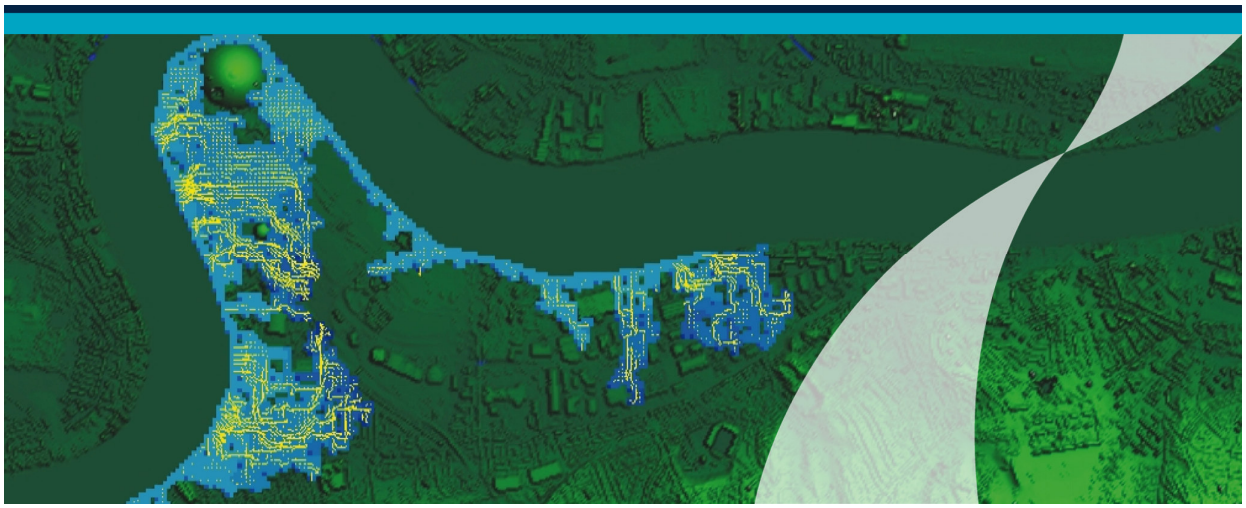


Flood-risk mapping in an uncertain world

Water engineering and management

By allowing for uncertainty in flood maps, we enable more robust decision making in flood-risk management.

The appraisal of flood-risk management (FRM) options is better informed by reference to probability-depth maps which consider natural variability and uncertainties in our knowledge and natural variability.

Similarly, the use of flood maps to support development-control decisions or emergency response is more dependable where the user has an appreciation of the potential sources of flooding and underlying uncertainties and can communicate this to other stakeholders, such as developers or emergency response teams.

Our approach

At Halcrow, we enjoy working with our clients to continually drive innovation in FRM. By understanding client needs, we have developed practical approaches to probabilistic flood mapping, flood-risk mapping of different sources of flooding and communicating uncertainty using flood maps. Keeping client needs in mind, we strive to develop methods that are practical, transparent and robust.

Our flood-risk mapping experts are well qualified to recognise and advise on the treatment of uncertainty in flood modelling and mapping.

Our methodologies for communicating uncertainty help our clients maximise the benefit from their flood maps by ensuring better understanding of the information portrayed.

By listening to our clients, we have successfully developed and implemented innovative methods and tools to produce probabilistic flood maps (such as probability-depth grids), facilitating more detailed appraisal of FRM options. We have also developed innovative methods for mapping flood risk from different sources of flooding.

Our services

We provide our clients with expert services in all areas of flood mapping and uncertainty assessment.

