



# NeXt Warning System (XWS)

## Discovery report

Version 1.1

March 2020

XWS Discovery Team

We are the Environment Agency. We protect and improve the environment. Acting to reduce the impacts of a changing climate on people and wildlife is at the heart of everything we do.

We reduce the risks to people, properties and businesses from flooding and coastal erosion.

We protect and improve the quality of water, making sure there is enough for people, businesses, agriculture and the environment. Our work helps to ensure people can enjoy the water environment through angling and navigation.

We look after land quality, promote sustainable land management and help protect and enhance wildlife habitats. And we work closely with businesses to help them comply with environmental regulations.

We can't do this alone. We work with government, local councils, businesses, civil society groups and communities to make our environment a better place for people and wildlife.

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# Executive summary

As a Category 1 responder under the Civil Contingencies Act, the Environment Agency (EA) has a legal obligation to prepare for emergencies including warning and informing others of the location, timing and magnitude of flooding from rivers and the sea in England.

This Discovery report looks at how the current flood warning service and supporting systems are designed, support and delivered. It outlines why we now need to change our approaches and proposes recommendations on how we can build a next generation flood warning system to support the needs of our users, the business and wider government. This report has recommendations on the next steps required in an Alpha phase - taking us closer to our next generation warning system.

Before starting our research, we needed to create a problem statement to help us frame the challenge we face, what our ultimate goal is and to provide a solution agnostic way of describing the issue.

*How can users at risk of flooding (or other hazards), receive relevant, useful and timely warnings so they can take appropriate action? What are we not currently doing to meet these needs?*

The Environment Agency aspires to be a forecast-led organisation that responds to the growing demands of climate change and extreme weather. We have seen a big increase in demand for our services and matched by a change in user expectations – as an organisation it's vital we respond to those user needs and think about our entire incident management response, and not just focus on floods.

In FWS, we currently have a system which provides a secure, resilient, accurate and timely service for our users. This system is however almost entirely flood focussed and is becoming inflexible to changing user needs. We have also changed as a business. The creation of the Incident Management and Resilience (IM&R) function in the Operations directorate means we have a greater opportunity to expand our horizon to include other environmental impacts across the EA - and potentially Defra, even the wider government.

Our Discovery took place over 10 weeks and follows the Government Digital Service (GDS) Discovery process, which focuses on identifying:

- potential end users of a service and what they're trying to achieve
- constraints that may affect the service, including departmental and agency policy intent
- opportunities to improve things

We have a good understanding of who are users are based on previous research for the Flood Information Service on GOV.UK, which is part of the same user journey for XWS – for this reason sharing these users across our service makes sense. ‘Users’ are defined as anyone interfacing, using, maintaining, or supporting the current Flood Warning System (FWS) and identified as benefiting from its added and revised components (XWS).

Based on our Discovery, we recommend that the XWS project should proceed to an Alpha stage. We recommend breaking down Alpha into three distinct parts, each focussing on an area of development highlighted as an issue in Discovery. Our proposed Alpha phase prototypes are (provisionally):

1. A redesigned message sending process for staff to simplify and speed up the sending process and improve message quality for users
2. Refining a new online registration mechanism and user data model to allow a simple, easy to manage process for registering to the service

3. Designs for the “core engine” at the heart of the warning system. This is where the relationship between the what, where and who is calculated

Additionally, if we have time:

4. Creating a link to the GOV.UK Notify platform so we can send end to end messages via text and email to users as part of our testing and development

By proceeding in a low risk step by step approach, we can test the various products and delivery permutations and carry out essential additional user testing throughout the Alpha phase. Testing our most challenging assumptions and approaches in Alpha will allow us to find and rectify bottlenecks with our services and systems before we commit to our final design. These prototypes will allow us to identify problems in the key parts of the system as early as possible so we have time to decide how we will solve them.

We expect some of the components to be designed and developed in-house, some elements we are likely to outsource as small packages of work to suppliers on the G-Cloud framework (or similar). In line with the GDS service standard, we would seek to own (and share) the code, designs and output of anything developed by a supplier. By the end of Alpha we will be in a position to decide which of the ideas we have tested are worth taking forward to Beta.

We need to take bolder steps so we are able to respond to growing user expectations and the rapid developments in technology. Any new system will need to be managed to ensure that it provides a user focused, cost effective, resilient and accurate means of delivering warning information to our users.

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# Introduction

In England, around 5 million (or 1 in 6) homes are at risk of flooding with 2.6 million of these at risk from rivers or the sea. As a Category 1 responder under the Civil Contingencies Act, the Environment Agency has a legal obligation for warning and informing others of the location, timing and magnitude of flooding from rivers and the sea in England.

The Environment Agency (EA) has provided a flood warning service to the public, partners and the media for over a decade but it has remained largely unchanged for many years. The flood warning service is supported by systems maintained by the EA and third-party suppliers in order to provide accurate and up-to-date information to users.

The flood warning service and the flood warning systems are intrinsically linked - you cannot change one without changing the other. It's vital that we also understand the service we are providing to our users, so we can better understand how we can develop and improve our systems.

This Discovery report looks at how the current flood warning systems are designed, support and delivered, outlines why we now need to change our approaches and proposes recommendations on how we can build a next generation flood warning system to support the needs of our users, the business and wider government.

# Where we are now

This section looks at the current state of play with the Environment Agency's (EA) warning services. It outlines the responsibility as a flood warner, and how we currently deliver that responsibility.

## The Environment Agency's role in flood warning and informing

Under the Flood and Water Management Act 2010 the EA takes a lead role on river and coastal flooding in England whilst lead local flood authorities (LLFAs) take a lead role on local flood risk, including surface water, groundwater, and minor watercourses. Natural Resources Wales (NRW) and the Scottish Environmental Protection Agency (SEPA) have the same responsibilities in Wales and Scotland respectively.

The Environment Agency is a designated Category 1 responder under the Civil Contingencies Act, and as such we have a legal obligation to prepare for emergencies - in a flood incident, our role focuses on operational activities such as; predicting the location, timing and magnitude of flooding, warning and informing others, and operating our flood defence assets to protect communities and critical infrastructure.

The Environment Agency and LLFAs have powers to provide forecasting and warning services for the flood risks they lead on. The Environment Agency also has a strategic overview role for all sources of flooding and provides guidance and knowledge to LLFAs so they are better placed to deliver their responsibilities. As of March 2020, no LLFAs provide a formal warning service for surface water flood risk - although there are some surface water related flood warning areas in the Flood Warning System (FWS) that are used by local EA Area teams.

## Our flood technology estate

To provide flood forecasting and warning services to its users, the Environment Agency manages a complex technology estate, provided by a variety of suppliers and partners. This estate includes telemetry systems, forecasting systems and services all feeding into the decision making that then triggers messages being issued from the flood warning systems. The diagram in Appendix A provides a visual representation of the entire flood estate. This section focuses on the background of each of the flood warning system elements - what they provide and how they operate.

### Flood Warning System (FWS)

FWS is the EA and NRW's primary flood warning system - it holds large quantities of user data, as well as being the definitive source for flood warning area extents. The system is used by Area Duty Officers to issue flood alerts and warnings to our users. Downstream systems are also updated from data held within FWS, either directly in real-time or via scheduled data exports.

FWS is built largely on the prior Floodline Warnings Direct (FWD) system that Fujitsu designed in the mid-2000s and implemented and operated between 2006 and 2017. Whilst some system elements were modernised and updated, large elements of the system were ported over directly from FWD when FWS went live. This included little used elements that have been in the system since the inception of FWD and system parts (such as the user interface that duty officers use) have largely stayed the same for over a decade. Other elements were modernised and added as part of the Future Flood Warning System (FFWS) project and we began moving away from expensive proprietary software such as Oracle, to open source software such as Postgres - increasing the overall resilience of the system and lowering costs. We also retired little used contact channels (fax and pager), introduced new channels such as XML in the Common Alerting Protocol format and we began to use APIs for elements like map backgrounds, text messaging through GOV.UK Notify and neural text to speech conversions using Amazon Polly.

FWS is hosted on Fujitsu "private cloud" environment at their data centre in Stevenage, with the disaster recovery failover provided at the London East Data Centre. FWS is now almost entirely virtualised, offering flexibility in regards to provisioning and replication of our systems and

architecture. We continue to use a number of ISDN lines based in Fujitsu's data centres to send a proportion of our flood warning messages via telephone.

The Flood Warning System also hosts data to provide the River Advice for Boaters service in the EA. This is used by Waterways colleagues to inform river users of strong currents, high river levels or cold weather conditions for some rivers in England. Information is provided by automated telephone calls, email, text message and via an Interactive Voice Response (IVR) option.

## **Online Registration pages (OLR)**

The online registration pages allow home and business users to register, update and cancel their flood warning system accounts. The page designs were updated to comply with GDS style guidelines with the move to FWS, and rules regarding data input have been tweaked and improved to stop poor data entering the system since then. In almost every other respect, the OLR pages have remained largely the same and use the same user "flow" that was employed in FWD nearly 15 years ago.

The OLR pages are hosted on Fujitsu infrastructure, and are not formally part of the GOV.UK website. The FFWS project failed the GDS service assessment and therefore the online pages were not provided with a formal GOV.UK service link. Users can also update and cancel their accounts via the OLR pages - however, we see very few users actually doing this in practice. River Advice for Boaters users cannot use the OLR pages to register, maintain or cancel their details.

## **Targeted Flood Warning Service (TFWS)**

The Targeted Flood Warning Service (TFWS) provides an online service<sup>1</sup> to approximately 100 organisations in England and Wales with a more targeted and efficient flood warning service so that they can easily monitor multiple assets at risk from flooding. The system has been operational since 2011 and is provided by JBA as a subcontractor in the Fujitsu contract.

TFWS provides email notifications and displays flood warnings relating to locations stored within the system. Users can also create their areas of interest, based on administrative boundaries, such as County, Unitary Authority, Police or NHS areas. It will be of the greatest use and benefit for organisations that have multiple locations at risk of flooding or have a large operational boundary they want to monitor.

Initially this service was available to emergency responders and critical infrastructure operators but is now open for any organisation to register, both commercial and non-commercial. For commercial organisations and Category 2 emergency responders the service costs £4,700 per year. The service is free to non-profit organisations including Category 1 emergency responders.

## **Floodline Interactive Voice Response (IVR)**

Since April 2017, the IVR (Interactive Voice Response) system has been included as part of the FWS platform provided by Fujitsu. The Floodline IVR (and associated contact centre) are a key part of our service for supporting "assisted-digital" users who cannot or do not want to use our online services.

The system works by recognising the phone number (CLI) of the user and automatically playing the flood warning information relevant to them. Alternatively, the user can enter a Quickdial code or enter a combination of their landline telephone number and postcode to find information for their area. This information is then played from a recording created from FWS and data inputted by local Area teams. Users can also speak to the call centre before or after hearing their real-time flood warning information. Data required to make the IVR work is stored in FWS.

## **Extended Direct Warning contacts (EDW)**

This is our opt-out registration process that we have developed with telephony providers under the Civil Contingencies Act. The EA works with Fujitsu and the telephony providers to obtain contact numbers for unregistered properties in flood warning areas. Landline numbers are obtained from the BT Emergency Services Database and mobile numbers directly from providers using their

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<sup>1</sup> <https://www.fws.environment-agency.gov.uk/app/olr/fwslogin>

billing address (O2, Three, Vodafone and EE). Data is refreshed with providers on a set schedule. Once in the system EDW contacts will receive any Flood Warning or Severe Flood Warning message issued for their area via a telephone call. Most of our flood warning contacts are harvested through the EDW process.

Due to Data Protection laws, the telephony providers will only provide unlinked lists of telephone numbers and matched properties against each flood warning area - we cannot link the property related to its number or its occupants. Due to these data protection laws and the resultant way we designed the service to accommodate them, users registered via EDW cannot use our online registration pages to update or cancel their accounts - all account maintenance must be performed via our Floodline call centre or EA staff. Telephone numbers provided by the telephony companies are also redacted in the FWS database and user interface.

## Other systems and services

Although not part of our core warning system, it's important that we consider the impact that any system changes will have on services and systems that interact with the core system. These include:

- Floodline call centre - our primary call centre for dealing with flood related queries and incidents. This is integrated with the IVR which customers see as the same service as both are accessed via the same 0345 988 1188 telephone number. Data is also provided to the Floodline call agents regarding flood risk on a property level basis
- The Flood Digital team builds, runs and manages the Flood Information Service (FIS) which is hosted on the GOV.UK pages<sup>2</sup>. These pages contain live flood warning information that is supplied by FWS. These pages are incredibly popular during large flood events and we refer our users to the pages to get more information. For example, we supply direct links to these pages in the flood warning text messages we issue to registered users. Although not part of our contract with Fujitsu, it's important that we consider the impact that any system changes will have on the flood information service pages and involve the Flood Digital team in our decision making and prioritisation of work
- Flood Warning Information System (FWIS) - this is a service that provides data to populate live flood warnings on the internet. This is an automated process and is completed every 6 minutes. A replacement is in development for release in August 2020 which brings the management and development of this service in house.
- Google Public Alerts – flood information from the FWS is displayed on the Google Public Alerts website<sup>3</sup>, and for some severity messages, also in Google search results pages and in other Google products such as Maps and Assistant. Google Public Alerts uses data delivered via a Common Alerting Protocol feed on the public internet<sup>4</sup>
- Extended Floodline Service - a component of the Floodline call centre allowing local authorities to provide supplementary local flood information and direct transfers, in order to improve the customer journey of some callers
- BlueBox - a non-public facing system that processes flood data sets for use in other systems. Inputs include Flood Risk maps, flood warning areas and telephone STD codes. Data is currently uploaded manually by authorised Agency users. It is only available to internal Agency users, with a maximum of 5 users concurrently
- The Flood API<sup>5</sup> provides developers with access to near real time information covering including flood warnings and flood alerts extents (provided quarterly via the BlueBox) and the current live flood warning information (provided by FWS via FWIS). The Flood API is provided by Swirl and managed by the FCRM Data & Systems team in the Digital and Skills directorate

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<sup>2</sup> <https://flood-warning-information.service.gov.uk/warnings>

<sup>3</sup> <https://google.org/crisismap/uk>

<sup>4</sup> <https://cap-xml.prd.defra.cloud/messages.atom>

<sup>5</sup> <https://environment.data.gov.uk/flood-monitoring/doc/reference>

## Provision of managed services to other organisations

The Environment Agency works with similar organisations in Wales (Natural Resources Wales) and Scotland (Scottish Environmental Protection Agency) and provides managed services for some flood warning related systems and services. A managed service is one where the Environment Agency owns the contract with the supplier and we onwardly provide a service to a third party who contributes financially towards the service. We receive payments from the third party for the administration, licensing, data processing, reporting, compliance and all associated tasks that are relevant for the maintenance, and provision of the service. Costs for the services are broadly 10% across the board but not in all cases.

In the last few years NRW have developed their own digital services and requested the removal of their data from the GOV.UK on the basis that they believe this provides a better service for Welsh customers with all their services in one place in NRW's own website. The table below shows (as of March 2020) the flood warning systems and services shared between the organisations:

Service / System	EA	NRW	SEPA
Flood Warning System	Y	Y	N
Targeted Flood Warning Service	Y	Y	N
Floodline Call centre	Y	Y	Y
Extended Floodline Service	Y	Y	N
Floodline IVR	Y	Y	N <sup>6</sup>
Extended Direct Warnings	Y	Y	N
Flood Guidance Statement	Y	Y	N <sup>7</sup>
Flood Information Service on GOV.UK	Y	N	N
Google Public Alerts	Y	N	N
Flood API	Y	N <sup>8</sup>	N
BlueBox	Y	Y <sup>9</sup>	N

## Other alerting services in the EA, Defra and wider government

In FWS, we currently have a system which provides a secure, resilient, accurate and timely service for our users. This system is however almost entirely flood focussed and is becoming inflexible to changing user needs. The introduction of the Incident Management and Resilience (IM&R) function in the Operations directorate of the EA means we have a greater opportunity to expand our horizon to include other environmental impacts across the EA - and potentially Defra, even the wider government. The Environment Agency has several alerting systems already, besides FWS. These include:

- A Business Continuity Text Alerting tool to alert staff of issues with local sites and large scale events that may impact staff welfare
- Localised alerting systems, such as the Herts and North London Water Quality Incident alerting tool. This has been developed in house to serve a community of river users in north London
- The River Advice for Boaters service - although part of FWS, the River Advice for Boaters service is a separate alerting service for boaters used in several parts of the country. This

<sup>6</sup> SEPA have their own IVR service that links to Floodline

<sup>7</sup> SEPA have their own Flood Guidance Statement created with the Met Office

<sup>8</sup> NRW have their own API used to provide flood warning information

<sup>9</sup> Used to provide data for NRW website and Floodline

service provides alerts to when there are particularly strong currents in the navigable waters managed by the EA

We will engage with other departments in the EA, Defra and wider government to understand what existing alerting systems and services are in use - and how they work, who they target and what user needs they fulfil. We will also seek where there are potential "gaps" that could be filled with a common alerting engine.

# Drivers for change

## Changes to our organisational approach to incident management

The Environment Agency aspires to be a forecast-led organisation that responds to the growing demands of climate change and extreme weather. We have seen a big increase in demand for our services and matched by a change in user expectations – as an organisation it's vital we respond to those user needs and think about our entire incident management response, and not just focus on floods.

The Environment Agency's Incident Management Strategy 2017-2022<sup>10</sup> states that we must have clear and effective accountability, decision making and delivery across incident management. We need to be in the best shape possible to respond to the opportunities presented by incident experiences, government reviews and future spending reviews. Our ambition is to be a professional, trusted emergency responder and this strategy defines what more we need to put in place to achieve this. The introduction of the Incident Management and Resilience (IM&R) department in the Operations directorate was a step towards enabling better response across the business, for all incidents. Digital Services in IM&R have been tasked with supporting our incident response through digital channels, focussing on user needs and delivering products and services to serve these needs. The IM&R department was designed to ensure:

- we have a capable, committed and scalable workforce
- we work in partnership with others
- we are prepared and ready
- everyone has the right information to make decisions
- incident management is integral to what we do

As part of Discovery, we explored designing a system that is flexible enough that it could be used to warn citizens and partners for not only flooding, but also other incidents. This could include incidents managed by the Environment Agency, such as major pollution events - or incidents lead by other responders such as terrorism or fires, where there could also be a common requirement for a public alerting engine. This would allow for the system to be used across the Defra family, and even across the wider government – saving money, development time and providing a seamless service for citizens.

## A changing climate and increased extreme weather events

The Met Office's National Climate Information Centre team have produced a report<sup>11</sup> that reveals changes in extreme weather in the UK as measured by temperature and rainfall extremes since 1961. The report concludes that compared with 50 years ago, the maximum daily deluge each year has risen by 17% from 64mm to 75mm, while the longest wet spell has increased from an average of 12.4 days to 12.9 days.

Met Office forecasters cannot confirm that storms in the UK will become more powerful or more frequent in the future but they are confident that extreme rainfall is more intense. "The headline is wetter winters and drier summers, but there is still uncertainty over how much wetter and drier," said Jeff Knight, the Met Office's manager of climate variability modelling<sup>12</sup>. While future scenarios for rainfall and runoff are highly uncertain, there is less doubt that the future has greater variability

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<sup>10</sup> [http://ams.ea.gov/ams\\_root/2017/51\\_100/80\\_17.docx](http://ams.ea.gov/ams_root/2017/51_100/80_17.docx)

<sup>11</sup> [https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/state-of-uk-climate/soc\\_supplement-002.pdf](https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/state-of-uk-climate/soc_supplement-002.pdf)

<sup>12</sup> <https://www.theguardian.com/uk-news/2020/feb/17/uk-must-prepare-for-more-intense-storms-climate-scientists-say>

in extremes of rainfall, both in terms of flood and droughts. Problems are worsened by the degradation and concreting over of natural buffers, such as soil and green spaces.

During this Discovery phase, the UK experienced three successive large storms affecting England, Scotland and Wales - Storms Ciara, Storm Dennis and Storm Jorge. The 8th and 9th of February brought destructive winds and significant rainfall totals to the UK in the form of Storm Ciara. The strong winds brought widespread travel disruption and left over half a million homes without power. In terms of rainfall, the highest totals were recorded in the north west of England where 100 - 150mm of rainfall was recorded across much of Cumbria in 48 hours, with a few locations seeing over 180mm. North Wales and the Pennines also both saw a wide area exceeding 100mm of rainfall over 48 hours and some locations over 120mm in the same time period. As a result of this rainfall flooding affected many communities across northern England and Wales during the storm and over the subsequent days as water drained through catchments.

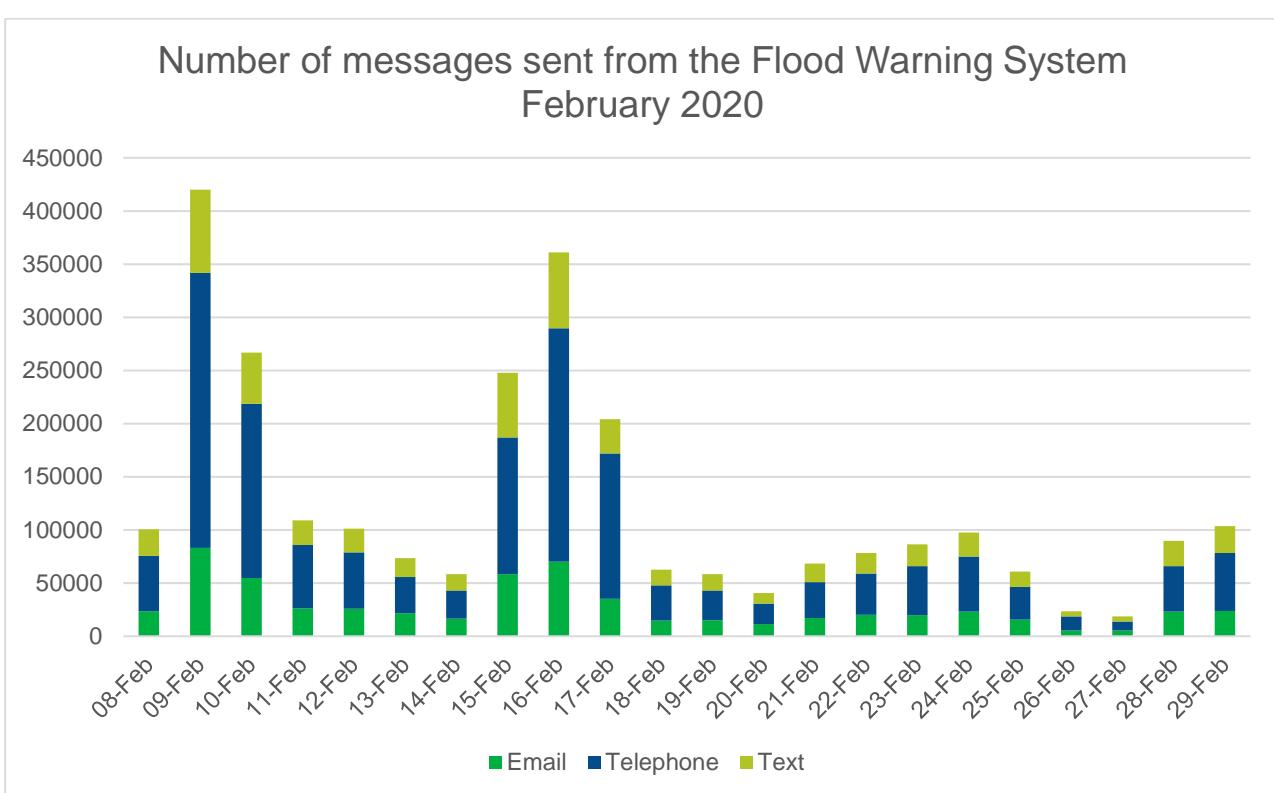
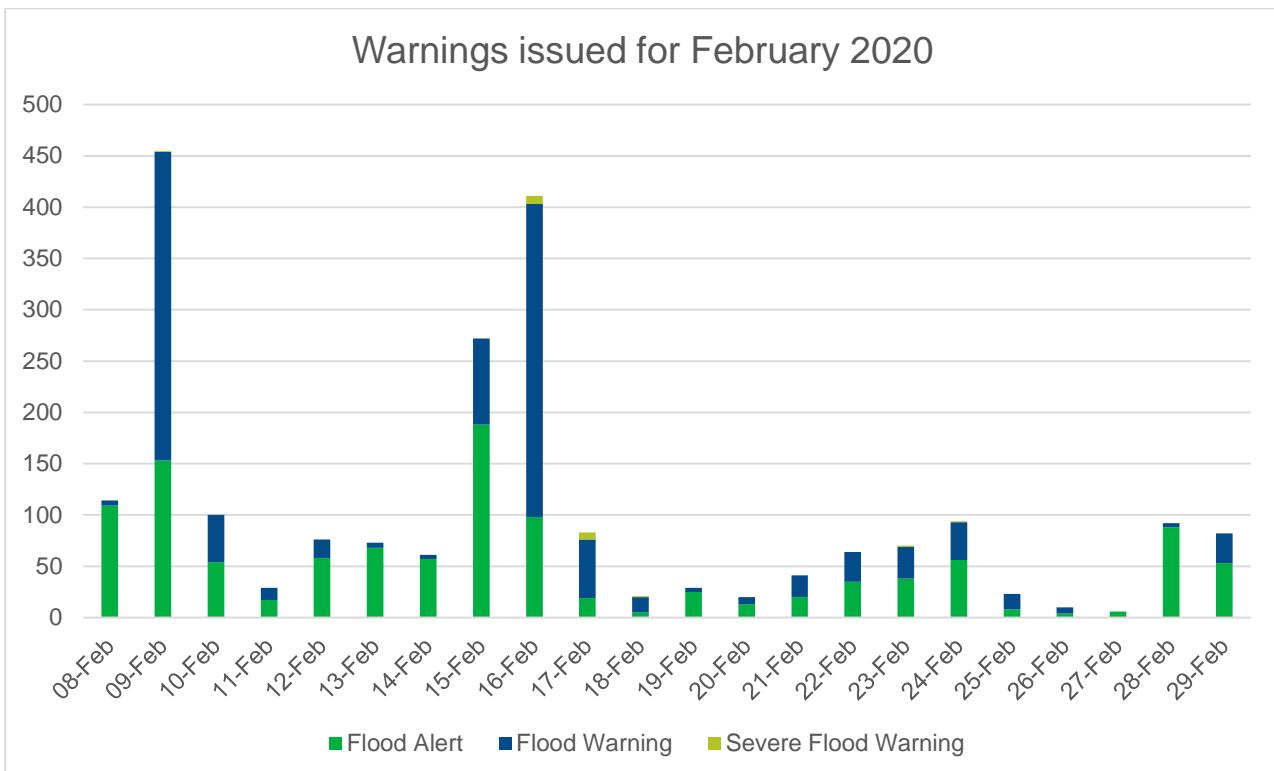
Storm Dennis arrived in the UK one week after Ciara, over the weekend of 15th and 16th of February. Wind strengths from Storm Dennis were comparable with those of Ciara, but the rain and subsequent flooding caused most of the disruption. The highest rainfall totals were recorded around the Wales/England border and in the south Wales valleys. When taken in isolation, the rainfall totals of Storm Dennis were less than those of Ciara; 50 to 100mm of rain on western uplands. However, this rain fell on already saturated ground and perhaps the more telling statistic is the 9 day window which covers both Ciara and Dennis where nearly all of the UK received the rainfall that would be expected across the entire month. Parts of eastern Wales/western England saw 150% of the monthly rainfall over these 9 days and some locations in Gloucestershire, Herefordshire and the Pennines saw double the monthly rainfall in just 9 days.

