



Scottish Flood Forecasting Service  
Working in partnership

# Annual Report 2017-2018



Image Credit: Peter Jolly, Northpix



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# Foreword

Welcome to our first Scottish Flood Forecasting Service Report. Here we've captured the achievements of the partnership during the 2017-2018 period, and our aspirations for future working.

The Scottish Flood Forecasting Service (SFFS) is an operational partnership between the Met Office and SEPA set up in 2010 with the support of the Scottish Government to bring our leading combined capability in weather and flood forecasting to Scotland. It delivers a daily Flood Guidance Statement to civil contingency responders and regional Flood Alerts to the public; it also supports local community Flood Warnings.

Through this report, we wanted to reflect on our activities over the recent period and wanted to share with our partners and with our own staff our achievements, our learning and the future aspirations for improved flood forecasting in Scotland. There are two key themes coming through - community action and informing; and improved forecasting capability and knowledge.

We hope you enjoy the report and would welcome any feedback. We hope to produce similar reports on an annual basis in the future.

We look forward to expanding the knowledge of flood forecasting across Scotland and working with you all in doing so.

Thank you

**David Pirie, Executive Director, Evidence and Flooding, SEPA**  
**Andy Kirkman, Director of Government Services, Met Office**



**David Pirie, Executive Director, Evidence and Flooding, SEPA**



**Andy Kirkman, Director of Government Services, Met Office**

# 1. Introduction

Flooding is a frequent natural hazard in Scotland which can have devastating impacts on people, our activities and our natural and built environment. The Scottish Flood Forecasting Service (SFFS) is a strong working partnership between the Scottish Environment Protection Agency (SEPA) and the Met Office which underpins the response to flooding by the emergency response community and by the public.

The SFFS partnership has been built to combine the knowledge, data and expertise of the Met Office and SEPA. It works both at an operational level – delivering a daily Flood Guidance Statement, and a strategic level – undertaking research and development and improving flood forecasting. Flood vigilance and preparedness amongst the civil contingency responder community is of particular importance, and we are looking to develop the knowledge and capability informing this.

Forecasting surface water flooding is one of the biggest challenges we face, and as a partnership the SFFS will continue to work closely together and with other organisations to develop and trial innovative new ideas. The same approach will be applied to snow, as the impact from melting snow can be significant when coupled with other meteorology.

Another significant on-going development is the creation of a new public version of the flood guidance statement to improve the awareness of flood risk to all communities in Scotland.

Biennially through the Emergency Responder survey conducted by the Met Office and Flood Forecasting Centre partnership, we receive a number of results relating to the operational outputs and actions of the SFFS. Those results and statistical analysis are noted throughout the report, highlighting things we do well and feedback on what we could improve operationally.

## SHARED CORPORATE OUTCOMES

Working at the forefront of weather and climate science for protection, prosperity and well-being

### THE IMPACT OF FLOODING IS REDUCING

The likelihood and potential impact of flooding across Scotland is understood and strategies are developed to tackle greatest risks.

Flood warnings are provided and business, communities and individuals understand the steps they can take to protect themselves from the impact of flooding.

Robust advice is given to ensure planning decisions are well informed and new developments are not located in high risks areas.

<sup>1</sup> SEPA Corporate Plan at <https://www.sepa.org.uk/media/286930/2017-2022-corporate-plan.pdf>

<sup>2</sup> Met Office Corporate Plan at <https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/library/2016-21-corporate-plan---2018-update>

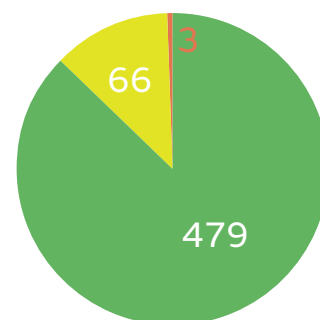


## 2. Operational Activity: April 17 - September 18

The 18 months to September 2018 were relatively quiet, particularly the spring and summer of 2018. We issued 552 Flood Guidance Statements. This included four afternoon updates, in addition to the usual morning issue, on days of elevated flood risk.