- flood mapping using one and two-dimensional model outputs
- fluvial, coastal, pluvial, groundwater flood mapping
- depth-probability and probability-depth mapping
- velocity and hazard mapping
- dam break hazard mapping
- levee or embankment failure hazard mapping
- using flood maps to appraise FRM options
- mapping residual risk from defence failure
- combining flood-map data from different sources
- identifying uncertainty in flood maps
- spatial coherence and joint probability
- tailor-made methods of uncertainty analysis
- application of Monte Carlo and Bayesian methods

Delivering value - case studies

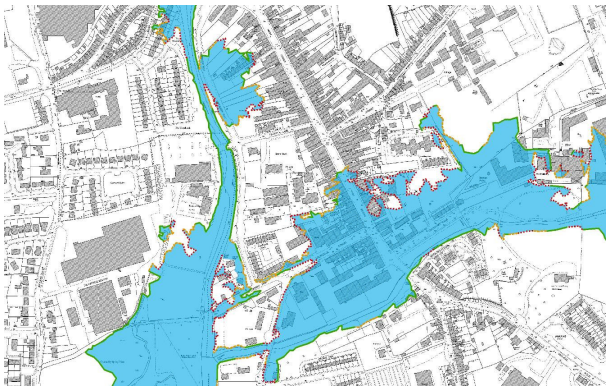
Thames Estuary 2100 – modelling for appraisal

The Environment Agency of England and Wales commissioned Halcrow to refine and apply our innovative and practical probabilistic modelling framework, initially developed in an earlier stage of the project, to support the final appraisal of options for the Thames Estuary 2100 flood-risk management plan.

The framework includes an integrated approach to analysing and allowing for uncertainties, providing clients with a better understanding of residual risk for each option. The probabilistic treatment and adjustment of input variables (such as model boundaries and defence fragility) is accommodated by the framework.

The principal outputs from the study are depth-probability grids and water levels. Water levels were then used to calculate direct property damage while the depth-probability grids were applied to calculate social and environmental impact, as well as annualised risk to life and injuries from flooding.

Communicating uncertainty in flood maps



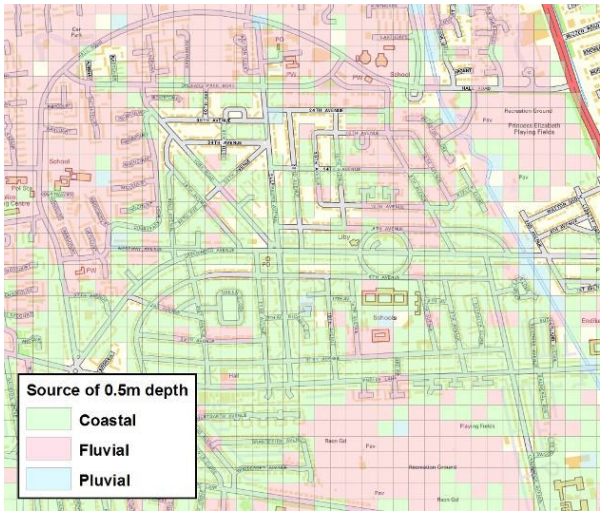
Communicating uncertainty in flood extents

Traditionally, predictive flood mapping has presented a single contour defining the limit of flooding for a particular event. This type of mapping fails to identify and communicate the potentially significant uncertainty inherent in those flood limits.

The Office of Public Works in Ireland identified a need to assess and communicate uncertainty in its flood maps. Halcrow's flood-risk mapping experts used their knowledge of flood-risk mapping and uncertainty analysis to help the client develop a tiered approach to quantifying uncertainties in its flood maps.

The tier-three method, along with mapping and visualisation tools, provides a rapid mapping method which the client can apply with the minimum of extra modelling effort. Potential flood extent is shown using different line styles.

Sources of flooding



Mapping of flood risk from coastal, fluvial and pluvial sources

Flood maps are generally produced from model simulations or historic floods that consider only one or two sources of flooding. Fluvial models, for example, consider river flooding in isolation while tidal (estuary) models consider a combination of fluvial and coastal inputs. Our research for the Environment Agency has generated a methodology (MAST) that combines multiple sources of flood-risk information, showing the predominant source of flooding in an area.

MAST takes multiple sources of flooding and communicates the combined risk when fully integrated modelling is not possible or appropriate. MAST works with most sources of flooding, including fluvial, coastal, dam breaks, pluvial and groundwater.

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