



Protecting key infrastructure sites from flooding

Utility companies are under pressure to protect essential resources from the dangers of floods. Dr Justin Butler, continuing a previous article, explains how new technology might assist utility companies.

After a lacklustre British summer, high intensity rainfall is set to increase as a result of climate change and flooding is a growing danger. The drainage network is ill-equipped to cope and it's no longer safe to assume that if you haven't flooded before, you won't flood in the future. Essential utilities like energy and water companies must improve the accuracy of their flood risk analysis so that they can prevent the kind of flooding we saw in summer 2007.

Since 2001, utility companies have had a legal responsibility to assess the flood risk of potential sites. However, accurate assessment for planning, infrastructure upgrades, or business continuity and risk management purposes can be complex.

For these high value sites, the problem of flooding is compounded by the concentration of assets in high risk locations, for example, in low lying areas adjacent to rivers and the coast which have historically attracted human settlement and development. Flooding is of particular concern to utilities because of the widespread nature of their assets, with facilities often located in at-risk areas. It has been estimated that over 2,000 power substations and around 750 water and sewage treatment works in the UK are currently at risk of flooding.

An improved understanding of flood risk

In 2007 Britain experienced some of the worst flooding it had seen for many years and utility companies were badly affected. Severn Trent Water and national grid electricity facilities were severely impacted in Gloucestershire, while Castlemeads substation was shut down leaving 42,000 people without power. If floodwaters had risen only marginally higher the number of people affected could have exceeded 600,000.

Mythe Water Treatment Plant in Tewkesbury was also inundated leaving 140,000 homes without running water and around 13,000 homes were left without electricity in Sheffield after the electricity infrastructure

was submerged by floodwaters.

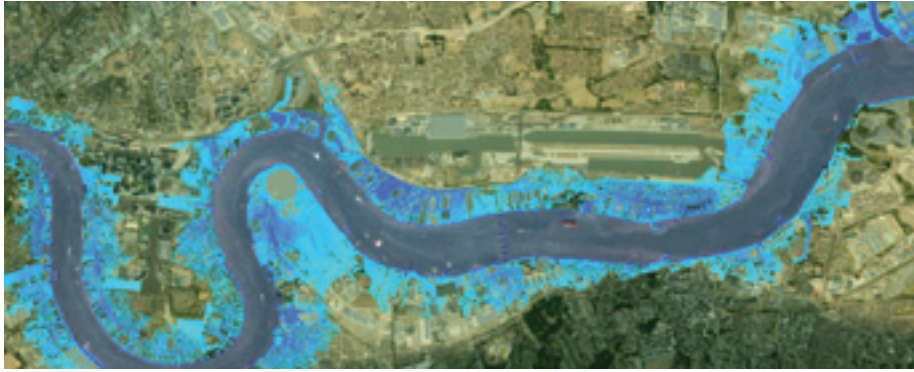
Improved understanding of the precise nature and multiple sources of flood risk is required if the impact of significant flood events in future is to be reduced. Further investment is also needed to map, model and assess flood risk. Continued pressure needs to be put on government to prevent development on floodplains, increase flood defence spending and improve drainage networks.

Problems with the UK's drainage network

Many utilities use the same data and tools available to property developers and the general public i.e. publicly available data from the Environment Agency and relatively simple risk assessments. However, the basic risk mapping currently available focuses solely on fluvial (i.e. river) and tidal/coastal flood risk. This data neglects other sources of flooding, particularly pluvial (otherwise known as surface water flooding).

Pluvial flooding (*see previous article published within the Risk Section in Geo:UK Vol.6. pg. 38. NoE*), associated with extreme precipitation in urban catchments, often poses the greatest risk. High intensity, long duration rainfall events and insufficient sewer network capacities combine to trigger complex flow paths within urban areas. These flow paths converge at topographic low points and are unable to drain away due to high levels of impermeability.

A recent study conducted by Ambiental on behalf of Thames Water showed that the coverage of impermeable surfaces within selected London Boroughs has increased, on average, by nearly 20 per cent over the last 30 years. Rates of change in impermeability were found to be variable between Boroughs but this is still a concern given the link between reduced infiltration (e.g. via conversion of green spaces to industrial estates or paving of driveways) and increased urban flood risk.