Medium risk forecasts (areas coloured amber) featured on 3 days during this period: 16 October, 2 January and 24 January. There were no days of high risk (red). Appendix 1 has a table summarising the Flood Guidance Statement daily highest colour during the period.

SEPA's Flood Forecasting Hydrologists issued 186 active Flood Alerts across the 19 regions during this period. A discussion of three notable events from the 18 month period follows.



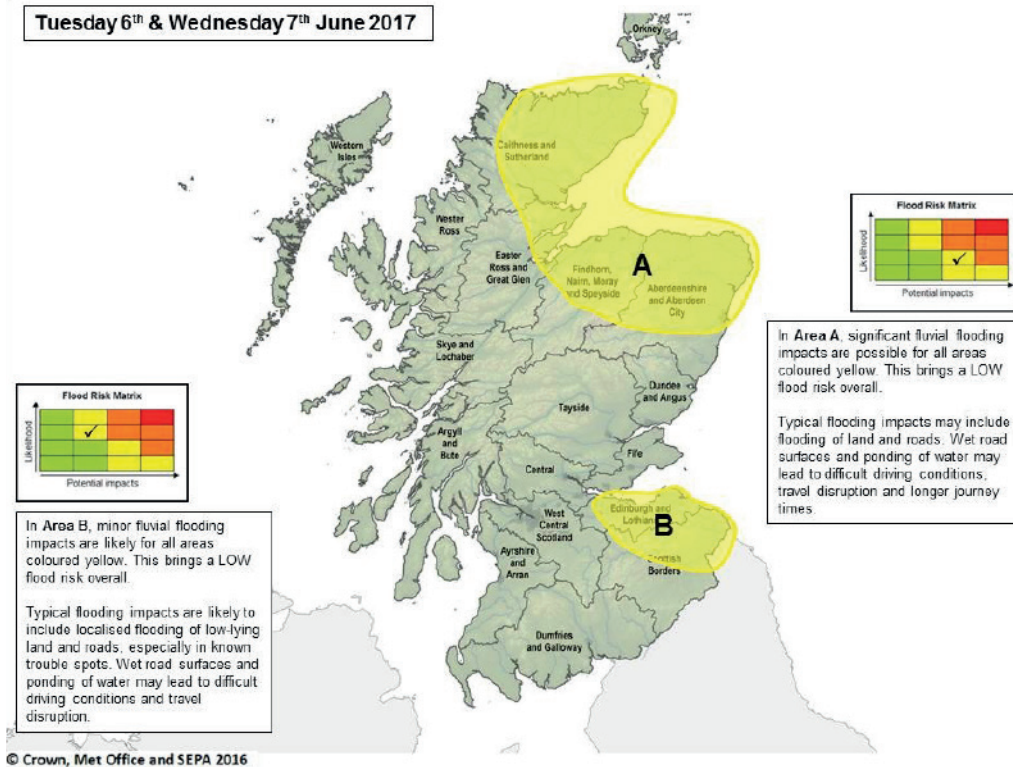
April 2017 - September 2018  
Days with max FGS colour



A relatively quiet period for the service, though with some notable events.

## 6 June 2017

There was some widespread significant flooding in June, in particular river flooding in Moray and the north east, and surface water flooding in Edinburgh and the Central Belt. Whilst heavy rain was expected, there was considerable uncertainty within the forecasts as to the severity and location. To reflect this uncertainty the Flood Guidance Statement indicated a low likelihood of significant flooding, as shown in the Area of Concern map.



In the event, over 100mm of rainfall in 24 hours fell in some areas, with flooding impacts from rivers in locations such as Portsoy in the north east (see picture on previous page). Properties were evacuated and the Inverness to Aberdeen railway line was flooded. There was also widespread surface water flooding, particularly in Edinburgh.

### Things we learned from this event:

The significant event in the north east had been forecast at this level of impact.

The potential for flooding in Edinburgh was also identified in advance, although not the level of impacts.

