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Flood risk mitigation through natural flood management: reducing uncertainty through process studies at the local catchment scale

M.E. Wilkinson, P.F. Quinn, A. Nicholson, and G.M. O'Donnell

Newcastle University, School of Civil Engineering and Geoscience, Newcastle Upon Tyne, United Kingdom (m.e.wilkinson@ncl.ac.uk)

Intense farming has the potential to increase runoff rates. Therefore, there is great potential for managing land use to play a role in local scale strategies for managing flood risk. The European Floods Directive has created a platform for the management of flood risk. Natural flood management measures have a role in the implementation of the directive. One type of such natural flood management measures are Runoff Attenuation Features (RAFs). RAFs are cost effective soft engineered features used for slowing and storing water at the source during flood events. For the optimal use of such features, there is a need to ascertain how they operate across a range of flood events of varying return periods. Based on local scale knowledge and understanding, runoff flow pathways are identified, managed and runoff is tackled at the source.

The Belford catchment, UK (5.7km2), is an example of a catchment whereby a range of RAF measures have been implemented to help reduce flood risk. Hydrological data from an extensive nested monitoring network have been collected over a four-year period. Over this period numerous RAFs were installed throughout the catchment and their effectiveness was tested against a large number of storm events. There are currently 30 RAFs in the catchment storing ∼15,000m3. Qualitatively, evidence from the RAFs has showed that the features are functioning correctly during large events. They are slowing and storing runoff, and disconnecting fast flow pathways that are contributing to the flood hydrograph. There is also emerging evidence that suggests that the travel time of the peak is also being delayed. However, there is a large degree of uncertainty quantifying the degree in which the features are attenuating the flow, owing to natural variability in the short dataset. There is a need for data driven models based on field evidence to reduce the uncertainty. Quantitative analysis of the impact the RAFs have on reducing and delaying the peak discharge relies on a range of models including rainfall-runoff models, a detailed pond 'forensics' model and a 2D hydraulic scheme. This analysis relies on the abundance of observed flood flow events and water level recorders positioned in RAFs. The paper will demonstrate the effectiveness of altering flood waves at the local catchment scale.