



Flood Risk Mapping & Modelling - The Surface Water Threat

Unlike other types of flood, surface water flooding has the potential to affect every urban centre in the UK. Dr. Justin Butler, Managing Director of Ambiental (www.ambiental.co.uk) discusses surface water flooding; its modelling, mapping and prediction

Once again, flooding is in the news. This is not surprising given the catastrophic losses experienced last summer, the degree of exposure faced by the UK's mission critical infrastructure, and the ongoing debate as to what is a 'sufficient' level of flood defence spending.

For local authorities, city council planning departments and water companies, flood risk is rapidly moving up the agenda. With increased development in floodplain areas, coupled with more frequent 'extreme' rainfall, potentially resulting from climate change, flood defences and drainage capacities are being tested to the limit, and beyond. Just because you are not located on the coast or by a river no longer means that you are safe from flooding. The spectre of surface water or pluvial flooding, can strike anywhere but the risks and impacts are particularly severe in urban areas. However, as I will outline in this article, help is now at hand for city planners, insurers, water companies and emergency responders...

What is Surface Water Flooding?

Surface Water or Pluvial Flooding is defined as: "Flooding that results from rainfall generated overland flow and ponding in depressions before the runoff enters any watercourse or sewer" (Source: NERC).

In other words, intense rainfall that is unable to soak into the ground or enter drainage systems runs off the land and results in localised, but potentially severe flooding.

The Flood Events of Summer 2007

The flood events of summer 2007 were different in scale and type from previous severe floods in the UK. In particular, a much higher proportion of the flooding than normal came from surface water rather than from the

sea or rivers. May, June and July were the wettest months since records began, with the resulting floods damaging approximately 48,000 homes and 7,000 businesses (Source: Pitt Review: Learning lessons from the 2007 floods).

The Association of British Insurers (ABI) has released figures on the cost of the June and July 2007 floods. The total cost is now estimated at £3 billion, with around 180,000 claims being made such that,

"The summer floods have engendered the largest natural catastrophe insurance loss ever recorded in the UK." (Source: ABI)

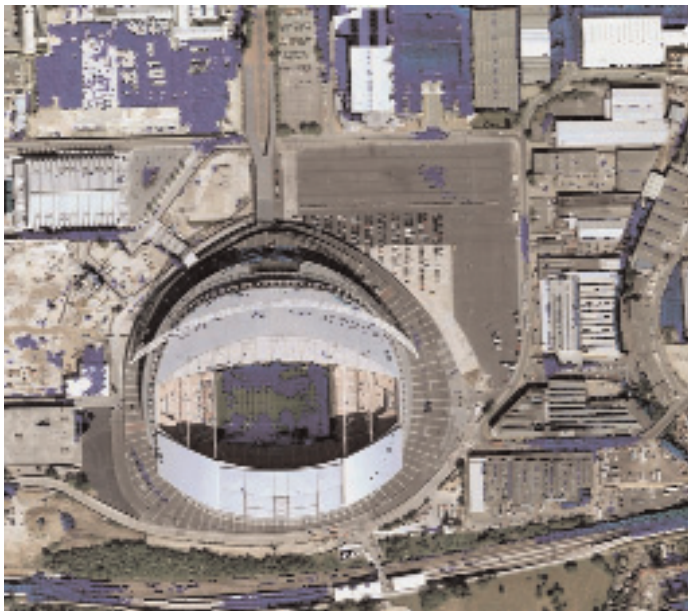
Surface water flooding was most severe in cities such as Hull, but properties all across the country were affected. The Environment Agency's review of the summer floods found that, in London, virtually all of the 1,400 properties flooded, were due to surface water. Surface water flooding problems are set to increase with development pressures, climate change and an ageing infrastructure.

Despite this, and as acknowledged by the Pitt Review, the risk of surface water flooding across the country is currently not well understood. Until now, risk mapping and modelling tools have not been available to identify, and help prevent flooding induced by heavy rainfall events and ineffective drainage.

