Flooding and GIS: opportunities for public health
Workshop report

PHE Victoria, Thursday 30th January 2014
About Public Health England

Public Health England's mission is to protect and improve the nation’s health and to address inequalities through working with national and local government, the NHS, industry and the voluntary and community sector. PHE is an operationally autonomous executive agency of the Department of Health.
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Executive summary

PHE and the Steering Group members greatly appreciate the high level of interest in this workshop and the engagement by the presenters and delegates within the discussion on the day. The workshop aimed to develop cross-government relationships and collaborative opportunities to reduce the health effects of flooding. There was a clear message that delegates want to see progress on this issue within the near future and that the momentum gained on the day should be maintained.

Despite the clear support from delegates, challenges exist for greater coordination of effort across the organisational boundaries within the Natural Hazards Partnership (NHP). Delegates agreed that a lot of activity is going on in the field, but were not aware how coordinated this might be. It was also clear that the different NHP partners who attended the workshop are at different stages in the development of spatial data for flood management. The workshop aided the development of the cross-government relationships and the collaboration needed for action to be taken on the health impact of flooding. Furthermore, the existing knowledge gaps and research needs identified during the workshop are the basis for the next stage of the process.

The event highlighted that all partners experience similar issues and obstacles and this demonstrates the opportunity for working together to form a solution. We also heard about the barriers to greater interoperability and data sharing including licensing conditions and lack of standardisation in data format.

The delegates agreed that future developments must be user led and there is a significant need for stakeholder mapping to ascertain user needs and enable better decision making. Furthermore, the delegates agreed to consider the creation of a joint developers working group to identify the opportunities for collaboration and greater interoperability.

The creation of this working group, and the continued dialogue between interested parties, may improve multi-agency working. Perhaps the greatest challenge is for partners to collaborate at the commissioning phase so shared areas of research can be identified from the outset.

The steering group wish to acknowledge and thank the Water Security Knowledge Exchange Programme who sponsored the event.
Background

The effects of flooding on health are often extensive and significant\(^1\).

Public Health England (PHE) is committed to reducing the health impacts from flooding. To achieve this, it is essential to identify vulnerable or high-risk populations before floods occur and to determine how to learn from flood events which affect the health of populations.

The Extreme Events and Health Protection section of PHE has reviewed the literature to determine the health impacts of flooding and identify good practice for health protection in relation to flooding. This evidence-based guidance supports public health preparedness and response to better protect human health before, during and after flooding events.

PHE is a member of the NHP which provides information, research and analysis on natural hazards for the development of more effective policies, communications and services for civil contingencies, governments and the responder community across the United Kingdom.

The NHP aims to:

- Establish a forum for the exchange of knowledge, ideas, expertise, intelligence and best practice in relation to natural hazards
- Provide a timely, common and consistent source of advice to government and emergency responders for civil contingencies and disaster response
- Create an environment for the development of new services to assist in disaster response

The NHP’s areas of work include development of a Hazard Impacts Model to quantify the risks and impacts of natural hazards, allowing a better understanding of the impacts of single and coincident events.

Aim of the workshop

The aim of the workshop was to establish cross-government relationships and collaborative opportunities to reduce the health effects of flooding, identify existing knowledge gaps, and establish future research strategies.

The workshop brought together the developers and users of existing flood risk management tools including the Hazard Impact Model (HIM), and Strategic Health Asset Planning and Evaluation (SHAPE) tools, to enable future development needs to be identified.

The workshop was sponsored by the Natural Environmental Research Council (NERC) via the Water Security Knowledge Exchange Programme (WSKEP).

Steering group

The following members of the Steering Group oversaw this project and assisted in the production and delivery of the workshop and workshop report.