Over the final weekend of February (28th and 29th) Storm Jorge (as named by AEMET in Spain) tracked to the north and west of the UK bringing further strong winds (although less so than Ciara and Dennis), heavy rainfall and snow across Scottish high ground. Again, the rain was concentrated on the already saturated ground of western England and east Wales, with isolated areas of Wales seeing another 100mm of rain from this storm alone.

The cumulative effect of the rainfall from three significant storms was both dramatic and prolonged. The quicker responding catchments along the Welsh border and across northern England saw communities quickly flooded and isolated. In contrast the events on the slower responding Severn, Wye and Aire catchments ensured that the cumulative impacts of these storms remained in the public eye days and weeks after they had passed.

Sadly, fatalities were once again reported both as a result of falling debris caused by the high winds and from the powerful and unpredictable currents of a river in flood. Some 4600 properties flooded in England from these record breaking events though Environment Agency assets protected over 128,000 properties.

A total of 16,054 messages were sent between 8<sup>th</sup> February 2020 and 1<sup>st</sup> March 2020 inclusive. These include 25 individual severe flood warning messages and 1,121 individual flood warning messages. A total of 3,150,858 calls were sent - a call is an attempt by FWS to contact a customer using a method or methods chosen by that customer. Each Customer may receive calls via a number of different methods.



## Flood warning service assessment (2016)

The Government Digital Service (GDS) are responsible for ensuring government organisations create and operate good public services in line with the Government Service Standard<sup>13</sup>. It's the responsibility of a central government department to have their services assessed by GDS in order

<sup>13</sup> <https://www.gov.uk/service-manual/service-standard>

to gain Cabinet Office spend approval. A service assessment of the Future Flood Warning System (FFWS) project which lead to the roll out of FWS, highlighted some core issues with the approach taken when the system was designed, developed and rolled out, in particular:

- There was insufficient user research, and the user research that was conducted was relatively limited in scope and detail, so provides limited insight into the needs of affected users
- The team consisted of permanent civil servants from functional ‘pools’ of specialists in Defra, supplemented by developers from Defra’s supplier, Fujitsu. The nature of the contractual relationship between Defra and Fujitsu meant that they did not work as a conventional agile development team, but this is expected to change once new contractual relationships are in place. Defra should seek to reduce its dependence on third party suppliers, and aim to recruit development capability to ensure sustainable, continuous improvements of this and other related services
- There was no plan to allow a gradual introduction or real-world testing of the new service, and no fall-back plan in the event of problems with the new untested service. The ‘big bang’ approach to migration is a high-risk one, and whilst it may be the cheapest approach, it is not one that GDS would recommend. Some form of dual-running would be very valuable, both in terms of learning to improve the service from a subset of users, and in terms of de-risking the migration. We would urge Defra to reconsider this approach, which is a high-risk strategy

It's vital that we learn from this feedback and act on it when developing any new flood warning systems. GDS are key partners for ensuring that the services we provide the public are fit for purpose, affordable and delivering user needs. We need to move away from the ‘black box’ from a dominant single supplier and we won't be able to tackle some of the fundamental challenges we face if we replace like for like.

GDS have approved funding to extend the FWS contract through December 2022 on the provision that XWS address the shortcomings of the current service as outlined in a 2016 service assessment. Fujitsu is an excellent supplier and we could still expect to work with them in the future. Over the next 2.5 years we'll work with Fujitsu to deliver continuous improvement of FWS that can feed directly into our ambitions for XWS.

# Our approach to Discovery

Our Discovery took place over 10 weeks and followed the Government Digital Service (GDS) Discovery process<sup>14</sup>, which focuses on identifying:

- potential end users of a service and what they're trying to achieve
- constraints that may affect the service, including departmental and agency policy intent
- opportunities to improve things

What we learned during Discovery will help us decide if we need to move forward to an Alpha phase – and if we are, where we should focus our efforts and resources.

## Using the Government Service Standard

The Government Digital Service Standard is a set of criteria to help the government create and run good services. It's mandatory for services which exceed 100,000 transactions per annum and is used by departments and GDS to check whether a service is good enough for public use and exists to help the government build and run effective, user-focused services.

The flood warning service must meet the Service Standard to ensure that the service is part of the GOV.UK website, as well as ensuring it is a good digital citizen.

Throughout Discovery we have used the Service Standard criteria to guide our thinking across user research, data analysis and in our Discovery recommendations so that we can provide the best possible experience for users.

## The Discovery team

In line with GDS guidelines in the Service Manual, we created a small team working on Discovery, with a mix of EA and Defra Digital, Data and Technology Services (DDTS) staff.

The team comprises of:

- Business Project Manager from the EA
- Senior User / Product Manager from the EA
- Project Executive / Service Owner from the EA
- User Researcher from DDTS
- Business Analyst from DDTS



## Service Standard

<b>Meeting users' needs</b>	<b>1</b> Understand users and their needs <b>2</b> Solve a whole problem for users <b>3</b> Provide a joined up experience across all channels <b>4</b> Make the service simple to use <b>5</b> Make sure everyone can use the service
<b>Providing a good service</b>	<b>6</b> Have a multidisciplinary team <b>7</b> Use agile ways of working <b>8</b> Iterate and improve frequently <b>9</b> Create a secure service which protects users' privacy <b>10</b> Define what success looks like and publish performance data
<b>Using the right technology</b>	<b>11</b> Choose the right tools and technology <b>12</b> Make new source code open <b>13</b> Use and contribute to open standards, common components and patterns <b>14</b> Operate a reliable service

[www.gov.uk/service-manual/service-standard](http://www.gov.uk/service-manual/service-standard)

<sup>14</sup> <https://www.gov.uk/service-manual/agile-delivery/how-the-Discovery-phase-works>

## Defining the problem

Before starting our research, we needed to create a problem statement to help us frame the challenge we face, what our ultimate goal is and to provide a solution agnostic way of describing the issue.

*How can users at risk of flooding (or other hazards), receive relevant, useful and timely warnings so they can take appropriate action? What are we not currently doing to meet these needs?*

It's important to define what we mean by relevant, useful and timely.

- Relevant - for the area the user is in or is interested in and for a hazard the user is potentially at risk from
- Timely - the information is provided at an appropriate time to take action
- Useful - provides information and advice specific to that scenario, hazard, place and user in accessible and understandable ways

To answer this problem statement, we need to focus on learning about our users and their context, the constraints that affect this problem and what opportunities there are to improve the existing services. We have chosen to focus on 4 key areas to help us answer this problem statement and guide where we place our efforts in Discovery. These four key areas will help us uncover existing challenges, future opportunities and help us hone in on options for moving forward.

### User needs

- How are warning messages constructed, reviewed, sent, and distributed?
- What systems are involved, and can the as-is user journey be improved?
- How are warning messages received by different members of the public?
- What are the different user needs of our warning services from different user types? What is their end to end journey?
- What is the overarching user need for consuming non-flood related warning messages?

### Business needs

- What statutory duties do we need to fulfil via our warning service?
- How could the body responsible for warnings target specific users at risk?
- How can warning messages be effectively managed?
- How can warning messages be created accurately and quickly?
- How can warning messages be sent quickly and appropriately?
- What are the limitations of the existing warning services?

### Technology

- What level of resilience do we need to provide to a lifesaving digital service?
- What security do we need to implement to protect our data?
- What are the limitations of the existing warning systems?
- What data standards do we need to follow to ensure an effective and efficient service?
- What other systems need to interact with a warning system?

### Processes and data

- What data is required to provide a warning service?
- Where does this data come from?
- How do we manage this data to ensure effective use and accuracy?
- How do we align digital and non-digital warning services?

## System scope

Our current flood warning estate, as described in the first chapter is vast - built largely independently over many years to service many different user and business needs. In order to have an effective Discovery, we placed emphasis on the key warning elements of the flood estate, and devised a system scope diagram - this can be found in Appendix B.

All the systems within the dotted line are included in XWS Discovery. This means that we investigated each element, to better understand how they operate, what information they provide and how they relate to other estate systems. All lines, or data flows, entering the dotted box were included as part of XWS Discovery - these data flows provide key information to existing systems that are services outside of the scope of XWS. Some of these "downstream systems" already exist and are in use, whilst others are in development stages. For example, the IMFS system will go live in summer 2020, but the design is largely complete. By focusing on these core system components, we aimed to make best use of the Discovery time available.

## Scope and approaches to user research

Our Discovery addresses three key research questions, each with a specific objective. These objectives are key to enable us to understand how we can address our problem statement. Our user research findings are all mapped to these research objectives.

Research Question		Research Objective
1	How are flood warning messages constructed, reviewed, sent, and distributed by the Environment Agency?	To map out our current internal service usage and overlap, in relation to its user need.
1a	What systems are involved, and can the as-is user journey be improved?	To document and highlight internal user pain points, and recommend user-centric improvements.
2	How are flood warning messages received by different members of the public?	To understand and explore the landscape of external usage of EA warnings from end-end (from user finding about FWS service, to signing-up, use during high-stress scenario, and maintenance of their FWS accounts).
2a	What are the different user needs of our warning services from different user types? What is their end to end journey?	To understand and map our different user archetypes, including both FWS and TFWS.
3	What is the overarching user need for consuming non-flood related warning messages?	To explore what user appetite there is for receiving non-flood related alerts and warnings.

As a part of this Discovery process, we completed a number of user research activities with the flood response community. The main areas of activity we focused on were:

- Reviewing existing and/or overlapping information - focusing on recent relevant user research from other projects
- User interviews - focusing on responder context and behaviour. Interviews covered the existing processes for flood response, how information is received and how the responder approach could evolve if more information was provided
- Using semi-structured questionnaires - this element sought to test what elements of an information product would be valuable to responders and their tolerance to variations in notice given, spatial accuracy and confidence
- Usability testing - using mocked up information products, users were given task-driven activities in order to determine whether our proposed products were usable and valuable

Before we can begin to answer the research questions and objectives, we need to define an overarching methodology to ensure we remain on track to answer our Discovery problem

statement. Due to the nature of the warning service, we chose to focus on the ‘Who, Where, When, Why, What’.

1. Who are our existing users? Are there any new user groups that could benefit from a vanilla government warning service? What are their needs and what pain points do they have using the existing service?
2. Where is our service available and how does our service specify where warning messages are sent. How is this performing?
3. When are warnings issued? What services will we interface with that trigger when a flood warning is issued
4. Why is a service of this nature important for citizens?
5. What service do we currently provide? Is it performing and are there any missed user needs? What are the main pain points for our internal users and how does their experience influence external users

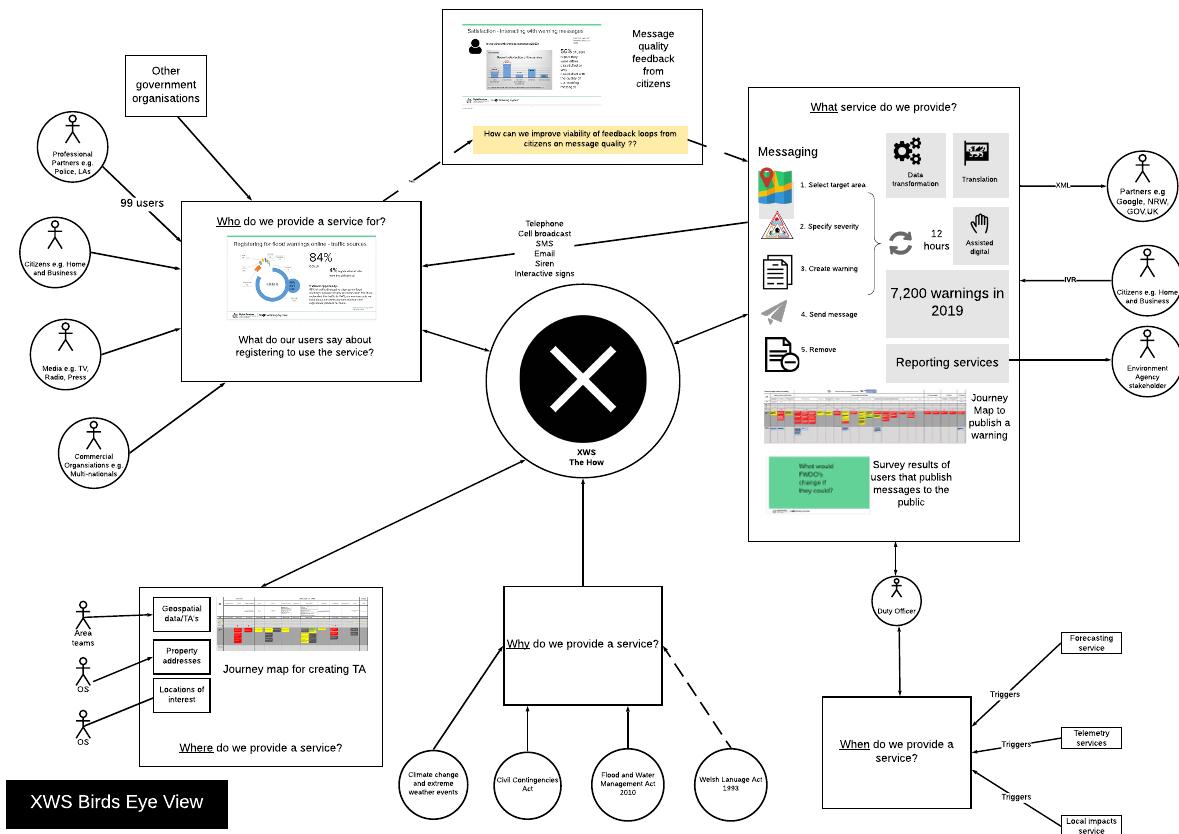


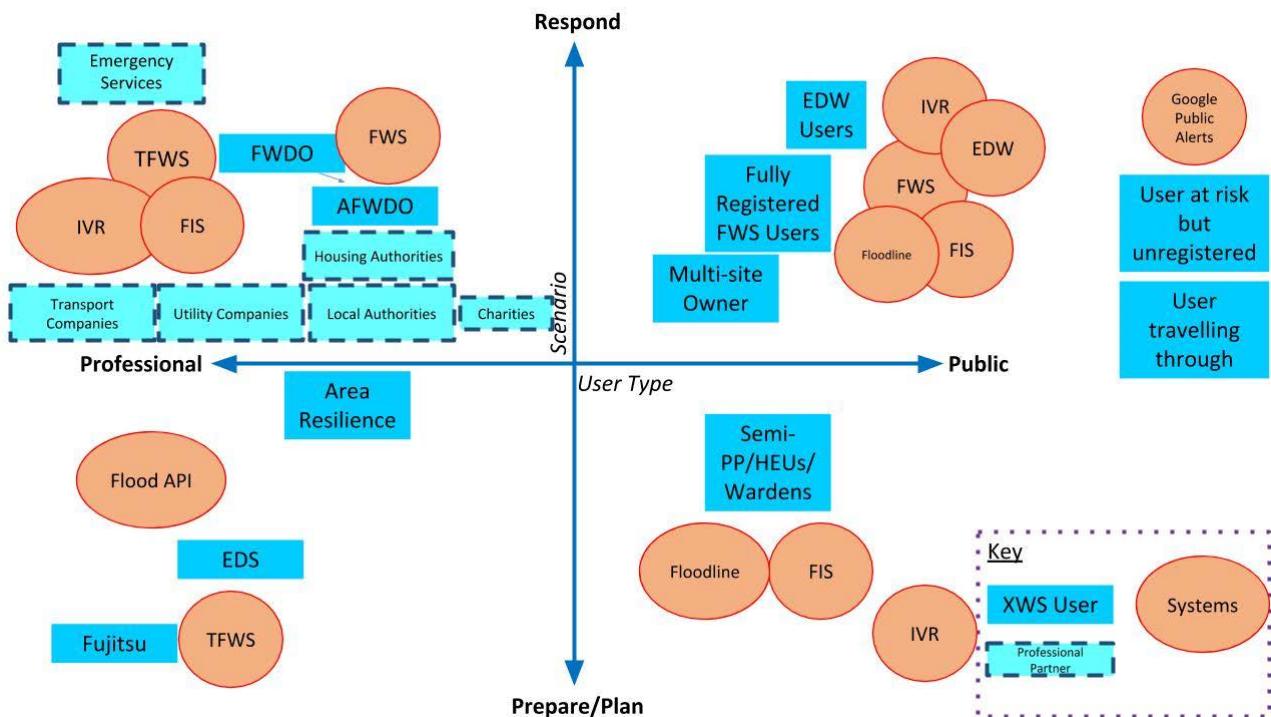
Figure 1: XWS Discovery Birds eye view

## Identifying who our users are

We have a good understanding of who are users are based on previous research for the Flood Information Service on GOV.UK, which is part of the same user journey for XWS – for this reason sharing these users across our service makes sense.

'Users' are defined as anyone interfacing, using, maintaining, or supporting the current Flood Warning System (FWS) and identified as benefiting from its added and revised components (XWS).

The following user compass offers a breakdown of this usage, plotting users on a usage nature scale (professional vs personal) and its stage through the incident stages (prepare/plan vs respond). A further distinction is placed between system users and professional partners, and systems are also visualised for this purpose.



## External users

Within our external user group, there are several key users with specific needs. Within these groups will inevitably be smaller sub-sections of users, for example users with accessibility needs or assisted digital users. However, in order to focus on the core needs of the service we chose to use the groupings below. By focussing on these broader user categories, we will also naturally begin to address the sub-section of users within each group too.

- Registered users

These are users who are currently fully registered to FWS and receive a full flood warning service and have flexibility in the locations they are interested in, the contacts they have registered and whether they receive optional messages (currently Flood Alert and Warning No Longer in Force messages).

- Opted-in users

These are users who have been automatically opted into receiving flood warning information via the EA and NRW Extended Direct Warnings service. They have their available landline and/or mobile contact registered to receive any flood warning or severe flood warning messages that affect their property associated with their telephone account.

- Unregistered users

The bulk of the population of England fall into this category. These users are not registered to receive any kind of flood warning information, but could be at risk, or may travel in areas at risk of flooding.

- Professional Partners

These users have a duty to carry out actions to plan, respond, or recover from incidents and need to be provided with accurate, relevant and timely information during incidents in order to effectively carry out their duties.

- Multi-site Owners

This user group includes current and prospective users of the Targeted Flood Warning Service (TWS). Their needs are broadly similar, even if they are commercial enterprises or not-for-profit organisations – they need to be informed in real-time of flooding for a number of different assets and/or locations.

## **Internal Users**

As with our external user group, there are several key internal users with specific needs. Within these groups will inevitably be smaller sub-sections of users, for example users with accessibility needs. As before, in order to focus on the core needs of the service we chose to use the groupings below.

- Flood Warning Duty Officers (FWDO) and Assistant Flood Warning Duty Officers (AFWDO)

These Duty Officers draft, issue, update and remove the flood warning messages through FWS. These use supporting tools and information to create a meaningful real time information message to include in the messages to provide advice and guidance to FWS users.

- Flood Resilience teams

Flood Resilience teams are responsible for updating, managing and removing the Target Areas (TAs) in FWS – these TAs represent the geographical areas that may be affected by flooding. They also provide support and training to their Area Duty Officers to ensure the system is used effectively and appropriately during incidents.

- IM&R Digital Services

These national teams are responsible for the ongoing availability, support and maintenance of FWS and supporting services and systems. They are vital for ensuring that the system is improved continuously in response to user needs support Area teams through training and documentation. They work with national colleagues to ensure that the digital systems and services provide the desired policy intent for the business.

- Other Environment Agency teams

Other teams in IM&R help provide our flood warning services, via policy, service management and training of internal users. We also have colleagues in the Digital and Skills department who share our flood warning information with external parties.

## **Personas**

Personas are used to illustrate our user base effectively. These have been developed and based on previous personas crystallised from research for the Flood Information Service on GOV.UK, which is part of the same user journey for XWS. We have created 10 personas as a result of user research from the XWS Discovery, and blended with our user knowledge of the overall immediate flood journey service design. Using an agreed persona set across IM&R/FCRM would be a powerful tool. The persona set can be found in Appendix D.

# What we have discovered

This section outlines our findings from the Discovery. The information and data below give an idea of how our users feel about our existing flood warning services – from these we have created hypotheses and user needs. The hypotheses and user needs outlined in this report will need to be validated in the Alpha stage of the project.

## External user research

### Contacting our users

We approached user research with external users in several different ways:

- We circulated a public survey<sup>15</sup> asking for behaviours, Common Alerting Protocol (CAP) thresholds and feedback around flooding incidents. As of 17<sup>th</sup> March, we have had 318 responses, and will continue collecting responses through the Alpha and Beta stages. We will follow-up specific feedback through interviews with users who have provided us with their contact details
- We have tested our ‘Get Flood Warnings’ prototype<sup>16</sup> in usability sessions and interviews with targeted user groups at UX labs in Norwich and Leeds focussing on users with: assisted digital needs and those classified as very low (2) on the digital inclusion scale, from a very low income, users suffering from mental health issues (anxiety, Asperger’s) and dyslexia, as well as being mobility impaired. Our second set of users included people whose houses had flooded, and who did not receive a warning
- We issued questionnaires to users who recently cancelled their Flood Warning account to understand motivations, and had follow-up conversations with them
- We had scheduled three focus groups with specially recruited users (with experience of flooding, from understudied demographics, with low digital skills, etc.), which had to be postponed due to the ongoing coronavirus situation. These 30 users have been contacted to switch their time to in-depth interviews which will take place during the Alpha stage
- We have analysed over 6,000 items of user feedback left through our GOV.UK Flood Information Service and Flood Warning Service online registration pages to understand user behaviours, pain points, and needs. We have analysed our web and general analytics from the past 24 months to cross-analyse our findings
- Overall, we have been in contact with over 50 professional partners during our Discovery. Existing networks of emergency responders and resilience direct were leveraged to elicit user needs from different areas of professional partners. Research with professional partners has been hampered by ongoing flooding incidents through February and early March, meaning most conversations have been postponed
- We hosted 8 meetings across government departments to understand wider alerting needs
- We also want to Mytholmroyd during the February flooding to see first hand the impact of a major flood event in effect

Whilst the sample size of user feedback is significant in research terms, it represents a small fraction of total service users. We’ve also assumed that users have been able to articulate what they need.

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<sup>15</sup> [https://defragroup.eu.qualtrics.com/jfe/form/SV\\_1AC4sIAvD8Poull](https://defragroup.eu.qualtrics.com/jfe/form/SV_1AC4sIAvD8Poull)

<sup>16</sup> <https://demo.fws.environment-agency.gov.uk/>

## Satisfaction with the current service

The combined satisfaction scores show that 62% of users were either satisfied or very satisfied. However, once the feedback was broken down further, it gave a different picture and highlighted options for continuous improvement.

