Creating a digital smart flood warning system for surface water flooding in West Yorkshire

Review of 'good practice' examples

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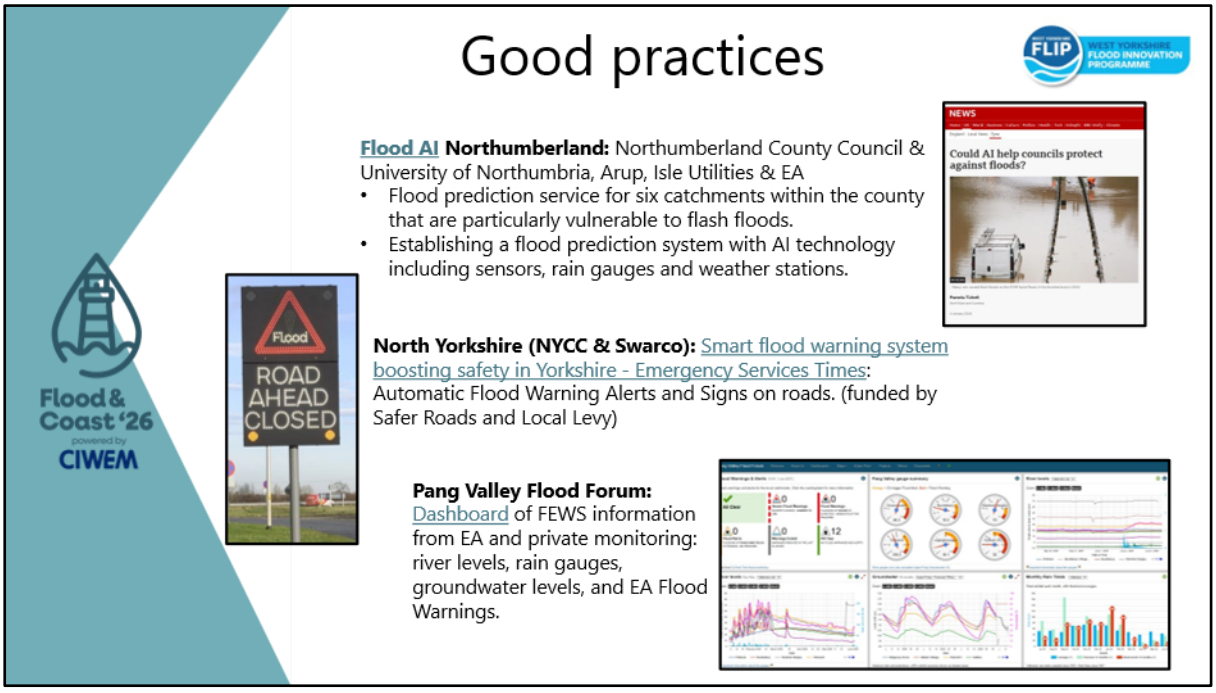
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Project Summary

As part of the West Yorkshire Flood Innovation Programme's (WYFLIP) Digital Smart Flood Warning Systems project, we reviewed examples of relevant good practice across the UK through site visits, interviews with project leads and internet searches/media reports. We have also sense checked our findings with the project working group – a group made up of regional risk management authority representatives - and through a presentation at Flood & Coast conference in June 2026.

Our review includes projects focusing on: 1) Integrating forecasts, sensors, and warning systems; 2) Flood Road Warning Signs, 3) Gully Monitoring and 4) Dashboards. This includes projects developed by the Flood and Coastal Resilience Innovation Programme (FCRIP) projects; by lead local flood authorities (LLFAs) working with the private sector; and projects developed by communities/ flood groups.



Key findings

1. WYFLIP project partners are particularly interested in practical solutions around Flood Road Warning Signs activated automatically through water-level sensors, and Gully Monitoring

2. Although the project was focused on surface water flooding, this document also features projects which monitor water levels on small rivers/ becks/ streams/ becks/ brooks not covered by EA flood warnings (e.g. in FCRIP projects and projects being developed by Flood Groups). This is an area of interest for the project working group in terms of identifying potential flooding and baselining/ monitoring the impacts of flood interventions upstream.

3. Dashboard development did not emerge as a significant immediate priority. Instead, LLFAs are focusing on improving data as first priority, and open to working with private sector providers and use their dashboards. However, we investigated dashboard options

in case this becomes a priority as projects develop and feature the Pang Valley Flood Forum Dashboard below.

