afforded by a series of cross-tabulations, starting from the total numbers of respondents who said they took each preparatory step (i.e. from the left-hand side of the list above). These totals were first broken down by customer type.

For those sub-totals, percentages were derived of respondents who actually deployed each step as an action, after receiving a Floodline message. In addition, the analysis is also elaborated, to try to assess other influences on 'follow through' from preparedness step to action being taken.

The first such influence was intended to explore whether consulting the additional information available via the Floodline website and phoneline had any effect on the association between preparedness and follow-through. To explore this, the set of respondents was thus narrowed to include only those who said that they had consulted the Floodline website and/or phoneline.

The second influence was even more specific, focussing down on those who had consulted the additional information on the Floodline website and phoneline, and who rated the website and/or phoneline as 'Good' or better. This specific group was included to explore the hypothesis that their high rating of the website and/or phoneline indicated that they were more likely to value the information provided via the phoneline or website.

All told then, the analysis includes cross-tabulations for four different 'preparedness step/action taken' pairings, and for three different groupings of respondents. It should also be noted that the formulation of this analysis means that the total numbers of respondents for each individual cross-tabulation is specific to that cross-tabulation. In other words the base counts differ from those in earlier Tables 22 to 27. All the cross-tabulations are presented together overleaf in a single layout (Table 28).

Table 28 – Percentage 'follow through' for four different preparedness steps

1.
All respondents taking preparedness step

Flood kit (81% of 410)				Flood protection (83% of 402)				Contact numbers (79% of 613)				Info to others (79% of 290)			
	Alert	Both	Warning		Alert	Both	Warning		Alert	Both	Warning		Alert	Both	Warning
Taken action	65.5%	66.4%	76.2%	Taken action	68.2%	74.1%	73.5%	Taken action	70.8%	71.7%	79.2%	Taken action	78.9%	82.8%	83.9%
Base count	139	110	84	Base count	154	135	113	Base count	212	152	120	Base count	90	58	62

2.
All respondents taking preparedness step,
and who had used either or both Floodline website and phoneline

Step: prepared a flood kit (88% of 321)				Flood protection (90% of 358)				Contact numbers (86% of 465)				Info to others (80% of 226)			
	Alert	Both	Warning		Alert	Both	Warning		Alert	Both	Warning		Alert	Both	Warning
Taken action	71.1%	69.1%	80.3%	Taken action	70.6%	75.0%	77.3%	Taken action	76.0%	73.6%	84.0%	Taken action	81.3%	83.3%	86.3%
Base count	114	94	66	Base count	119	116	88	Base count	171	125	94	Base count	75	54	51

3.
All respondents taking preparedness step, and who had used either or both Floodline website and phoneline,
and who rated both website and floodline as 'Good' or better

Step: prepared a flood kit (91% of 148)				Flood protection (91% of 161)				Contact numbers (90% of 205)				Info to others (86% of 111)			
	Alert	Both	Warning		Alert	Both	Warning		Alert	Both	Warning		Alert	Both	Warning
Taken action	77.1%	70.8%	81.6%	Taken action	65.9%	80.4%	84.3%	Taken action	80.3%	80.0%	88.7%	Taken action	80.0%	89.3%	89.2%
Base count	48	48	38	Base count	44	51	51	Base count	71	60	53	Base count	30	28	37

Notes:

Italicised text above table headings states the particular group of respondents included. Red text shows how the groups differ from each other.

Table headings indicate preparedness step taken.

Numbers and percentages in the table headings indicate the total number of respondents considered in each cross-tabulation. For example 'Flood kit (81% of 410) indicates 410 of all respondents indicated they had taken the preparatory step of preparing a flood kit, but the table counts only 81% of them (i.e. 333 respondents). The other 19% of the 410 did not give a response to survey Question 28 on whether or not they actually took the action. Thus, it must also be noted that the percentages given in the body of each cross-tabulation are based on the numbers of respondents who did give responses to Question 28 on actions taken.

A first observation, across all the cross-tabulations, is that the level of follow-through on preparedness steps is generally very good, indicated by the high percentage values (lowest = 65.5%; highest = 89%). Overall, comparing across the four different preparedness steps indicates that percentages of respondents following through are lowest for those saying that they had 'Prepared a special Flood Kit, and highest among those who said that they had 'Provided information to others'. Percentages for the other two preparedness steps lie between the above two, being generally higher for the step 'Prepared a list of useful contact numbers' than for 'Obtained and know how to use sandbags or flood protection'.

It is intriguing that percentages tended to be higher for respondents who said they took the step 'Obtained flood protection' than for respondents who said they 'Prepared a special Flood Kit', as obtaining flood protection is likely to be more time-consuming and costly than preparing a flood kit. These differences may be due to the manner in which respondents interpreted the survey questions.

A second general message from the tables is that the percentages of respondents who followed through on preparedness steps are higher among respondents who said they had also used either the Floodline phoneline or website, and are highest among those who indicated they had used the phoneline or website, and who had given the latter 'Good' or better ratings. For example, of the respondents who 'Prepared a special Flood Kit' and who had used either the Floodline phoneline or website and rated them highly, 77% gave a response indicating that they had followed through by preparing/checking a flood kit ready to use on receipt of a Floodline message. This compares to 65.5% of all respondents generally who had prepared a flood kit.

Third, across all four preparedness steps, lowest percentages are for respondents registered to receive Flood Alerts only, and highest percentages are for respondents registered to receive Warnings only. This patterning of differences holds for most of the cross-tabulations, with only a few exceptions, although none were found to be statistically significant (see below).

For example, consider the respondents indicating that they had taken the preparatory step 'Obtained and know how to use sandbags and other flood protection'. In the subset of such respondents who had also used either or both the Floodline phoneline and website, 71% of those giving responses and registered for Alerts only indicated they had deployed such protection after receiving a Floodline message, compared to 77% of respondents registered for Warnings only and 75% of respondents registered for both Alerts and Warnings.

All these cross-tabulations must (like previous tables) be interpreted cautiously. Two separate questions from the customer survey are being compared, and there was no direct link between them included in the survey. In addition, the appropriateness of deploying actions will vary across different flood situations, and it is impossible to factor such differences in here.

Moreover, recourse as before to Chi-Square testing showed there were no statistically significant differences between respondents registered for Flood Alerts only, Flood Warnings only, or both Flood Alerts and Flood Warnings within any of the cross-tabulations. Nonetheless, it does appear that use and high rating of the Floodline website and/or phoneline are associated with increased follow-through on preparedness steps in flood risk situations. As such, ensuring that the information available via such sources is an appropriate guide and stimulus for what actions to take should be an important consideration, moving forwards.

Section summary

The final research question on actions taken on receipt of flood warning messages has been explored in this section. It opened by picking up on the dissatisfaction with Flood Alerts discussed in the previous section. The fact that Flood Alerts are not targeted to specific areas or hence needs of specific customers appears to have had a 'cry wolf' effect on attitudes towards the utility of such messages among a relatively large proportion of respondents, who had failed to act on the Alerts, in some cases not even reading them.

A lower percentage of Alert-only customers was prepared to rate the website as being 'Good' or 'Very Good'. This contrasts the fact that Alert-only respondents were the largest respondent group of all three surveys.

The Floodline phoneline was used by a very small percentage of respondents. However, of greater concern perhaps is the fact that over a quarter of respondents who had received a Floodline message said that they had not used either the Floodline website or phoneline to access additional information.