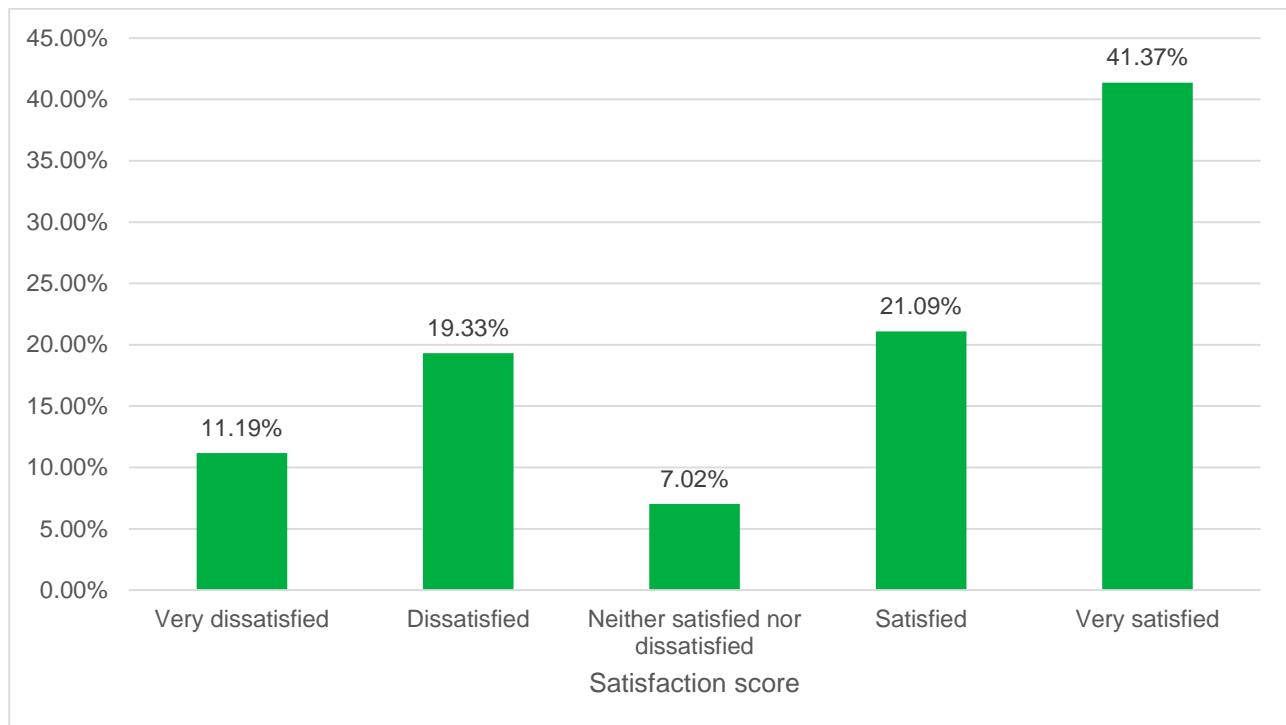
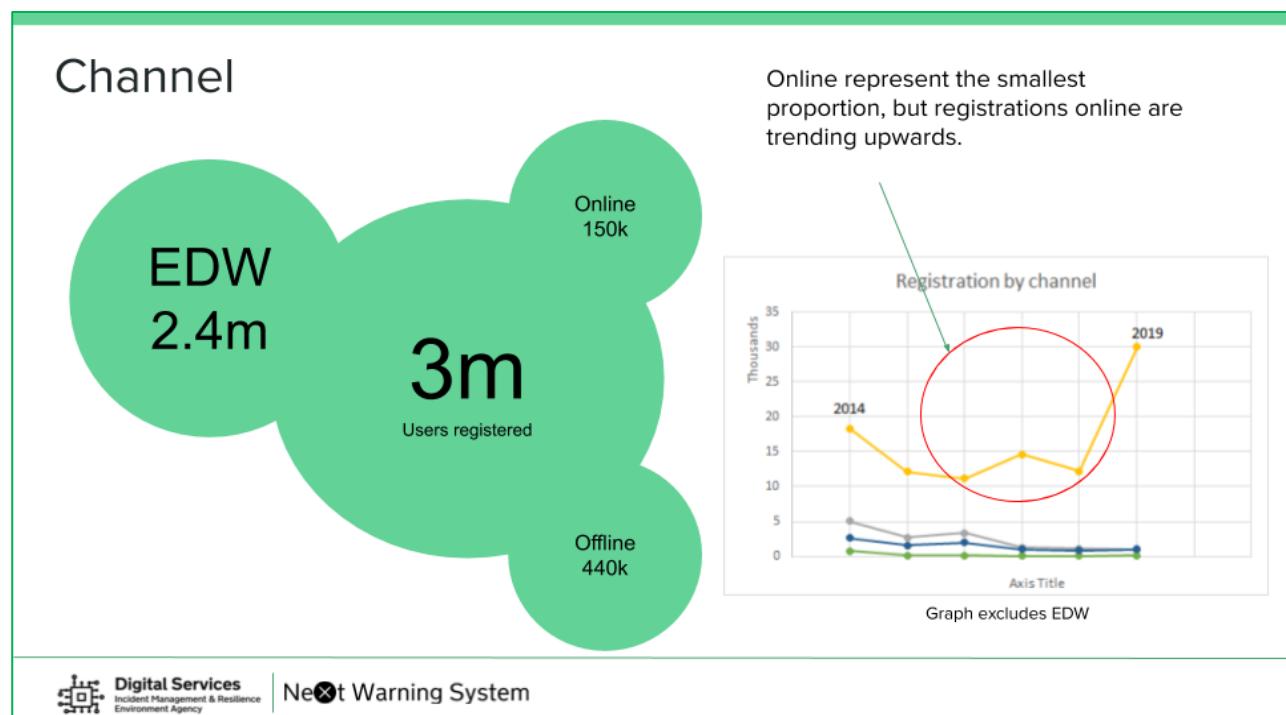


Figure 2: Overall external user satisfaction scores for the current flood warning service

The largest proportion of registered users to the flood warning service are automatically enrolled via the Extended Direct Warnings service. Over the past 24 months, this initiative has led to a significant increase in the number of citizens we have been able to warn about flooding. Online represents the smallest proportion of registered users, but is trending upwards. Offline registrations are mostly historic records migrated from previous warning services such as the AVM and FWD and were created before a digital service was available.



## Signing up for flood warnings and maintaining an account

Whilst the majority of users told us they were satisfied or very satisfied with the existing registration process<sup>17</sup>, we discovered other evidence to suggest there may be room for improvement.

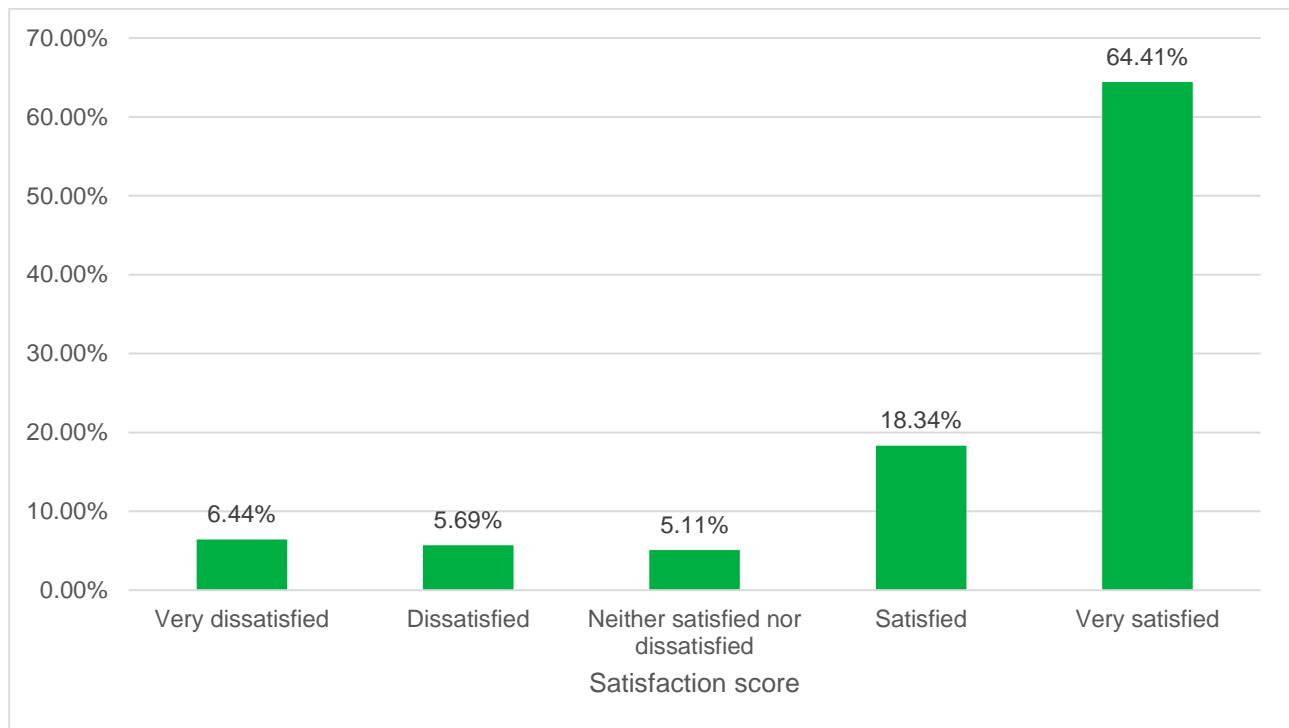


Figure 3: Satisfaction scores when signing up for flood warnings and maintaining an account.

Only 52% of users that start a registration finish the process. The largest drop off rates are shown below.

A screenshot of a GOV.UK service page titled 'Sign up for flood warnings'. The top navigation bar includes the GOV.UK logo and a 'Sign up for flood warnings' title. A 'BETA' label with the text 'This is a new service - your [feedback](#) will help us to improve it' is also present. Below the title, a question 'Are the flood warnings for a home or business?' is displayed. Two radio button options are shown: 'Home' (selected) and 'Business'. A red text overlay on the right side of the screen states '7% dropout at this stage'. At the bottom of the form, there is a 'Continue' button.

*Hypothesis: The conversion rate could increase by 7% if we don't ask users to specify that they are registering for their home or business.*

<sup>17</sup> <https://www.gov.uk/sign-up-for-flood-warnings>

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*Hypothesis: For some users, the distinction between home and business is irrelevant – farmers, pub landlords etc.*

---

The screenshot shows a web page with a black header bar containing the GOV.UK logo and the text 'Sign up for flood warnings'. Below the header, a red 'BETA' box contains the text 'This is a new service - your [feedback](#) will help us to improve it'. A 'Back' link is located just below the header. The main content area has a heading 'Select an address'. Underneath, there is a 'Postcode' field containing 'WA14 5QR' with a 'Change' link next to it. Three address suggestions are listed below: '1 BOLLIN DRIVE, TIMPERLEY', '11 BOLLIN DRIVE, TIMPERLEY', and '13 BOLLIN DRIVE, TIMPERLEY'. To the right of the address input area, the text '13% dropout at this stage' is displayed in red. The entire screenshot is enclosed in a green border.

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*Hypothesis: The conversion rate could increase by 13% if we don't ask users to specify their address.*

---

*Hypothesis: Users are unhappy sharing their property details, so choose to drop out of the registration process at this stage. Providing a non-property specific option may increase take up of the service*

---

11% of users leave the service when we ask them for a name and email address. We don't currently request this information for our EDW customers and are still able to issue warnings. Name details are only used for sending fulfilment (letters and emails) to inform the user of changes to their service. They are not used anywhere else in the system.

---

*Hypothesis: The conversion rate could increase by 11% if we don't ask users to provide an email address and contact name.*

---

*Hypothesis: We should only be gathering the user data we need to provide an effective and efficient service.*

---

## Sign up to flood warnings - feedback



*Hypothesis: Customer satisfaction and conversion rate will increase if more users are able to find their address when registering*

*Hypothesis: Customer satisfaction will increase if we give users the option to opt-out of being called by telephone when a warning is issued*

*Hypothesis: Customer satisfaction will increase if we give users the option to control when they receive warnings*

## Maintain a flood warnings account

There was evidence suggesting that users struggle to login to the online pages. The current hypothesis is that the random 8 digit number given to a user when they register and required when logging into their account causes issues. Further to this, we estimate that there are potentially 20,000 user accounts that are duplicates and were created by users that forgot their 8-digit login number. This means users receive duplicate messages for the same warning.

Passwords also pose a problem, with people unable to remember their password and therefore unable to log in. This causes calls to the Floodline call centre where accounts can be edited by the Floodline staff – we explore this later.

*Hypothesis: By changing the user name from a random 8 digit number to something more memorable, we will reduce the amount of duplicate accounts in the service and stop duplicate warnings being issued to citizens.*

*Hypothesis: Removing the need for a password will help people access their accounts for maintenance purposes.*

Through six lab usability sessions with users, we tested the existing flood warning online registration pages and a new prototype that has been developed as a possible replacement in the

next warning system. We focussed on users with; assisted digital needs and those classified as very low (2) on the digital inclusion scale, from a very low income, users suffering from mental health issues (anxiety, Asperger's) and dyslexia, as well as being mobility impaired and a set of users included people whose houses had flooded, but who did not signed up for or received a warning. We created journey maps to better understand the user pain points, and we observed several areas for improvement including:

- Forcing users to sign-up to warning calls before allowing them to consume text warnings (which was often the desired channel)
- Poor explanations on the differences between an Alert and a Warning
- Once signed-up, amending contact details or locations is also difficult due to the requirement to remember a random 8 digit number and password
- The process of accessing one's existing user account and updating details, is so convoluted that users prefer cancelling the account altogether, and in some cases open up a new one.

---

*Hypothesis: Users should be able to register for the channels they want, and not be forced into signing up for a telephone message if they don't want it.*

*Hypothesis: It should be clear to users what they are (and are not) signing up for during the registration process. This includes clarity on available optional messages such as Flood Alert and Warning No Longer in Force messages*

---

## Flood warning message quality

56% of users surveyed told us they were either very dissatisfied or dissatisfied with the quality of our flood warning messages.

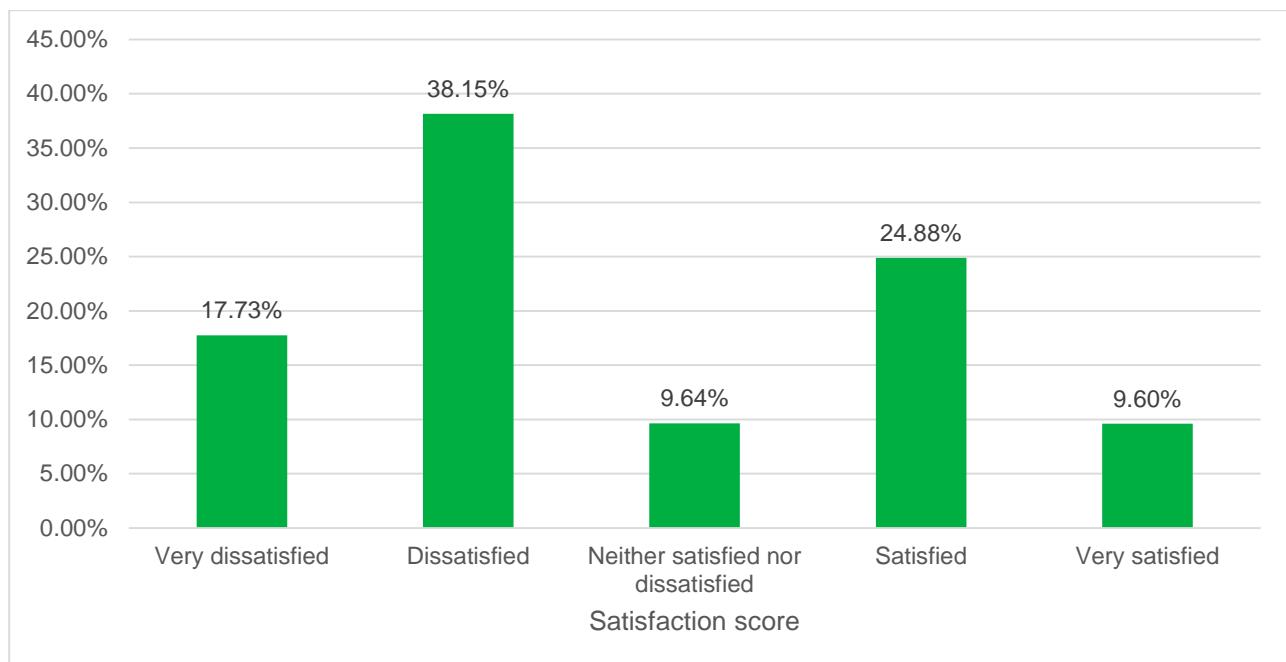


Figure 4: Satisfaction scores for flood warning messages.

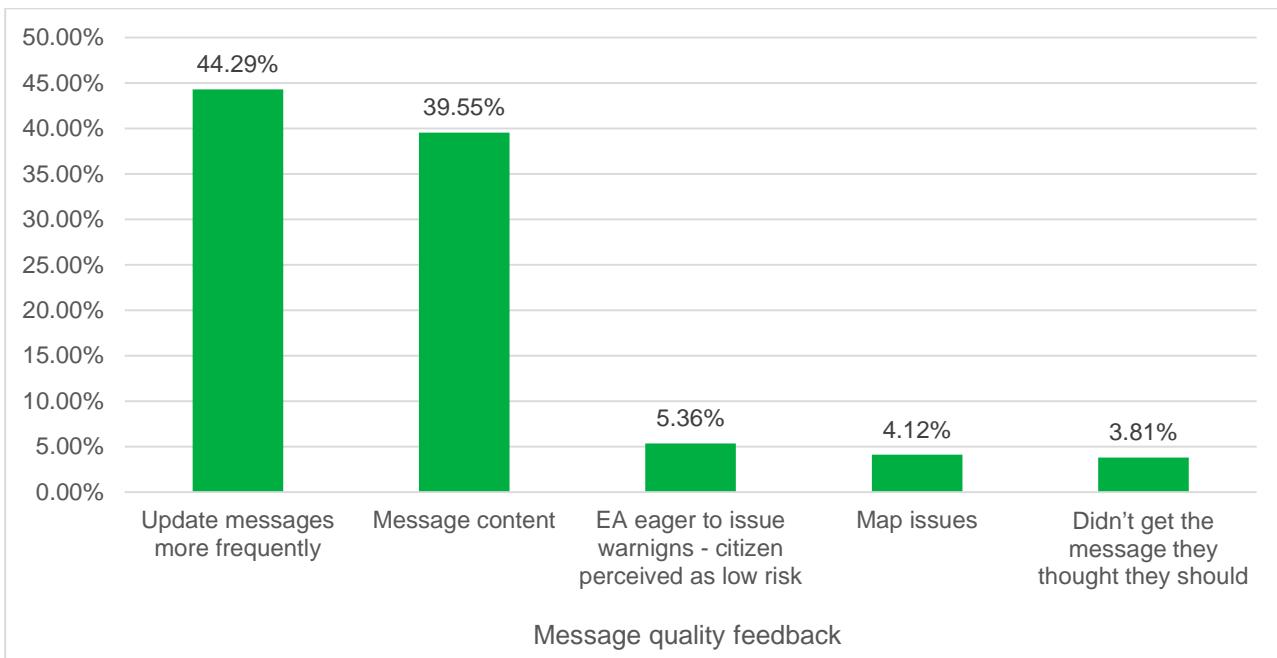


Figure 5: Reasons for low message quality

The need for messages to be updated more frequently was the biggest contributor to negative feedback about message quality. Further investigation is required in Alpha to test the suitability of the current message update policy which instructs Duty Officers to issue an update every 12 hours. In the middle of a busy event with the situation changing rapidly, citizens require frequent updates, but the inefficiencies of the current service act as blockers. This should be an area for investigation in the Alpha phase.

---

*Hypothesis: Removing the inefficiencies in the message sending and updating process will allow for more frequent updates for our users.*

---

*Hypothesis: Allowing automation of update messages will mean more frequent updates for our users.*

---

Whilst interviewing Duty Officers, who are responsible for updating messages, we heard that the EA place a priority on issuing new warnings over updating those that have already been published. Clearly the need to inform citizens ahead of flooding is important but helping busy Duty Officers update existing messages could help improve satisfaction scores.

---

*Hypothesis: internal message quality analysis only focuses on new messages. This creates an unfair emphasis on these new messages rather than updating ones that are already in force*

---

## Update messages more frequently - citizen feedback

More regular updates, been 5 hours since last one, being told 'next update is in the morning' is not very reassuring, when you are watching water rise by your home.

I have been watching the warnings for Carlisle throughout the day, in particular the Caldew. The last update on this was a red warning that said it would be updated in 8hrs or when changes occur. It is now 11.5 hours since that message and no further updates have appeared.

The message says it will be updated on morning of 25 October but it hasn't been (im writing this message at 13:15 on 25 October). The site says message was last updated 6:49pm on 24 October.

This can be improved by ensuring the 8 hour update is kept to. Last update for Rivers Lowther and Eamont was 2.31pm Sun 11 Aug and this had not been updated at 8.00am Monday morning. The householder is then left with a nagging doubt about the current validity of the last information given.

The only complaint I have is that you don't update it often enough! People in this situation need to be informed, even if there's no change.

Have regular updates. The update has not changed in over 7 hours

More updates needed - It is now over 3.5 hours since last one.

Keep it up to date. The roads around from Whittlesey to Peterborough cannot handle this and it is unacceptable to close roads for days and not update or review for over 24 hours

Update it daily! How is information a week old useful!

Message content was the next biggest issue our external users had with our message quality. We have found that users need more information in the message content to help them understand the flood event. Feedback on message content falls within three main categories:

- Impacts
- Location
- Accuracy and language

### Impacts

## More information needed to help users assess the impact of flooding

*"Include an indication on whether the A141, March Road at Rings End/Guyhirn is likely also to be closed"*

*"Provide any information about when the flooding is likely to peak."*

*"What car parks are open in Shrewsbury?"*

**"Are the roads open or not!"**

This information does not state whether a flooding is imminent, it only gives the various gauge levels. What would be more informative is to know at what point, i.e. are we 2 cm away from the point where flooding may occur or 20cm on the gauge/s?

**"Please can you also say the time you are expecting the river to peak"**

---

*Hypothesis: Customer satisfaction will increase if we include road closure information in our flood warning messages.*

*Hypothesis: Customer satisfaction will increase if we include peak levels information in our flood warning messages.*

*Hypothesis: Customer satisfaction will increase if we explain risk more clearly.*

*Hypothesis: Customer satisfaction will increase if we display river levels in the message.*

---

Our public survey has collected over 318 responses, and over 50% of respondents either thought that a flood alert was more significant than a flood warning, was unsure, or did not know.

---

*Hypothesis: Our flood warning codes are not understood by half our users. The words "Alert" and "Warning" are often interchanged by the public and do not provide a clear distinction on the level of risk.*

---

## Location

Location specificity is not good enough for users to understand the risk of flooding at their location.

"The old info would give place names and actual locations. This just repeats the same general info, a backwards step."

"I wanted to know if any homes were affected. I don't know the area that well"

"The alert is quite clear but does rely on local knowledge - e.g. I had no idea where Cavendish Bridge is. Perhaps add significant place names to help, such as 'Cavendish Bridge, near Shardlow'."

A	B	C	D	
Year	Properties warned in FW Area	Properties warned	flooded	Strike rate
2010	15,331	68		0.40%
2011	12,277	167		1.40%
2012	226,235	3814		1.70%
2013	190,930	5076		2.70%
2014	260,200	1901		0.70%
2015	5,273	7		0.10%

"The warnings do not really relate to our property."

Might not be a bad thing if we warn citizens that don't flood as they may be impacted other ways e.g. travel out of the impacted area. Is strike rate for property flooding the right metric?

---

*Hypothesis: Customer satisfaction will increase if we are more specific with the location at risk from flooding*

---

Our public survey asked users what content they find most important in a flood warning message. Over half responded with "locations of areas affected".

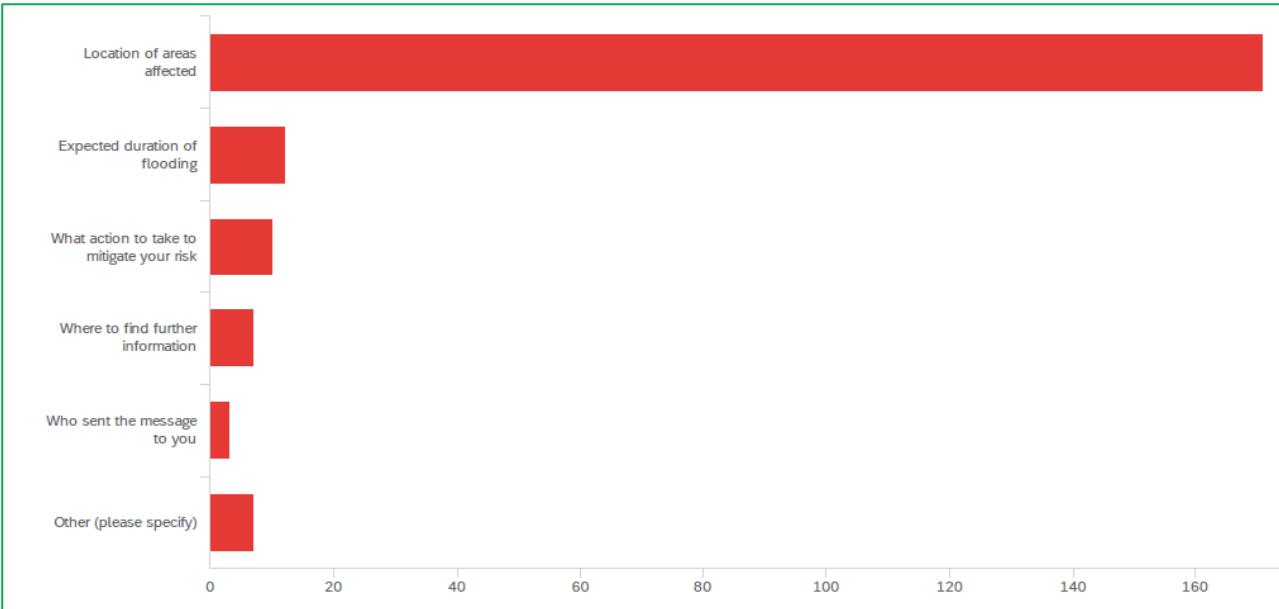


Figure 6: What content in a flood warning message do you find most important?

## Accuracy and language

### Warning messages are too technical

*"can you explain what all this means ?"  
mAOD" and mCD"*

Define for the lay reader what astronomical tide levels are and mean and what levels in excess of astronomical tide levels imply

*"Please try not to use technical terms without an explanation. For example 'tidal locking' needs an explanation plus information on the impact of 'it'"*

Jargon alert. What is AOD in relation to sea level??

*Hypothesis: Customer satisfaction will increase if we stop using technical flood jargon in our messages.*

Citizens are dissatisfied with being warned about flooding when the perceived risk is low. This is especially visible in fast responding catchments that can flood regularly and quickly. In areas such as these, citizens told us that flood warnings are devalued and sometimes ignored. During Discovery we collected data showing the number of warnings issued Vs properties flooded. The Environment Agency refers to this as the match rate. The table below shows the match rate between 2010 and 2015.

Year	Properties warned	Properties flooded	Match rate (flooded / warned)
2010	15,331	68	0.4%
2011	12,277	167	1.4%
2012	226,235	3814	1.7%
2013	190,930	5076	2.7%
2014	260,200	1901	0.7%
2015	5,273	7	0.1%

A contributing factor to a low match rate is the way in which target areas are designed. A target area is the place at risk and shows the total extent of flooding based on a 1/1000 year flood event. Although the severity and frequency of flooding are increasing, we question the need to warn the entire target area when only a small proportion of homes may flood. However we acknowledge the impact of flooding extends beyond property flooding and citizens can still be affected even if their homes don't flood.

Research conducted by the Flood Information Service team indicates the impact of flooding extends beyond property, to include for example road and critical infrastructure closures. Work is currently underway to display such impacts to the public and it's an aspiration of XWS to enable citizens to register to receive warning messages for more localised impacts.

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*Hypothesis: Enabling citizens to view and sign up to receive warnings for local impacts, such as road closures will improve satisfaction scores and help citizen's better respond to flooding.*

---

*Hypothesis: Reducing the size of the target areas will stop citizens at low risk from flooding being warned unnecessarily.*

---

## Flood warning channels

External users showed an overwhelming preference for flood warnings and other emergency alerts to arrive automatically to their handsets. In recent years the Environment Agency has increased these types of notifications through the Extended Direct Warnings opt out service, and the introduction of Google Public Alerts. They have also begun exploring cell broadcast technologies that would further increase "push" messaging capability to users.