4. Common challenges across all projects investigated include defining reliable trigger thresholds, development of user-friendly dashboards, and sustainability and maintenance of systems long-term.
5. For example in terms of sustainability, the FCRIP projects focus on integrating flood forecasting, sensors and warning systems but face significant sustainability issues when there funding is due to finish in 2027. In contrast, Leeds City Council has developed a more sustainable system that could be expanded across West Yorkshire (please see section 2.3).
6. Some systems piloted across the UK have not yet been subject to flood conditions, with some projects ending before any significant rainfall events. There is a need to monitor how well different systems respond during real flood conditions.
7. Different mechanisms for data communication – including Long Range Wide Area Network (LoRaWAN), Long Range Local Area Network (LoRaLAN) and Cell-based networks – operate best based on geographical requirements. For example there can be challenges with the use of LoRaWAN in locations such as steep sided valleys impacting on intervisibility between sensors and receivers (gateways).
8. Although not featured in the good practice examples, WYFLIP is investigating a future partnership with Netmore which could provide access to an extensive LoRaWAN network which could help WYFLIP partners.
9. Successful examples show that real value comes when monitoring is directly linked to decision-making; when projects are sustainable in the long-term; and where there is a partnership between RMAs, the private sector and ideally academia (depending on funding).
10. During the Flood & Coast conference there was significant interest in the use of AI, although this has not been a key feature in the good practice examples (with the exception of the Flood AI FCRIP project highlighted below).

Using the findings from this good practice review, this document recommends next steps for continuous development of Digital Smart Flood Warning Systems in West Yorkshire, including in three key areas of particular interest to WYFLIP: Flood Road Warning Signs, Gully Monitoring, and Integrating Flood Forecasting with sensors and warning systems.

Review of good practice examples

1) FCRIP projects (integrating flood forecasting, sensors and warning systems)

Blue Heart Project (East Sussex/ Eastbourne) blueheart.org.uk *(involving Environment Agency, East Sussex Council, JBA and the University of Exeter).* This project uses a cellular network and has set-up nearly 500 sensors to monitor the catchment for surface water flooding including 25 in situ sensors covering 25 hotspots, 7 boreholes, 25 SuDS planter devices, 16 rain

gauges, 15 gully sensors, and work with water companies on sewers (anecdotally the most monitored catchment in Europe).

- The project has developed a new platform BeFloodWarned for alerts from the project and existing EA/MetOffice warnings.
- At the time of the meeting in winter 2025, the project has not been able to move onto establishing trigger points & flood warnings yet but is working with JBA on this. A significant issue is that it has not flooded since 2014 and there is not a lot of historical data to help build models.
- In addition, it has developed a hydrological catchment model to predict flood impacts but this model requires 72 hours to turn round information at the moment.
- A further issue is that funding finishes at end of March 2027 there are significant concerns about sustainability (with local authority reorganisation also a factor).
- There is limited community involvement.

Flood AI Northumberland *(Involving Northumberland County Council, the Environment Agency and Northumberland University).* The research project aims to trial a flood prediction service for six catchments within the county that are particularly vulnerable to flash floods. There is a focus on flash flooding and Surface Water flooding – working in flashy catchments with small communities and existing flood groups/ wardens (good community engagement). The project has established a flood prediction system with AI technology including sensors, rain gauges and weather stations (said very hard to get the sensor part off the ground). The system uses LoRaLAN which has provided good results from tests during 2024. Now developing a dashboard. As with Blue Heart, funding due to finish March 2027, so sustainability is an issue.

Fair Project (Staffordshire) is developing a forecasting & warning system, which issues automated notifications based on forecast data for rainfall and expected impacts. However, it is also utilising sensors and weather stations with thresholds to give warnings – currently just to officers rather than members of the public.

2) Local authority projects with the private sector

2.1) Flood - Road Warning Signs

North Yorkshire (North Yorkshire County Council & SWARCO, funded by the Regional Flood & Coastal Committee - local levy): Smart flood warning system boosting safety in Yorkshire - Emergency Services Times: Automatic Flood Warning alerts on roads. We visited the SWARCO North Yorkshire Office in April 2026 and were given a guided tour and demonstration of the flood warning signs, and a tour of the factory. Currently the system operates through sensors and through a Cellular Network, but SWARCO was confident it could be adapted to LoRaWAN

- ***Next steps:*** WYFLIP to organise a site visit from SWARCO to West Yorkshire to provide quotes (first stage is to develop specification)

SWARCO has also developed a similar system in Warrington: SWARCO UK & Ireland installs intelligent flood warning systems for Warrington Borough Council | SWARCO

Welney Flood System, Norfolk County Council & Westcotec.
https://www.westcotec.co.uk/flood-system/

- The Signs are fully customisable in terms of the image they display. Water depth displayed can be either real-time and changeable, or a fixed value which lights up when water depth exceeds that. It is possible to add diversion route information to these signs
- The signs can be fitted with LoRaWAN to show depth at a chosen location nearby (e.g., for surface water), or be configured to read real-time information from EA river gauges.
- There are currently two working examples, one in Welney, Norfolk and in Leicestershire. The Leicestershire example shows set level height (depth) only, whereas the Welney sign shows variable water depth.
- The estimate for a 'complete scheme' is £15-20k. This includes access to their data viewing and analysis platform Westconnect – they store historical data on this site too. Norfolk County Council have invested in the Welney sign without subscription to the data management service which is less expensive (no cost yet provided).
- Westcotec provide free site surveys and would be willing to visit West Yorkshire (Leeds City Council are already in contact with Westcotec)

2.2) Gully Monitoring

Installing Gully Monitoring is a key focus of the WYFLIP partners and a number of private providers are developing products which could be suitable including Aquasition, Andel, Karbon-tech, Detectronic. For example, Aquasition are supporting the South London Innovate Project including Kingston, Richmond and Sutton, this includes Aquasition's first gully monitoring project installed as part of an Innovation Project in 2021.