London Flood - C Copyright Ambiental Technical Solutions

The UK's outdated sewer and drainage network can no longer cope with increased runoff and the monsoon-like rainfalls which have been increasingly experienced in recent years. In the light of recent research which suggests that this type of rainfall will be more common in the future, utility companies will need to improve surface water drainage capacities and flood defence planning to prevent a repeat of last summer's catastrophe at Hull happening elsewhere. Risks to individual sites and hot spots within urban catchments need to be thoroughly understood so as to ensure flood defences are effective and infrastructure upgrades are correctly designed and specified.

Protection and prevention

The implications of flooding to power stations, water treatment plants and distribution networks are many and varied. Even relatively short-term flood damage to smaller infrastructure sites such as electricity substations can cause large-scale power cuts over indeterminate periods of time. Flooding of water infrastructure can also cause complex adverse effects. For example, floodwater can enter freshwater supplies causing contamination; exacerbating the polluting effect of floodwaters.

Damage to water infrastructure reduces its ability to operate as normal, and this has implications for insurance, business continuity and interruptions to service provision as well as capital replacement and repair costs. Overflowing drains or sewers are a public nuisance and water companies have even been taken to court for breach of human rights.

Assets at the highest level of risk can often be smaller installations where the risk and impact of flooding may not have been assessed as comprehensively as they would for larger installations. Utility companies should also consider evacuation routes and continuity of business relocation sites as part of the wider business continuity management planning function (BCMP). Any new infrastructure built will have to adhere to PPS25 (Development and Flood Risk) guidance. If a potential site is identified as being at risk of flooding, this regulation means the risk must also be appropriately mitigated. Small scale sites not classified as being at risk of flooding from fluvial or tidal sources can potentially 'slip through the net' as they may not be required to conform.

Better technology for key infrastructure

At Ambiental we have developed a modelling approach which can account for these factors. FlowrouteTM is an ultra high-detail, three-dimensional flood risk modelling platform for evaluating risk and impact. It is used to accurately model and understand flood risk in any of the following circumstances: i) risk posed to existing buildings and infrastructure, ii) dangers to new buildings and future developments and iii) changed flood risk resulting from potential future climate change. Flood depth maps, generated using FlowrouteTM for various scenarios can, for example, be used to inform flood defence requirements and cost-benefit analyses of alternative engineering solutions.

The topographic data that we have used to model outcomes for Thames Water comes principally from LiDAR data which is used to build up a detailed, three-dimensional digital model of the topography.

Our high detail digital flood risk and depth maps are being used by Thames Water as part of the 'logging up' process to lobby for increased funding and enable sewer upgrades. Our flood data can also be used to assess what damage might be caused by a burst water main and/or heavy rainfall. This provides added value relative to conventional modeling approaches which cannot show how flooding (in terms of depth and extents) evolves over time down to the level of individual buildings.

Andrew Hagger, network modelling manager at Thames Water who has been using Ambiental's digital flood maps to assist with network planning and to inform capital investment programmes said:

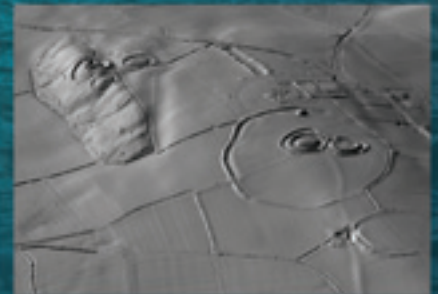
"Although we know we need to invest money in a particular area, we can now be much more precise in the location, size and specification of the solution that needs to be implemented. These flood maps and models have been very useful and the Wastewater Operations Director was most enthusiastic about the application of the technology."

Flooding, especially in the UK, is likely to be at the forefront of the political and risk management agenda for a long time to come. It is therefore extremely important for utilities to recognise the importance of their role in helping to better understand and reduce flood risk and resultant impacts to key installations as well as to their customers.

Dr Justin Butler Managing Director Ambiental, www.ambiental.co.uk

GIS for a Global Environment

Data Acquisition
GIS Data
Mapping
City Modelling
Consultancy



Head Office:
Fugro-BKS Limited
Ballycairn Road
Coleraine
Co. Londonderry
BT51 3HZ
United Kingdom

GB Sales Office:
Fugro-BKS Limited
31 South View
Uppingham
Rutland
LE15 9TU
United Kingdom

T: +44 (0)28 7035 2311
F: +44 (0)28 7035 7637
E: info@fugro-bks.com

T: +44 (0)1572 822963
F: +44 (0)1572 822963
E: sales@fugro-bks.com

www.fugro-bks.com