- Kevyn Austyn, Public Health England
- Barbara Coyle, Public Health England
- Dr Rutger Dankers, Met Office
- Dr Owen Landeg, Public Health England
- Kate Marks, Environment Agency
- Dr Crystal Moore, Flood Forecasting Centre
- Prof Virginia Murray, Public Health England (chair)
- Neil Runnalls, Centre for Ecology and Hydrology
- Russell Turner, Flood Forecasting Centre

Caveat

The comments, discussions and recommendations contained in this report have been summarised from the direct delegate feedback. They do not necessarily reflect the views and opinions of the steering group members, Public Health England, or the affiliated organisations.
Programme

09.00 – 09.30  Registration and coffee

09.30 – 09.40  Welcome and introduction
Professor Virginia Murray, Head of Extreme Events and Health Protection, Public Health England
Neil Runnalls, Business Development Manager, Centre for Ecology and Hydrology

09.40 – 10.20  Morning presentations:

Flood guidance services
Dr Crystal Moore, Head, Flood Forecasting Centre, Environment Agency

New flood risk maps: Improving the way we communicate flood risk
Mark Todd, Senior Advisor, Flood and Coastal Risk Management, Environment Agency

Hazard Impact Model (HIM)
Dr Helen Balmforth, Head of Spatial Intelligence and Knowledge Analysis team, Health & Safety Laboratory
Hazel Napier, Skills leader, Spatial Information and Technologies, British Geological Survey

Strategic Health Asset Planning and Evaluation (SHAPE) tool
Barbara Coyle, Programme Manager, Strategic Health Asset Planning and Evaluation team

10.20 – 11.20  Topic carousel
Group A  – Hazard Impact Model
Group B  – Strategic Health Asset Planning and Evaluation

11.20 – 11.40  Coffee break

11.40 – 12.30  Breakout groups
Breakout Group A
Breakout Group B
Breakout Group C

12.30 – 13.00  Feedback from discussion groups

13.00 – 14.00  Lunch
14.00 – 14.10  **Introduction to afternoon session**  
*Dr Crystal Moore, Head, Flood Forecasting Centre, Environment Agency*

14.10 – 14.30  **Afternoon presentations:**

**The Filton flood and lessons learnt**  
*John Lawson, Head of Business Continuity, NHS Blood and Transplant*

**Benefits and uses of integrating GIS into community led flood risk management**  
*Ruth Webb, Community Resilience Officer, National Flood Forum*

14.30 – 15.15  **Breakout groups**

Breakout Group A  
Breakout Group B  
Breakout Group C

15.15 – 15.45  **Feedback from discussion groups**

15.45 – 16.15  **Panel discussion: Actions and strategies for future work**

*Neil Runnalls, Business Development Manager, Centre for Ecology and Hydrology,*  
*Barbara Coyle, Programme Manager, Strategic Health Asset Planning and Evaluation team, Public Health England*  
*Dr Crystal Moore, Head of the Flood Forecasting Centre, Environment Agency*  
*Dr Helen Balmforth, Head of Spatial Intelligence and Knowledge Analysis team, Health and Safety Laboratory*  
*Mark Todd, Senior Advisor, Flood and Coastal Risk Management, Environment Agency*

16.15 – 16.30  **Summary and closing remarks**  
*Professor Virginia Murray, Head of Extreme Events and Health Protection, Public Health England*

Presentations are available upon request from extreme.events@phe.gov.uk
Flood management tools

Flood Guidance Services: Flood Forecasting Centre
The Flood Forecasting Centre offers flood guidance services to a wide range of emergency responder customers. These services include:

- Flood Guidance Statement: a daily assessment of flood risk for England and Wales over five days
- Flood Advisory Service: telephone conference system of support and information to government and partner contacts
- Specially tailored forecasts, alerts, consultancy and support for the Environment Agency
- Coastal flood forecast outlook and alerts for the UK including Scotland and Northern Ireland
- 3 day flood risk forecast for the public available on the Environment Agency website

To find out more call 0300 1234501 or email ffcenquiries@environment-agency.gov.uk

Environment Agency: New Flood Risk Maps
The Environment Agency has reviewed their maps showing national flood risk. They are available from Environment Agency’s website (http://www.environment-agency.gov.uk).