Improved Prediction of Surface Water Flooding

Surface water flooding occurs when drainage systems have insufficient capacity to deal with the volume of rainfall, it therefore happens quickly and is hard to predict.

Ambiental, in collaboration with The GeoInformation Group is currently working on an ambitious project to model and map pluvial flood risk hot



spots for every major city in the UK, using Flowroute™. Flowroute is Ambiental's proprietary flood risk mapping and loss estimation platform. By combining unique spatial datasets provided by The GeoInformation Group (including LiDAR, building class and 3D building data) with Ambiental's leading-edge flood modelling and GIS mapping expertise, the new UK-wide surface water flood risk dataset will benefit a wide variety of markets including insurance, government, emergency planning and the utilities.

Flowroute™ has been optimised for ultra high detail / accuracy flood risk assessment, down to the level of individual buildings, for entire cities. Early adopters include Thames Water with considerable interest being shown by several local authority clients and the emergency services.

Flowroute™ is a novel, innovative approach to flood risk modelling and mapping that is used to predict the depth, duration, velocity and extent of flooding from rivers, the sea, defence breaches, dam bursts and surface water. Ultra-high resolution Digital Elevation Models (DEMs) are employed to inform a physically realistic mathematical representation of fluid flow over topographic surfaces. Using the latest high resolution LiDAR DEMs, Flowroute™ accurately captures the complexity of flood risk within the urban fabric by allowing water to flow down streets and around individual buildings.

One of the major advances of this technology is the ability to predict the impact of surface water flooding and drainage surcharging caused by intense rainfall events in urban areas. Extensive building-by-building validation against historical flood events is used to check and calibrate the model so as to maximise accuracy of the predictions. The Flowroute™ modelling technology also includes the impact of drainage systems by allowing



water to enter and leave the floodplain through sewers, dependent on their capacity.

For insurers, more detailed flood risk maps enable improved underwriting, pricing and loss estimation by providing more specific risk ratings for different probability events or return periods.

Surface water floodmaps are created by combining hydrological data about flood events with a combination of satellite imagery, maps, digital terrain data and 3D buildings. Ambiental are working closely with The GeoInformation Group to provide high-resolution flood model coverage of all major UK cities. Ambiental has identified 135 UK towns and cities at risk of flooding, each with its own unique set of risks, critical infrastructure and challenges. The derived risk maps and models can be distributed in a variety of ways including through Google Earth, commercial Geographical Information Systems (GISs) and even spreadsheets, making ultra-high detail flood risk information accessible to a much wider audience for the first time.

Providing a more complete picture of the nature and extent of flood risk in the UK will help insurers, local authorities, conveyancers, risk managers and eventually, the general public, to better understand, and map relative flood risk and potential impacts.

The Future....

The summer 2007 flood events highlighted the importance of recognising additional sources of flood risk. Climate models indicate a likely increase in the frequency of heavy precipitation as a result of climate change. The prevalence of very high intensity, long duration rainfall is placing a strain on stormwater drains, with increased urbanisation acting to reduce the permeability and infiltration capacity of surfaces which, in turn, promotes increased runoff rates and flash flooding. This, in conjunction with increased development in floodplain areas means that the risk is set to increase over time.

It is vital that we have appropriate systems and mapping tools in place that can be used to predict, and hence mitigate, the catastrophic impacts of flooding now and in the future. If people and property are to be protected, government, emergency-planners and insurers now need better ways of modelling and managing the risk of flooding. Ambiental's latest developments in three-dimensional flood-mapping technology provide a more complete understanding of flood risk. Planning departments, insurers and risk managers that invest in flood risk assessment technologies can optimise and better target infrastructure spending and save millions through improved risk management.

Editor Note – Ambiental TS is developing pioneering new technology to help mapping and modelling environmental risk. Specific details of the technique and its applications will follow in a subsequent Issue.

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