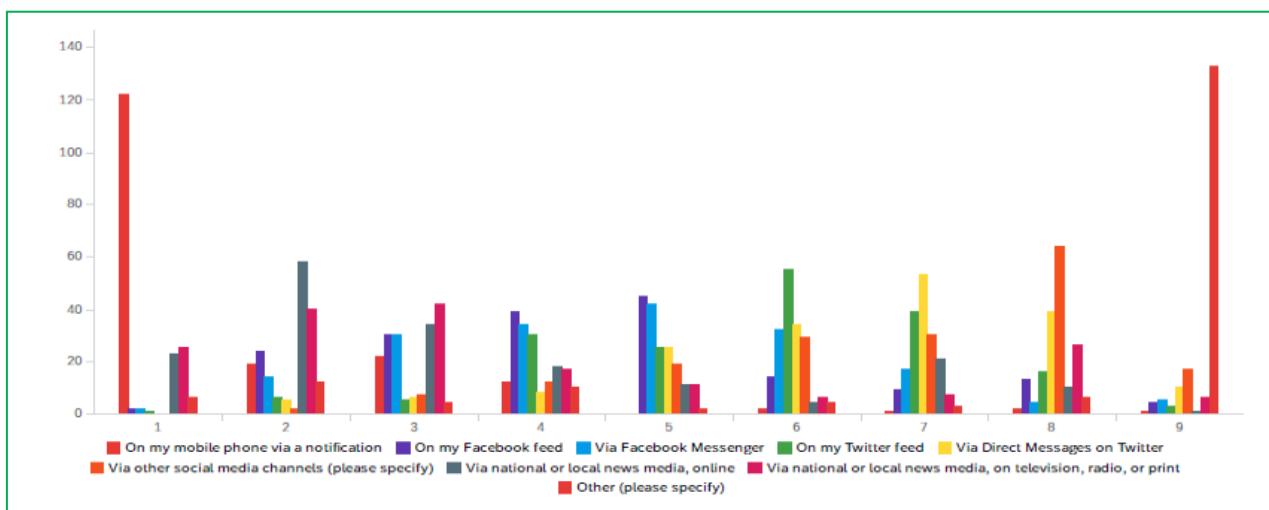


Figure 7: If your life or property were at risk of flooding, how would you expect to be warned?

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*Hypothesis: Citizens want to be proactively warned about flooding, rather than sign up to receive information. We should look to use more “push” warning capabilities to inform users of risk.*

---

## When users want to be informed about flood risk

We also used our public survey and interviews to ascertain when users would want to be informed about flood risk. These questions were included in order to pinpoint the optimal warning point for users so we can avoid over-warning and message fatigue.

We used the Common Alerting Protocol (CAP) criteria as a basis for the questions, looking at the urgency, severity and certainty thresholds that users would want to receive an alerting message for flooding. The CAP criteria can be found in Appendix C.

### Urgency

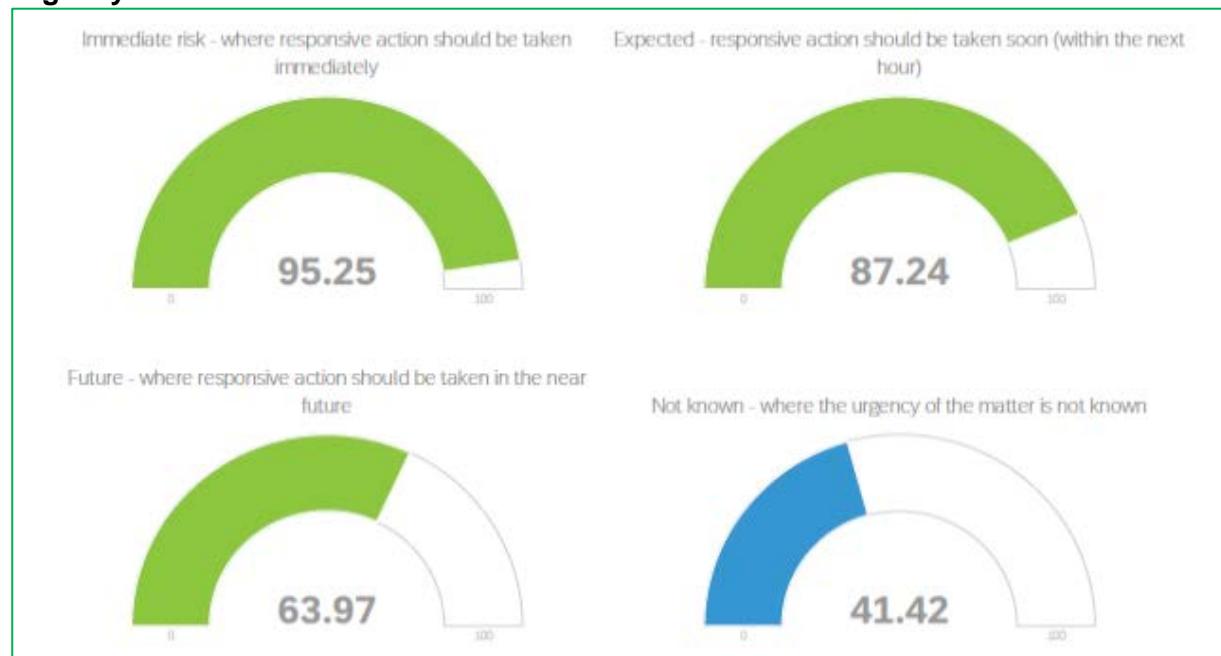


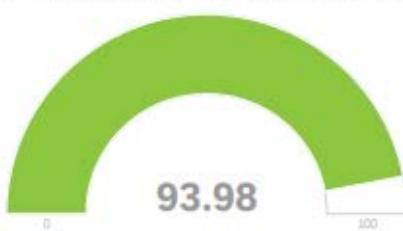
Figure 8: What urgency would justify receiving an alerting message?

## Severity

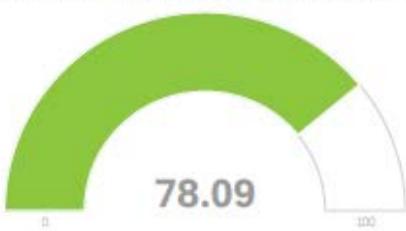
Extreme - where there is an extraordinary threat to life or property



Severe - where there is significant threat to life or property



Moderate - where there is possible threat to life or property



Minor - where there is minimal to no known threat to life or property



Not known - where the severity of the matter is not known



Figure 9: What severity would justify receiving an alerting message?

## Certainty



Figure 10: What certainty would justify receiving an alerting message?

*Hypothesis: The appetite for receiving warnings increases proportionally to the risk. By considering urgency, severity and certainty in our messages we can minimise user alert fatigue through better targeting of our messages.*

## Professional Partners

Existing networks of emergency responders and resilience direct were leveraged to elicit user needs from different areas of professional partners. Two interviews were secured with the Emergency Resilience Manager of Kent County Council, and one with a Police and Support Officers charity. Correspondence with other partners was undertaken (of the ones who could not commit to a telephone conversation), and these emails offered highlights of what was working and what was not.

The major findings from these conversations were:

- Local authorities' boundaries often do not match to the EA Warning and Alert TAs. This causes the impression of EA being over-alerting their residents.
- The message content we provide is not always read by Professional Partners or not deemed meaningful enough to have any practicable use in response activities
- Some LLFAs might have capacities to consider surface water alerting in the future. We should be supporting LLFAs who want to do this, and ensure a joined up service with the river, coast and groundwater warning service
- Faster and more accurate predictions during incidents would be appreciated particularly on number of properties affected, or projected to be affected

---

*Hypothesis: The information needs of the public and our professional partners are different. The information we provide in the real time information is not widely used in the professional partner community as it is not deemed useful enough to provide operationally useful*

*Hypothesis: Supporting LLFAs who want to provide a surface water flood warning service would ensure a joined up service for the public alongside the river, coast and groundwater warning service*

---

Some Professional Partners use the Targeted Flood Warnings Service to monitor flood risk for multiple properties/assets. Users of the service can bulk upload property locations and get notified when there are alerts and warnings nearby. The service currently has less than 100 users. There are aspirations to extend the reach of the service, but this is currently constrained by the limited availability of resources to maintain it, process new applications and issue invoices for those customers that pay a subscription fee.

We received responses to a usability and preference questionnaire sent to TFWS users, for which we have received 8 responses. In one case, a follow-up interview was requested to provide further information. The journey through the service is as follows;

- Registration: To register, users supply their contact details and approve a contract. Depending on the type of organisation and the sector in which it operates a subscription fee is charged. Once registration is complete a super user admin account is created and is used to create and maintain other users and set up the reporting structure.
- Reporting structure and users: The super user admin can create a structure to organise the information in the service and assign users authority to view the information. This journey must be completed before the admin user can upload properties/assets.
- Uploading properties/assets: The admin uses an Excel template that once complete is uploaded into the service. The Excel template contains information about the at risk properties/assets including their location, name, a bespoke grouping category and a radius buffer which specifies a distance around the location to trigger a warning should it be outside a target area.
- Viewing at risk properties/assets: Properties/assets are mapped to flood risk target areas and when a warning or alert is triggered users get notified and directed to view detail of the warning.

The screenshot displays two main sections of the service. On the left, the 'Your assets' page shows a table of uploaded properties. The table includes columns for Asset ref, Asset name, Type, Severity, Last changed, and View. The first three rows show entries for '1 Keelmans House', '2 Keelmans House', and '3 Keelmans House', each with a yellow warning icon and a timestamp of 13/03/2020 11:23:27. On the right, a map shows the locations of these assets with red markers. A legend indicates 'Flood extents' (light blue), 'Flood warning areas' (orange), and 'Flood alert areas' (yellow). Below the map is a table titled 'Associated flood alert or flood warning areas', listing 'North Sea at Blyth' and 'Northumberland coast' as flood warning areas.

Through research with TFWS users and administrators we have identified several pain points in the current service.

User	Pain point	Impact
<b>Organisation</b>	The process of registration is resource intensive due to the lack of automation and the need for a contract to be signed	Slows down the registration process and draws on resource which is a constraint of extending its use
<b>Environment Agency</b>	The process of registration is resource intensive due to the lack of automation and the need for a contract to be signed	Slows down the registration process and draws on resource which is a constraint of extending its use
<b>Super user admin</b>	Setting up the reporting structure is cumbersome and relies on Environment Agency resources to support users	Draws on Environment Agency resources to support the super user admin which is a constraint of extending its use
<b>Super user admin</b>	Some organisations use a bespoke criticality measure to group property/assets. Currently this can't be mapped over to TFWS	Users cannot see which of their most critical assets are at risk
<b>Environment Agency</b>	Lack of awareness of the service	Usage is low
<b>Environment Agency</b>	We have heard that the annual charge for TFWS is putting potential users off signing up for the service	User instead use the free FWS service that doesn't meet all their complex user needs

*Hypothesis: More organisations would use the service if the Environment Agency had resources to promote its use.*

*Hypothesis: The TFWS service could be extended further if registration and creating team structures could be completed without support from the Environment Agency.*

*Hypothesis: The “take up” of TFWS is low in the Professional Partner community due to lack of awareness in that community. Raising the profile of TFWS would increase usage.*

*Hypothesis: User satisfaction would increase if properties/assets could be tagged with the user’s organisation risk groupings.*

*Hypothesis: The “take up” of TFWS is low in the Professional Partner community due to costs applied to some users of the service - removing the cost may make the service more attractive to Professional Partner users.*

*Hypothesis: The “take up” of TFWS is low in the Professional Partner community due to fact only emails can be sent from the service - adding text and telephone channels would align it with the existing Flood Warning System and make it more attractive to Professional Partner users.*

## Assisted digital support

We must make sure everyone who needs your service can use it and sometimes users will need help to use our services online. This is known as ‘assisted digital support’. We currently provide this support via our Floodline call centre – which we share with SEPA and NRW. The Floodline call centre operators provide vital support and guidance to users often during difficult times.

The operators provide support and guidance to users as well as information on flood risk and actions. They also help users register, update and remove their details from the flood warning system if a user cannot enter their information themselves (if, for example, they lack digital skills or have no internet access).

We have been provided with data on the queries that Floodline gets from our users, in an effort to understand if there are pain points in our current service that cause users to call Floodline for assistance. The data shows that approximately 27% of the calls to Floodline since January 2018 have been related to FWS and fall into the categories below:

Reason for call	Calls to Floodline since Jan 2018
FWS - details updated or checked	3058
FWS - request to cancel	1612
FWS - request to register	905
EDW - general enquiry	770
FWS OLR - assistance / general query	133
FWS OLR - password reset	73
FWS OLR - request for customer RIN	51

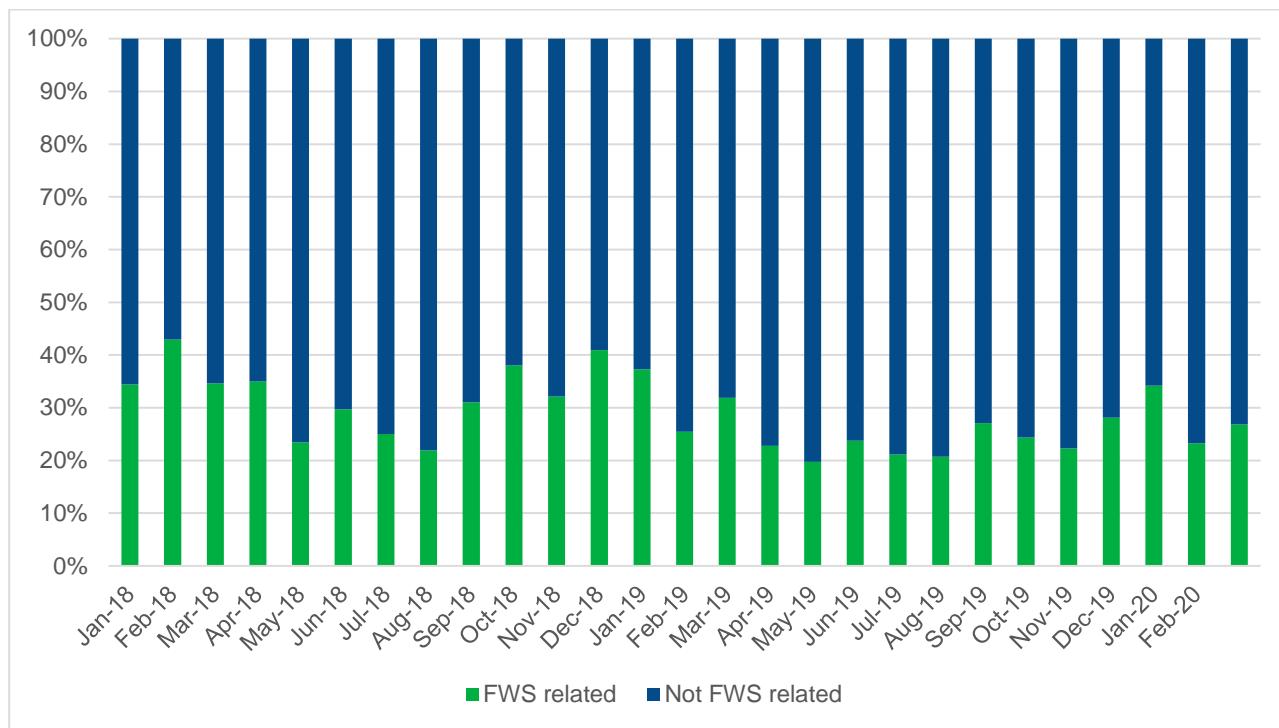


Figure 11: FWS related calls to Floodline since January 2018

*Hypothesis: Users have issues maintaining, registering and removing their FWS accounts via the online pages so call Floodline for help. If we can improve the online pages we would lower calls to Floodline by around 27% on average*

# Internal user research

User research with our internal users has irregularly happened in the past through surveys run by the Digital Services team in the EA, and the Discovery team felt that XWS Discovery was an excellent opportunity to spend time to deep dive into user needs for this community.

## Contacting our users

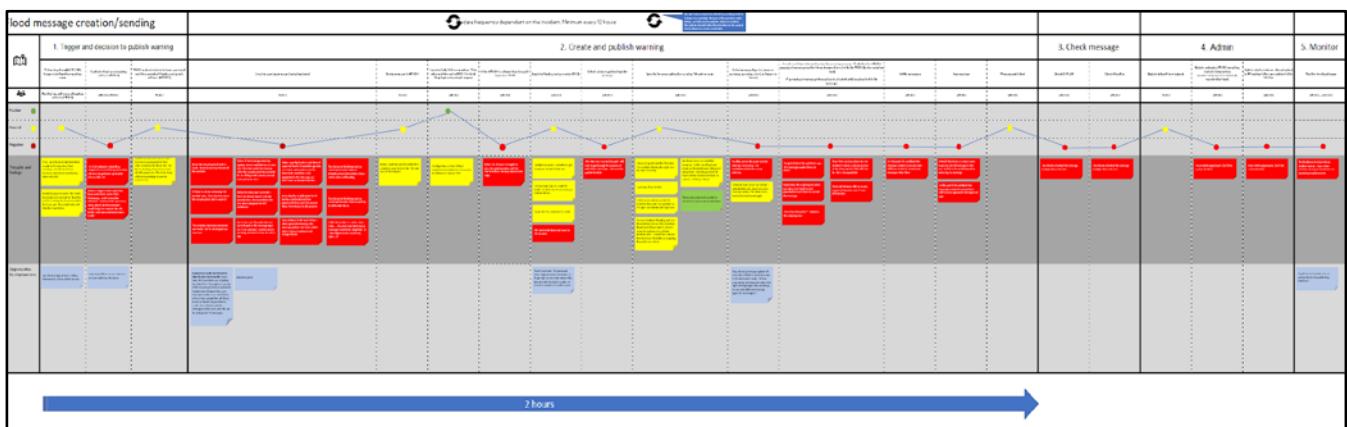
We approached user research with external users in several different ways:

- We circulated a survey to Duty Officer teams which garnered 162 responses. The major flood events during February and March provided an interesting challenge – the people we wanted to contact were busy with incident response, but they were also experiencing issues that we wanted to document.
- We circulated a survey to Flood Resilience teams who administer FWS on behalf of the Duty Officers locally in order to understand issues they have with Areas based system maintenance and management
- We undertook 22 1-2-1 meetings with Duty Officers to further understand the issues they have with the existing systems

## Creating and updating flood warning messages

The creation and dissemination of flood warnings is the core service offering to citizens. These tasks are completed by a Duty Officer and an Assistant Duty Officer when flooding is forecast to happen (or has actually happened). Providing accurate and relevant real-time information messages is vital for providing a meaningful response from users. Having an intuitive and simple system for sending messages is vital for ensuring timeliness of our warning messages.

Since citizen feedback on the quality of our flood warning messages is poor relative to other areas of the service, we chose to focus our research with Duty Officers centred on the creation and sending of flood warning messages. We created a user journey map that highlighted the steps (and resultant pain points) that they go through when issuing flood warning messages from the existing system.



- Step 1: Risk assessment and decision to publish a flood warning message

A Monitoring and Forecasting Duty Officer will notify a Duty Officer when a river level threshold has been exceeded. They typically discuss the risk of flooding based on the current situation and a forecast where these exist. The Duty Officer will then make a decision to issue a flood warning message.

User	Pain point	Impact
Duty Officer	When a Duty Officer is working remotely they struggle to access telemetry services on a mobile device. Access to telemetry services are needed to evaluate the flood risk and sometimes trigger advanced polling if this is not automatic for the area.	Delay in making a decision to issue a warning.

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*Hypothesis: The decision making time to issue a warning would be reduced if Duty Officers could access telemetry services on mobile devices.*

*Hypothesis: Citizens would see stations move into advanced polling more quickly if Duty Officers could trigger this on mobile devices.*

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- Step 2: Create the flood warning message

A Duty Officer creates the warning message in a scripting tool, which is typically in the form of an Excel document and is accessed from a network drive. The scripting tool aims to reduce the time it takes to create each message and standardise it to a national set of guidelines. It does this by auto generating content based on checkbox options selected by the user. There are slight variations of the tool across each Environment Agency area. In some areas the tool is used to capture and present information that is used by the Area Based Controller to support operational awareness. For now, the scope of XWS excludes the processing and presentation of information that is used in the rolling brief and situation reports.

We asked Duty Officers how the scripting tool could be improved. The graph below shows their feedback.

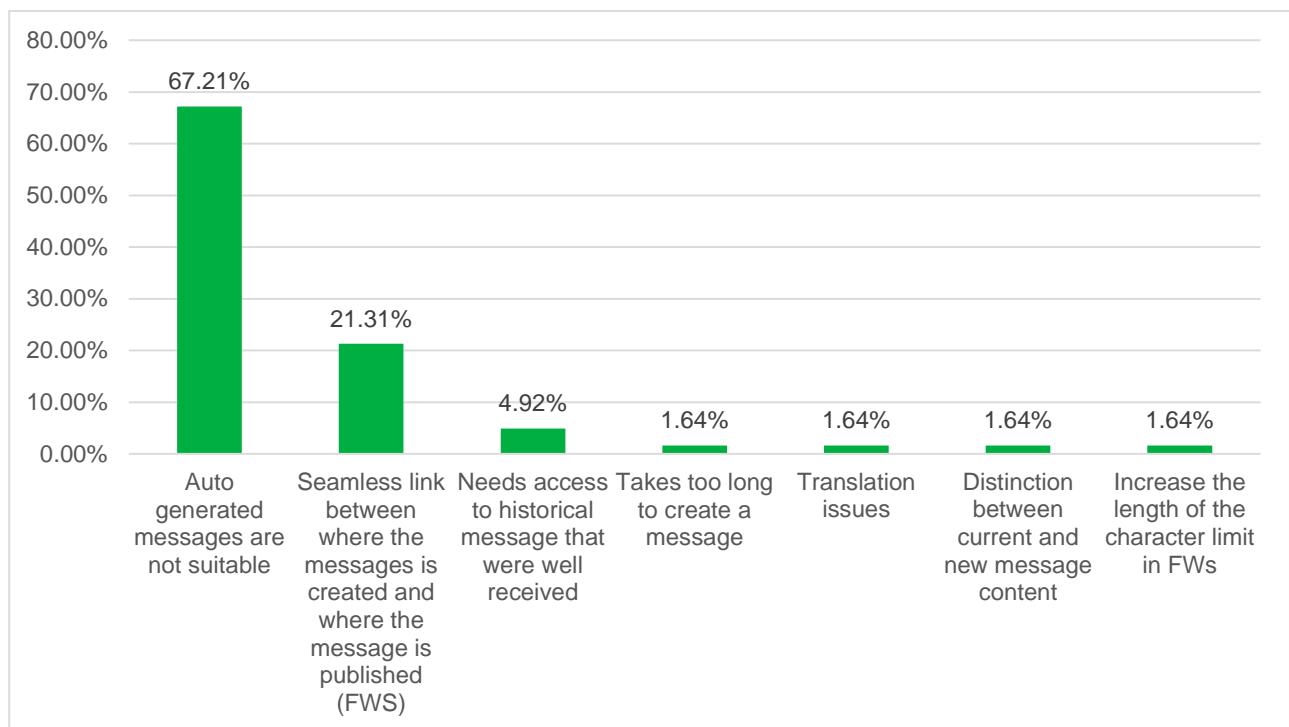


Figure 12: how can the scripting tool be improved?

User	Pain point	Impact
Duty Officer	Scripting tool output is too robotic. Who wants to receive a message that sounds like it was generated from a robot in what could be one of the most stressful times of your lives?	Message quality
	The character limit imposed on warning messages stops us including more information about the locations of flooding.	Message quality
	Needs more options (more applicable to local situations) without becoming overly onerous to use.	Message quality

User	Pain point	Impact
	Greater flexibility to the message content. It is often tempting to simply copy the content into MS Word and change the message in there.	Message quality
	Some of the message selection options are not suitable for my area and I have to tweak the message after the scripting tool has created it. i.e. sifting weed screens are not relevant to my area	Cause of delay in publishing the warning message
	Punctuation is added to the message which has to be removed so it's phonetically eligible for the IVR service.	Cause of delay in publishing the warning message
	Users of the scripting tool and FWS feel it would be more efficient if the message was created and sent in the same place.	Cause of delay in publishing the warning message
	A bank of good example messages would be useful; ideally linked to river/ tidal alert/warning levels as per procedures.	Message quality
	When the scripting tool loads in Excel, the user has to zoom out to see all the controls.	Cause of delay in publishing the warning message
	I have to close the scripting tool down and re-open this if I want to create a warning message for another area.	Cause of delay in publishing the warning message
	When the message is created, I have to remove spaces and add punctuation. Also sometimes the tool does not generate full sentences.	Cause of delay in publishing the warning message
	Don't show me TA codes that are not relevant to the message type. I.e. if I've selected I want to send a warning, then don't show me alert TA's.	Cause of delay in publishing the warning message

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*Hypothesis: Visualising citizen feedback about message quality in the same place where messages are created and updated will help Duty Officers improve quality.*

*Hypothesis: Increasing the character limit to permit the addition of more location specific information will improve quality.*

*Hypothesis: Creating and sending the message in the same place will reduce the time it takes to publish a message.*

---

*Hypothesis: Addressing the usability issues with the current scripting tool will reduce the time it takes to publish a message.*

- Step 3: Send the flood warning message to the Assistant Duty Officer - once the message is created, it's sent, usually via email, to an Assistant Duty Officer.

User	Pain point	Impact
Assistant Duty Officer	I've got to leave the system to copy message content from an email.	Cause of delay in publishing the warning message

*Hypothesis: Creating and sending the message in the same place will reduce the time it takes to publish a message.*

- Step 4: Input the flood warning message in FWS

The Assistant Duty Officer selects the location of the flood warning area, copies the message from the Duty Officer, checks it and then sends it to registered users via SMS, email, phone and downstream systems. When asked how creating flood warning messages in FWS could be improved, Assistant Duty Officers told us the following.

- 42% reported that the creation of the message in the flood warning service has the biggest scope for improvement
- 36% reported that the User Interface (UI) design of the current service causes them issues
- Further pain points relating to the use of the current service were identified. Due to the time box nature of Discovery, the team focused detailed analysis on the top two pain points i.e. message creation in the flood warning service and UI design

We have observed incorrect messages going out during large events, likely due to the Duty Officer load for issuing, updating and removing messages during busy periods. The example below shows a corrective message sent via Twitter after a Severe Flood Warning was accidentally issued to an area with an existing Flood Warning in force. The Duty Officer selected the incorrect Update message in FWS and issued a System Update for a Severe Flood Warning. Luckily this was quickly spotted by the Duty Officer and rectified. In this case it only updated the downstream systems (FIS, TFWs, and IVR etc.) and did not send emails, texts or calls to members of the public and partners.