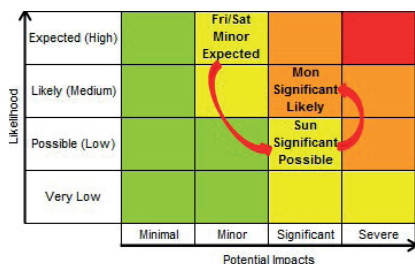
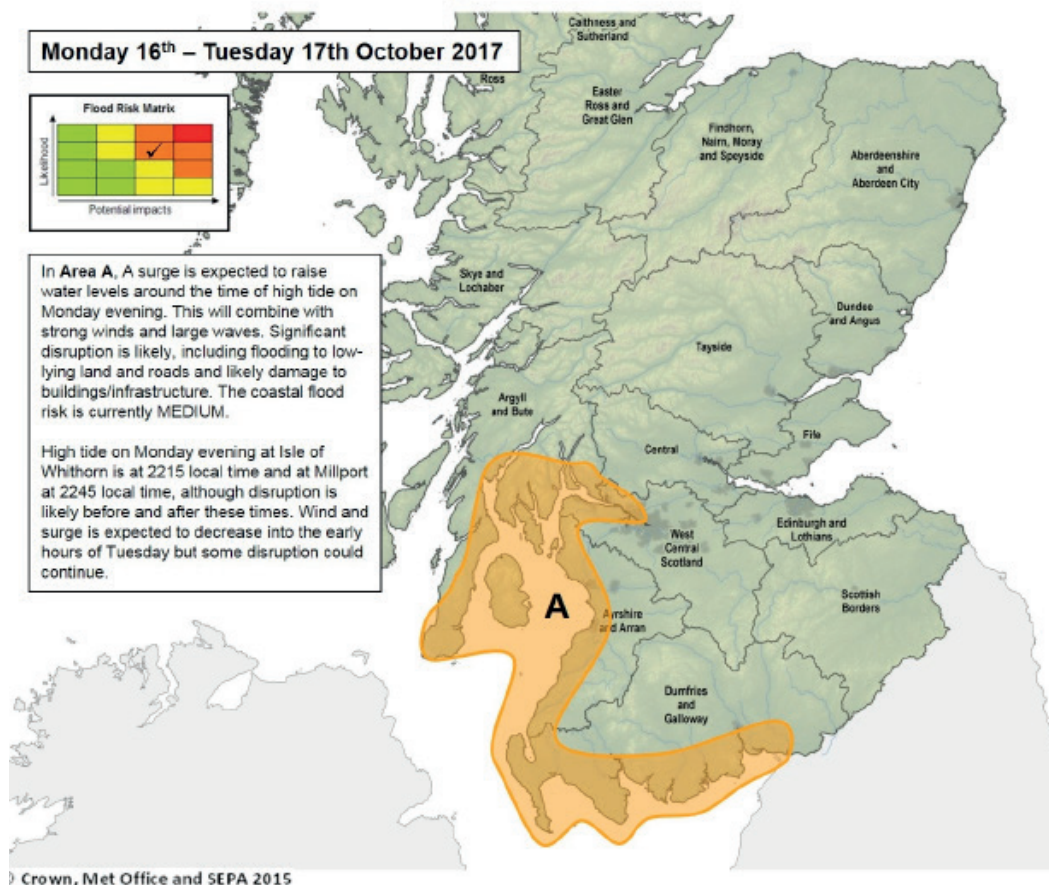
Surface water forecasting is subject to a great deal of uncertainty. We aim to address this in the future by implementing higher resolution ensemble forecasting and developing surface water impact modelling capabilities, as indicated in the Flood Warning Development Framework.

<sup>3</sup> Flood Warning Development Framework 2017-2021 <https://www.sepa.org.uk/media/219818/sepa-flood-warning-development-framework-2017-2021.pdf>

# 16 October 2017

Ex-hurricane Ophelia brought with it heavy rain and strong winds. The main risk was for coastal flooding in the south west of the country, leading to medium (amber) status on the Flood Guidance Statement. There were some impacts in this area, however our forecasting models for the Solway coast were still fairly new, so the forecasts erred on the side of caution and impacts were probably over-forecast here.

## Specific areas of concern



The FGS indicated low (yellow) flood risk, with minor coastal impacts expected, from Friday 13 October. The status remained low over the weekend, though the message was now that significant impacts were possible. Finally on Monday the message was that significant impacts were likely and the risk was escalated

to medium (amber). This is a good example of how thinking on impact and likelihood will often change in the lead in to an event.