The purpose of publishing this information is to inform people about flood risk and help householders, businesses, local authorities and others to be prepared for flooding. The new maps encompass the following flood risk scenarios:

- Risk of flooding from rivers and sea
- Risk of flooding from surface water
- Risk of flooding from reservoirs

The risk of flooding from rivers and sea map now takes flood defences into account and continues to be updated. For the first time the risk of flooding from surface water is also being published. The Environment Agency continues to provide flood risk information for reservoirs on their website.
Strategic Health Asset Planning and Evaluation (SHAPE)
SHAPE is a web enabled, evidence based application which informs and supports the strategic planning of services and assets across a whole health economy. Its scenario planning features help determine the service configuration that provides the best affordable access to care.

SHAPE links clinical analyses, public health, primary care and demographic data with healthcare estates performance and facilities location. The application includes GIS mapping and supports travel time analysis. Current developments include mapping flood risk zone areas and the identification of vulnerable populations and key assets.

Hazard Impact Model (HIM)
HIM is a hazard impact forecasting service, which will combine data and expertise from NHP partners to identify areas and assets which are most vulnerable to a particular hazard. The model aims to quantify the impacts from a range of hazards, through a series of work packages focused initially on hazards such as surface water flooding, wind and landslides, against information on population and other receptors held by the Health and Safety Laboratory (HSL).

The model requires cross agency, time dependant hazard, vulnerability and exposure datasets for a range of infrastructure types such as road and rail networks, as well as information on population distribution and building type. The HIM will ultimately allow the following objectives to be met:

- Enable the NHP partners to better quantify the impacts of multiple natural hazards on society and the environment
- To strategically position the NHP at the heart of the government
- To develop and build strong scientific and technical collaboration with NHP partners
Topic carousel

To ensure delegates were familiar with the flood management tools, the following 30 minute demonstrations were held in two breakout rooms:

- The HIM was presented in the Blackfriars room by Tim Aldridge, GIS Scientist, Health and Safety Laboratory and Dr Rutger Dankers, Manager, Weather Impacts Science, Met Office
- The SHAPE model was presented in the Jubilee room by Barbara Coyle, Senior Programme Manager, SHAPE and Ashley Clough, Web developer, Parallel

Breakout groups

Morning session
Aim: To explore the potential role that HIM and SHAPE may have in promoting health resilience and preparedness, understanding and/or minimising the impact of flooding upon health (including infrastructure), and improving recovery after a flood event.

Delegates were asked to identify three strengths of the flood management tools and three user-specific needs.

Afternoon session
Aim: To identify research gaps on the health impacts of flooding, consider how GIS tools might address these gaps and identify opportunities for future collaboration.
Strengths of the flood management tools

Key points:
- Each tool potentially complements the other in emergency management
- The joint working of the models could present a common operational picture
- Future networking event is required to share ideas and case studies

Other points:
- The joint working of the models could present a common operational picture which could aid communication, response and coordination
- Ease of use and accessibility – having these data online means they could be accessed from anywhere
- Both tools could potentially reduce the lag time for taking effective action and reduce the recovery gap. Whilst each tool contains the same types of data, the models vary significantly in resolution and level of detail
- HIM and SHAPE are distinct tools that have a complementary role in managing assets and communities during a flood. Datasets currently exist across different organisations but not widely known or disseminated
- Tools come from different perspectives and the potential for strategic versus operational tension may exist. HIM is operational, whereas SHAPE is a more strategic tool; joint working particularly in recovery and evaluation could prove very beneficial
- Each flood risk management model is strong in specific areas and demonstrates the range and strength of information available. Potential exists to incorporate health impacts into HIM
- The population and infrastructure data within HIM are from the Health and Safety Laboratory and populations are defined as “sensitive”, “working”, “at home”, and “transport”. There are also day and night scenarios
- Traditionally, SHAPE has supported NHS decision-making and aimed at future planning but does contain short-term data that could be applicable to flood emergencies. SHAPE contains Hospital Episode Statistics, Quality and Outcomes Framework data and health infrastructure data
- SHAPE data could be used to ensure that all health infrastructure is identified. Standard Industrial Classifications within SHAPE provide workplace data, travel time and distance catchments, and demographic data that includes social deprivation
- Potential future case study – Kent County Council used SHAPE before the December 2013 floods to plan who was particularly vulnerable and who may require evacuation (e.g. care homes)
User needs