Environment Agency - Yorkshire & North East  @EnvAgencyYNE  
Replies to @matti\_colley

 The Severe Flood Warning issued at River Calder at Brierley and Luddenden Foot was made in error due to a coding issue. The Flood Warning remains in place.  
Apologies

10:44 PM · Nov 7, 2019 · Twitter for iPhone

When creating a flood warning in the current service, Assistant Flood Warning Duty Officers told us there was a lot of checking and previewing of the same content, just at different stages of the process. We saw how workarounds had been found to avoid some of the quality assurance constraints. For example, there is a requirement for phonetic messages to be listened to before publication. We observed users start listening to the message, but then click the browser back button to skip the checkpoint. Whilst we don't think it would be appropriate to remove all quality assurance checkpoints, perhaps there is scope to test a reduction in checks.

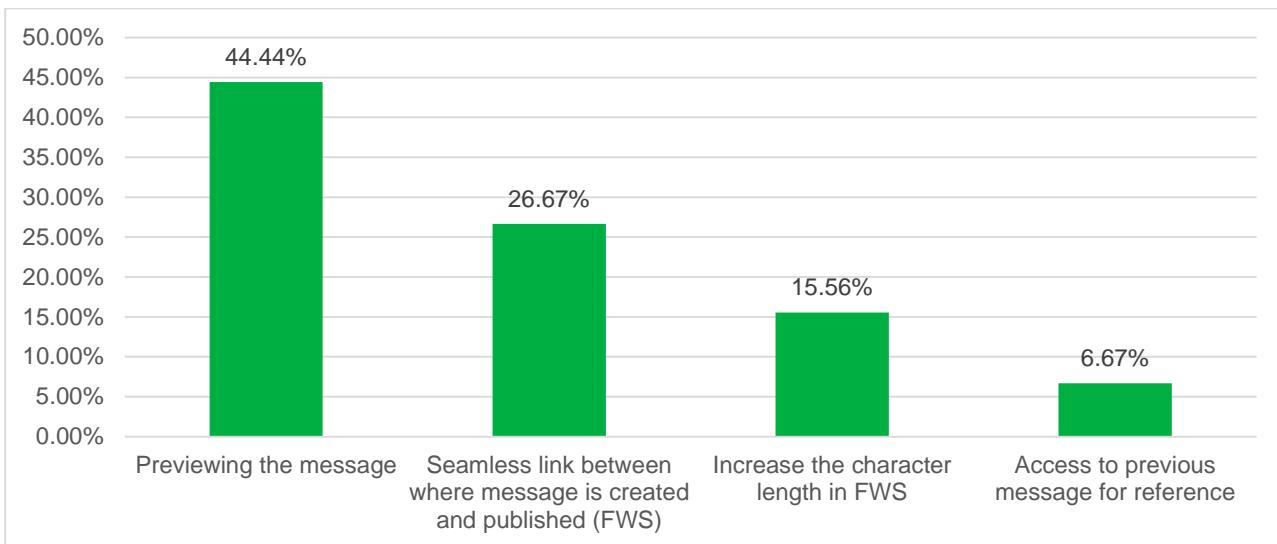


Figure 13: Where are the biggest challenges in the message creation process?

User	Pain point	Impact
<b>Assistant Duty Officer</b>	Users spend a lot of time checking the same content at different stages during the sending of a message	Cause of delay in publishing the warning message

*Hypothesis: Reducing the number of assurance checkpoints will speed up the process of publishing flood warning messages and stop users having to find ways around the system, which could be putting quality at risk.*

Assistant Flood Warning Duty Officers also told us the user interface of the current service could be improved by reducing the number of steps required to publish warning messages. They also told us it would help to see a report showing the success rate of messages sent.

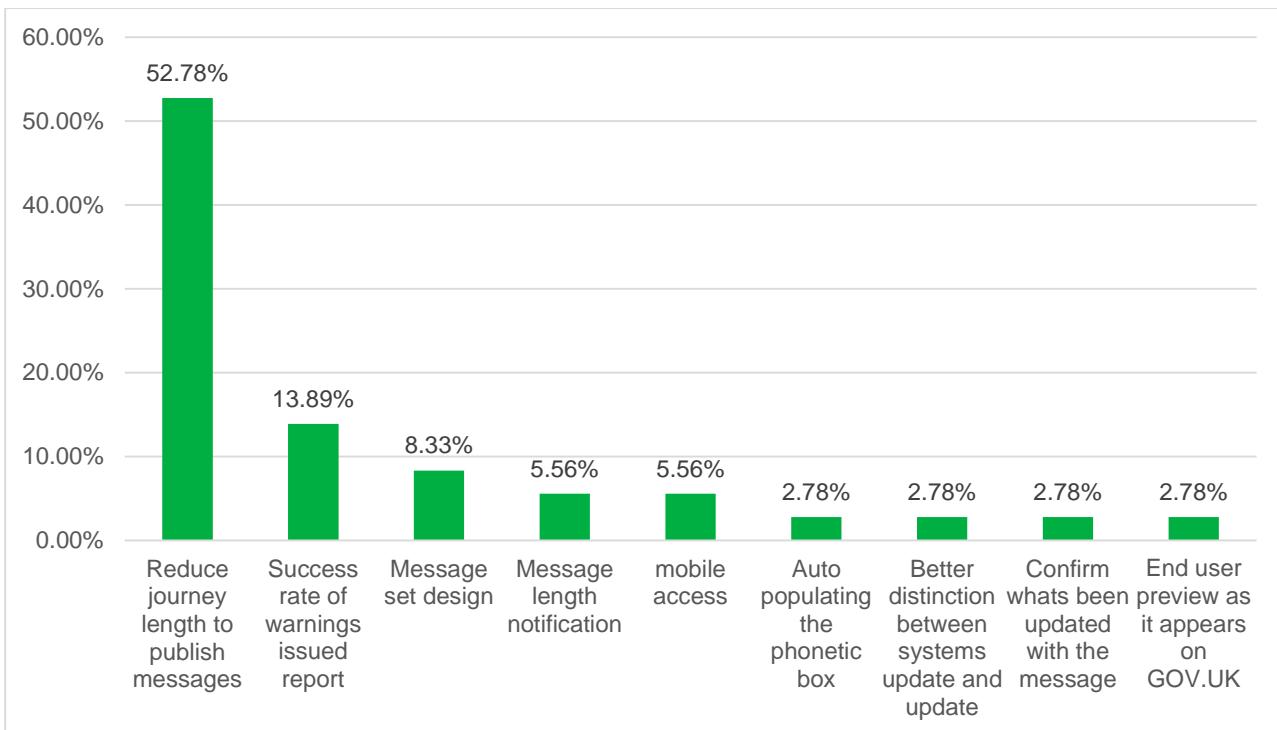


Figure 14: Where are the UI issues in FWS?

User	Pain point	Impact
Assistant Duty Officer	Assistant Duty Officers are required to navigate through a lot of screens to publish a warning message.	Cause of delay in publishing the warning message

*Hypothesis: redesigning the message sending process to be more efficient will speed up the message sending process*

- Step 5: Validate the message has been sent/updated

The Assistant Duty Officer is required to validate the message has been sent by checking the message endpoints. To do this they go to the flood information service and check the IVR service on Floodline.

User	Pain point	Impact
Assistant Duty Officer	Checking the message has reached its endpoint is another job to do for the Assistant Duty Officer. During a busy event when lots of warnings are being issued and updated this checking process takes up time that could be better spent helping support the incident.	Takes up valuable time that could be better spent elsewhere during an event.

*Hypothesis: Automating the validation process will free up time for the Assistant Duty Officer and free up their time for other incident response*

- Step 6: Updating flood warnings

Once a warning is in force it should be updated at least every 12 hours in line with national guidelines. The process of updating flood warnings is the same as when they are first published, see steps 1-5. It can be the case that when a message is updated, the situation hasn't changed, so all that's required is a change to the date and time of publication.

User	Pain point	Impact
Assistant Duty Officer	Duty Officers have to go through the full publication process to update the timestamp on the message.	Takes up valuable time that could be better spent elsewhere.
Assistant Duty Officer	It's not easy to see what's in force and how long is 'left on the clock' before an update to the message	Message updates are sometimes "missed" and users don't receive flood warning updates when the EA has stipulated

*Hypothesis: Having a shorter process for updating the timestamp of messages will increase the speed messages are updated.*

*Hypothesis: Displaying warnings, on a single view, that are currently in force and when they were last updated will help Duty Officers better manage their workload of maintaining messages.*

- Step 7: Removal of a message

When there is no longer a risk of flooding a “Warning no longer in force” message is issued. This remains in force for 24 hours before automatically being removed from downstream systems

## Automated message sending

For some areas it could be suitable to automate the sending of the initial flood warning, or subsequent System Update messages. This would work for areas that have predictable flooding impacts, but requires further investigation in Alpha.

Links between the forecasting and telemetry systems would be required in order to provide automated message sending. The Incident Management Forecasting System (IMFS) is due for release in summer 2020 and provides a flexible system that can interact with upstream and downstream systems. The XWS team advises that discussions with the IMFS team continue so that XWS can be developed to receive and interpolate forecast information from IMFS.

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*Hypothesis: By linking the IMFS and XWS systems, automated messages can be sent based on flood forecast outputs – increasing the speed that messages can be delivered to users*

---

The Future of National Telemetry (FoNT) project is looking to create a robust, resilient, fit-for-the-future telemetry service that's managed and used by the right people with the right skills. The new telemetry service will introduce consistent ways of working around a single national system. To do this, the project will create national interoperability between computer systems. This will give us consistent results and a national service that meets all our customers' needs – with a go live date of 2022.

For rapid responding catchments, or areas without traditional forecast models, it may be suitable for warnings to be sent directly to users based on observed levels from the telemetry system.

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*Hypothesis: By linking the FoNT and XWS systems, automated messages can be sent based on observed levels – increasing the speed that messages can be delivered to users in rapid responding catchments and areas without traditional forecasting models*

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## Closing the loop between Citizens and Flood Warning Duty Officers

To support Duty Officers continuously improve the quality of their warning messages, the flood information service team launched a reporting dashboard which displays real-time citizen feedback about flood warning message quality.

The dashboard has 2,650 items of feedback. During Discovery the team learned that feedback is often not used/seen until after a flood event. We learned that Duty Officers have to balance access to many services and the citizen feedback dashboard is just another screen to look at and unfortunately therefore is underutilised.

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*Hypothesis: If we surface citizen feedback in the same place the flood warning message is created, then this will help Duty Officers be more responsive to citizen needs.*

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We did learn that citizen feedback is used, but it's not officially recognised in the policy as a performance measure. A contributing factor that could be causing this behaviour is how the Environment Agency measures the quality of its messages. Each quarter the Environment Agency randomly samples 20 published flood warning messages from each area and a review panel uses the quality scoring criteria used in the table below, which does not contain a scoring category based on citizen feedback/satisfaction.

Message content to be scored	Weighting	Score
<b>High level headline</b>	2	0,1 or 2
<b>Timings of flooding</b>	3	0,1,2 or 3
<b>Location of impacts</b>	3	0,1,2 or 3
<b>Forward look (how will the event progress)</b>	3	0,1 or 2
<b>Actions/advice for the public</b>	2	0,1 or 2
<b>Actions that the Environment Agency and Authorities are doing</b>	2	0,1 or 2
<b>When will the message be updated</b>	2	0,1 or 2

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*Hypothesis: If the criteria used to evaluate message quality is changed to include citizen feedback, then Duty Officers will have more of an interest in what citizens are saying about the content they create.*

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## Area management of the flood warning systems

Flood Resilience teams are responsible for managing the flood warning service in their respective Environment Agency Areas. They manage and maintain for Target Areas used to issue flood warning messages to users, as well as input into system improvements and reporting for their Area.

Thorough surveys and interviews, we have discovered several key issues that Flood Resilience teams have with the existing flood warning systems:

1. Lack of consistency in Areas around manual use of FWS
2. Maintaining of scripting tool causing undue delay, and producing scripts below expectations
3. Target Area creation used as a measure to create on-the-spot warnings for non-textbook flooding incidents
4. Low awareness of National resources such as FWS Training Documents, Easinet Pages, FWS related Operational Instructions, Data reports, FWS audit reports, and training packages (even where it is welcome)
5. User Interface of FWS is below standards, and causes delay and difficulty to the user

## Target areas

A target area is a geospatial area that specifies a location at risk from flooding. When a warning is triggered, citizens who have a property in that Target Area and are registered to receive messages will be notified. There are two different types of target area, alerts and warnings.

- Alert: Flooding is likely to impact low lying land but not to property. Alert areas are typically very large and tend to cover the entire rare catchment. They can only be sent Flood Alert messages which are optional messages for users
- Warning: Flooding is expected to impact properties. When a danger to life is expected a warning area is escalated to severe. Warning areas tend to be smaller than alert areas and trace the boundary of local communities. They can receive both Flood Warning and Severe Flood Warning messages. They are mandatory for users

In the context of XWS, the creation and maintenance of flood warning target areas happen outside the warning system in geospatial applications and XWS provides an interface for Flood Resilience teams to upload new and updated shapefiles.

However target area design has an impact on the delivery of the flood warning service and we are interested in understanding how the current ways of working impact citizens. Earlier in this report we displayed information that shows the low match rate of properties flooded Vs warnings issued. This is symptomatic of the way the Environment Agency design its Target Areas. During Discovery we found feedback from citizens who told us the value of flood warnings is being devalued when the perceived risk of flooding is low.

*"Telling me spray may come over the town sea front wall will not affect my property in the slightest....I will cancel if you cannot make this service specific to me. ONLY tell me when there is a risk of flooding in my exact location, i.e. when I need to rush home and enact my flood plan!!!!"*

*"After living in Torksey for over 40 years the present flood warning system is hopeless, if you look at the map the whole country would be under water or could be, in reality there is virtually no chance of a flood"*

We don't know where these types of citizens live in the target area, but it's possible they have homes on the outskirts of the target area and are warned when properties much closer to the source of flooding are at risk. This would warrant further research during Alpha.

For catchments that flood with very little lead time, levels at which warnings are issued can be set to very low levels which compounds the issue of being warned when their perceived risk is low.

*"This constant sending of Flood Alerts when river levels are demonstrably low is potentially very dangerous, and could easily lead to people ignoring the one alert that is important! Can you please stop trying to cover your own position and actually give the public something that is of use. The current position will lead to dangerous conditions, as people will just ignore your warnings."*

*"Why do you continue to issue flood warnings for Preston beach when there is no record or evidence of ever having property flooding here. The latest modelling from Hyder consulting suggests the defences have a standard of nearly 1 in 500, there's almost no possibility of flooding occurring here. "*

*"I have been living in the village since 2001 and in these 20 years there has not been any serious flooding, no house has been flooded, and there has been, just once, some surface water on Main Street and Bishopthorpe Rd next to the Archbishop's Palace. With this exaggerated flooding risks you are just allowing insurance companies to charge us more and more, year after year, for home insurance."*

We've also seen feedback from citizens that request an increase to the size of the warning area.

*"The area on the map highlighted as potential flood risk is not extensive enough. My sisters house in Challenger Close in Paddock Wood was flooded as were many other areas. Dimmock Close should also be included. You will find much evidence of surface water flooding on Social media."*

We've learned that target area design is a complicated process and although it's outside the scope of XWS, we feel that it is responsible to consider the process and how we could assist Flood Resilience teams to better understand the feelings of our users. This could be achieved by visualising feedback about target area design with those responsible for its design.

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*Hypothesis: Satisfaction scores related to the accuracy of warnings would be improved if we visualised citizen feedback and shared this with the teams responsible for creating and maintaining TAs.*

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## Creating and maintaining Target Areas

The process for creating and maintaining target areas is broken into four core activities.

- Step 1: Create the target area shapefile: This is done in consultation with flood modelling specialists that have local knowledge of the area and access to geospatial software to create a shapefile.
- Step 2: Upload the shapefile: This activity is related to the upload of a shapefile and specifying attributes that define the target area which are seen by users.
- Step 3: Activate target area: When a target area is activated, downstream services are updated with the new information. The Environment Agency currently publishes 4 updates per year. There is an aspiration to move to an on demand publication process, but this would require updates to downstream systems so they can consume information on the fly.
- Step 4: Administration: This is activity related to maintaining systems outside of the warning system that help flood resilience team members track and report on the previous steps in the process.

User	Pain point	Impact
<b>FWVDB, NRW website, FIS, BlueBox, API, Easimap, I drive, EDW</b>	When a TA update process runs, downstream services have to do a manual update. Although this is a well-rehearsed BAU process, the constraint of having to manually run the updates means target areas are refreshed quarterly. During times of heavy flooding there is a need to publish/amend TA's more frequently to better serve public interest?	Accuracy of the information we present to citizens and partners
<b>Flood resilience teams</b>	When creating and updating target areas, CMP (central modelling platform) can sometimes be slow. This can cause issues when we have to meet tight deadlines.	Delay in responding to requests to create/amend TAs.
	Large target areas don't upload to the flood warning service	TAs have to be cut down and may no longer accurately represent the area at risk
	One of our key issues is communications regarding flood map updates. We often become aware of flood map changes after they have "gone live". Therefore our flood warning areas do not match up with flood maps, something some of our more engaged customers are aware of	Accuracy of the information we present to citizens and partners
	We have lots of TA's and it can be hard to see the state of each TA and when it was last updated. This can lead to TA's becoming out of date.	Accuracy of the information we present to citizens and partners
	Long winded update process and its easy to lose track of progress. Simple process but takes a very long time and a lot of resource	Delay in responding to requests to create/amend TAs.
	Confusion re terminology around TA uploads (export means two things in FWS, unclear if TA is current or has been put forward for upload, dates of uploads not given in FWS)	Usability and terminology confusion

User	Pain point	Impact
	Run out of node points when designing shapefiles	Accuracy of the information we present to citizens and partners

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*Hypothesis: Target area changes can be published more frequently than every quarter if we automate the update process for downstream services.*

*Hypothesis: The process of creating and updating target areas will be quicker if Central Modelling Platform performance is improved.*

*Hypothesis: The accuracy of information we provide will be improved if we synchronise flood zone layer and target area updates.*

*Hypothesis: The accuracy of information we provide will be improved if we visualise the status of flood target areas and when they were last updated.*

*Hypothesis: The time taken to update and create target areas will be reduced if we shorten the journey of completing these tasks in the flood warning service.*

*Hypothesis: The accuracy of the information we provide to citizens and partners will be improved if we increase the number of node points in shapefiles.*

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These hypotheses are formulated and supported by a tailored semi-structured survey circulated to the Area Flood Resilience teams, which collected 28 responses. Some of the participants' answers have been followed up for 1:1 interviews.

The lower than expected survey turnout is due to the ongoing flooding incidents which saw the majority of incident staff work day and night, and weekends. Participation in research took lower priority, but we have made a commitment to Areas to engage with them more extensively in the Alpha phase.

The survey focused on all-round responsibilities by the resilience officers, and gave plenty of free-text space to elaborate on specific issues. Maintaining the scripting tool surfaced as an element of dissatisfaction within the team. Below are a few notable comments:

*I don't believe the scripting tool is fit for purpose - it requires a lot of editing from the duty officers once the message has been created, so creates more work than it should. I don't believe the scripting tool should reference the gauging station used to issue the TA - this gauge is not relevant as the message needs to be appropriate for the whole target area, not just the issuing site - i.e. the level may be falling at the issuing site but it could still be rising downstream. This does not come across well in the scripting tool. The scripting tool also is not good for a falling river level, plus it has too much generic advice, which should already be auto populated into the message set in FWS.*

*The scripting tool is very unstable so we are always concerned about it. We always have backup copies in case something goes wrong. There is a requirement for message quality to make the content that comes out of the scripting tool to be a lot more specific than what we were originally given so it needs a lot of improvement on what's actually included.*

*There are too many bugs to use the tool effectively and it is not obvious who to ask for help. I am not trained in solving Excel bugs and managing such an extensive Excel document with macros etc. There needs to be a better system maybe than a spreadsheet. There are also no guidance documents on how to update the spreadsheet. The fact that the tool has so many bugs is putting duty officers off using the tool.*

*It's not always the most intuitive to edit, but having experience with data validation and macros certainly helps. The spread sheet is so heavily controlled, duty officers can sometimes struggle to adapt if there are glitches/quirks. This can result in duty officers going "off script" if they are unable to make the tool work. This is often related to user error, therefore it is best to keep the tool as simple as possible!*

We also asked Flood Resilience teams if they have ever had to create TAs “on the fly”. This means creating and activating a new or amended TA outside of the regular update process nationally. We found that many different Area teams have had to do this over the years for a variety of different reasons. Some of these are shown below:

*“We had to create a new target area in response to increased flood risk in a particular area due to a collapsed culvert - creating the new TA solved the issue.”*

*“It was on FWD not FWS, following the 2013 tidal surge. FWS was supposed to have the capability to create target areas on the fly, so it would be good to have that in the new system.”*

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*Hypothesis: Areas need to be able to respond to urgent changes to our service in order to provide the most accurate information we can. XWS needs to support these no notice changes.*

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## Business needs research

Under the Flood and Water Management Act 2010<sup>18</sup>, the Environment Agency has a remit to warn citizens about flooding from rivers (main river only) and the sea. Warning citizens about flooding from surface water sits with the relevant local authority. However, as a Category 1 responder, we could be called upon by other Category 1 or 2 responders to assist with response – including assisting with warning and informing. We should therefore consider how we could support other responders as a requirement for any new warning service. This includes thinking about how they would access the system, what messages they would send and to whom.

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*Hypothesis: Creating a warning system that could be utilised by other Category 1 responders would help the Environment Agency support in the response for public emergency situations*

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Beyond a stated remit for providing a flood warning service as outlined in the Flood and Water Management Act 2010, the scale and shape of the service can be defined by the Environment Agency (and NRW and SEPA). This responsibility in the Environment Agency sits with the Flood Incident Management Team in the Service Management department in IM&R.

Our Flood Warning service covers fluvial and coastal risk to the full extent of Flood Zone 2. Some warning services have been developed for places outside of flood zone 2, such as communities at combined risk from fluvial and surface water flooding, subject to rapid response hazards or groundwater flooding. Some of these warning services may be community led, others may be assisted or delivered by the Environment Agency. Flood Zone 2 areas are assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

This flood warning service provides flood-risk information and warnings on a community scale across England to residential and business properties, infrastructure and those who live, work, visit or pass through in those communities. In practise, the service has been delivered at a property level. In limited locations, where it is technically possible, we are also able to warn people of groundwater flooding. At present we can only raise awareness of the potential for surface water flooding through our web based 5 day flood risk forecast.

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*Hypothesis: Our warning service is designed for at the scale of communities and catchments – but we offer property specific registrations to the public. This disparity means that some users get warnings unnecessarily.*

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For some time, policy decisions for the flood warning service have been driven by the systems. This is largely due to the fact that the systems have been delivered faster than policies have been reviewed and updated – this needs to change. The consequence is that the design of the service has been retrospective after the systems have been developed.

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*Hypothesis: By not iterating our flood warning service policy quickly, we are failing to meet our users' needs. By developing low-level policy in iterative cycles alongside the service and systems teams, policy teams can see how their best*

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<sup>18</sup> <http://www.legislation.gov.uk/ukpga/2010/29/contents>

*guesses actually operate in the real world and adjust before initial rules are finalised.*

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*Hypothesis: Historical bias about the current flood warning service limits our vision for XWS.*

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All parts of the business involved with flood incident management policy and teams involved with system support and development need to work much closer together. The symbiotic relationships between policy, services and systems support necessitates closer, frequent working to deliver exactly what our users want, and ensure that our policy, services and systems reflect real-world needs.

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*Hypothesis: Delivery will be more effective (where we build the right thing, in the right way, at the right pace) if the XWS team includes a mix of policy, design, business and technical backgrounds.*

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It is vital that we work closely with other departments in the Environment Agency and across Government to ensure that the services and systems we deliver meet our user needs and wider organisation and government intent.

We need to ensure that we work in a manner that allows quick, iterative improvements to the service (and systems) to match changes to our user needs. Traditionally, the Environment Agency has operated in an environment the pace of change was a lot slower than it is today. Our services remain unchanged for a long time – partly due to software and systems being expensive and time consuming to build, and digital skills were difficult to acquire.

Our existing service is a reflection of that environment – largely unchanged for over a decade, with policy to match. We have created an environment and organisation that are rigidly structured around very specific sets of tasks; strategy and planning, response, service management and digital delivery.

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*Hypothesis: Our service must work in a way that does not unnecessarily expose our organisational structures*

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*Hypothesis: A culture of silo working in the Environment Agency will slow down the learning process as XWS is developed.*

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Instead we should be designing our organisations and ways of working around what our users need and be set up to meet these needs quickly and effectively. We need to put user needs first, and then create and change policy in the context of these needs. Only then can we begin to build a responsive flood warning service and effectively achieve the goals our policies intend.

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*Hypothesis: A culture of silo working in the Environment Agency will slow down the learning process as XWS is developed.*

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*Hypothesis: Developing policy around a deep understanding of the needs of its intended users reduces the guesswork and increases ongoing situational awareness. We must create a technology, policy, and operations feedback loop that connects intention with implementation.*

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In Discovery, we have seen common issues that citizens are reporting about the current service. We need to work with the Flood Incident Management Team (Service Management) and the Flood Warning Expansion Project (FWEP) team to understand the policy challenges that require attention to meet these. These are principally around target area design, flood warning codes, message quality and thresholds.

### Target area design

During Discovery we found feedback from citizens who told us the value of flood warnings is being devalued when the perceived risk of flooding is low. We think this is exacerbated by the way we have designed our target areas, which extend to the boundary of Flood Zone 2.

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*Hypothesis: The number of citizens unnecessarily warned would reduce if we used more refined flood forecast data to determine the “true” at risk areas and only warned citizens that live in these areas.*

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### Warning codes

Each Flood Warning code is designed to communicate the likelihood of flooding, or the severity, in a particular area. In addition to this, updates should be used to communicate important new information or to update Floodline and GOV.UK to show that we are still monitoring the situation. Currently the policy when issuing flood warnings via three warning categories (plus one “remove” category):

- Flood Alert: Flooding is possible - be prepared
- Flood Warning: Flooding is expected – Take Action
- Severe Flood Warning: Severe flooding - danger to life
- Warning no longer in force: No further threat of flooding – warning removed

Due to the complex nature of flooding it can be very challenging to categorise a warning into one of three categories which can result in the true nature of flood risk not being accurately portrayed to citizens.

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*Hypothesis: The timeliness, accuracy and reliability of forecasts vary across the country – our current three tier warning service does not provide enough scope to provide accurate and meaningful information to our users.*

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During the February flooding event we saw evidence of real-time information inputted by the Duty Officer being contradictory to the “core” advice associated with the flood warning codes. As an example, the table below shows real time information where mismatching advice for the severity of that TA has been highlighted.