## Things we learned from this event:

Some refinement of warning thresholds is required along the Solway coast. We are gathering more impact information with the assistance of local authorities and will review the warning thresholds next year.

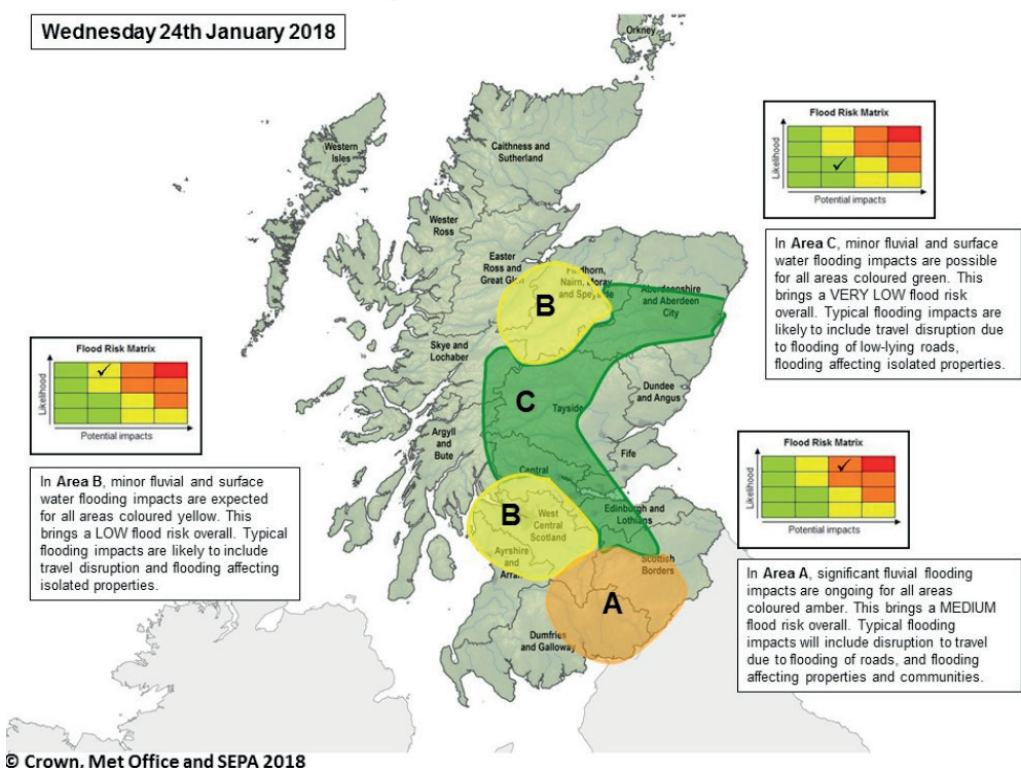


# 24 January 2018

On Wednesday 24 January a combination of rainfall and snow melt led to increased runoff and flooding in the south of Scotland, particularly the Borders. A heavy build up of snow in preceding days was rapidly melted when milder conditions arrived.

This proved challenging to forecast. During the preceding few days forecasts indicated enough rainfall and melting of the snow pack to suggest that minor impacts would be possible. This very low flood risk was indicated on the Flood Guidance Statement, with an area of concern map on Tuesday 23 January. On Wednesday the risk was elevated to medium (significant impacts expected) due to reports of flooding on some trunk routes.

## Specific areas of concern



This event shows firstly the difficulties of forecasting when there is snow on the ground that may melt. The extent and depth of the snow pack are hard to estimate. It also illustrates that the evolving forecast of impacts (from minor to significant) can affect the flood risk message considerably.

### Things we learned from this event:

Further improvement of snow forecasting capabilities is required. We are addressing this through a review of monitoring and forecasting techniques. This will include making near real time snow depth information more accessible to the forecasters.

Improvements in how we communicate complicated and uncertain forecasts are required. Further liaison with partners can help this.

