

# Evaluating Leaky Barriers Created Through a Defra Community Natural Flood Management (NFM) Grant

Gabrielle Powell<sup>1</sup> | Joanna Clark<sup>1</sup> | Tom Nisbet<sup>2</sup>

## Introduction

There is a national drive for natural flood management (NFM) to emulate and restore natural catchment processes, to mitigate flooding sustainably for the environment, economy, and society<sup>1,2,3</sup>. There is insufficient research on:

- The effectiveness of different styles of leaky barriers on slowing the flow for different size rainfall events and the impact they have on flood peaks<sup>4</sup>.
- The experiences of community flood groups during the application of funding and delivery of an NFM project.

This poster outlines research exploring the efficiency of two styles of leaky barriers (Stroud and Pickering), and the experiences of flood group Pang Valley Flood Forum (PVFF).

## NFM and Leaky Barriers

NFM emulates, restores, alters, and protects natural catchment processes<sup>1</sup>. By **slowing and attenuating flows**, NFM can reconnect rivers with the floodplain, improving ecosystem and hydraulic functioning<sup>5</sup>. **Leaky barriers are a form of NFM**. Timber is laid across the channel (Figure 1), allowing baseflow passage but slows the flow of excess water, reconnecting the river with the floodplain and groundwater.



Figure 1: Pickering style leaky barrier and level monitoring equipment

## Defra Community NFM grant/Bourne NFM project

- £1 million Defra NFM grant** to implement small-scale local interventions to reduce flood risk, supporting catchment partnerships, and communities, giving up to **£50k per project**.
- PVFF acts as the principal consultation body for flooding and **drainage issues in the Pang Valley**. They won Defra funding for their NFM project.
- Planned **using local knowledge** of the catchment, the River Bourne was chosen for the NFM project because it was known to be a flashy tributary with clay ridges, upstream of the Pang, with nearby available timber. 38 leaky barriers were chosen under the influence of the Stroud NFM project.
- PVFF had to negotiate changes to the EA partnership grant conditions to make them apt to groups like PVFF. For a while, it was **unlikely the project would proceed**.

## Aims

- Explore the potential of the community design of NFM measures through modelling
- Evaluate the impact of NFM measures
- Evaluate the co-production of research and community partnership in future monitoring