Those who had used the website and/or phoneline were more likely to have taken actions after receiving a Floodline message. Actions taken most frequently were to do with ensuring they had mobile phones charged and a list of contact numbers, checking on roads, transport and a safe exit, and moving documents and vehicles.

Those who rated the information available on the website and/or phoneline as 'Good' or better are more likely to have taken action after receiving a Floodline message than those who received a message but who gave lower ratings to the information on the website/phoneline.

Attention was also turned to assess differences in preparedness steps taken by survey respondents. The preparedness actions taken most frequently were knowing how to shut off electricity, gas or water supplies, preparing a flood plan, flood protection, preparing a flood kit and providing others with information.

In general, percentages taking preparedness actions were significantly higher among those who had experienced flooding compared to those who had not (see Table 27). This includes participation in local flood action groups.

The 'follow-through' from preparedness steps to actions actually taken on receipt of a Floodline message was also explored. Percentages of respondents following through were generally high, and were highest for those checking on others, after taking the preparedness step of providing information to others. The lowest follow-through percentages were for those indicating they had prepared a Flood Kit. 'Follow-through' percentages were higher among respondents who used the Floodline website and/or phoneline, and who rate the latter as 'Good' or 'Very Good'.

Taken together the findings from this section would suggest a need to try to counter the corrosive attitudes towards Flood Alerts, to prevent customers from disengaging with the Floodline service. They also suggest that more customers need to be driven towards using the additional information via the Floodline website or the Floodline phoneline, as use of this additional information is linked to increased odds of taking action, including preparedness steps. The more highly customers rate this additional information, it seems the more likely they are to take action or preparedness steps. Thus, using the website to maintain a strong position as the leading source of information on developing flood risk situations is crucial.

As the propensity to take preparedness steps is highest among those who have experienced flooding, means of tapping into the latter's perspectives and stories could be considered, as a means to try to convey to others the benefits of taking such steps.

8 Conclusions

Following the objectives set out in the tender (*reproduced in italics*), the following conclusions are offered:

Identify whether Scotland's flood warning service is meeting the needs of its customers through damage mitigation actions

This is a complex objective, as there is no single causal chain between use of the Floodline service and actions taken. Rather the view of registering for Floodline as being one rung on a longer ladder of preparedness measures and response actions has been discussed. Nevertheless, the analysis does provide some findings on the associations between receipt of messages, use of additional information available via the Floodline website and phoneline, and actions taken. One of the key intentions of the service is to direct people to such additional information, so this link is important. Those who responded saying that they had used information via the website and/or phoneline after receiving a message were also generally more likely to have taken mitigation actions than those who said they had not used the information.

A range of actions recommended by SEPA was asked about. Actions reported as being taken most frequently were ensuring mobile phones were charged, having a list of key telephone numbers, checking roads and availability of a safe exit and moving documents and vehicles. In addition, respondents were questioned on a range of preparedness steps, again based on SEPA recommendations. The most frequently reported such steps were knowing how to shut off gas, electricity and water supplies, and having adequate flood insurance cover. For some though not all such steps, socio-economic differences are apparent. For instance, a higher percentage of home owners than renters indicated they had altered their properties. Similarly, a higher percentage of residents in low deprivation areas indicated they were aware of a local flood group, and participated in such groups, compared to percentages of respondents in high deprivation areas.

Generally speaking, those who had experienced flooding were more likely to have reported taking preparedness steps than those who had not been flooded. Overall however, less than half of all respondents reported having experienced flooding at their registered Floodline location – i.e. the experiencing of flooding did not appear to be so clearly associated with Floodline registration.

The association between a range of preparatory steps and actions actually taken after receipt of a message was also investigated. 'Follow through' from taking a preparatory step to actually taking action was again higher among those who had used the additional information from the website/phoneline, and higher still among those who use the information and who gave a good rating to the website/phoneline.

While there is a positive association between steps and actions taken and use of the additional information that the Floodline service points customers towards, over a quarter of respondents who had received a message said that they had not used that information. In addition, a large proportion of respondents registered for Flood Alerts complained about the fact that Alert messages were not specific to their locations. Several such respondents further commented that, in consequence, they had developed a 'cry wolf' attitude of ignoring such messages, and were becoming somewhat disenchanted with the Floodline service.

Identify whether customers value the current flood warning service as a vital tool in being more resilient to flooding

The research did not explicitly examine whether customers see the Floodline service as being vital to their flood resilience. However, a perspective on this issue can be gained by considering the satisfaction with the service expressed by research respondents. In this regard, there appear to be two main sets of findings. On the one hand, only very small percentages of respondents in all three main customer groups (Warning, Alert and 'both' customers) indicated that their overall satisfaction with the service was low - instead most respondents indicated high overall satisfaction levels.

Moreover, the percentage of respondents giving a high satisfaction rating was greater among respondents who had previously received a Floodline message than among the others (the minority) who had not. Similarly, percentages giving high ratings were greater among respondents registered in 'High message frequency' Flood Warning Areas than among respondents in other Warning Areas. This suggests an association between satisfaction and the level of experience with the Floodline service, in terms of messages received.

On the other hand, there also appear to be clear demands for the service to offer more to its customer base. Most apparent here is the aforementioned *dissatisfaction* expressed by a relatively large number of customers registered for Flood Alerts regarding the geographic detail of messages (see first conclusion, above).

A variety of other suggestions were made about how to increase value of the service. One such suggestion was for more information to be made available on current water levels. Another was on developing, or at least communicating better, a more joined-up approach to flood risk management, including not just what individual customers should do, but what other organisations do and what assistance they can provide. Some respondents suggested risk levels could be communicated more clearly.

Some respondents indicated that they felt they got better information on flood risk from other sources outside of the Floodline service, e.g. SEPA's river levels site and other third party services. It is possible that the latter also entail a degree of re-packaging Floodline/SEPA information into a more user-friendly format. Nevertheless, in a the context of a widening digital environment, in which there are multiple and multiplying communication channels, there is a challenge to ensure that Floodline and the related website/phoneline remain important 'go to' resources.

Understand whether all customers have identical requirements of the flood warning service or whether the service is used differently by separate and unique customer groups

There is no a priori reason to think that all customers will have identical requirements – indeed the very design of the Floodline service, with the distinction drawn between Alerts and Warnings, speaks to differing needs among different groups. However, the findings from this work do help to explore areas of commonality as well as areas of difference between key groups.

In terms of commonalities, one point has already been made, about increasing the geographic detail of messages. This was expressed by sizeable numbers of respondents registered for Alerts. Not all of those respondents would have close knowledge of the differences in details between Alerts and Warnings. Nevertheless, it seems reasonable to say that the level of geographical detail contained in Warning messages is close to the sort of detail that the Alert respondents are seeking.

A second area of commonality has also already been mentioned, concerning the relationship between overall satisfaction and level of experience with the service. Notwithstanding the complaints levelled against Alerts for the lack of geographical detail, getting a message appears to be an important step in deciding what to do and in judging what the service offers for all main customer groups. However, there also appear to be some differences in relation to the frequency with which messages are issued. Among some of the Alert-only respondents who raised the lack of geographical detail in Alerts as an issue, there is a view that Alerts are being issued too frequently, and consequently ignored. In other words, some customers are frustrated that the messages they receive are not relevant to their own needs. Even if Alerts do encompass their own locations, customers may not be clear on what actions (if any) are the best ones to take.