**Key points:**
- Greater collaboration between models is required
- Joint working group of SHAPE and HIM developers could be established
- A stakeholder analysis and user mapping exercise should be undertaken

**Data:**
- Flexibility to add new datasets – how quickly can new data be added? For example, NHS Blood & Transplant could map critical suppliers to understand their vulnerabilities and risk
- If feasible, live data would be extremely useful, gaining access to the National Flood Risk Assessment (NaFRA) dataset would be beneficial. Combining the systems to provide a joint real-time impact model that contains vulnerability would enhance recovery
- These data could potentially be beneficial to the community and voluntary sector and local government as a visualisation tool to improve decision making, for example, the decision where to focus recovery efforts and identify those most vulnerable
- Better contact between models is needed. A joint working group of SHAPE and HIM developers could be established to identify the opportunities and barriers for greater data sharing. This working group could also consider the challenges of a logical stepwise approach in integrating the work streams of each tool
- Consideration should be given to the potential use of future open source data. Crowdsourcing and Weather on Web could be used to compare publically recorded impact(s) with GIS maps. This could enable local variation to be identified within the affected population(s) and may help better define community resilience
- The inclusion of health data in HIM would assist in the identification of the health impacts of flooding (short and long-term) and identify knowledge gaps to inform future research strategies. Furthermore, health impact analysis could include stress/mental health and permit the tailoring of public health interventions
- Care must be taken and consideration given to how data may be interpreted by the user
Access:
- Permission to access SHAPE could be extended to other Cat 1 & 2 responders, so they can get an overview of the local area in planning, response and recovery. Being aware of sensitive populations and infrastructure before an incident means that it is quicker and easier during an incident to see what needs to be done.
- There is a challenge in making this information freely available. Organisations need to be comfortable in allowing other organisations to use their resources and data.
- Secure access and dialogue is required, could Resilience Direct\(^2\) potentially provide an opportunity for dissemination.
- There is a need to increase awareness of the tools through development of systems and awareness campaigns. Potential opportunities include Local Resilience Forum demonstrations or publication of case study examples.
- A stakeholder analysis and user mapping exercise is required to ascertain who the potential users are, how the tools are accessed and used, and what the end users’ requirements are.

Other points raised:
- The tools could improve access to healthcare in flooded areas and improve long-term flood resilience in health infrastructure. The tools could also potentially minimise the impact of flood events and speed up the recovery process.
- HIM is still in development and aimed primarily at Flood Forecasting Centre and the Met Office National Severe Weather Warning Service personnel.
- SHAPE model has started with flooding but this area of work could potentially be extended to other hazards.

\(^2\) ResilienceDirect is an online private ‘network’ which enables civil protection practitioners to work together – across geographical and organisational boundaries – during the preparation, response and recovery phases of an event or emergency.
Research gaps

Key points:
- Standardisation of data is required to improve interoperability
- Further research is required to quantify the health consequences of flooding
- Mapping and analysis of different user needs and interpretation is required