## Conceptual Framework

This is a rationale for the approaches and perspectives given

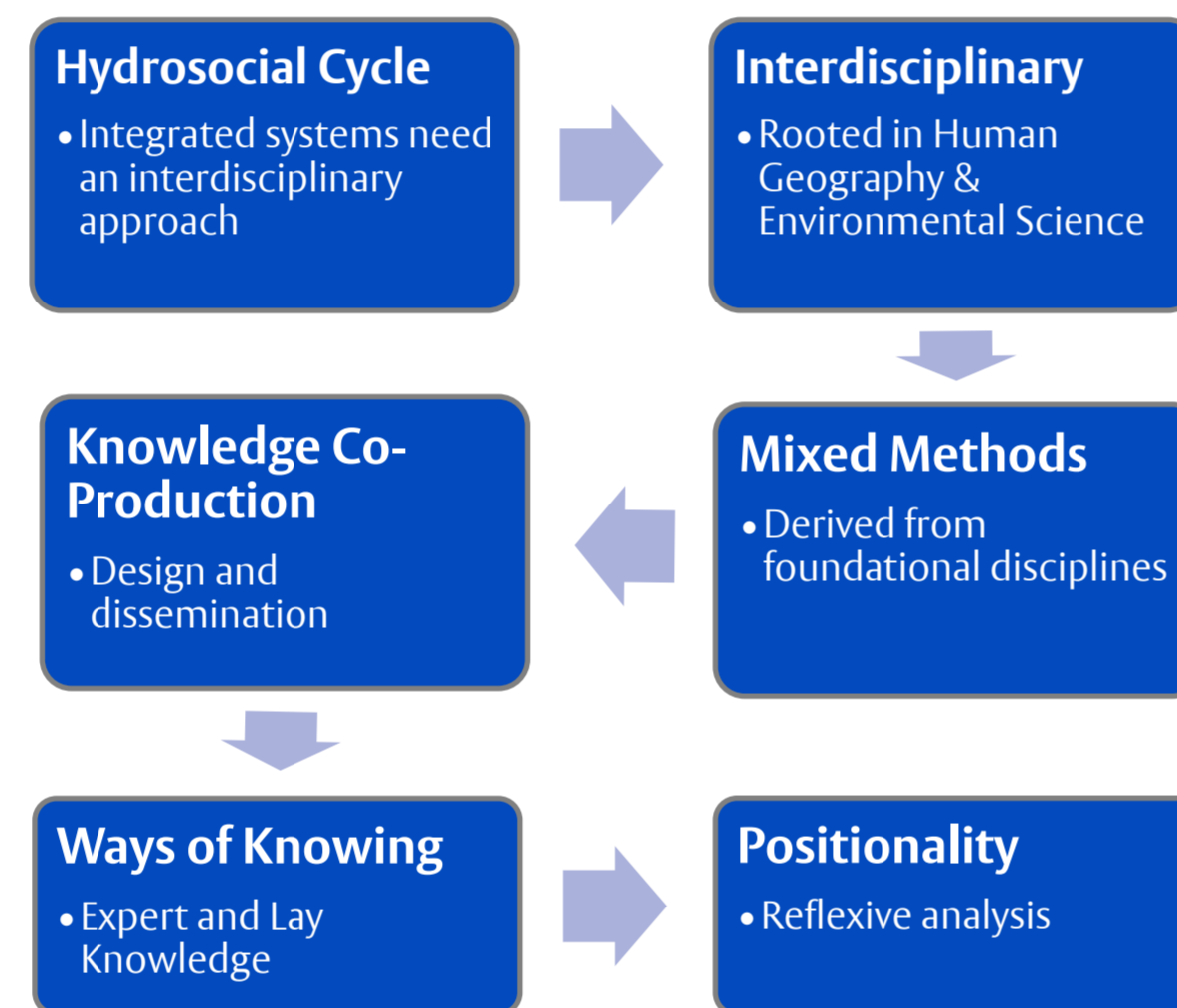


Figure 2: Conceptual framework process

## Methods

- Geomorphic Surveys
- Modelling
- River Level Monitoring
- Participant Observation
- Semi-Structured Interviews



Figure 3: Stroud style leaky barrier, oblique across channel

## Preliminary Results

### Geomorphic Surveys

- Two key styles of leaky barriers identified:
  - Stroud:** Natural looking, oblique across channel, close to channel bed (Figure 2)
  - Pickering:** Neat, perpendicular, clearly-defined logs, high above channel bed (Figure 1)
- Geomorphic characteristics:**
  - Plunge pool/deepening underneath the leaky barriers
  - Scouring where leaky barriers are placed oblique to the bank
  - Shallow gravel deposit approx. 2m downstream (Figure 4)

### River Monitoring

A hydrograph has been produced from the monitored data showing river discharge response to a large rainfall event in August 2020 (Figure 5).

The hydrograph shows a rapid response for inflow and a slower response for outflow; the lag time between peak rainfall and peak discharge for inflow and outflow is 4 hours. However, the amount of peak discharge is equal for both inflow and outflow (0.36 cumecs).

Seasonality and rainfall will affect catchment and river behaviour and the hydrograph shape.

This hydrograph is encouraging but not conclusive of the efficiency of leaky barriers, as it is expected the leaky barriers will slow and attenuate flow. There is still further analysis needed for the monitoring data.