Against this, among respondents registered to receive Flood Warnings, the direct association between high satisfaction and ratings and high message frequency has already been noted. Put another way, it appears that such customers benefit from greater experience with getting messages, which may be because they feel they gain more familiarity with knowing how to use the messages, and/or because they feel their locations are being appropriately monitored for flood risk.

In regards to taking preparedness steps, there were some differences with socio-economic status, but there was no single consistent type of difference across all preparedness steps. For example a slightly higher percentage of respondents with advanced educational qualifications reported making alterations to buildings and properties compared to respondents with lower levels of qualifications. However, a higher percentage of the latter than the former reported they had prepared a flood plan or flood kit. One of the clearest differences with socio-economic status concerned the step of participating in flood

action groups (see first objective above).

As also noted above, the experience of being flooded appears to have made a difference to taking preparedness steps, yet whether or not someone has experienced flooding does not have the same association with being registered with Floodline (see Objective 1).

Not surprisingly there were differences between respondents registered because of concern over risk of flooding to their current home (the majority of respondents), and those who registered for other reasons. Among the latter, most respondents indicated that flood risk to journeys made was an important reason for signing up for Floodline. That this was the most commonly chosen response seems quite surprising, although it may relate to journeys and routes which are taken regularly.

It should be noted that most Floodline messages have been issued to a small minority of customers registered in High Frequency-Low Impact and High Frequency-Medium Impact Warning Areas, where at-risk property numbers themselves are very limited.

Understand how customers respond to direct messaging received from Floodline in Scotland. Identify what actions customers take as a result of receiving flood alert and/or warning messages, including actions to mitigate flooding

Results from this research do go some way towards highlighting the actions customers take, if they had received a Floodline message. The vast majority of respondents to the customer surveys, over 90%, reported that they had received a message. However, it should be remembered that there is no single set of actions applicable to all customers. Actions considered here are those recommend by SEPA.

More than half of those customers in each of the three customer groups also said that they had used the Floodline website, but percentages reporting they had accessed additional information via the Floodline phoneline were much lower. As noted earlier, more than a quarter of respondents receiving a message had not used either the website or phoneline.

Those who had obtained additional information via the website or phoneline were more likely to have taken some action than those who had not obtained the information. For some actions the percentage of those using the additional information and taking action was more than double the percentage of those taking action but who had not used the additional information. This applied to the actions of having prepared a flood kit, phoning for assistance, moving animals, turning off power, vacating the property and 'other' unspecified actions. Smaller differences were observed for other actions, including charging phones, checking roads and safe exits, and checking on others potentially in need of assistance.

There were slight differences in percentages of each main customer group who had received a message and who took action. Percentages taking actions were lowest among those registered for Alerts, and greatest among those registered for Alerts and Warnings.

For a limited number of situations it has been possible to assess 'follow through', i.e., comparing percentages indicating they had taken a preparedness step against the percentage reporting that they had then taken action after receiving a Floodline message. Results suggest in general that percentages increased among recipients who had (a) received a message, (b) had used additional information from the Flooding website or phoneline, and (c) who gave a good rating to the website and/or phoneline. In other words, both use of, and high rating of, information via the website/phoneline is associated with increased percentages following-through to take action.

Present the benefits of the flood warning service in Scotland (both tangible and intangible).

Assessing specific benefits and whether they are tangible or intangible is a complicated task. As an analogy, Figure 3 shows only one framework in which outcomes (losses, in that case) may be classed as tangible and direct or indirect. The research presented here is not able to provide a similarly detailed account of tangible and intangible benefits.

However, research results do make clear that most respondents are overall quite or very satisfied with the current Floodline service, with many saying that they wanted more of the same, in turn pointing to the service providing an array of benefits, to different respondents. As discussed above, there is also evidence of associations between receiving a message, using the additional information from the website and/or phoneline, and taking an array of preparedness steps and risk mitigation actions.

However, overall satisfaction levels are also qualified by the view expressed among other respondents, wanting the service to go further, and to deliver more to them. This suggests that such respondents do not feel that the service is fully delivering on the benefits they feel it should.

Finally, there are grounds to think that the survey respondents represent a fairly typical representation of all customers, and what stands out is the predominance of well-educated professional types in the overall customer profile. These customers are likely to have the skills, background and resources to judge how to make the most of the service. There is a question of broader 'buy-in' to the service, beyond such groups to others in different situations.

9 Recommendations

1. Continue with the Floodline Service in order to maintain delivery of the benefits identified by respondents

2. Review the whole of the information landscape provided for Floodline on-line customers

Well engaged customers have an appetite for more information. Feedback from some of the open-ended survey questions and from most participants in the local workshops revealed interests in the following:

- Integrating real-time monitoring data into an information-rich website, which provides customers with additional information to the current provision. This may drive response; customers would be able to decide on actions on a better-informed basis. There is scope to include live data feeds on rainfall, river levels and sea levels.
- Providing local contextual information and historical references in connection with floods e.g. the River Tweed at Kelso is presently reading X metres (Y feet) and has risen xx metres (yy inches) in the past hour. For comparison, the record flood of 1948 reached M metres (F feet) while the 2015 flood reached N metres (G feet) at the same location.
- Incorporating locally specific information such as arrangements for sandbag distribution, if available.
- Access to forecast data, suitably qualified in terms of potential uncertainty.

3. Maintain and continue to develop awareness-raising activities

While mindful of existing best practice and the difficulties of increasing reach, we argue that the benefits of Floodline may be increased by:

- Continuing to innovate in the raising of awareness of Floodline
- Promoting better understanding of the information content and applicability of Floodline messages (not least distinction between Alerts and Warnings)
- Improving understanding of how Floodline works as a means of managing expectations; when messages are issued, why, the scope of messages, and to whom they are issued (links to message content below)
- Continuing to raise levels of preparedness, e.g. via collaborations with local authorities
- Raising understanding of responsibilities; who does what (e.g. householder installation of property-level flood protection products, local authority emergency responses)
- Issue of an annual registration confirmation message, confirming messaging preferences and offering the chance to alter preferences e.g. dual messaging by SMS/ email/voice call.

4. Review flood warning message content

- Ensure the severity of the forecast flood is reflected in the message (e.g. 'this flood is expected to be larger than any experienced in the past 40 years'; 'in most areas, this flood is expected to be similar in height and extent to the event experienced last week').
- Provide additional guidance, addressing likelihood of flood occurrence, extent and impacts, e.g. example messages at sign-up and within an annual service confirmation communication.
- Consider indicating how long a warning should be expected to be in force, and when a 'no longer in force' message will be issued.

5. Flood Alerts

We recommend that flood alerts are subject to fundamental review, given the relatively high level of customer dissatisfaction with them, and the extent of confusion about what the service does and does not provide.

- Given overall satisfaction responses, it is important to continue offering a service to persons not located within Flood Warning Areas. However, these individuals were the least satisfied respondents, with the lack of geographical specificity to messages being key to their concerns.
- Address dissatisfaction with Alerts by continuing to add to the number (and extent) of Flood Warning Areas.
- Continue to encourage new customer registrations, not least in under-represented groups: those in coastal areas and younger persons.