Target Area	Severity	Time and Date	Real-time information
River Wye at Blackmarstone, Hereford - 031FWFWY120	Severe Flood Warning	17/02/2020 12:18	This Severe Flood Warning has been issued because river levels have risen at the Old Wye Bridge river gauge as a result of heavy rainfall. Consequently, <b>flooding of property and roads is possible today</b> , Monday, 17/02/20. Please activate any property flood protection products you may have, such as flood barriers and air brick covers and have a bag ready with vital items like medicines and insurance documents. River levels at Old Wye Bridge have peaked at 6.11m midday today, Monday 17/02/20.

Target Area	Severity	Time and Date	Real-time information
			Further rainfall is expected over the next 12 hours as a result of Storm Dennis.
<b>Rivers in Accrington and Oswaldtwistle - 012FWFL52</b>	Flood Warning	09/02/2020 05:52	River levels have risen at the Milnshaw river gauge as a result of Storm Ciara. Consequently, flooding of property/roads and farmland is possible early today, 09/02/2020. The River Hyndburn, Woodnook & Broad Oak Water, Antley Syke, Pleck, Hynburn, Tinker, Lottice and Whiteash Brooks in Accrington and Oswaldtwistle. Comprising Dunnyshop, Baxenden, Lower Fold, Peel Bank, Barnfield and Little Moor End may be affected. This message will be updated in 8 hours, or as the situation changes.
<b>Severn Estuary at Oldbury-on-Severn, Oldbury Naite and Littleton Warth areas - 112FWTOLD01</b>	Flood Warning	10/02/2020 18:43	Strong onshore winds and a large tidal surge are forecast. The first high water is at 08:45 on Tuesday 11th February and the forecast tide level is 8.26 m AOD. The forecast wind is force 6 Westerly. Tide times and levels refer to high water at Avonmouth. Flooding may occur for about 2 hours either side of high water. Flooding is possible for the Severn Estuary from Oldbury-on-Severn to the Old Severn Bridge including Oldbury Naite, Thornbury Sailing Club, Oldbury Pill, Whale Wharf and Rusholme. Our incident response staff will closely monitor the situation along this coastline. This message will be updated on Tuesday, or as the situation changes.

*Hypothesis: The current warning codes are used variably across the country by Area team which creates an inconsistent national service – this is in part due to our current three tier warning service not provide enough scope to provide accurate and meaningful information to our users for every possible event*

We also saw evidence in our user research that many users do not understand the difference between a Flood Warning and Flood Alert, in fact, many believe that Flood Alert is a higher severity message. During user testing sessions, we asked the users which they believed to be a higher severity – Flood Alert or Flood Warning. 5 of the 6 user testing sessions said Flood Alert, and the final user could not say either way.

*“Warning means something might happen. Alert means something is happening”*

This is also shown in our public survey where over 50% of respondents either thought that a Flood Alert was more significant than a Flood Warning, was unsure, or did not know. With the proliferation of smart phones, the word “Alert” has become synonymous with instant notifications from news, weather and social media apps showing breaking news.



*Hypothesis: Our flood warning codes are not understood by our users. The words “Alert” and “Warning” are often interchanged by the public and do not provide a clear distinction on the level of risk.*

## **Message quality**

Earlier in the report we highlighted how the conflict between policy and user needs is impacting satisfaction scores relating to updating flood warning messages. The same applies to how message quality is calculated. The real time message structure that flood warning messages are scored against is as follows;

- High level headline to describe the situation
- Timings of flooding
- Location of impacts
- Forward look (how the event will progress)
- Actions and/or advice for the public
- Actions that we or the authorities are doing
- When will the message be updated

Citizen feedback is not used to assess the quality of flood warning messages.

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*Hypothesis: Citizen Satisfaction scores will increase if we start to use citizen satisfaction scores as a way of measuring message quality.*

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## **Flood Warning Expansion Project (FWEP)**

The Environment Agency is currently progressing a project to expand the flood warning service to every property at high risk of river or coastal flooding in England. This would enable the 26,000 properties at high risk of flooding from rivers or the sea without current access to flood warning information to now receive a service.

Around 8,000 of the high risk properties in scope are isolated and very hard-to-reach, which presents many technical and economic challenges for flood warning. The project team are trialling new innovative forecast techniques to provide flood forecasts for these areas, including use of national Grid to Grid models in a small number of catchments initially. These low resolution models will mean that forecasts for these areas are likely to be of a lower quality than traditionally modelled rivers, and therefore provide a lower certainty flood warning service.

The FWEP project team are planning to experiment with the use of the global alerting standard Common Alerting Protocol (CAP) alongside the existing flood warning codes. The CAP structure contains a more granular definition of risk by explicitly providing an estimate on urgency, certainty and severity as well as the response required. The CAP values can be found in Appendix C.

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*Hypothesis: By testing the use of CAP, we will be able to see if users find the more granular information we can provide useful.*

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*Hypothesis: Using CAP messages will allow for a more flexible, descriptive and useful flood warning service that can cater to many different flooding events, even if used to support the existing 3 tier model.*

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## **Support for surface water flood warning**

The changing nature of flood risk has been recognised in the government's 25 year environment plan<sup>19</sup>, released in 2018. Within its 10 overarching goals, it recognises both the need to achieve "a

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<sup>19</sup> <https://www.gov.uk/government/publications/25-year-environment-plan>

reduced risk of harm from environmental hazards such as flooding and drought" and to "make progress in mitigating and adapting to climate change."

During 2019, an updated draft version of the National Flood and Coastal Erosion Risk Management Strategy<sup>20</sup> was put out for consultation. The draft version includes support for continued joint working between the Environment Agency and Met Office to improve combined services for all sources of flooding. It also includes some specific measures related to surface water flood flooding and multi-agency response:

- By 2021 the Environment Agency will work with government and risk management authorities to clarify roles in relation to surface water flooding
- By 2025 the Environment Agency will work with government to better join up the organisations involved in providing incident response and recovery to provide a consistent and coordinated service.

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*Hypothesis: Any new warning system should be designed with enough flexibility that it could be used for issuing of surface water flood warnings from 2025 onwards.*

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The Flood Incident Management Plan for 2015-22 sets out principles and targets relevant to surface water flooding, including:

*Although our remit and priority is for flooding from rivers and the sea, it is crucial we work together to address the combined risks in communities. We will lead on providing an incident management service for rivers and the sea, but support all relevant partners and help local authorities develop services for other sources of flooding.*

The Environment Agency's current position statement on its response to flooding from surface water states that where possible it will add local value to forecasts and share intelligence on potential localised flooding. The Incident Management & Resilience Service Management team intend to update this position statement to improve clarity.

The Environment Agency and Met Office have recently completed a joint Discovery on scoping the development of an enhanced briefing capability for surface water flooding. This project is about exploring how to maximise the use of current data and advances in forecasting, to better support incident planning and response in fast moving situations. The Discovery concluded that:

- Responders have a desire for additional information, to ensure they are aware of the latest situation, to put them in a stronger position to make decisions, and to know when it is safe to respond
- There are sources of information that are currently available or likely to be available in the near future which may benefit responders, including real-time rainfall observations (telemetered and radar) and outputs from the Met Office's developing short range forecasting ('now casting') capability.
- There is no clear evidence at this stage that responders would change their operational processes, particularly before flooding occurs. Though there remains the potential for responders taking preparatory action that they otherwise may not have taken, we need to look into this further to understand the impacts and benefits that the information could have.
- There are other benefits to progressing this work, including:

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<sup>20</sup> <https://www.gov.uk/government/consultations/draft-national-flood-and-coastal-erosion-risk-management-strategy-for-england>

- providing a capability for forecasting community to share short notice and potentially valuable information
  - increasing public trust in forecasting and responding organisations
  - supporting and encouraging strategic and operational alignment across the EA, Met Office and Defra
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*Hypothesis: The EA should continue to work with the Met Office and LLFAs to scope options for the forecasting of surface water flooding.*

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The project recommended moving into an Alpha phase where they will try out different solutions to the problems learnt about in Discovery. The first stage will run for approximately 12 weeks during spring 2020.

## **Providing managed services to other organisations**

We currently provide a managed service to other organisations (SEPA and NRW) for some of our flood warning services, in exchange for a financial contribution. In order for our systems to function effectively and efficiently, the overarching services provided by the organisations need to have an element of alignment.

We need to be clear why we would share our systems between EA and NRW/SEPA. It shouldn't be about cost saving, it's not making life easy for the Managed Service Organisation (MSOs) – it should be about the end user experience - one joined up flood warning service between our organisations for the public and partners.

If the EA, NRW and SEPA are going to offer different services (which they already do to varying extents), then providing shared platforms begins to make less sense in the long term. Any service difference between the organisations will have knock on implications for the design and development of supporting systems. This is likely to cause increased complexity, costs and a potentially reduced end user experience.

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*Hypothesis: By providing single flood warning service across England, Wales and Scotland, users will get a more coherent service wherever they are.*

*Hypothesis: By sharing a flood warning system, organisations responsible for flood warning can share the cost of development and improvement of those systems. An improvement for one is an improvement for all.*

*Hypothesis: In order for shared systems to function effectively, organisations responsible for flood warning services need to work together to align their flood warning services into a coherent whole.*

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During the recent flooding events in February 2020, we saw user feedback on the GOV.UK Flood Information Service pages looking for flood information for Wales. Currently, the FIS pages only show information provided by the Environment Agency in England, with the exception of the 5 Day Forecast (England and Wales). It appears this is not intuitive to FIS users who see GOV.UK as a national website.

*There's going to be flooding in Wales and Scotland too this weekend. Why isn't that on the map?*

*Couldn't even get the network for Wales - useless*

*I can't get any information up about wales*

*Nothing in force in Wales? Your long term forecast says severe flood risk but nothing in force? Explain please*

*I think it is not appropriate that on a gov.uk website there is no information about flooding in Wales and one has to go looking on other websites!*

*There are 2 severe flood warning in Monmouth tonight and yet the England website implies for Monmouth there are none. I know this is an England v Wales thing but you need to flag borders areas like this should be checked on the wales site as well.*

*Neither your map nor list of locations includes ANYWHERE in Wales - therefore totally useless.*

*Why are you instead only showing, on both the map and in your list of places at risk, information for England?*

*Cannot find info on South Wales?*

*No information on wales. Disappointing*

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*Hypothesis: Our users want to see flood information in one place. Accessing the up to date information is more important than the organisation providing the service.*

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## Flood Incident Management (FIM) plan 2015 to 2022

As part of Discovery, the project team has examined existing strategies and policies that will affect the design of a flood warning service, and therefore the design and delivery of any related system.

The FIM plan sets out the EAs aspirations, outcomes and overarching principles for flood risk management. Some, but not all, of the plans outcomes and principles are relevant to the flood warning service and associated systems. The relevant outcomes and principles are listed below and should form a key part of any thinking related to a new flood warning system.

- We take a risk-based approach to investment and delivery of the service
- We put people and communities at the heart of what we do
- We work with communities to develop the service that is right for them
- We look for opportunities to work with others in every aspect of delivery
- Our decisions are evidence-based
- We communicate in ways that are easy to understand and accessible to all
- We make decisions about how we'll respond based on forecasts to enable us to 'think big, act early'
- We work with others to share resources and avoid duplication of effort, integrating our service for rivers and the sea with other services for surface and groundwater flooding where possible
- We are open to sharing our data and information to encourage others to use it in different ways
- We take a 'yes, if' approach in all we do

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*Hypothesis: Any improvements and development we make to the flood warning systems must consider the FIM plan ambitions. By making informed and*

*deliberate choices with our flood warning system development we can better help the wider business in achieving its overall policy goals.*

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A new version of the FIM Plan is currently being created, but has not been made available to the Discovery team for review. During any further development, any new or modified overarching strategy documentation should be considered for system delivery and deployment.

## **Defra Group Strategy**

Incident management is one of the EAs top priorities and is core to our role in helping to achieve one of the goals in Defra Group Strategy<sup>21</sup>:

*We will lead the response and recovery to floods, other natural hazards and emergencies. We will secure stronger levels of protection from flooding by investing in green and physical infrastructure, and champion approaches which embed resilience in long-term investment decisions.*

The flood warning service plays a key role in the response and recovery of flooding by providing information before, during and after a flood to affected users - it is one of the primary purposes of the Environment Agency. It's therefore vital that the service and supporting systems are provided with enough resources to be operated, maintained and improved effectively.

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*Hypothesis: By creating a flexible, reusable alerting platform, we can help Defra achieve its goal of leading the response to flooding and other natural hazards and emergencies.*

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## **Defra National Flood Emergency Framework for England**

The Framework<sup>22</sup> sets out the government's guidance and key policies regarding flooding and is a resource for all involved in flood emergency planning at local and national levels. It is a common and strategic reference point for flood planning and response for all tiers of government and for responder organisations. The Framework states that:

*Communicating with the public about emergencies is essential. A well-informed public is better able to respond to an emergency and to minimise the impact of the emergency on the community. By informing the public as best they can, all organisations will build their trust. Part of this is also avoiding unnecessary alarm.*

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*Hypothesis: By creating a simple warning service, and intuitive system we can provide our users accurate and relevant and provided to users who need it, when they need it and in ways that they want it. Only then can they be informed and take the right action.*

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*Hypothesis: We should also use the systems appropriately in order to build trust with our users and keep them informed without causing unnecessary alarm.*

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<sup>21</sup> <https://www.gov.uk/government/publications/defra-groups-strategy-creating-a-great-place-for-living>

<sup>22</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/388997/pb14238-nfef-201412.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/388997/pb14238-nfef-201412.pdf)

## **Government Transformation of public facing services**

The Government Transformation Strategy<sup>23</sup> recognises that government departments must focus on effectively delivering services to people, and to achieve this departments must have a deep understanding of those whom a policy or service will affect. The Strategy suggests that one of the best ways of doing this is by bringing policy development and service design closer together. There is currently a disconnect between the teams responsible for policy decisions regarding the flood warning service, and the teams managing, improving and delivering the systems that provide these services. There is a driver from the central government to have teams provide customer facing services “end-to-end” - from the point where the user starts trying to achieve a goal to the point when they’re finished. This includes website content, the transactional part of the service, the phone, post and face-to-face channels, as well as the digital elements. And it includes the internal processes that the government needs to deliver an outcome.

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*Hypothesis: The current separation between the systems, policy and service management teams means that our flood warning services are not meeting user needs as well as they could be. Aligning the systems and policy teams would enable closer development and future planning to take place, allowing for better use of resources and increased value for the users. The policies, the service and the systems must be designed, iterated and delivered in tandem.*

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<sup>23</sup> <https://www.gov.uk/government/publications/government-transformation-strategy-2017-to-2020/government-transformation-strategy>

## Technology research

Technological changes over the last decade have dramatically changed the world around us. Cloud computing has changed the entire fabric of the services we consume on a day to day basis – where once we had expensive and bespoke on premises infrastructure, you can now design scalable, inexpensive and flexible alternatives in the cloud.

In 2013, the government mandated a “cloud first” policy <sup>24</sup> for procuring and building new public sector services. By Cloud First, GDS means the public cloud rather than a community, hybrid or private deployment model. There are circumstances where the other deployment models are appropriate but the primary benefits for government come when we embrace the public cloud. Departments are encouraged to initially consider Software as a Service models, particularly for their enterprise IT and back office functions.

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*Hypothesis: XWS design should consider a “cloud first” deployment approach by default and embrace Software as a Service models*

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GDS states that all technology design should begin with user needs and that we shouldn’t just re-create the same system with new technology. Careful consideration should be taken to understand what service, and what user needs that service is providing before design and deployment of the supporting system(s) takes place.

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*Hypothesis: We need to understand the user needs and the service that meets those needs before we begin to design and deploy a new warning system*

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To help us understand the technology landscape that we have available to use for XWS, we held a remote workshop (due to the coronavirus travel advice) with technical colleagues in the Environment Agency, DDTs and Natural Resources Wales. All attendees have experience supporting existing flood warning services and systems in the EA and NRW, or have a wider role in Defra architecture design and policy.

We examined our current legacy estate (as shown in Appendix A) and spent time identifying what elements we would like to keep, and where we think some elements can be retired or replaced in XWS. We also spoke about the user research so far, and in particular the internal and external user needs and pain points we had discovered. We also spoke about the business needs for a new service, and what it would be expected to deliver now and in the future. The sections below outline the broad ideas and recommendations from discussions at the workshop and other technology based research the project team carried out in Discovery.

### Designing for reliability, accuracy and timelessness

We also held an exercise discussing how we can design a service that is performant and secure and provides reliable, timely and accurate alerts to our users.

- Reliability
    - Include accessibility checker into tool to ensure messages use accessible language but also have another route to the extra detail for those who need it
    - Decoupled micro services/serverless & queue architecture that can scale horizontally to handle demand spikes
    - Prioritise XML to enable hook and broadcast
- 

<sup>24</sup> <https://www.gov.uk/guidance/government-cloud-first-policy>

- Ensure key system resources (e.g. call capacity) are available
  - Ensure resilience through cloud - e.g. multiple locations and systems
  - Reliable on multiple levels - System & resilience - tech + money
- 

*Hypothesis: Designing a horizontally scalable micro services system will allow for “peaks” in the message sending without additional unnecessary cost*

*Hypothesis: Using multi cloud providers for our system components may increase our overall resilience*

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- Accuracy
  - Pre-format some lower risk messages so they can be sent more quickly, e.g. Groundwater may be in force for a long time, with the only change being the time issued and next update. These could be issued automatically after x hours.
  - Make XWS CAP compliant from day 1 even if not used. Allow picking of relevant CAP values during message sending process
  - Introduce CAP "action" status
  - Allow super users (Flood Wardens and the like) to provide locally relevant content.
  - Some users may want the headlines, others may want the technical details. We need to provide both as user perception of accuracy will be different. Maybe a message summary/details show more advanced info could be useful.
  - Ensure service is ready for proliferation of smart assistants e.g. Alexa (now in 40% of households).
  - Restrict the choices a duty officer has to only those that are relevant
  - See live feedback attached to TA codes
  - Use off additional data sources where available to provide extra information to warning i.e. River levels on the internet
  - Allow small target areas to be created whereas the risk is the same throughout the TA
  - Allow real time flood extents to be passed to the system instead of using pre-defined TAs
  - Scripting tool functionality needs to be in the application, needs to be accessed from a mobile phone so FWDO can populate the message, then info passed to AFWDO?
  - Allow "advice" to be picked as part of message creation process
  - More frequent/different method of TA updates to allow most recent information to become operational quickly
  - Build strong links with the IMTD (Threshold Database)
  - Single source of truth for data sets. Reduce the copies of the same data we have across the estate will reduce "sync" issues.

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*Hypothesis: In order to future proof our systems, we should build in CAP compliant messages from day 1 (even if not used)*

*Hypothesis: We can speed up the message sending process by getting the systems to create metadata and data sources for use by Duty Officers in the real time information – for example roads that may be affected*

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*Hypothesis: We can use targeted prioritisation to ensure messages go to the most at risk people first, with lower severity messages getting pushed “down the queue”*

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- Timely
  - Notifications to duty officers where to target efforts when updating messages - e.g. prioritise warnings where they have 1000's of people viewing the contact over warnings which have a handful of views
  - Only show messages current in force when a Duty Officer updates or removes a message
  - Option to refresh/re-issue existing messages at the click of a single button
  - Send combinations of TAs at once "grouped" where TAs are more specific to risk levels, e.g. 1 in 10 + 1 in 50 \_ 1 in 100
  - Remove duplicate messages before message sending as to not tie up resources unnecessarily
  - Prioritise use of resources (e.g. Rapid Response sent before Flood Alert)
  - Target area rest api for source data - e.g. [GET] /target-area/{ta-id}/{version} so that quarterly updates are not needed
  - Mobile design for issuing, updating and removing messages
  - Reuse previous message text and allow changes for current warning being issued
  - Enable use of personal devices to send messages
  - Automating messages from triggers in IMFS
  - Allow for "timed" refreshes for systems updates

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*Hypothesis: By using smarter system design, we can speed up the time it takes to issue, update and remove messages.*

*Hypothesis: Allow Duty Officers to use mobile devices, they can more quickly update and issue messages “on the go” rather than using cumbersome EA kit and network requirements.*

*Hypothesis: A streamlined mobile friendly design would increase the speed at which messages can be sent.*

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## Delivering XWS

It was felt that a combination of “in-house” and third party delivery would be required to build XWS within the allotted time scales. Our “in house” capability is dramatically improved since the last time we designed and deployed a warning system, and the internal teams have experience building, managing and running complex services in the flood estate, including the Flood Information Service, the new Flood Warning Information Service (FWIS) and the CAP aggregator.

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*Hypothesis: By building system components in house, we can upskill existing staff and make best use of resources we currently have.*

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*Hypothesis: By building a componentised system, we can utilise smaller third parties to design and build specific components. This spreads the risk for relying on a single supplier and allows us to “test” the small parties in a low risk way.*

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Very careful consideration needs to take place to avoid a “big bang” release – a strong criticism of the GDS Standard Assessment of FFWS. We need to carefully plan how we move from the existing systems to any new systems designed as part of XWS, this includes migrating TA data and most critically customer data.

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*Hypothesis: By working with our existing suppliers early, we can plan and prepare for a dual running of current and future systems. This will allow a low risk transition period rather than a high risk “big bang” approach.*

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## Technology Code of Practice

The Technology Code of Practice<sup>25</sup> is a set of criteria to help government design, build and buy better technology and contains guidance and case studies to help you migrate from legacy infrastructure and manage the full lifecycle of your technology. It's used as a cross-government agreed standard in the spend control process. Following the Technology Code of Practice will help us introduce technology that:

- meets user needs, based on research with our users
  - can be shared across government
  - is easily maintained
  - scales for future use
  - is less dependent on single third-party suppliers
  - provides better value for money
- 

*Hypothesis: Any warning systems developed should align with the technology code of practise to ensure that GDS provides us with approval to spend money on the service.*

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## Open Standards principles

The Cabinet Offices Open Standards principles<sup>26</sup> apply to every aspect of government IT and will improve public services for all users and use open standards principles and that will be applied across government to make services better for users and cheaper to run. By using the principles, government bodies are supporting:

- equal access to government IT contracts for open source and proprietary software providers
  - improved flexibility and ability when cooperating with other government organisations, citizens and businesses
  - sustainable cost for government IT projects
  - software interoperability
- 

<sup>25</sup> <https://www.gov.uk/government/publications/technology-code-of-practice/technology-code-of-practice>

<sup>26</sup> <https://www.gov.uk/government/publications/open-standards-principles/open-standards-principles#why-you-should-use-open-standards>

- reuse of software components built by others
- the sharing of data between services and systems
- reducing the overall cost of your digital service or technology programme
- avoiding vendor lock-in to a specific piece of technology, or supplier

These principles ensure our technology choices will be affordable, secure, and innovative. GDS insists that wherever possible, government organisations share code, patterns, platforms and components. We should share best practice for approaching technological and service design problems that apply across government and use and build on shared components and platforms to assemble business capabilities (the combination of the technology, processes and people required for a business outcome).

To make it quick, cheap and easy to assemble digital services and to provide a consistent experience for users across all government services, we will build more reusable shared components and platforms. We should share what we have built internationally and learn from best practice in other countries to continuously hone and improve our services.

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*Hypothesis: By developing an open alerting platform, we can help other departments provide alerting capabilities to their users in a consistent and coherent manner.*

*Hypothesis: By developing an open alerting platform, we can drive down costs associated with alerting users across government.*

*Hypothesis: By developing an open alerting platform, we can work with international colleagues to share best practices and create a global government alerting capability.*

*Hypothesis: By considering these open standard principles throughout the entire lifecycle of the systems we can develop an open alerting platform that is flexible, cost effective and secure.*

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During the Alpha phase, we will create a technical strategy showing the plan to design a new system to support the service and our users. This strategy will take into account recommendations from internal technical experts, GDS best practice and what we learn from Alpha prototyping.

## Data and processes research

Having the right data in a system is critical for enabling more efficient and effective services that respond to user needs. We must ensure that personal and sensitive data is treated safely and securely and used only to provide the stated service they have provided their information for. We need to review how our data is stored, processed and used so we can remove duplication, overlap and contradiction in the datasets we use. Data acts as the foundation upon which our systems, and our services are built.

Data processes translate our data sets into usable information in the service. It is vital that data processing is done correctly and efficiently as not to negatively affect the end product, or data output. Data processing includes data input, data storage, data manipulation and data exports.

### Data types and definitions

The table below shows a broad categorisation and definitions of the data stored and processed by the flood warning service.

Type	Description
Contact	Relates to a specific contact belonging to a user. Users will be alerted via these contacts.
Channel	Relates to the alerting channels offered for registration, including telephone channels, emails, texts and XML
User	Information related to the user associated with a contact - this includes language preference, and correspondence information.
Message	Relates to the messages (and associated content) that can be sent to users
Severity	The level of risk for a flood event
Location	This is related to the locations (houses, assets) that users care about if there is a risk of flooding.
Geospatial	Related to the geographical areas the Environment Agency feel are at risk from flooding and determine where the warning messages are sent.
Metadata	Additional data related to flooding incident including time and date of message issue, TA owner,
Real time information	Live real time descriptive data entered by the Duty Officer during the message sending process

### Data and process issues

During Discovery the team met with internal stakeholders responsible for the processing and maintenance of flood related data. We tested our assumptions about data flows from FWS to other services and discussed blockers and challenges in moving to a new service that meets the needs of users as identified during Discovery. An example of the mapped data flow can be found in Appendix E. We have discovered pain points that negatively impact our warning service.

Pain point	Impact
<b>To ensure all our systems are using the same target area data the update process has to be coordinated. This is scheduled every quarter.</b>	The benefits of updated target area information can't be realised until the next release. This could be impacting the accuracy of our warning service.
	During severe flooding a new target area could be required. The current process makes creating emergency target areas harder to do.
<b>It can take up to 6 minutes for warnings to appear on GOV.UK after they have been issued.</b>	GOV.UK appears to be out of date to citizens
	Its blocking the inclusion of TA specific links in SMS messages that route users through to GOV.UK to see real time information
<b>Currently we're unable to track the opening and click through</b>	We don't know how well email content is performing and can't test to establish the best performing content

Pain point	Impact
rate on emails because they are plain text.	
There are lots of unused data sets in the existing systems which require ongoing support.	There is an ongoing maintenance overhead to support this data, and it needs to be tested with each release, even if we don't use it.
Reports have to be built on request in the current service.	It's often the case that reports are required at short lead times to support an operational response to a flood incident. Having to request the 'build' of bespoke reports slows down the process.
Some downstream systems require bespoke data not provided by FWS.	Additional systems are required to calculate this data (BlueBox) – increasing estate complexity and introducing blockers in the TA update process.
Digital Services perform a number of data audits on system data to ensure it is fit for purpose	These data audits pick up errors and issues created by how the system is designed and operated. Not correcting these issues could impact service delivery and the messages available for our users.