Other points:
- Standardisation of data formatting is required to assist data interoperability e.g. file sizes etc.
- To promote better multi-agency working, a better understanding of partner needs is required to ensure recognition of the value of different data sources
- The creation of a web-based GIS platform whereby partners access and manipulate spatial data could aid the promotion of multi-agency working and data sharing. However, the resilience and security of this system would require consideration
- To ensure usability and encourage use, a friendly, easy to use graphical user interface should be created whereby spatial data is possibly grouped by decision needs
- Recognising that different users have different needs (e.g. local, regional and national level); there is a need to identify audiences to target the products. The flood management tools need to be flexible as planning for every eventuality is impossible
- Further research is required to quantify the direct and indirect consequences of flooding upon health in both the short and long term
- Research is required on the possible advantages of using a spatial platform in communicating with stakeholders and the public. This research should identify the drivers for public information, the potential modes of dissemination, and the added value of publically derived data
- The development of holistic, task-based exposure and vulnerability datasets are required to help improve the sharing of research findings. The development of technology and access to data gives NHP partners the opportunity to push research further
Barriers

Key points:
- Issues surrounding licensing and intellectual property can hinder effective data sharing
- Lay interpretation could potentially lead to risks being considered a forecast
- Modes of research funding can inhibit multi-agency working

Other points:
- Perceived barriers to effective working across organisational boundaries still exist.
- Issues surrounding licensing, ownership and intellectual property can hinder effective data sharing and expertise partnerships
- The public perception of trusted information sources is dynamic, particularly during times of emergency. Consistency of messaging is paramount
- Whilst a spatial flood management tool may benefit those unfamiliar with the data, lay interpretation could potentially lead to risks being considered a forecast
- An effective communication strategy is required to raise awareness and promote best practice
- Delivering the right information to the right people at the right time remains a challenge particularly within a dynamic emergency environment
- Any graphical user interface has to consider the needs of the end user. Ease of use, especially at the highest level is imperative. A multi-layered approach where partners can drill down to interrogate data would be best
- Delegates reported that the current way in which research programmes are funded was a barrier to multi-agency working
Evaluation of the workshop

The workshop was followed by a short, 16 question survey conducted to discover participants’ view on a number of aspects of the event. 56% of delegates responded to the evaluation survey.

The overall rating for the workshop was very good – 67% of those who responded stated the event was excellent, and the remaining 33% rated the meeting as good.

The main part of the questionnaire focused on evaluation of the presentations delivered during the day, using a 5-level performance scale: excellent, good, average, fair and poor. Additionally, delegates were asked to rate the breakout group they attended. Participants could also state whether there were any topics that had not been discussed during the workshop that they would like to see included in future events and to make any further comments about the event.

Feedback included:

• I think that it is essential that there is continued dialogue between some of the people and organisations that came together on the day, to have the best chance of securing the potential benefits identified. This may need to form of regular steering group discussion rather than relying on informal follow up
• Great opportunity to meet people from different organisations, with different ideas and views on flooding health impacts. Very important to keep up the momentum on this - the potential for benefit from collaborative work from partners was pretty clear, if appropriate funding can be found
• Great learning opportunity. Really good idea to have SHAPE there and demonstrating its use and value - it showed the non-health agencies that health does have something to bring to the table
• It may have been possible to cover a wider range of risks under a climate change banner rather than confine the topic to flooding. This may have appealed to a wider audience
• A wider consideration of health impacts to natural hazards (in addition to flooding) could be useful (for NHP)
• Opportunities for jointly funded, resourced and delivered projects, either through two agencies partnering together, or a larger number of agencies via the NHP - but this might be a way off yet
Next steps

Submission of the workshop report to the HIM advisory group & SHAPE steering group:

- to consider holding a future networking event of flood partners to continue to develop collaboration in spatial data and health research, share ideas and identify potential case studies
- to explore the issues surrounding effective data sharing and expertise partnerships
- to identify mechanisms for overcoming the barriers to effective and coordinated data sharing

The creation of a SHAPE / HIM joint working group:

- to identify pre-existing data across the NHP, improve interoperability
- to commission a stakeholder analysis to identify potential users and their needs
- to identify a secure and resilient platform for dissemination
- to identify opportunities for future collaborative working across organisational boundaries whereby resources can be pooled and impact can be achieved through publication
# Delegate list

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<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
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