Information from the Aquasition project lead on their approach: *'We have since added to the system with 16 low cost, low data, still image cameras and expanded into other London boroughs. In our experience where warnings of road flood is required the best solution is to not have the device in the gully pot or at least have the antenna as higher than any potential flood levels as radio frequencies don't propagate through water, so at the critical time you need communications you won't have any. Also, devices installed within the gully risk water ingress unless they are very well sealed, (harder to achieve than most devices manufactures believe) and gully installations also risk instrumentation damage from cleaning activities'.*

- ***Next steps:*** Potential to invite private providers to display latest products (including Aquasition, Andel, Karbon-tech, Detectronic), test in locations, or conduct site visits.

2.3) Integrating Flood Forecasting, Flood Sensors and Flood Warnings.

Integrating Forecasting, Sensors & GIS Mapping. Leeds City Council & Maprain (by Metasphere). This work does not have an official project name, but LCC is continuously developing a system to provide advance warning of flash floods/ surface water flooding using a combination of MapRain (Forecasting), GIS mapping, telemetry/ sensors, and extensive local flood knowledge for hotspot locations (e.g. Garforth, Thorner and Meanwood).

Maprain by Metasphere: Provides the following information/ services.

- Rainfall analytics
- Uses FEH data & 10 years historic radar data
- Currently adding in an NbS layer to calculate flood risk change

- Can host data from sensors, include real time data, rainfall depth and intensity
- Anglian Water partnership paid Metasphere to provide an Anglian Region solution.
- Working with Yorkshire Water to predict CSO spills using map rain – monitoring ~50,000 sewer level sensors

Leeds City Council is also working with **Andel Ltd** to integrate information from sensors into the information. This includes the development of a water-level sensor in a Bollard in a carpark which is vulnerable to flooding. Andel is also developing a wide range of other sensors and flood resilience products including: Flood Barriers, Flood Doors, Flood Walls and is working on a gully monitor. Andel is also supporting Aston Ingham flood group featured in Section 3 below,

Due to significant sustainability issues with FCRIP projects which have similar aims, we recommend reviewing the potential for this project to be expanded across West Yorkshire.

- ***Next steps:*** WYFLIP to organise information sharing session between LCC and other West Yorkshire Flood Risk Teams and then assess potential to expand scheme across West Yorkshire.

The following two projects focusing on flood sensors were also identified in our search but have not been investigated further:

(a) **Flood Sensor Pilot Project - Connecting Cambridgeshire** – pilot project using LoRaWAN.
(b) **Project Groundwater:** Lincolnshire County Council: Pioneering flood alarm offers hope for Lincolnshire residents - BBC News

3) Flood groups and communities

3.1) **Pang Valley Flood Forum:** Dashboard of FEWS information from EA and private monitoring: river levels, rain gauges, groundwater levels, and EA Flood Warnings & Flood Guidance Statements (FGS). This is the best example of an accessible Dashboard identified during the project.

3.2) **Whalley & Billington:** working with Previsico and Lancashire County Council, have installed monitoring equipment to view the water levels next to a trash screen. Alerts inform them when debris needs to be cleared, and this has helped prevent flooding a number of times.

3.3) **Aston Ingham**: Formed in 2023, but have worked with Andel Ltd to install three monitors on local rivers/ streams/ tributaries. The group meets regularly to review data and establish trigger points for warnings. This group was supported with a funding and research support from the University of Chester

3.4) South Oxford Flood Action Group received grant from Project Groundwater to develop a local flood monitoring and early warning system.

Next Steps

As a result of the good practice review, we recommend further investigations to further develop a digital smart flood warning system for surface water flooding in West Yorkshire:

1. **Flood Road Warning Signs:** Develop a specification for SWARCO visit to West Yorkshire and compare to quotes from Westcotec and Andel.

2. **Gully Monitoring:** Potential to invite private providers to display latest products (e.g. at WYFLIP Annual Conference) and/ or test products at different locations in West Yorkshire.
3. **Integrated Flood Forecasting, Sensors and Warning Systems:** Leeds City Council to deliver information session on how they use Maprain, GIS Mapping & sensors for West Yorkshire LLFAs - as a potential way forward to develop integrated forecasting and warning systems.
4. **Extending the LoRaWAN network:** In addition, a potential partnership with Netmore should be explored to increase LoRaWAN use.
5. **Development of Dashboards:** Although **Dashboard** development was not identified as an immediate priority at this stage, we recommend review of the Pang Valley Flood Forum Dashboard as an example of user-friendly, good practice.

Please contact Sam Ramsden by email to s.w.ramsden@leeds.ac.uk if you need further information on any aspects of this report.