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*Hypothesis: If we could release target area updates immediately, this would improve the targeting of messages sent to users.*

*Hypothesis: Satisfaction levels on the flood information service will increase if we reduce the time it takes for flood warnings to get onto the service.*

*Hypothesis: Reducing the time it takes for warnings to get on the flood information service means we can include direct links to GOV.UK in SMS messages.*

*Hypothesis: Monitoring open and click through rates on emails will help us assess the current performance of emails.*

*Hypothesis: Removing unused data sets will reduce the overhead of maintaining the service.*

*Hypothesis: Providing a centralised system to produce all the required data for downstream systems would enable live Target Area updates and a data synced flood estate. We may be able to retire supporting systems that currently do this work.*

*Hypothesis: We should use the Digital Services data audits as guides to data design issues that we should look to design out for XWS. This will improve data integrity and lower overhead on Digital Services teams.*

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*Hypothesis: Providing "self-service" reporting options will lower the overall overhead on the Digital Services team and provide a more consistent reporting overview for National and Area teams.*

## Other alerting needs

Although Discovery is focused on flooding, we've kept an open mind regarding its potential use across government as an open source and reusable product. It was encouraging to learn that other potential beneficiaries of a generic warning service had similar needs and challenges.

We have contacted other organisations with current alerting capabilities to understand the systems and services they operate, and look for overlaps with the flood warning service. This could allow us to design a “core alerting system” that could be used by multiple agencies. The table below shows a summary showing the high level alerting needs of organisations we've spoken with during Discovery.

Organisation	Service	Status	Why	Where	Who	When
Animal Health and Plant Agency (APHA)	Animal Disease Alerts <sup>27</sup>	Live	To warn of animal disease outbreak	Geospatial areas of the country mapped by the APHA which reflect the area at risk from infection	Staff, Citizens Professional partners e.g. vets and farmers	It's manual and based on case by case basis
Environment Agency	River Advice for Boaters	Live	Warns citizens and organisations that use waterways for leisure and/or part of their daily lives	1010km of navigable waterways in England	Staff, Citizens and organisations that live by the river	Triggers to issue strong stream advice are based on flow data recorded by the Environment Agency and riverside observations reported by lock keepers
Environment Agency	Fisheries alerting	Proposed	To provide specific forecast weather information to fisheries related users that may impact fish stocks	Could potentially be limited to East Anglia initially	Angling clubs, tackle shops, relevant fisheries charities and organisations	During prolonged hot summer periods
Environment Agency	Environment Management Alerts	Live	Provide advice and information for pollution events	Currently limited to North London river reaches but desire to expand to other rivers and other environmental hazards	Citizens, Professional Partners, Staff	It's manual and based on case by case basis
Home Office	Evacuation Alerts	In development	To communicate both emergency and out of hours issues	Address based	Staff	It's manual and based on case by case basis
Scottish Environment Protection	Flood Warning Service	Live	To warn citizens at risk from flooding	Areas at risk from flooding in Scotland	Citizens, Professional Partners	River and sea levels

<sup>27</sup> <https://www.gov.uk/guidance/apha-alert-subscription-service>

Organisation	Service	Status	Why	Where	Who	When
Agency (SEPA)						
Natural Resources Wales (NRW)	Flood Warning Service	Live	To warn citizens at risk from flooding	Areas at risk from flooding in Wales	Citizens, Professional Partners	River and sea levels

The table below shows the channels and features currently used by each of the existing services, and what would be potentially used by proposed services. A ✓ symbol represents that it is already in use. And a ? symbol represents that it could potentially be used.

	Flood (EA)	Flood (NRW)	Flood (SEPA)	Animal Disease (APHA)	River Advice (EA)	Fisheries (EA)	Environment Management (EA)	Home Office
Telephone calls	✓	✓	✓		✓			
Texts	✓	✓	✓	✓	✓	?	✓	?
Email	✓	✓	✓	✓	✓	?	✓	?
Common Alerting Protocol	✓							
EDW	✓	✓	?					
Cell broadcasting	?	?	?	?				
IVR	✓	✓	✓	?	✓			
Online registration	✓	✓	✓	?	?	?	?	
Property registrations	✓	✓	✓	?	✓	?	?	
Geo registrations	✓	✓		✓	✓	?	?	?
Multiple languages		✓				?		

We have discovered that almost all these services fundamentally want to provide the same core experience – issuing a message to an audience in a location via user defined channels. This is the what, who, where. This is broadly similar to the flood warning service. In Alpha, we would recommend that any alerting platform is designed in a “hazard agnostic” manner – so that others could use the design for non-flood related messaging.

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*Hypothesis: Providing a “hazard agnostic” alerting platform would allow others to use the same design to issue alerts for other hazards*

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# Recommendations for Alpha phase

The Alpha stage is where we seek to test ‘how’ we might meet the user needs we have identified in Discovery. Conducting the Alpha stage will allow additional user testing to help to confirm user needs and shape any proposed design and development of a warning system.

## Understanding our users’ needs

Users, and their needs need to be at the heart of any service we design and deliver. A service designed around user needs is more likely to get used and more likely to help the user get the right outcome (and therefore achieve overall policy intent). Throughout Discovery, we have been focussed on understanding who our users are, what they need from a warning service, how the current service and systems meet (or don’t meet) their needs.

Although our services should be built digital by default, we are also aware that our user’s needs will stretch across multiple channels as their circumstances change, and should therefore be consistent and available to complete over the phone and online and indeed wherever they are needed. It goes without saying that our services should be equally accessible to all users regardless of their experience or circumstance - whether that’s an individual, businesses, expert or complete beginner.

The user needs we have found in Discovery are not definitive, nor are they carved in stone. Users’ needs will evolve and change, and we should both appreciate and accept this. Our services need to be nimble enough to evolve with our user needs. The findings here can therefore be considered a snapshot in time. A list of user needs we have discovered can be found in Appendix F.

## Key findings from Discovery

The below list shows the most impactful findings we discovered. These will need to be validated in the Alpha stage of the project.

- We need to simplify our registration processes to ensure more users complete the flood warning registration journey (only 52% of people who start, finish the journey). The user journey for maintaining existing accounts needs to be dramatically improved for our users
- We are not currently supporting our biggest registered user base - Extended Direct Warnings users (of which there are around 1.2 million). We need to develop a mechanism that allows those users to manage their flood warning service in order to provide them with a more coherent, discoverable service
- In previous flood warning related projects, the needs of internal users have largely been ignored. Their experience has an impact on external users. In particular, the message sending process for Duty Officers causes issues related to timeliness and message accuracy. We should investigate how any future warning system can integrate with new forecasting and telemetry systems to provide an automated way of issuing low severity, or rapid responding flood warnings
- Feedback from our users (public, partners etc.) is not being used as effectively as it could be to inform the assessment of warning quality. We believe that Duty Officers could have a better “line of sight” to the feedback the messages they send get from users
- There is a lack of clarity from our users on our existing flood warning codes and messaging. Users are often confused as to the related severity and impacts of our existing 3 tier warning service.
- The Targeted Flood Warning Service is a much underused service. We need to invest in ensuring that TFWS is promoted more to our users with complex needs and improvement on the system should be undertaken to make it more attractive to users currently serviced by

FWS. This would allow the public warning service to be made simpler and more efficient in the long term

- The inability to update our flood warning service in real time is a potential reputational risk for the business. Although some systems are able to process real time changes to the flood warning service, others are not and need to be updated on a regular “schedule” (currently quarterly). This has impacts on our users, internally and externally, and we aren't providing the best service we could
- We need to work better as an organisation to collectively build our flood warning service (and in fact any alerting service). Our services should be based on a deep understanding of our user needs, and be flexible to changes in those needs

## Areas of focus

We recommend breaking down an Alpha phase into three distinct parts, each focussing on an area of development highlighted as an issue in Discovery. Our proposed Alpha phase prototypes are (provisionally):

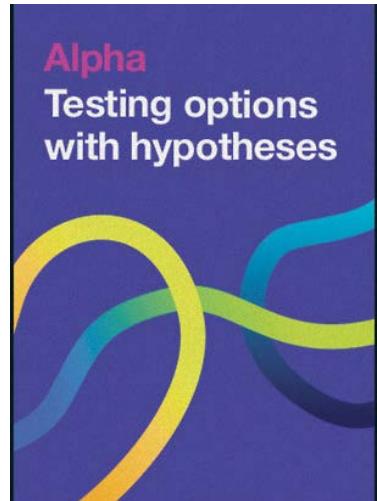
1. A redesigned message sending process for staff to simplify and speed up the sending process and improve message quality for users
2. Refining a new online registration mechanism and user data model to allow a simple, easy to manage process for registering to the service
3. Designs for the “core engine” at the heart of the warning system. This is where the relationship between the what, where and who is calculated

Also additionally if we have time:

4. Creating a link to the GOV.UK Notify platform so we can send end to end messages via text and email to users as part of our testing and development

By proceeding in a low risk step by step approach, we can test the various products and delivery permutations and carry out essential additional user testing throughout the Alpha phase. Testing our most challenging assumptions and approaches in Alpha will allow us to find and rectify bottlenecks with our services and systems before we commit to our final design. These prototypes will allow us to identify problems in the key parts of the system as early as possible so we have time to decide how we will solve them.

We expect some of the components to be designed and developed in-house, some elements we are likely to outsource as small packages of work to suppliers on the G-Cloud framework (or similar). In line with the GDS service standard, we would seek to own (and share) the code, designs and output of anything developed by a supplier. By the end of Alpha we will be in a position to decide which of the ideas we have tested are worth taking forward to Beta.



Following completion of the Alpha phases an “End of Alpha” report will encapsulate the findings of this phase, allowing decisions about whether the project proceeds to recommend development of a Beta (trial production service) capability.

## Challenges for Alpha

Throughout Discovery we have logged what we consider some of the key challenges for the Alpha phase. The table in Appendix G shows some of the key challenges, and we include them as a log to ensure that these challenges are addressed in the next phase.

## The team needed for Alpha

We anticipate the Alpha phase to take around 9 months – this is longer than a traditional Alpha phase. We feel there is so much to unpack based on our Discovery research that a longer Alpha

period will ultimately lead to an overall better product. The team size will increase during this period and we require the following roles.

Resource Type	Resource provider	Allocation
<b>Service Owner</b>	EA	0.5 FTE
<b>Product Owner</b>	EA	1.0 FTE
<b>Project Manager</b>	EA	1.0 FTE
<b>Delivery Manager</b>	DEFRA - DDTs	1.0 FTE
<b>Business Analyst</b>	DEFRA - DDTs	1.0 FTE
<b>User Researcher</b>	DEFRA - DDTs	1.0 FTE
<b>Content Designer</b>	TBC	0.2 FTE
<b>UX Designer</b>	DEFRA - DDTs	0.5 FTE
<b>Architect</b>	DEFRA - DDTs	0.2 FTE

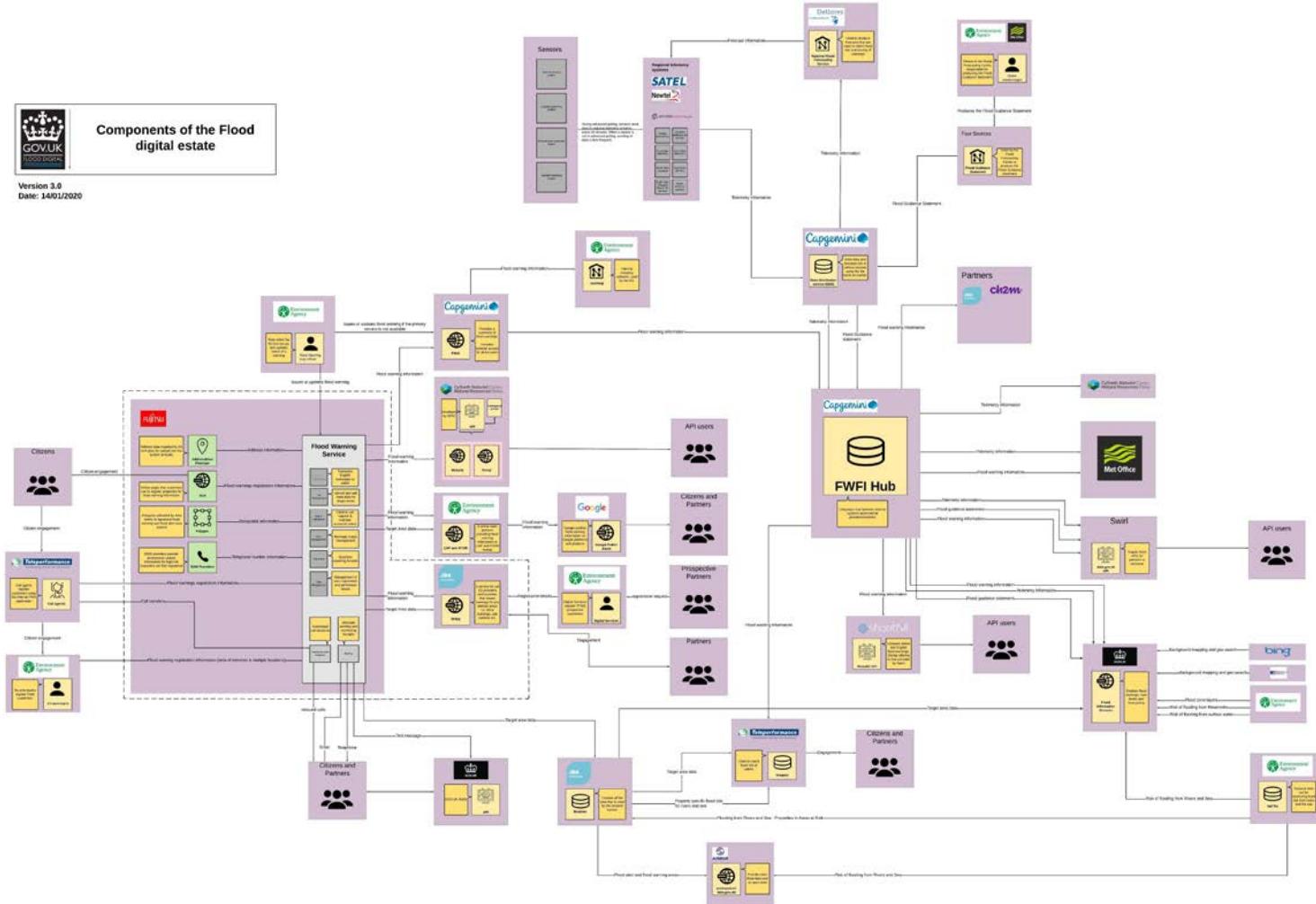
Resourcing Alpha is likely a combination of existing DDTs & IM&R staff, some recruitment (DDTs) and the use of external contractors for the development of prototypes. We expect additional support from Commercial as required depending on the level of outsourcing. The financial approvals will be pursued through the Business Case.

# List of abbreviations

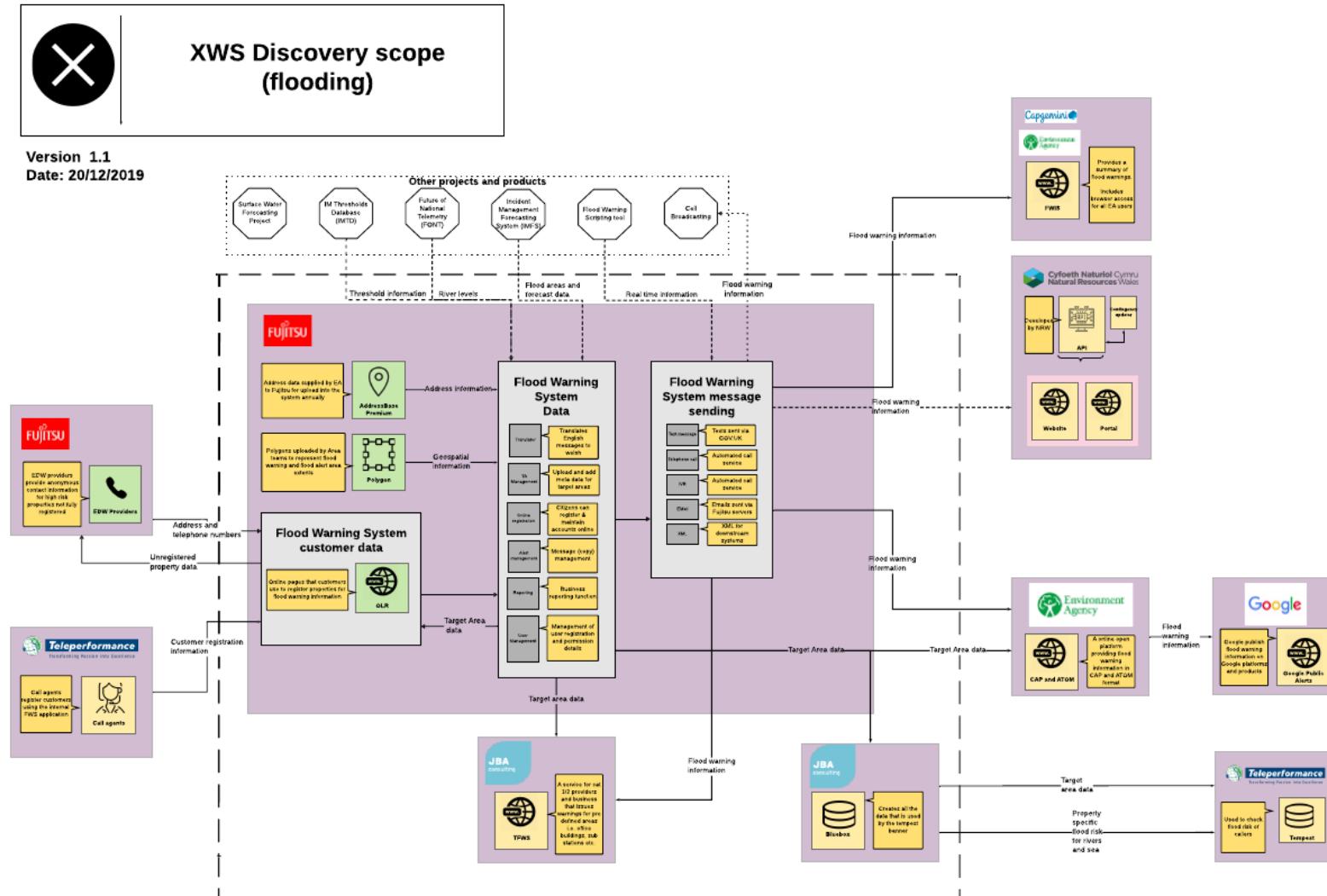
Abbreviation	Meaning
<b>AFWDO</b>	Assistant Flood Warning Duty Officer
<b>API</b>	Application Programming Interface
<b>CAP</b>	Common Alerting Protocol
<b>CLI</b>	Call Line Identifier
<b>CMP</b>	Central Modelling Platform
<b>EA</b>	Environment Agency
<b>EDW</b>	Extended Direct Warnings
<b>FCRM</b>	Flood and Coast Risk Management
<b>FFWS</b>	Future Flood Warning Service
<b>FIS</b>	Flood Information Service
<b>FWD</b>	Floodline Warnings Direct
<b>FWDO</b>	Flood Warning Duty Officer
<b>FWIS</b>	Flood Warning Information System
<b>FWS</b>	Flood Warning System
<b>GDS</b>	Government Digital Service
<b>IM&amp;R</b>	Incident Management and Resilience
<b>IMFS</b>	Incident Management Forecasting Service
<b>ISDN</b>	Integrated Services Digital Network
<b>IVR</b>	Interactive Voice Response
<b>LLFA</b>	Lead Local Flood Authority
<b>NHS</b>	National Health Service
<b>NRW</b>	Natural Resources Wales
<b>OLR</b>	Online registration
<b>SEPA</b>	Scottish Environmental Protection Agency
<b>STD</b>	Subscriber Trunk Dialling
<b>TA</b>	Target Area
<b>TFWS</b>	Targeted Flood Warning Service
<b>VOIP</b>	Voice Over Internet Protocol
<b>XML</b>	Extensible Mark-up Language
<b>XWS</b>	NeXt Warning System

# Appendices

## Appendix A - Flood estate diagram



## Appendix B - XWS system scope



## Appendix C - Common Alerting Protocol criteria

<b>Element</b>	<b>Values</b>	<b>Description</b>
<b>Urgency</b>	Immediate	Responsive action SHOULD be taken immediately
	Expected	Responsive action SHOULD be taken soon (within next hour)
	Future	Responsive action SHOULD be taken in the near future
	Past	Responsive action is no longer required
	Unknown	Urgency not known
<b>Severity</b>	Extreme	Extraordinary threat to life or property
	Severe	Significant threat to life or property
	Moderate	Possible threat to life or property
	Minor	Minimal to no known threat to life or property
	Unknown	Severity unknown
<b>Certainty</b>	Observed	Determined to have occurred or to be ongoing
	Likely	Likely ( $p > \sim 50\%$ )
	Possible	Possible but not likely ( $p \leq \sim 50\%$ )
	Unlikely	Not expected to occur ( $p \sim 0$ )
	Unknown	Certainty unknown

## Appendix D - Personas

### Sandra and Steve

#### Flood Warden Duty Officer (FWDO) and Assistant Duty Officer (AFWDO)

Sandra has been a FWDO at the EA for ten years. Steve is training as an Assistant FWDO in an incident role for the EA.

Sandra and Steve use the Flood Warning System to create and issue flood alert and warnings to end-users.

##### Goals

To be able to **craft and issue flood messages** as quickly and efficiently as possible.

To be able to **make an informed decision** on issuing alerts & warnings under high stress scenarios

To be able to **update and amend messages on FWS systematically**, and keeping track of them *"Sometimes it can take me up to 40 minutes to write up a script. The scripting tool is fiddly, and there is lots of proofreading to do"*

##### Barriers

Crafting messages through the **scripting tool can be time consuming and frustrating**

No clear **consistency of what risk values** equate to an alert or warning in current hard codes.

Keeping all messages updated in a pressurised environment in the incident rooms.

**Digital inclusion scale** – Fluent in FWS and AIR tools

'We need a better and faster way of issuing system updates'



### Dan

#### Flood Resilience Advisor

Andy's role is to make sure that all the Target Areas (TAs) on the system are updated, and provide local Area knowledge and expertise to the issuing of alerts and warnings

Andy helps maintain FWS functionality, and it a central port of call for assistance with the flood systems during incidents

##### Goals

To be able to **update and upload a new Target Area shapefile** easily and efficiently.

To ensure that the **local mapping is up-to-date** to issue alerts and warnings during incidents

To **incorporate Area-specific material** and options in FWS and supporting tools

##### Barriers

**Inflexibility in TA shapes** means that they are sometimes inadequate in emergency flood scenarios

Current **flood warning codes** do not afford the possibility of tailored alerting, resulting in over-alerting.

**Poor User Interface** of FWS causes delay and difficulty in system maintenance

**Digital inclusion scale** – Admin level. Fluent in FWS and AIR tools



*"The scripting tool is very unstable so we are always concerned about it... We always have back up copies in case something goes wrong. ...so it needs a lot of improvement on what's actually included."*

'I have had to create new TAs 'on the fly' during incidents to compensate for non-textbook flooding'

# Molly and Roger

## Vulnerable elderly citizens

Both Molly and Roger are **registered blind**. Molly is Roger's carer.

During the December 2013 floods they were evacuated from their Lincolnshire home and **feel let down** by the local authority as they received no assistance.

Roger and Molly are **active in the community**. Roger chairs the Boston Disability Forum.

Roger uses mobile phone software that reads messages aloud.

### Goals

To get timely warnings despite their disabilities, and be empowered to recover quickly.

### Barriers

Molly uses a screen magnifier package called "Zoomtext". Roger uses a screen reader (voice) package called JAWS. There's significant **financial cost** involved.

They have **concern for other elderly** and less able residents of their community.

Reading is OK for Molly if **large print** or magnified if online. Roger can read **Braille**.

### Digital inclusion scale

Task specific



*'We were badly let down during the floods'.*

**'We are aware of gov.uk but can't do anything with them as we can't complete the forms and tick boxes'**

# Alan

## Non-online and flood warden

Flood warden Alan has lived in the same village all his life. He retired from his warehouse job last year after 22 years' service. He and his wife Susan wanted to live close to the river and have spent 20 years in the same house. Alan uses the river for fishing or walking nearly every day.

Their home **was flooded twice in 2017**. They now have property level protection they fit when they think they might flood.

Susan uses the river level service to check levels ahead of Alan's fishing trips.

### Goals

To be kept informed of risk and river levels **without using a computer**.

To be **able to warn and inform neighbours** when flood alerts and warning are in force.

### Barriers

Alan has an old computer he uses to store his photos. He has **no interest in going online**. He relies on his wife using the internet (assisted digital). He has, however, a direct number for the incident room.

### Digital inclusion scale -Non-online



**'I've managed 62 years without needing a computer, so I think I'll manage another 62!'**

# Karl

## Community champion

Father of two, town councillor, and former town mayor, Karl is part of a flood group which supports the Environment Agency. He's also an area **flood warden**.

Visits neighbours to ask them to move any cars at risk and move property upstairs; helps evacuate local schools if necessary and will direct traffic to keep it out of flood water.

Karl, a property developer who also works part-time in a warehouse, had six of his seven properties badly damaged during the Boxing Day 2015 floods. Water reached 10ft in his home.

### **Goals**

To receive **timely updates** from duty officers and to relay this to the community via Facebook.

To review and **test evacuations plans** ahead of incidents.

To help **evacuate local schools** if necessary and **direct traffic away from floods**

### **Barriers**

Deal with different flood risk appetites in his community

### **Digital inclusion scale**

Confident



*"A lot of our work is based on effective communications: making sure people don't panic. We ask people to stay at home, turn their radios on and, if they have elderly neighbours, to check on them."*

The effects of floods are so devastating it's much better to be warned and be safe, than sorry."

# Francesca

## Busy parent

Francesca's home flooded in the Boxing Day floods of 2015, and is more flood-aware as a consequence. She worries she might flood again, but does not have a chance to mitigate or prepare for the eventuality.

### **Goals**

I need to ensure the **safety of my children**, home, and pets.

I need to know as early as possible my house might flood.

I use **social media** for everything, I expect warnings to show up on my feeds.