6. Introduce a 'no warning'/reassurance message type

- In order to enhance customer satisfaction by building on the observed direct link between message frequency and satisfaction, we recommend that Flood Warning schemes offer an additional message type in the form of 'SEPA is aware of heavy rainfall and is monitoring the situation…. at the present time there is no expectation that flood warning levels will be reached'.
- Messages could be issued when the flood risk is in the area but flooding issues are not 'currently' expected in the particular Flood Warning Area. A link to live rainfall, river level etc. feeds (Recommendation 1) would helpfully support this message.
- The issue of a Flood Alert to Flood Warning customers may serve the required purpose well.

7. Review the potential for tailored content

Possible aspects to consider here include:

- Content based on precise location within a Warning Area, recognising that each Warning Area has a vertical profile, such that those closer to normal water levels will typically be more often/significantly at risk than those on higher ground. It may be foreseen that some customers in a Warning Area will not be at any meaningful risk on a particular occasion when a warning is issued, owing to their elevation.
- Content based on customer type, e.g. exclusively for transport and utility operators, office complexes, factory operators, agricultural customers, operators of vulnerable properties (such as a nursing home or caravan park), or vulnerable individuals. Some of these may face difficulties in responding within a normal warning window but may be willing to accept lower-confidence warnings as the price for benefiting from greater lead times.

8. Maintain phone/Interactive Voice Response service

This service is important in maintaining service resilience, coverage and meeting the needs of a minority of customers dependent on voice-based communication.

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Appendix 1 - Creation of Message Frequency – Flood Impact Categories for Flood Warning Areas

The nine categories of Message Frequency versus Flood Impact were created with reference to records from SEPA's Horizon system on Flood Warning Areas. These records contained the number of Flood Warnings and Severe Flood Warnings issued as well as the number of at risk properties (see also Section 2 of this report).

The nine categories were created using:

1. Message Frequency: was divided based on the number of times a warning (initial trigger) had been issued since the start of the Floodline active dissemination. Categories of frequency were split into Low (message issued 0-2 times), Medium (3-9 times) and High (greater than 10 times).

2. Flood impacts: were divided into categories of Low, Medium and High based on an operational guidance tool used by SEPA's Flood Advisors.

These dimensions were then intersected to create the nine final categories. There was also some discussion about potentially distinguishing a 'Very High Frequency' category to include e.g. Glen Lyon and Earn Warning schemes, but ultimately this was not implemented.

Figure 23 compares distributions across these categories for the following groups: all customers registered for Flood Warnings (from SEPA's Horizon database); respondents to the customer questionnaire survey conducted for this study registered to receive Flood Warnings only; and survey respondents registered to receive both Flood Alerts and Flood Warnings

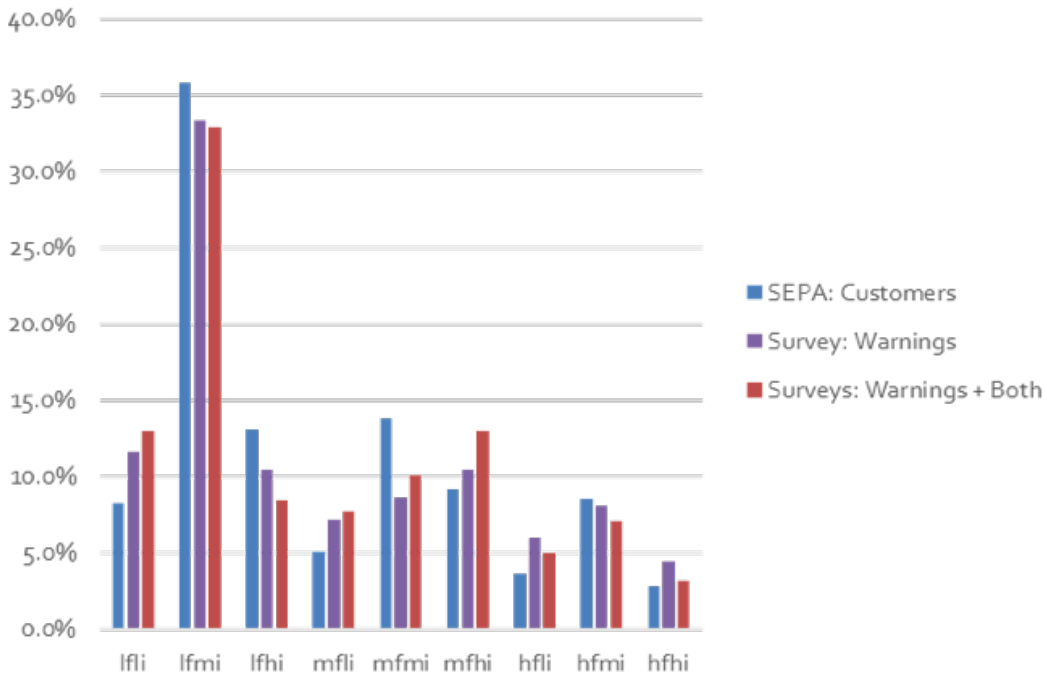

Figure 23 Percentage of SEPA customers and survey responses by frequency-flood impact categories

Appendix 2 - GIS methodology used to link Data Zones/ SIMD16 to Warning Areas

Each Data Zone[7] was represented by its centroid (its centre point). These centroids used were the officially-calculated population-weighted centroids, i.e. located towards the more populated part of each Data Zone.

To circumvent this 'thin' representation of each Data Zone area by only a single point location, GIS was also used to calculate the distance of each centroid to the Warning Area that was closest to it. Distances were calculated from the Data Zone centroid to the outer edge of the nearest Warning Area. Using these distances made it possible to consider not only centroids that fell within a Warning Area, but also those that were *close* to a Warning Area. Data Zones with centroids close to a Warning Area are likely to overlap into the Warning Area, with the closeness of the centroid (i.e. smaller distance) likely to signify a large degree of overlap.

Judging what is close/not close is an arbitrary decision. For simplicity, an arbitrary distance threshold of 200m was used as the cut-off for identifying Data Zones with centroids close to Warning Areas. Figure 24 illustrates the methodology just described. One single Warning Area (classed as 'Low Frequency – High Impact') is shown, together with Data Zone centroids and Data Zone boundaries.

On this illustration, Data Zone centroids highlighted as cyan blue circles are those within 200m of the Warning Area. Thus the illustration shows that one Data Zone has a centroid within the Warning Area envelope, and a further seven Data Zones have their centroids within 200m of the Warning Area.

The Data Zone boundaries show that most of the selected Data Zones have a considerable overlap with the Warning Area, although for others the overlaps are smaller - an inevitable consequence of this simple spatial data integration methodology, even with the distance threshold applied.