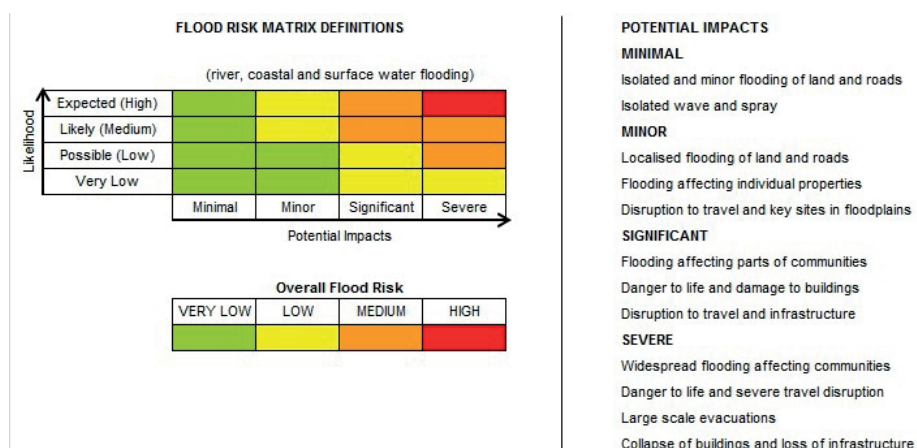
# 3. Service Improvements

Following customer feedback we have reviewed the Flood Guidance Statement and made some changes. A major review of the statement is about to commence.

## How we have responded to feedback:

86% of responders surveyed have told us that they were very or fairly satisfied with the Flood Guidance Statement. 88% use the flood risk matrix. Although these figures are high they represent a slight fall on previous years, therefore we made some simple changes to the statement in 2017.

This included **the addition of a revised risk matrix graphic and description of impacts** (see below). This should aid our customers in interpretation of the impact and likelihood language used in the statement. It also means that we can reduce the amount of text we use when describing impacts in more generic terms.



71% of the responders told us that they would find a **6-10 Day Outlook section** useful. During the spring of 2018 we launched an Outlook section in the Flood Guidance Statement. This will provide us with an opportunity to inform our partners on the occasions when possible impacts are forecast for beyond the five day period. We don't expect to use this very often, but it may apply for situations such as Atlantic ex-hurricanes, spring tides, snow melt and specific periods when a longer forecast may be helpful (such as at Christmas).

We are also looking further ahead to the future shape of the Flood Guidance Statement. This will tie in with other reviews carried out by SEPA and the Met Office into how we alert and warn for severe weather and flooding. A **public facing flood forecast product** is under development, as promised in SEPA's Flood Warning Development Framework. 63% of responders told us that they support this development.

A revised Guide for Users of the Flood Guidance Statement will be published in 2020.

# 4. Partnerships and External Engagement

We continue to work with our colleagues across the UK and beyond, to improve our forecasting capabilities and our influence.

## **Our partnerships:**

We work closely with the Flood Forecasting Centre (FFC) and other UK agencies. This ensures a pooling of knowledge and resources where appropriate, as we look to achieve similar outcomes in differing environments.

We are a member of the UK Coastal Flood Forecasting partnership, alongside the Environment Agency, Natural Resources Wales and the Department for Infrastructure Northern Ireland. The partnership maintains marine monitoring gauges and data that are used for coastal flood forecasting and works closely with supporting organisations such as the National Oceanography Centre and the Centre for Ecology Fisheries and Aquatic Sciences.

We have worked with the Centre for Ecology and Hydrology and with the FFC, in a review of snowmelt forecasting techniques, some of which work has fed in to improvements in our 'Grid-to-Grid' forecasting model used this past winter. We have also worked with these partners to look at ways of verifying rainfall and river flow ensembles; this work will continue on this during the coming year. We attended the quarterly meetings of the Inter Agency Committee for the Hydrological Uses of Radar (IACHWR).

## **Our external promotion:**

We have had a regular presence at conferences and workshops throughout the year, within Scotland, other parts of the UK and abroad. Some of these are listed in Appendix 3.

The SFFS blog provides commentary on flood events in Scotland and developments within the service. It can be found at [www.floodforecastingservice.net](http://www.floodforecastingservice.net).



