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Offline Storage Areas as a Natural Flood Management intervention: Evidence from the Evenlode catchment, UK

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Catchment-based approaches that work with natural processes for fluvial flood risk reduction are currently the subject of much interest both internationally and in the UK, where they are known as *Natural Flood Management* (NFM). NFM schemes typically seek to replicate, restore, or enhance natural features of the environment so as to store and/or slow floodwaters during storm events. Benefits over traditional hard-engineered flood management approaches include reduced capital costs and carbon emissions, and they can deliver positive outcomes for both water quality and biodiversity. Despite a small number of studies indicating their potential value, the further uptake of NFM schemes is limited by a lack of empirical evidence demonstrating their effectiveness.

We present results from an intensive monitoring network within a tributary (catchment area 3.4 km^2) of the Littlestock Brook, a lowland agricultural catchment within South East England that presents a flood risk to the downstream village of Milton-under-Wychwood. The catchment forms part of the first NFM scheme of its kind within the River Thames basin, currently being delivered in partnership by the Evenlode Catchment Partnership and the Environment Agency as part of a five-year project (2016-2021). Precipitation, stream discharge, and water level within eight offline storage areas have been continuously monitored since September 2019. High resolution topographic surveys of each storage area enable filling, storing, and drainage dynamics to be determined and compared with downstream hydrograph metrics. A series of storm events between October 2019 and February 2020 have provided a unique dataset for investigating the performance of the NFM scheme.

Data from four storms with estimated peak-discharge return periods ranging from 2.7 to 5.5 years demonstrate the potential for reducing peak discharge. During the largest storm, flood volume across the peak of the hydrograph was reduced by 22%, with 64% of total storage capacity remaining unused. Variations in the filling, storing, and drainage characteristics of each storage area have consequences for the overall effectiveness for reducing downstream flood risk and

these will be discussed.