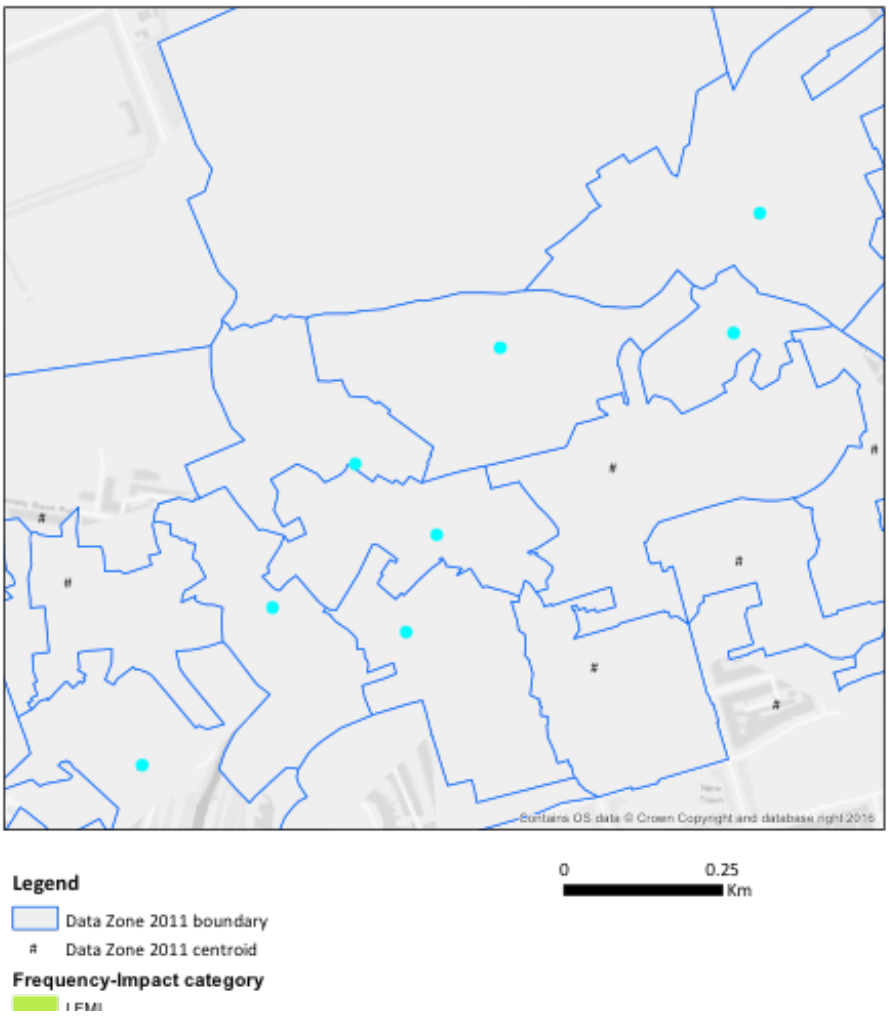

Figure 24 Illustration of Data Zone selection methodology

[7] **The 2011 version of Data Zones were used.**

Appendix 3 - Coding frame used for customer surveys

Question	Response	Routing: Who can see this question
2. Please choose the option below which best describes the main reason you signed up to receive Floodline messages.	Concern about flood risk to your current home (i.e. your current residence)	All
	Other reason	
3. Which of the following best describes your home?	Owned outright	Residential
	Owned with a mortgage	
	Rented from a private landlord	
	Rented from a housing association	
	Other reason	
3.a. If you selected Other, please specify:		Residential
4. Which of the following best describes your housing type?	Detached	Residential
	Semi-detached	
	Terraced	
	Basement or ground floor tenement or flat	
	First floor (or above) tenement or flat	
	Caravan	
	Other reason	
4.a. If you selected Other, please specify:		Residential
5. How long have you lived there?	Under 1 year	Residential
	Over a year but less than 5 years	
	Over 5 years but less than 10 years	
	10 years or more	
6. Please indicate which of the following reasons were important, and which were not important, to you.		Non-residential
6.1. Risk to another residential property you own, or are responsible for (not the property you live in)	Important	Non-residential
	Not important	
6.2. Risk to business premises that you are responsible for or that you work at	Important	Non-residential
	Not important	
6.3. Risk to land you own or rent	Important	Non-residential
	Not important	
6.4. Risk to journeys you make	Important	Non-residential
	Not important	
6.5. Risk to services and amenities which you use	Important	Non-residential
	Not important	
6.6. Risk to other people you are concerned for but who do not usually live with you	Important	Non-residential
	Not important	
6.7. Other	Important	Non-residential
	Not important	
6.a. If you selected Other, please specify		Non-residential
7. Have you ever experienced flooding affecting the location you registered with Floodline?	Yes	All
	No	
8. Please can you let us know how many times?		Flooded
9. When were you flooded? (Please indicate the most recent time, if flooded more than once).	Within the past 12 months	Flooded
	Over 12 months ago but within the last 10 years	
	Over 10 years ago	

10. Can you tell us more about your experiences of flooding at the location you registered with Floodline? Please select all relevant options below. (Please tell us about your worst experience, if flooded more than once.)		
10.1. Flood water inside your accommodation	Yes	Flooded
	No	
10.2. Flood water on land (e.g. gardens; fields)	Yes	Flooded
	No	
10.3. Damage to property (e.g. car; boundary walls)	Yes	Flooded
	No	
10.4. Loss of electricity or gas power supply	Yes	Flooded
	No	
10.5. Loss of water supply	Yes	Flooded
	No	
10.6. Loss of phone or Internet communications	Yes	Flooded
	No	
10.7. Streets, roads and other access cut-off	Yes	Flooded
	No	
10.8. Disruption to shops and amenities you use	Yes	Flooded
	No	
10.9. Other	Yes	Flooded
	No	
10.a. If you selected Other, please specify		Flooded
11. Please can you tell us which of the following recommended steps you have taken already, and which you have not taken.		All
11.1. Prepared a Flood Plan for your registered property (a list of actions you would take on receipt of a flood warning)	Taken this step	All
	Not taken this step	
11.2. Prepared a special Flood Kit for your registered property (e.g. torch, medication, insurance details)	Taken this step	All
	Not taken this step	
11.3. Know how to shut off gas, electricity or water supplies	Taken this step	All
	Not taken this step	
11.4. Prepared a list of useful contact numbers in the event of a flood	Taken this step	All
	Not taken this step	
11.5. Obtained and know how to install sandbags or flood protection products appropriate for your registered property	Taken this step	All
	Not taken this step	
11.6. Ensured you have adequate insurance cover for flooding	Taken this step	All
	Not taken this step	
11.7. Made alterations to the structure of buildings	Taken this step	All
	Not taken this step	
11.8. Made other alterations to your property (e.g. built walls, ditches)	Taken this step	All
	Not taken this step	
11.9. Provided information on flood risk to others at the registered location (e.g. employees, tenants, visitors)	Taken this step	All
	Not taken this step	
11.10. Other	Taken this step	All
	Not taken this step	
11.a. If you selected Other, please specify		All
12. Do you know if an organised flood action group exists for your local area?	Yes I am aware of a local flood action group	All
	No I am not aware of a local flood action group	
13. Do you participate currently in a local flood action group?	Yes	All
	No	