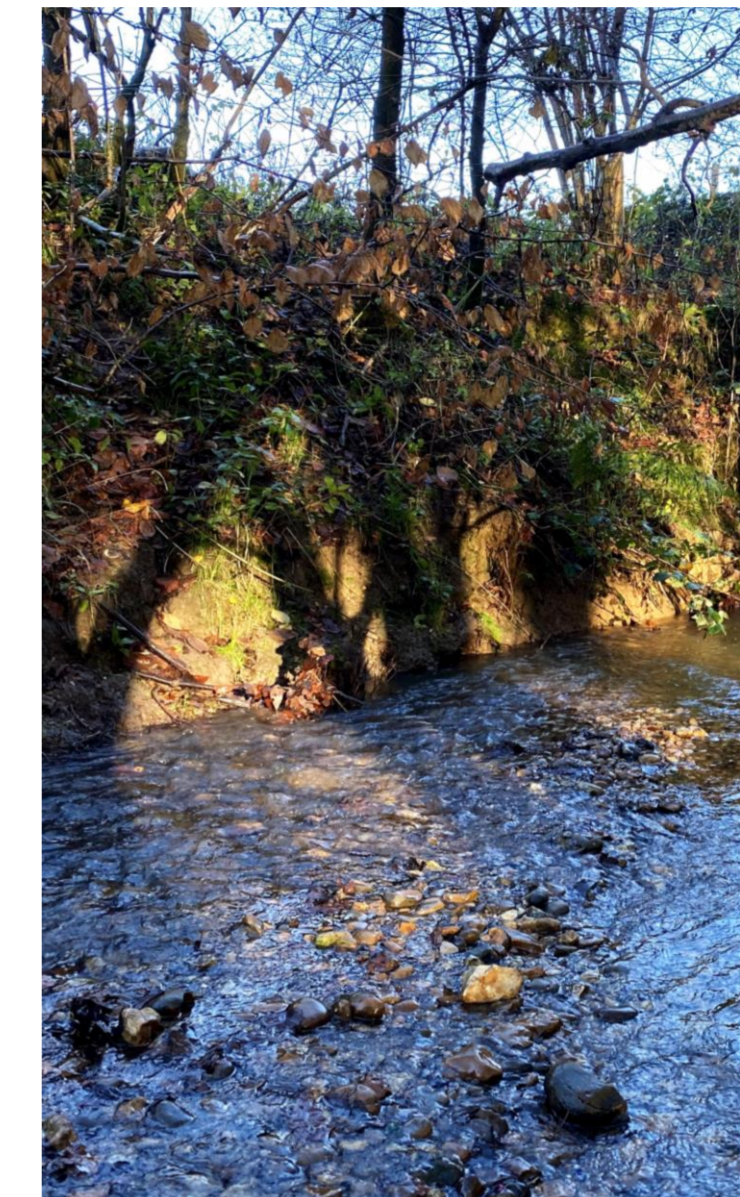


Figure 4: Gravel deposit and scouring below oblique leaky barrier

## Summary

- There is a national drive to implement NFM, but there is insufficient research in select areas.
- 38 leaky barriers of 2 different styles (Pickering and Stroud) were installed by PVFF on the River Bourne thanks to a Defra NFM grant
- This project aims to explore the community design of NFM through modelling, evaluate the impact of NFM measures and the co-production of research and community partnership in future work
- This project uses a conceptual framework based on the hydrosocial cycle which calls for an interdisciplinary approach with mixed methods
- Preliminary results show a delay in peak discharge between inflow and outflow