## Our customer engagement:

The 2017 biennial Emergency Responder Survey was undertaken for ourselves jointly with the Met Office and Flood Forecasting Centre, and reported in the spring of 2017. There were continuing high levels of satisfaction with the Flood Guidance Statement and useful feedback on current and possible future products. Some of the results have been referred to earlier in this report. Others are shown in Appendix 3.

The partnership is encouraged by the results but, as with any operational service, we are always looking to make improvements and efficiencies. These include consideration for an increasingly mobile workplace and responder environment and how can we improve the accessibility of products.



Image Credit: Duncan Brown Photography

# 5. Future Strategy

The SFFS is a partnership, through which both SEPA and Met Office corporate objectives and aims are being addressed. We contribute to SEPA's Flood Warning Development Framework for 2017-2021, and the Met Office's Our Plan 2016-2021 (update 2018) by protecting people, property and prosperity in Scotland.

## Our future aims:

The three main future aims for the SFFS partnership are:

### 1. Maintenance of existing services

- continue to deliver daily flood guidance and regional flood alerting
- support community flood warning activity

### 2. Development and innovation to

- improve short and medium range forecasts
- explore approaches to surface water forecasting
- improve our knowledge of the processes involved in forecasting snow melt
- move towards real time impact forecasting
- produce a public facing daily flood forecast

### 3. Engagement with partners and customers to

- explore effective communication routes for our services
- make sure SFFS partnership between SEPA and Met Office continues to thrive by seeking feedback
- ensure most appropriate communication of flood risk

To support these aims, we have developed a Science Development Plan which combines the relevant capabilities of both partners, including:

- increasing lead time of short range forecasts
- improvement of high resolution ensemble forecasts
- implementation of NEMO (Nucleus for European Modelling of the Ocean) surge model
- extension of ensemble forecasts to five days
- using live wave buoy data to improve coastal forecasts
- upgrading surface water forecasting capabilities

We hope to report on progress of these initiatives in future annual reports.

# 6. Training and Development

The staff who support our forecasting service are key to our success. It is important that they have the right knowledge, skills and experience to help deliver world class services for Scotland. By investing in training and support for our staff, we have a team which is always ready for the next flood.

## Our staff:

The SFFS operates daily, with SEPA and Met Office teams linking up several times a day to exchange knowledge and expertise for the Flood Guidance Statement. Being a virtual service, this does not deter close working to make those operational decisions. The teams also have workshop-type knowledge exchanges throughout the year to share innovative ideas and ways of working.

Our customers and stakeholders can have full confidence in the talented teams working with the SFFS; they all have continual professional development plans and undertake regular training. Take for instance SEPA, our staff are scheduled to study and be assessed for the Diploma in Operational Hydrometeorology. Our Met Office staff are at the forefront of weather forecasting, and are continually receiving professional development in the interpretation of forecasting models such like the latest in coastal products.

Bridging the two disciplines of hydrology and meteorology, we currently have two hydrometeorological trainees from SEPA who have completed the Operational Meteorology Foundation course at the Met Office College in Exeter. Both spent several months of assessed operational forecasting at Met Office Aberdeen where they worked with operational meteorologists producing a variety of forecast types. Now that their traineeship is complete, their combined skills in hydrological and meteorological interpretation will be very beneficial to the SFFS – this could be the blueprint for training future flood forecasting specialists.



Colin Smith and Laura Wilson, our hydrometeorological trainees.



# Appendix 1.

## Flood Guidance Statement in 2017-18

The table below shows the highest risk flagged on the Flood Guidance Statement published on that day, whether Very Low (green), Low (yellow) or Medium (amber). There were no days when the flood risk was assessed to be High.