14. How do you rate the risk of flooding to the property or location you registered with Floodline?	Not at risk	All
	Low risk	
	Medium risk	
	High risk	
15. How worried are you about flood risk to the property you registered with Floodline?	Not at all worried	All
	Slightly worried	
	Worried	
	Very worried	
16. Do you think flood risk to your registered property or location has changed recently?	Has increased a lot	All
	Has increased a little	
	Stayed about the same	
	Has decreased a little	
	Has decreased a lot	
17. How well informed do you feel about the risk of flooding to your property or location registered with Floodline?	Very well informed	All
	Well informed	
	Not very well informed	
	Not at all informed	
18. Which kind of Floodline messages are you registered to receive?	Messages for a broad geographic region	All
	Messages for a locally specific area	
	Both	
19. Have you ever received a Floodline message?	Yes	All
	No	
20. How far do you agree, or disagree, with the following statements?		Have not received a message
20.1. "I would like to receive a Floodline message at the earliest indication of potential flooding in my area - even if the specific risk of flooding to my registered location is not well known at the time."	Strongly agree	Have not received a message
	Agree	
	Neither agree nor disagree	
	Disagree	
	Strongly disagree	
20.2. "I would like to receive a Floodline message only when the risk of flooding to my registered location is known clearly - even if this means receiving a message just a short time in advance."	Strongly agree	Have not received a message
	Agree	
	Neither agree nor disagree	
	Disagree	
	Strongly disagree	
20.3. "I expect the Floodline message to contain all relevant flood information (e.g. time of onset of flooding, time of peak floodwaters, indication of depth and severity)."	Strongly agree	Have not received a message
	Agree	
	Neither agree nor disagree	
	Disagree	
	Strongly disagree	
20.4. "I expect the Floodline message to be short. It will notify me of potential flooding, and will tell me where I can find out further details."	Strongly agree	Have not received a message
	Agree	
	Neither agree nor disagree	
	Disagree	
	Strongly disagree	
21. Have you ever used the Floodline website or Floodline phone service after receiving a message?	Yes I have used the Floodline website	Have received a message
	Yes I have used the Floodline phone line	
	Yes I have used both	
	No I have used neither	
22. If you have received more than one message - how do you rate the frequency of the messages you have received?	Good	Have received a message
	Neither good nor poor	
	Poor - too frequently	
	poor - not frequent enough	
	I have only ever received one message	

23. How do you rate the timing of the message(s) you have received?	Good - I received the message in good time	Have received a message
	Adequate (neither good not poor)	
	Poor - the timing was too late	
24. Did the message(s) adequately convey to you the likely impact of flooding?	Yes	Have received a message
	No - the impact was worse than conveyed	
	No - the impact was not as bad as conveyed	
25. What could be done to improve these messages in the future?		Have received a message
26. Is there any information you do not receive from Floodline messages, the Floodline website or the Floodline phone service that you think could be helpful?		Have received a message
27. Please can you give your views on both of these information sources by ticking the relevant boxes.		
27.1. Information on Floodline website	Very good	Have received a message
	Good	
	Neutral	
	Poor	
	Very poor	
	Never used it	
27.2. Information via Floodline phone service	Very good	Have received a message
	Good	
	Neutral	
	Poor	
	Very poor	
	Never used it	
28. Please tick the boxes below to indicate which action(s) you have taken, or not taken, after receiving a message from Floodline.		Have received a message
28.1. Prepared a flood kit or checked one was ready	Taken this action	Have received a message
	Not taken this action	
28.2. Made or checked you had a list of key phone numbers	Taken this action	Have received a message
	Not taken this action	
28.3. Made sure your mobile phone was charged	Taken this action	Have received a message
	Not taken this action	
28.4. Phoned for assistance from others	Taken this action	Have received a message
	Not taken this action	
28.5. Moved important documents to a safe place (e.g. insurance documents, passport)	Taken this action	Have received a message
	Not taken this action	
28.6. Moved valuable possessions to a safe place	Taken this action	Have received a message
	Not taken this action	
28.7. Moved pets and/or other animals to a safer area	Taken this action	Have received a message
	Not taken this action	
28.8. Moved vehicles to a safer area	Taken this action	Have received a message
	Not taken this action	
28.9. Shut-off all supplies of electricity, gas and water	Taken this action	Have received a message
	Not taken this action	
28.10. Deployed sandbags or other flood protection products to your property	Taken this action	Have received a message
	Not taken this action	
28.11. Checked on others who might need assistance (e.g. family, friends, or neighbours)	Taken this action	Have received a message
	Not taken this action	
28.12. Checked if you had a safe exit from your property	Taken this action	Have received a message
	Not taken this action	
28.13. Checked if local streets or roads or transport networks were affected	Taken this action	Have received a message
	Not taken this action	

28.14. Vacated your property	Taken this action	Have received a message
	Not taken this action	
28.15. Other	Taken this action	Have received a message
	Not taken this action	
29. Which of the further action(s) below have you have taken, or not taken, after receiving a message from Floodline?		Have received a message
29.1. Notified other regular users of the registered property (e.g. employees, tenants) that a Floodline message had been issued	Taken this action	Have received a message
	Not taken this action	
29.2. Notified others scheduled to be at the registered property (e.g. customers, suppliers, visitors)	Taken this action	Have received a message
	Not taken this action	
29.3. Contacted those responsible for the property (e.g. service/management company, factor)	Taken this action	Have received a message
	Not taken this action	
29.4. Moved electrical equipment to a safe place	Taken this action	Have received a message
	Not taken this action	
29.5. Moved livestock to a safe area	Taken this action	Have received a message
	Not taken this action	
29.6. Moved tools/machinery to a safe area	Taken this action	Have received a message
	Not taken this action	
29.7. Ensured hazardous materials (e.g. fuels, chemicals) were stored securely	Taken this action	Have received a message
	Not taken this action	
30. Please let us know of other action(s) not included in the previous questions that you have taken, after receiving a Floodline message.		Have received a message
31. Overall, how would you describe your level of satisfaction with the Floodline service?	Very high	All
	High	
	Neutral	
	Low	
	Very low	
32. Can you add a comment on why you have chosen this response?		All
33. Here is the opportunity to provide any further comments on improvements Floodline can make to improve in the future. Provide suggestions and comments in the box below.		All
34. Please provide the postcode for the location to which your Floodline messages refer, e.g. the location of your home or work premises, or the home of a family member on whose behalf you have registered. This information will allow us to analyse responses for groups of respondents on a geographical basis, e.g. for particular rivers or coastlines.		All
35. What is your sex?	Male	All
	Female	
36. What age are you? Please indicate the correct age range.	18 to 34	All
	35 to 54	
	55 to 64	
	65 or older	

37. Please select one option below which describes the highest educational qualification you have currently.	1 See below	All
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
38. What is your current employment status? Please tick all options that apply.		All
38.1 Working (full-time or part-time) as an employee in paid employment	No	All
	Yes	
38.2 Self-employed (full-time or part-time)	No	All
	Yes	
38.3 Unemployed	No	All
	Yes	
38.4 Student (full-time or part-time)	No	All
	Yes	
38.5 Retired	No	All
	Yes	
38.6 Long-term sick or disabled	No	All
	Yes	
38.7 Looking after home/ family	No	All
	Yes	
38.8 Other	No	All
	Yes	
39. Please indicate if you would be willing for us to contact you again, for more information on your view on Floodline		All
39.1.a. Yes I can be contacted again. - Email address or phone number to use		All
Date		All

Notes:

Question 1 asked for respondents to confirm their agreement to start the questionnaire and is not included above.