### **Barriers**

I **don't have much spare time** for browsing or looking for specific information on google.

I am often **holding my child**, and never sit down at a computer.

I **didn't know what to do** even if I were told I was going to flood when I did.

### **Digital inclusion scale**

Francesca is a part-time paralegal, and is confident with digital use for pleasure and business.



*'I don't have time to keep an eye on river levels, or to look for detailed information online.'*

*'I need immediate reassurance that my family and children are safe'*

**'When I see a map or graph, I just keep on scrolling. Maps is a man thing.'**

# Max

## Authority mistrust

Max lives in a high-risk for coastal flood area. He has flooded a number of times in the past, but does not take mitigations in preparations for flooding. He rents his accommodation, and has low concern about property damage.

He is mistrustful of central and local government, and will not positively receive flood warnings from the Environment Agency, as most warnings are perceived as otherwise false alarms.

### Goals

To recover quickly from flooding.

### Barriers

Max doesn't trust government to tell me him what to do

Perception that he cannot afford flood protection due to **low income**

He lives in **temporary accommodation**, and he would just 'move on' somewhere else

### Digital inclusion scale

Max uses a smartphone for daily use, but does not own a PC. He has access to an iPad from his local library, which he uses for browsing and occasional email.



*"If I'm going to flood, I'm going to flood.  
There's nothing I can do to stop it."*

'I don't use GOV.UK for anything'

# @Polly

## Tourist and climate change vlogger

Polly loves to travel, and to record her experiences in a popular video blog which she shares through her extensive social media network.

She is a passionate climate change activist. She also loves to kayak, and is seeking to revive it as a trend. Polly now checks the river levels on GOV.UK before her kayaking expeditions. She subscribes to weather channel push notifications as she is often on-the-go. She is also a subscriber to the 'River Advice for Boaters' service.

### Goals

To keep safe when visiting new places near water

To check river levels are safe before kayaking

To share her experiences and learning with her social network

### Barriers

Did not initially know of our river level service

She's often in **places without 4G network coverage**

Is not aware of the difference between fluvial flooding and **surface water flooding**

**Digital inclusion scale** - Polly mostly uses her smartphone for recording her video blogs and social media. She has a chromebook and a number of other devices she uses with confidence.



*"When you visit somewhere new, you never know what the dangers might be - especially something like flooding."*

'Thank goodness for river levels online.'

# Mark

## Business owner

Mark lives near a main river, but uphill. His property has never flooded before, but he owns several businesses around the area and the country, which are at risk of flooding. One of his factories is bordering a flood plain, and some of his storage facilities are also at high risk of surface water flooding.

When heavy rain hits, Mark needs to be able to monitor all his facilities. Some of his plants have flooded before, and it has substantially cost his business, as well as doubling his insurance costs. Mark subscribes to the Flood Warning Service for most of his business addresses.

### **Goals**

To **monitor the safety** of his employees, stock, machinery, storage plants, and equipment.

To have **enough warning** to move stock, if at all possible

To **minimise loss of business**

### **Barriers**

When the rain hits, it is difficult to make an informed decision on which site to manage first, as it has a **knock-on impact downstream**.

**Difficult to manage flood alerts** for all his site locations

Is concerned of the **impact climate change** might have on his **loss of business**

**Digital inclusion scale** – Highly proficient



*"Flooding can cost my businesses a lot of money. I try to minimise its impact as much as possible"*

**'It's difficult to keep track of the alerts for all my sites'**

# Bhagrat

## Professional Partner

Bhagrat works for Leeds City Council in the emergency planning department. He was in post during the 2015 floods and saw the impacts of city-wide flooding..

He wants to be able to provide up-to-date and accurate advice to residents and partners to help them prepare, respond, and recover from floods.

### **Goals**

To **provide accurate and timely advice** to his residents

To **know which areas** and infrastructure will be affected and when.

To know **who to contact** for definitive information

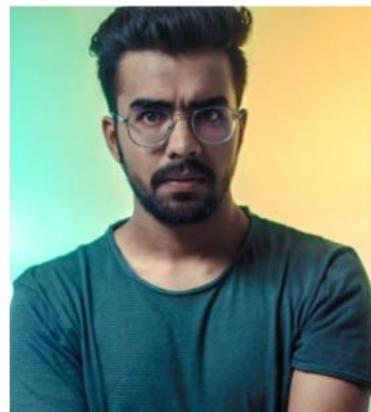
### **Barriers**

Difficult to pinpoint **which key infrastructure will be affected** in floods

Flooding **information** received during a bit event can be **overwhelming, confusing** and sometimes **contradictory**.

Challenging to know which **information is the most up-to-date**.

**Digital inclusion scale** Proficient



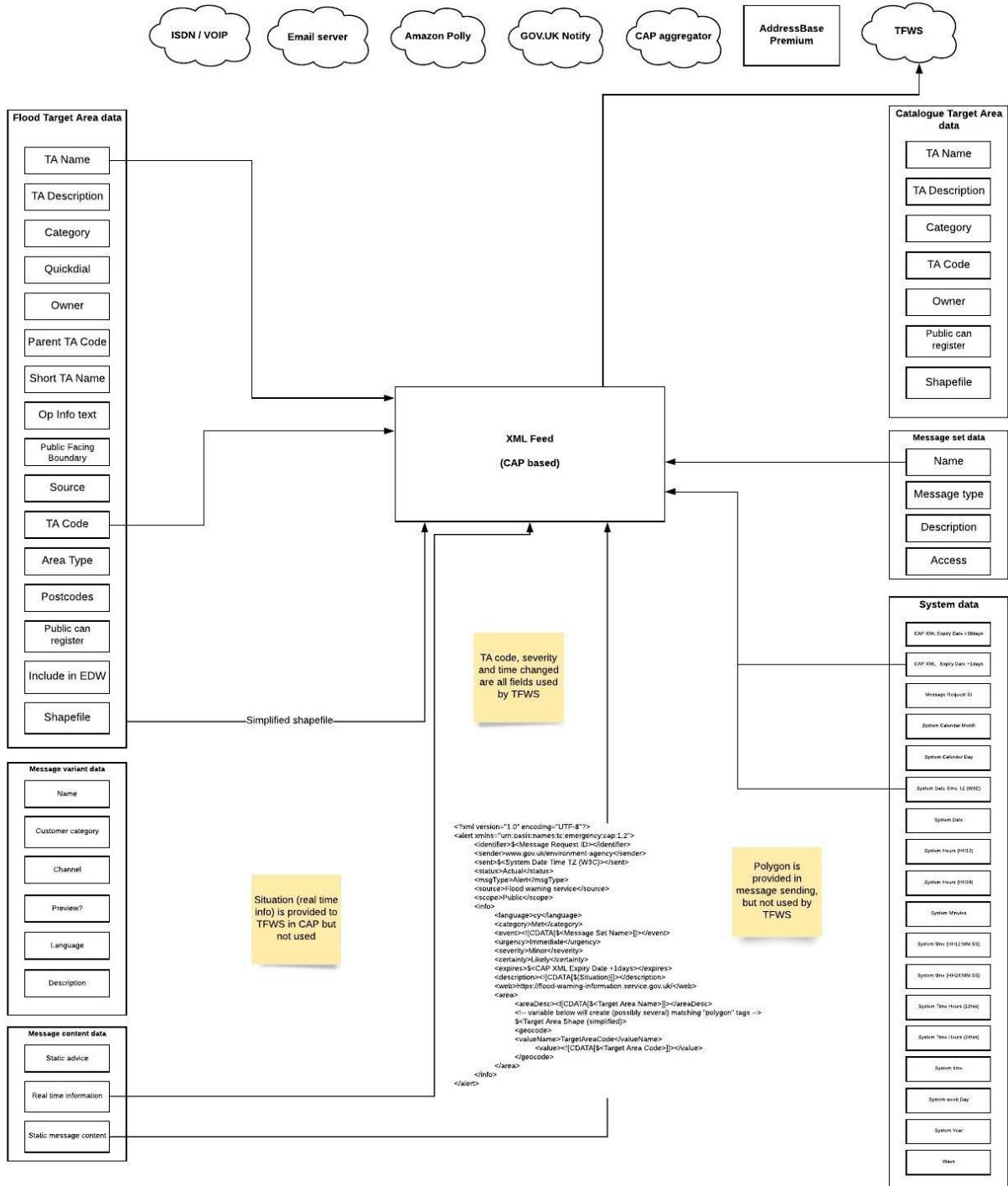
*"I worked during the Leeds flooding a few years ago - we took a long time to recover from it".*

**'During an incident, I need to know which information is the most accurate and updated'**

## Appendix E - Example data flow map

### FWS data flows: XML

Next Warning System



## Appendix F - List of Discovery phase user needs

Epic	User	Story	Dependency	Comments
<b>Publishing a warning</b>	MFDO	As an MFDO I need for the forecasts to be as accurate as possible So that I don't give bad forecasts to the Duty Officer which could prompt a false flood warning		Out of scope for XWS?
<b>Publishing a warning</b>	MFDO	As an MFDO I need a way of contacting the Duty Officer when the forecast indicates there may be a flood risk So that the Duty Officer has the forecast information to decide if a warning is needed		Out of scope for XWS?
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need to trigger advanced polling on stations, if not already So that citizens have the latest river levels data		Out of scope for XWS?
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need access to telemetry systems So that I can make an informed risk assessment of flooding		Out of scope for XWS? Duty Officer usually mobile and the app for telemetry isn't very user friendly
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need to select a geographical area where the warning is for So the warning goes to the right place	TA Areas	
<b>Severity</b>	Duty Officer	As a Duty Officer I need to select the severity of the warning So the warning reflects the severity of risk		The current 3 tier flood warning system is too broad to provide meaningful advice to citizens and partners during flood events. Adopting the CAP values would provide more flexibility to Duty Officers to provide more tailored, yet still structured, warning messages.
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need to select the message types to be sent So that the different types of registered users get tailored messages	Message sets	Are we doing this? We're all citizens
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need to create the flood warning message real time information So that citizens have guidance about flooding		Message length is currently too short  To standardise message creation and reduce variability the EA created the scripting tool which builds messages based on check box selection. This is not currently sitting well with users and DO's we've interviewed. Too robotic and sometimes not national standards not always relevant to local situation.

Epic	User	Story	Dependency	Comments
				The outputs of the scripting tool formatting that has to be stripped out before the message is added to XWS.
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need the warning message to be created and sent from the same place So that I don't have to use multiple systems to create and send a message		
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need to see previous messages that have ranked well with users So that I can improve the quality of my messages	Historical messages Smart Survey data	
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need to see feedback from citizens about my flood warnings, in the same place as the message is created So that I can use this to improve the quality of my messages	Smart Survey data	
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need to see the full message before its sent So that I can QA the message before its sent		Currently lots of points in the process where the message is QA'd. We should remove these!
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need to publish the message So that citizens get it	Messaging services - Phone (Polly) - SMS - email - Cell broadcast - CAP - XML	
<b>Publishing a warning</b>	Duty Officer	As a Duty Officer I need confirmation that the message has reached its end points So that I don't need to manually check the message has been sent.		
<b>Update message</b>	Duty Officer	As a Duty Officer I need to see the warnings I've issued So I know the warnings I'm currently responsible for updating		
<b>Update message</b>	Duty Officer	As a Duty Officer I need to see the last updated time So that I know which warnings to prioritise updating		
<b>Update message</b>	Duty Officer	As a Duty Officer I need to be notified when a warning update is due So that I don't miss an update window		

Epic	User	Story	Dependency	Comments
Update message	Duty Officer	As a Duty Officer I need to update the 'last updated' time but not the message if the situation has not changed So that I don't have to go through the full publication process and citizens know we've reviewed the situation		
Update message	Duty Officer	As a Duty Officer I need to update the severity if its changed So that citizens know about the change in risk		
Update message	Duty Officer	As Duty Officer I need to update the real-time message So that citizens know about the change in risk		
Update message	Duty Officer	As a Duty Officer I need to publish an update to a warning So that citizens and partners get the updated message		
Remove a message	Duty Officer	As a Duty Officer I need to remove a warning So that citizens know there is no further risk of flooding		
Consuming the message	Citizen	As a citizen at flood risk I need to be notified when flooding is likely So that I can take action		Push notifications, phone, sms, email, Public alerts, and partners.
Consuming the message	Citizen	As a citizen that has received a warning notification I need to see the full message So that I can manage my flood risk		Hook and broadcast
Consuming the message	Citizen	As a citizen at flood risk I need the message to contain information about road closures So I can assess the impact		
Consuming the message	Citizen	As a citizen at flood risk I need the message to contain information about peak levels So I can assess the impact		
Consuming the message	Citizen	As a citizen at flood risk I need the message to explain the risk in a language I understand So I can assess the impact		
Consuming the message	Citizen	As a citizen at flood risk I need the message to be specific to my location of interest So I can assess the impact		User research needed to understand what location of interest means. Is it property, infrastructure, both?
Consuming the message	Citizen	As a citizen at flood risk I need the message to be updated to be updated when the EA say they are going to update it So I can assess the impact		
Governance	XWS service owner	As an XWS service owner I need the message quality framework to take into account feedback from citizens So that Duty Officers take citizen feedback into account when they are creating flood warnings		EA board agreeing to change the assessment framework
Translation	Citizen	As a Welsh Speaking Citizen I need to receive the warning message in Welsh So that I can assess the impact	Translation service	

Epic	User	Story	Dependency	Comments
<b>Assisted digital</b>	Citizen	As a citizen that can't access the Internet I still need to be able to consume the flood warning message So that I can assess the impact and take action	IVR	
<b>Registering</b>	Citizen	As a citizen I need to register a location of interest So that I get warnings for my location of interest when they are issued by the Environment Agency	Address location search Background mapping TA's Historical flood information (this area had x number of warnings in past 12 months)	
<b>Registering</b>	Citizen	As a citizen I need to register multiple contacts to receive warnings So that friends and family know when I'm at risk and can help me take action		
<b>Registering</b>	Citizen	As a Citizen I need to specify what channels I want the EA to use So the Environment Agency knows how to contact me about flood risk		
<b>Registering</b>	Citizen	As a Citizen I need to specify when the Environment Agency can contact me So the Environment Agency know when I can be contacted about flood risk		
<b>Registering</b>	Citizen	As a Citizen I need to specify what warnings the Environment Agency can send me So the Environment Agency knows what warnings to send me		
<b>Registering</b>	Citizen	As a Citizen I need to test the warning service So that I know I'll receive a warning when there is flood risk.		
<b>Registering</b>	Citizen	As a Citizen I need to register to receive warnings for local impacts So that I can be warned when local areas of interest are at risk from flooding		
<b>Registering</b>	Organisation with multiple locations	As a an organisation with multiple locations of interest I need to register So that I get warnings when my locations of interest are at risk		
<b>Updating account</b>	Citizen	As a citizen registered to receive flood warnings I need to tell the environment Agency when my details change So that they have my latest preferences		
<b>Notified when removed</b>	Citizen	As a citizen I need to know if I'm no longer considered at risk So that I know not to expect a flood warning when I would usually get one	TA's	

Epic	User	Story	Dependency	Comments
<b>Cancel</b>	Citizen	As a citizen I need to cancel my flood warning account So the Environment Agency stop sending me warnings		
<b>Cancel</b>	Organisation with multiple locations	As an organisation I need to cancel my flood warning account So the Environment Agency stop sending me warnings		
<b>EDW</b>	Citizen	As a citizen I need to know why I've been signed up to EDW So that I can understand how the EA is using my information to warn me about flooding		
<b>EDW</b>	Environment Agency	As the EA responsible for warning citizens about flooding We need to tell mobile operators & BT property addresses we think are at risk from flooding So that they can send us citizen details which we will use to issue warnings	TA's Address details	
<b>EDW</b>	Environment Agency	As the EA responsible for warning citizens about flooding We need to import customer data from mobile phone operators & BT So that we have the details to warn citizens about flooding	External datasets from BT and Mobile phone operators	
<b>Target Areas</b>	Flood Resilience	As a flood resilience team member I need shape files to be provided by the consultant So that I can process these to create a new TA code in the warning service		Out of scope for XWS
<b>Target Areas</b>	Flood Resilience	As a flood resilience team member I need ability to edit the shape file So I can make necessary changes ahead of creating a new/updated TA		Out of scope for XWS
<b>Target Areas</b>	Flood Resilience	As a flood resilience team member I need to create a new target area So that a community can get warned when there is a flood risk		Lots of attributes associated with a TA (see journey map) Needs to be able to deal with large TA's (what's a large TA??)
<b>Target Areas</b>	Flood Resilience	As a flood resilience team member I need to update an existing target area So that the warning messages published accurately reflect that community at risk		Lots of attributes associated with a TA (see journey map)
<b>Target Areas</b>	Flood Resilience	As a flood resilience team member I need to see what TA's I've changed and when So that I when an update could be due		
<b>Target Areas</b>	Flood Resilience	As a flood resilience team member I need for TA's to be published So that warnings services using TA's have the latest information about where to send warnings	Integration with downstream services and their ability to update on demand	
<b>Target Areas</b>	Flood Resilience	As a resilience team member I need the warning area to be created on the fly based on the available forecast	Reliable forecasts	Lots of challenges with this i.e. accuracy of the forecast All services would have

Epic	User	Story	Dependency	Comments
		So that only those at risk from flooding are warned		to consume the on the fly TA at the same time
<b>Target Areas</b>	Flood Resilience	As a resilience team member I need to see citizen feedback about the accuracy of the TA's the team design So that we can take citizen feedback into consideration when we design TA's		
<b>Target Areas</b>	Flood Resilience	As a resilience team member I need to see the status of TA's in my patch So that I know which ones are due for publication next		
<b>Authentication</b>	Admin	As a user of XWS I need access to XWS when I've signed on to EA network So that I don't have to login to multiple services		
<b>Authorisation</b>	Admin	As an admin of EA systems I need to know what users have access to XWS So that I can grant access accordingly		
<b>Maintenance</b>	Admin	As an admin of EA systems I need to know what authorisation (what they can see/do) So that I can give the right permissions		
<b>Threshold crossed</b>	Duty Officer	As a Duty Officer I need to know when an operational threshold has been exceeded So that know about a potential flood risk		
<b>Threshold crossed</b>	Duty Officer	As a Duty Officer I need a warning to be issued automatically when a threshold is exceeded So that the lead time to warn a community is reduced		
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to report on the number of warnings in force, their severity and time issued So the EA can see the overall risk		
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to know where warnings are in force So that the EA know where the risk is		
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to see the total number of registered users in a Target area So I know how many citizens will receive warnings		
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to see how many citizens have been warned successfully So the EA know how many citizens have been warned	Notify Telephony	
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to see how many messages have been sent by channel So the Environment Agency can report to the national incident room		
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to see user satisfaction with the service So we can evaluate performance	Smart Survey	

Epic	User	Story	Dependency	Comments
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to see cost per transaction So we can evaluate performance	Financial Google Analytics	
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to report on the number of warnings in force, their severity and time issued So the EA can see the overall risk		
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to know where warnings are in force So that the EA know where the risk is		
<b>Reporting</b>	User of information in XWS	As a user of information in XWS I need to see the total number of registered users in a Target area So I know how many citizens will receive warnings		

## Appendix G - Challenges for Alpha phase

Business/system area	Challenge for building an Alpha/beta service	Ideas
Alert management	<p>Are we migrating all the existing message warning templates?</p> <p>How many variants do we have, are all these needed and if so what's the migration plan and data mapping to determine which are used and when?</p>	Remove need for Area specific messages, and instead include the Area specific requirements in another area of the system, for example an owner/organisation database
All	<p>If the current service components are to be split up, we need to know the data dependencies between these. System integration could be offered in the form of APIs, but is dependent on knowledge of the data and how this is used by downstream systems. Example OLR produces the following data during interaction with a user. This data is used to inform what, when and how messages get sent by FWS</p> <p>Location -- either TA code or UPRN --This is used to determine the location of interest in relation to active target areas. It's used to determine when a message is sent, but also the variant of message the user gets. Some TA's have bespoke messaging</p> <p>Customer type -- Either business or public -- Each customer type has different message sets</p> <p>Channel preferences -- SMS, tel, email - All used by FWS to inform message sending</p> <p>Alert/warning preferences -- Variants of message issued depending on the type i.e alert vs warning area -- All used by FWS to inform message sending</p>	For each component of FWS, a data flow/use case and data dictionary should be produced so it's known what is required for each component to operate and what other services require from each component to operate. Before Alpha is started the project should prioritise the components so the team building the service know what to focus on first. BA's can work ahead of the development team collecting logic, business rules and data ready for development.
All	Migration of data strategy into Alpha. How do we keep the live service and Alpha synced? How do we remove duplicates - are we cleaning the data before migration?	
All	Testing (end-to-end)	The development team will need access to fully integrated test environments to system test interconnected components of FWS. If the project is to outsource this to various suppliers then the need to run fully integrated end to end testing should be stipulated during procurement.
Culture	<p>The current service has evolved to meet the needs of a complicated business and much of the configuration is open for the EA to maintain. I.e. there is a customer type called 'staff' which I learned is used to contact EA staff when arranging meetings or when DO's are needed in the office to support an incident. He's also added that the system has been designed to be open i.e. meaning the EA can create its own configurations. Left unchecked this has its own challenges and very quickly the service can get very complicated without the right governance. We'll need to be mindful of this culture when designing the new service and strike the right balance between openness and governance.</p>	Create a core system that can be deployed independently multiple times for use for other services and alerting requirements. this could be used in isolation from the flood warning system, and allow for differing levels of SLA and management

Business/system area	Challenge for building an Alpha/beta service	Ideas
<b>Culture</b>	The new service is going to be designed to meet warning/incident management needs wider than flood. This could mean a greater level of standardisation, which is contrary to how the business currently consume/maintain the current FWS service.	
<b>Design</b>	Continuous deployment and delivery - we need to be able to deploy updates in real time with downtime necessary.	Move to micro service architecture may help here.
<b>Design</b>	Duel running, data sync with the current service i.e. if someone registers in both services.	Create a "live" customer data feed from FWS to XWS that syncs customer contacts and locations between the services in real time
<b>Design</b>	EDW management. The EDW element of FWS is tied directly to the core system - and applied by Fujitsu. We need to ensure that we "detach" EDW from XWS or we may risk further vendor lock in. Investment needs to be made to allow this to happen	Detach EDW as part of FWS CI to create an EDW API designed in coordination with the XWS design to ensure that we can transfer over "elegantly" in 2 years' time.
<b>Design</b>	How can we create a system that could be used for different hazard types? Does it make more sense to group by org or by hazard?	Initial view is it makes sense to group by Hazard – as this makes most sense for users. They would not want to sign up for multiple flood warning accounts for EA, NRW and SEPA for example. A single flood warning system therefore makes sense in this context.
<b>Message</b>	Getting Duty Officers to use feedback from users on the quality of messages	Embed Smart Survey feedback directly into XWS message update UI.
<b>Message</b>	How would the business respond to changing the SLA of message update to more than every 12 hours? Users seem to be demanding this.	
<b>Message</b>	If we automate or semi automate messages, how we do ensure a sensible message is created by the (upstream) system(s) for sending to users?	
<b>Message</b>	Removing potential duplicate messages at point of issue. Need a method to find and remove maybe via a location hierarchy. Need to link to smallest location associated with the contact	
<b>Registration</b>	Can we lose the licencing agreement for TFWS given the data shared is made available under the Government Licence.	Alternatively make it a tick box similar to FWS T&Cs.
<b>Registration</b>	How do we measure improvements to a new OLR?	Configuring feedback loops to measure the improvement on baseline i.e. 45% conversion rate and 67% overall satisfaction rating
<b>Registration</b>	If we extend registration module to other departments, what does the data model look like and does this need to be tailored to meet the needs of individual stakeholders.	
<b>Registration</b>	Need to test the flexibility in the civil contingencies act to accommodate citizens being able to remove 24/7 messaging by telephone	
<b>Registration</b>	OLR and other FWS services currently uses OS for background mapping and address lookup. FIS uses Bing. There are differences in how the two services operate which impact the user experience. Are we sticking with what we have, or taking this opportunity to consolidate?	

Business/system area	Challenge for building an Alpha/beta service	Ideas
Registration	What is the unique identifier for a user? How do we stop multiple/duplicate accounts? What are the rules for cleaning the data before we migrate?	
Security - business	<p>Data segregation - are we copying the current data segregation rules?</p> <p>Roles are split into</p> <ol style="list-style-type: none"> <li>1) owner groups: which dictate the access to data based on location</li> <li>2) Functionality groups: which dictate access to functionality</li> </ol> <p>NRW: Have their own view of the data (limited to customers with a registered property in Wales and TA's in wales) They can only issue warnings for TA's in wales</p> <p>EA: Have their own view on the data (limited to customers with a registered property in England and TA's in England). They can only issue warnings for TA's in England</p> <p>EA region: EA data segregation is further split by region so functionality and access to data is limited depending on where the DO is located. There is a facility to override this (need to get name of function)</p> <p>Also super user that can do/see everything (with exception to EDW data which is redacted)</p>	<p>We'll need a permissions library. Mapped from the current service and then updated to meet any new requirements.</p> <p>Careful consideration required if NRW and or SEPA want to use the same flood warning system. How do we partition user and TA data without compromising system and data integrity.</p>
Security - business	We know the data captured/generated during registration. What controls need to be in place to store and process this?	CIA assessment
Security - technology	Currently FWS only permits access to the service from the EA network, TPUK network, and NRW network. We'll need to be mindful of this when setting up the architecture as it uses fixed I.P addresses to authenticate the client at the firewall.	Host on "open internet" with appropriate log-in security and strong penetration tests
Security - technology	In the event that a connection drops between third party and FWS then there are contingency iPads that EA, NRW and TPUK have access to.	There are security certificates on these that would need review if the environments/network changes in Alpha/beta
Security - technology	<p>User authentication varies for DO's in NRW and EA.</p> <p>NRW use single sign on</p> <p>EA don't use single sign on because there are shared machines in incident rooms</p> <p>Is the NRW sign on provided by Defra or their own. If their own how would we integrate with this?</p> <p>How happy are we have shared machines in incident rooms - there is no accountability/traceability for publication of messages.</p>	Suggest a review of the policy around shared PC's.
Spatial	What are the needs of area teams uploading spatial data? Do we replicate this and what's the migration plan from the current service to Alpha? What are the various states of spatial data i.e. draft, active, inactive	
Target Area	If we automate or semi automate new Target Areas, how do we ensure the required attributes are created?	XWS would ingest the TA extent (as a shape of geojson file) and auto create required TA attributes using underlying data sets

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