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Runoff Attenuation Features: A Nature Based Solution for flood and water pollution management

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Nature Based Solutions (NBS) (including Natural Water Retention Measures [NWRM] and Natural Flood management [NFM]) have now developed to a stage of widespread uptake alongside traditional techniques. Whilst NBS have plenty of benefits, the basic principles of 'slowing the flow' of storm runoff requires a better empirical evidence database and clearer practical design and management guidelines. Whilst there are positive messages for the benefits of, for example, sediment ponds, Rural SuDs, buffer zones, wetlands and woodland riparian management options, there is still a need to define what works best, where it works best and why. Also, there is a need to further explore end users uptake and acceptance. Here we will show one type of intervention, the Runoff Attenuation Feature (RAF) and highlight why they could be more cost effective at the catchment scale for accruing multiple benefits.

A RAF is a soft engineered structure that intercepts surface runoff flow pathways in or around the ditch or channel, which is either online (within the channel) or off-line (out of channel). The primary goal is to reduce flow velocities and create temporary flood flow storage zones. The primary function of a RAF is to generate new flood storage potential within a catchment that has minimum impact on other land uses (e.g. agriculture). Thus, the concept entails creating new zones of high roughness (and drag) with new physical storage capacity for flood waters. The volumes of such individual measures can range from 50m3 for large woody debris dams to 5000m3 for large offline leaky dam. Vital to a RAFs functionality are the relatively high drainage rates and integrated overflow features, which are referred to as the 'leakiness'. Therefore a well-designed RAF will operate effectively at high flow rates (i.e. times of flooding). A RAF will thus augment current NBS features such as ponds, wetlands and riparian woodland and create the ideal circumstances to attenuate flow, induce sedimentation (if desired) and enhance recharge rates. Here we demonstrate the stages of RAF design and function (with fully built examples from UK case studies) ranging from a managed bare channel, through various stages of RAF options including on line large woody debris dams, to large off line leaky dams on floodplains, and finishing at an engineered storage detention pond. Thus the design concepts migrate from low roughness to high roughness (drag) and from low storage to high storage dams as a continuum of design options. Therefore, we suggest that certain future flood management schemes could include design elements that are based on networks of RAFs, which exploit ditches and small floodplains, which can give tangible multiple benefits at the catchment scale, assuming these are designed correctly.