### April 2017 - Sept 2018 Flood Guidance Statement highest colour (any day)

APRIL							MAY						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
						1		1	2	3	4	5	6
2	3	4	5	6	7	8	7	8	9	10	11	12	13
9	10	11	12	13	14	15	14	15	16	17	18	19	20
16	17	18	19	20	21	22	21	22	23	24	25	26	27
23	24	25	26	27	28	29	28	29	30	31			
30													

JUNE							JULY						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3							1
4	5	6	7	8	9	10	2	3	4	5	6	7	8
11	12	13	14	15	16	17	9	10	11	12	13	14	15
18	19	20	21	22	23	24	16	17	18	19	20	21	22
25	26	27	28	29	30		23	24	25	26	27	28	29
							30	31					

AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
		1	2	3	4	5						1	2
6	7	8	9	10	11	12	3	4	5	6	7	8	9
13	14	15	16	17	18	19	10	11	12	13	14	15	16
20	21	22	23	24	25	26	17	18	19	20	21	22	23
27	28	29	30	31			24	25	26	27	28	29	30

OCTOBER							NOVEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
1	2	3	4	5	6	7				1	2	3	4
8	9	10	11	12	13	14	5	6	7	8	9	10	11
15	16	17	18	19	20	21	12	13	14	15	16	17	18
22	23	24	25	26	27	28	19	20	21	22	23	24	25
29	30	31					26	27	28	29	30		

DECEMBER							JANUARY							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	
					1	2			1	2	3	4	5	6
3	4	5	6	7	8	9	7	8	9	10	11	12	13	
10	11	12	13	14	15	16	14	15	16	17	18	19	20	
17	18	19	20	21	22	23	21	22	23	24	25	26	27	
24	25	26	27	28	29	30	28	29	30	31				
31														

FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3					1	2	3
4	5	6	7	8	9	10	4	5	6	7	8	9	10
11	12	13	14	15	16	17	11	12	13	14	15	16	17
18	19	20	21	22	23	24	18	19	20	21	22	23	24
25	26	27	28				25	26	27	28	29	30	31

APRIL							MAY						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
1	2	3	4	5	6	7			1	2	3	4	5
8	9	10	11	12	13	14	6	7	8	9	10	11	12
15	16	17	18	19	20	21	13	14	15	16	17	18	19
22	23	24	25	26	27	28	20	21	22	23	24	25	26
29	30						27	28	29	30	31		

JUNE							JULY							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	
					1	2								1
3	4	5	6	7	8	9	1	2	3	4	5	6	7	
10	11	12	13	14	15	16	8	9	10	11	12	13	14	
18	19	20	21	22	23	24	15	16	17	18	19	20	21	
25	26	27	28	29	30		22	23	24	25	26	27	28	
							29	30	31					

AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
			1	2	3	4							1
5	6	7	8	9	10	11	2	3	4	5	6	7	8
12	13	14	15	16	17	18	9	10	11	12	13	14	15
19	20	21	22	23	24	25	16	17	18	19	20	21	22
26	27	28	29	30	31		23	24	25	26	27	28	29
							30						

# Appendix 2.

## Engagement in 2017-18

These are some of the events in which team members in the service were involved during the year.

- Flood and Coast – Telford, March 2017
- European Geophysical Sciences General Assembly – Vienna, Austria, April 2017
- Royal Meteorological Society – Exeter, June 2017 – poster on Radar Application In Northern Scotland project
- Stakeholder and User Group of the Flood Forecasting Centre – London, May and November 2017
- CIWEM Surface Water Flooding conference – London, September 2017
- Anywhere conference - Helsinki, Finland, September 2017 – poster summarising the entire forecasting, warning and dissemination service
- Delft-FEWS International User Days - Delft, Netherlands October 2017
- Flood Risk Management Conference – Glasgow, January 2018 – presentation on surface water forecasting developments
- European Flood Awareness System - Norrköping, Sweden, March 2018 – poster on flood events of the past year

# Appendix 3.

## Emergency Responder Survey 2017

Here is a sample of answers from the 2017 Emergency responder Survey. 153 responders took part in the survey. This includes both direct and indirect customers of the Flood Guidance Statement.

- Very/fairly satisfied with Flood Guidance Statement – 86%
- Access FGS mostly on a mobile – 48%
- Likely to be accessing FGS on mobile in next two years – 56%
- Area of Concern map is very important or essential – 87%
- Use the flood risk matrix – 88%
- FGS gives time on most occasions to take action – 82%
- Support a public facing FGS type product – 63%
- Would find a 6-10 day outlook useful – 71%





Contact email: [flooding@sepa.org.uk](mailto:flooding@sepa.org.uk)



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