Categories for Education are as follows:

1 School leaving certificate, National Qualification Access Unit

2 O Grade, Standard Grade, GCSE, GCE O Level, CSE, National Qualification Access Cluster, Intermediate 1 or 2, Senior Certificate or equivalent

3 GNVQ/GSVQ Foundation or Intermediate, SVQ Level 1 or 2, SCOTVEC/National Certificate Module, City and Guilds Craft, RSA Diploma or equivalent

4 Higher, Advanced Higher, CSYS, A Level, AS Level, Advanced Senior Certificate or equivalent

5 GNVQ/GSVQ Advanced, SVQ Level 3, ONC, OND, SCOTVEC National Diploma, City and Guilds Advanced Craft, RSA Advanced Diploma or equivalent

6 HNC, HND, SVQ Level 4, RSA Higher Diploma or equivalent

7 First Degree, Higher Degree, SVQ Level 5 or equivalent

8 Professional qualifications e.g. teaching, accountancy

9 Other qualifications not mentioned above

10 No qualifications

Appendix 4 - Sample of respondents to the customer surveys

As noted in the Introduction, the survey of Floodline customers was organised into three parallel surveys, reflecting the three key groups of message recipients:

- Those registered to receive Flood Warnings, as a result of registering a location assessed by SEPA to lie within a specific Warning Area;
- Those outside of the above registered to receive the regional-scale Flood Alerts
- Those opting to receive both Flood Warnings and Flood Alerts.

However, while the survey was split across these three groups, all other aspects of organisation were identical. The same questionnaire was used for all three groups, and all three surveys were carried out over the same time period from mid-December 2016 to mid-January 2017.

Use of the BoS survey involved distributing a web link with the survey questionnaire, distributed by email to all Floodline customers who had emails recorded in the SEPA/Horizon system. Of the over 25,000 customers registered for Floodline, around 18,000 had given an email address as a means of contact at the time of their registration.

The bar graph in Figure 25 shows firstly the responses received on a daily basis, during the month during which the surveys were open for receiving responses.

For all three versions of the survey, the profiles are believed to be close to a typical web survey response profile, with most responses occurring very soon after the initial release of the survey, with a long much lower tail of responses thereafter. The additional effect of a survey reminder issued in early January is also clearly evident in this graph.

Having no information in advance of the surveys save for email address meant that there was not a full sampling frame on which to base sampling. Consequently, as discussed more fully in Section 4 of this report, it is not possible to determine precisely if the respondents represent a representative random sample of all customers, i.e. whether the sample satisfies the requirements for making statistical inferences from the sample to the customer population overall. However, we can say for certain that all aspects of survey administration were the same for all three parallel surveys, and that that sample size obtained is respectable.

Some bias among the sample respondents may be present, as a result of having to exclude those without an email address, and we could speculate that the latter group is more likely to include elderly people and lower socio-economic groups, respectively less familiar with and less able to afford Internet access, although the ongoing spread of access continues to alter existence of the 'digital divide'.

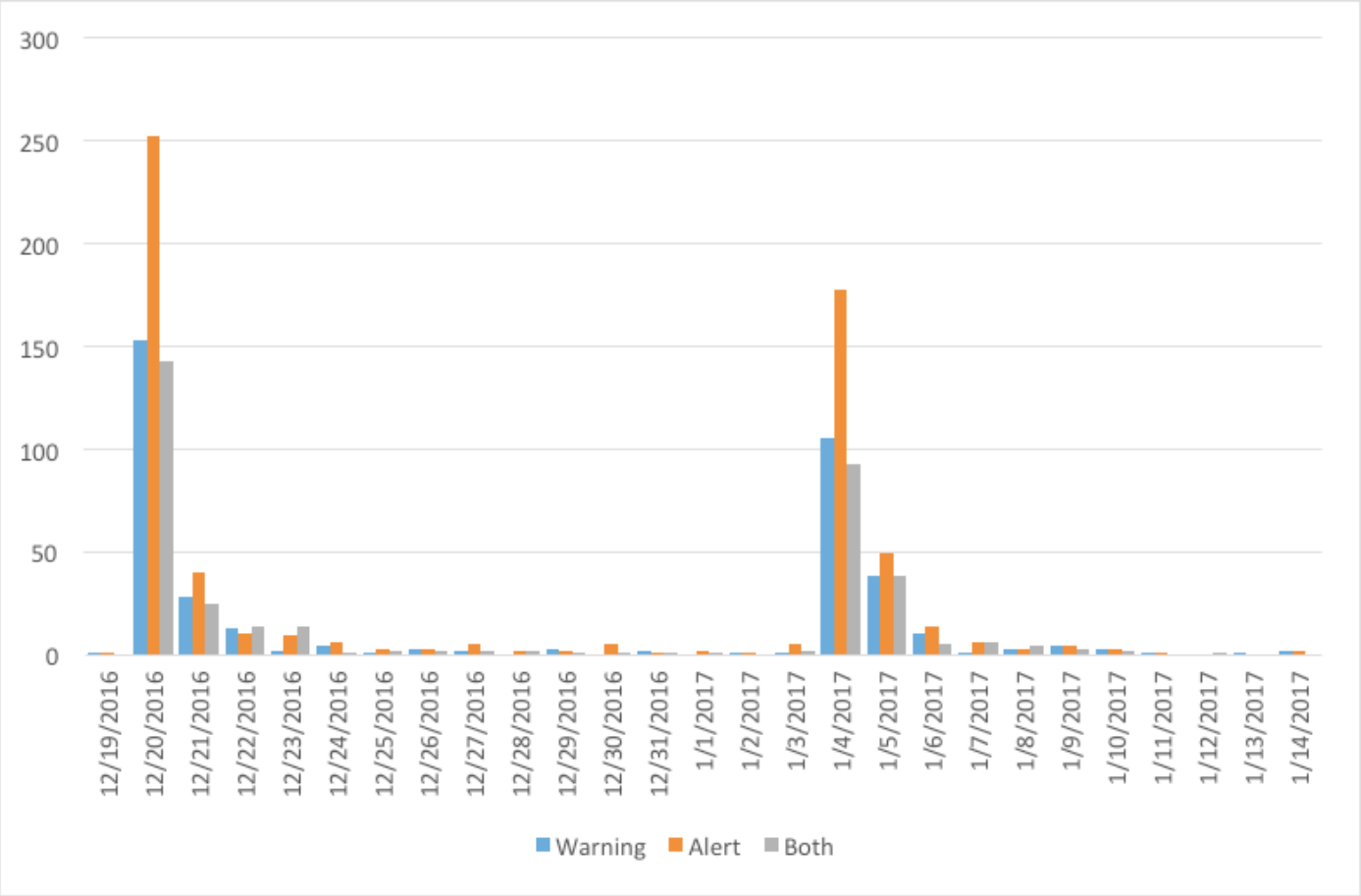

Figure 25 Bar graph showing number of survey responses received by day[8]

[8] **Totals for the final date shown of 14/01/2017 actually include a small number of responses for a period of several days from and after that date.**

Appendix 5 - Methodology for spatial integration of survey respondents' locations

Step 1 - Geocoding

Most respondents provided a full postcode, and most of the latter were matched to current ('live') postcodes listed in the Scottish Postcode Directory (SPD)[9]. This provided a basis for geocoding, as, among other things, the SPD provides spatial coordinates for included postcodes.

The coordinates assigned in the SPD are those for the address judged to be nearest the centre of the populated part of each postcode. In addition, a key assumption of this geocoding approach is that the postcode respondents provided for the survey were for the locations they registered with Floodline. In reality this will not always be the case.

Around 5% of respondents provided only the first part of their postcode, identifying a postcode district rather than an individual unit postcode. In this situation, spatial coordinates were assigned in a different way from above. In these cases, a mean Easting and Northing location for the postcode district was derived from the SPD and then allocated. This procedure was also applied to a smaller number of cases in which respondents provided a place name.

Postcodes given by a small number of respondents were for 'deleted' postcodes, i.e. no longer in use, according to the SPD. No attempt was made to investigate these further, and instead these postcodes and their coordinates have been included in the analysis. The number of postcodes in this category is very small and may have been given as a result of minor typing errors, e.g. AB41 7PP given in place of AB51 7PP. Clearly this affects the allocated coordinate position, albeit not in a dramatic way.

Overall 96% of respondents gave information (Table 29) which enabled geocoding to be carried out.

Table 29 - Results from geocoding customer surveys

Survey by message type	Valid responses	Supplying postcode (for geocoding)
Alerts	603	578 (96%)
Warning	377	364 (97%)
Both	361	348 (96%
Total	1,341	1,290 (96%)

[9] https://www.nrscotland.gov.uk/statistics-and-data/geography/nrs-postcode-extract. SPD Version 16/2 was used.

Step 2 - Matching to Flood Alert areas

Respondent locations represented as the geocoded points were linked to boundary files for Flood Alert regions supplied by SEPA. Total respondents per Alert Region could then be counted and compared to the overall numbers of customers in each region as also supplied by SEPA (Table 30).

Columns 1 of this table shows the Flood Alert regions, and columns 2 and 3 provides the overall numbers and percentages of all Alert customers from the Horizon system – this provides a rough yardstick for comparing the geographic distribution of survey respondents. Column 5 provides the corresponding percentages of respondents per region. Arrows in column 5 signify the degree of difference in the percentages in columns 2 and 3.

Generally this comparison adds to view that the surveys are representative of the overall Floodline customer population. For 13 of the 19 Alert regions the percentages of survey respondents is within +/- 0.5% of the percentage of the customers in those regions according to the Horizon system records. In the three Alert areas of Tayside, Dumfries and Galloway, and especially in the Scottish Borders, the survey percentages are more than 0.5% above the corresponding Horizon percentages. The largest difference for the Borders area probably reflects the enduring impact of the winter 2015/16 floods on residents in that region.

In contrast, in West Central Scotland, the percentage of survey respondents is more than 0.5% below the corresponding percentage of customers (difference of approximately 4%).

Table 30 - Distribution of survey respondents by Flood Alert region, compared to distribution of customers obtained from the SEPA Horizon database

1 Alert region	2 Horizon dataset 02/06/16 Numbers	3 Horizon dataset 02/06/16 %s	4 All 3 surveys %	5 Survey % (col 4) – Horizon% (col 3)
Aberdeenshire and Aberdeen City	2357	16.2%	15.7%	←
Edinburgh and Lothians	1713	11.8%	12.0%	←
West Central Scotland	1691	11.7%	7.4%	↓
Tayside	1316	9.1%	10.1%	↑
Findhorn, Nairn, Moray and Speyside	1139	7.9%	7.9%	←
Central	1042	7.2%	6.7%	←
Ayrshire and Arran	1035	7.1%	6.3%	↓
Scottish Borders	994	6.9%	9.4%	↑
Dumfries and Galloway	777	5.4%	6.7%	↑
Fife	574	4.0%	4.2%	←
Dundee and Angus	558	3.8%	4.3%	←
Easter Ross and Great Glen	497	3.4%	3.9%	←
Argyll and Bute	373	2.6%	2.7%	←
Skye & Lochaber	175	1.2%	0.3%	↓
Caithness and Sutherland	114	0.8%	1.3%	←
Orkney	54	0.4%	0.5%	←
Shetland	54	0.4%	0.3%	←
Wester Ross	25	0.2%	0.1%	←
Western Isles	20	0.1%	0.2%	←
Base	*14,508*	*100%*	*1,290*	

Key: ← = Survey % (column 7) within +/- 0.5 of % from Horizon dataset (column 3); ↑ = Survey % more than 0.5% above the Horizon value; ↓ = Survey value more than 0.5% below Horizon value.

Step 3 - Matching to Flood Warning Areas

The geocoded survey respondent locations were also matched against the Flood Warning Areas, using the same process as above and with Warning Area boundaries supplied by SEPA.

However, in this case, the option to measure the distance from each geocoded respondent location to its closest Warning Area was also used as part of the matching process. These distances provided for a degree of tolerance when comparing geocoded respondent locations to the Flood Warning Areas, allowing for a level of spatial uncertainty in the datasets. This uncertainty existed primarily because respondents were geocoded to centroids of postcodes, not to their precise locations. In addition, there would also be a degree of imprecision in the spatial boundary datasets obtained from SEPA. Thus in matching survey respondents to Warning Areas, an arbitrary distance cut-off of 200 metres was used – similar to the basis used to match Data Zone centroids to Warning Areas (see Appendix 2).

The results from this process are summarised in Table 31.

The key groups here are in column 5 of the table, combining respondents to the Warning-only customer survey and respondents to the survey for customers registered for both Warnings and Alerts. According to the guidance issued by SEPA all such customers should have been registered to receive messages for addresses that fall within a Warning Area. To a large degree the tabulated percentages bear this out, since of the total 712 such customers with geocoded locations, 88% were matched to a Warning Area, 71% of whom had a location falling inside a Warning Area (see 2nd row of Column 5). The latter percentage was higher for Warning-only customers at 77% (2nd row of Column 2), compared to 66% of those responding to the survey of customers registered for both Alerts and Warnings (2nd row of Column 3). In theory, no respondents to the survey of Alert-only registered customers should be located within Warning Areas. Column 4 suggests that this also broadly true, with only 3% with a location matched inside a Warning Area.

The geographic breakdowns of the subset of geocoded survey respondents who were matched to Warning Areas were also examined. These subsets included those respondents with locations matched within a Warning Area or within 200 metres of the nearest Warning Area.

For those registered for Warnings only, the highest proportions of respondents are in two Warning Areas - Mussleburgh Coastal, and North Muirton Industrial Estate to North Inch in Perth, each with 4% of geocoded respondents. Other Warning Areas with 3% of respondents each include the following: Roseburn in Edinburgh; Ballater; Shawlands, Langside and Cathcart in Glasgow; Haddington (Green); Stonehaven; and Forres.

For the survey of customers registered for both Warnings and Alerts, the highest proportions of respondents were in Ballater and Stonehaven, with 7% of respondents each. A further 4% are in each of the Forres and Comrie Warning Areas, and 3% each are in the two Target Areas of North Muirton Industrial Estate to North Inch and Inverurie.

Table 31 - Distribution of survey respondents in relation to Flood Warning Areas

1 Geocoding against Warning Areas	2 Warnings survey %	3 Both Survey %	4 Alerts Survey %	5 Warnings + Both %	6 All 3 Surveys %
Total geocoded	364	348	603	712	1290
Located within a Warning Area	77%	66%	3%	71%	41%
Within <= 200m of nearest Warning Area	16%	18%	18%	17%	17%
> 200m from nearest Warning Area	8%	16%	79%	12%	42%
Total located within or <= 200m from nearest Warning Area	92% (n=336)	84% (n=291)	21% (n=121)	88% (n = 627)	58% (n = 748)

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CREW is a Scottish Government funded partnership between the James Hutton Institute and Scottish Universities.