## References

- Barlow, J., Moore, F. and Burgess, L. (2014) *Working with natural processes to reduce flood risk R & D framework : science report*. Environment Agency. Available at: [http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM\\_Project\\_Documents/WWNP\\_framework.slib.ashx](http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/WWNP_framework.slib.ashx).
- Lane, S. N. (2017) 'Natural flood management', *Wiley Interdisciplinary Reviews: Water*, 4(3), p. e1211. doi: 10.1002/wat2.1211.
- Nicholson, A. R. et al. (2019) 'The potential of runoff attenuation features as a Natural Flood Management approach', *Journal of Flood Risk Management*, (March), pp. 1–14. doi: 10.1111/jfr3.12565.
- Environment Agency (2018) *Working with Natural Processes – Evidence Directory*. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/681411/Working\\_with\\_natural\\_processes\\_evidence\\_directory.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/681411/Working_with_natural_processes_evidence_directory.pdf).
- Fuller, I. C. and Death, R. G. (2018) 'The science of connected ecosystems : What is the role of catchment - scale connectivity for healthy river ecology?', (March 2017), pp. 1413–1426. doi: 10.1002/jdr.2903.

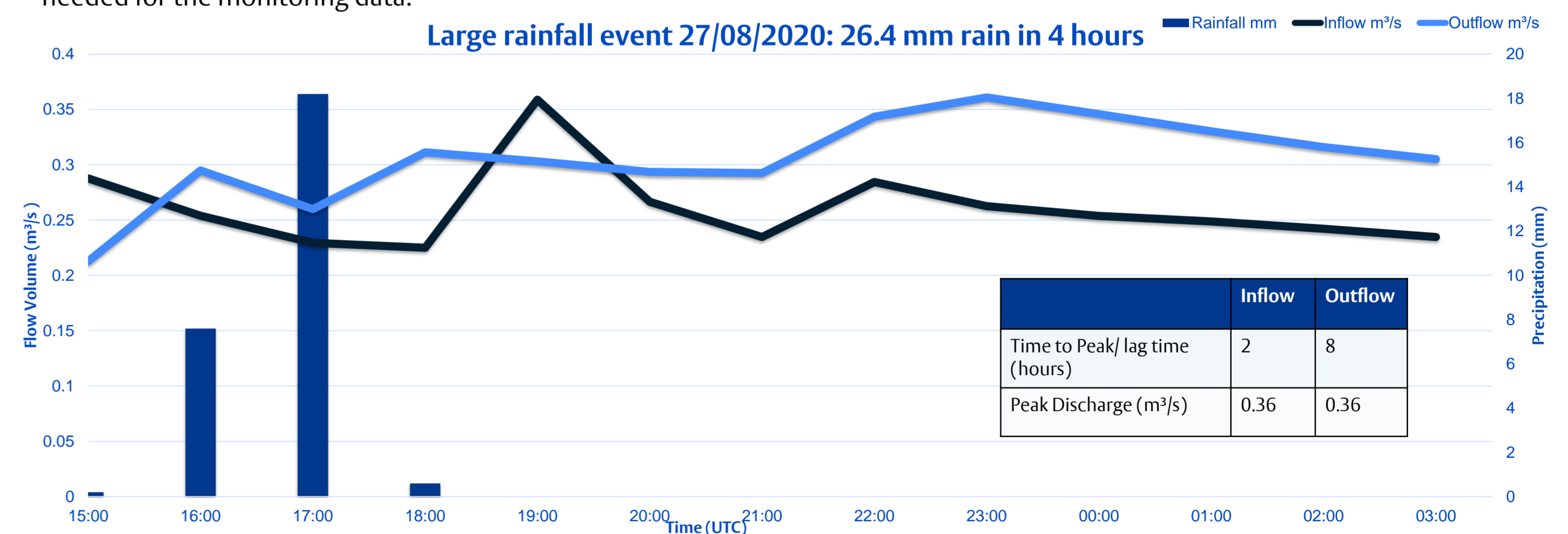


Figure 5: Hydrograph of the response of the River Bourne to 26.4mm of rain

**Contact information** Department of Geography and Environmental Science, University of Reading, Whiteknights, RG6 6AH, Email: [g.b.powell@pgr.reading.ac.uk](mailto:g.b.powell@pgr.reading.ac.uk)

**Affiliations** 1. University of Reading (UoR), Whiteknights, RG6 6AH 2. Forest Research, Alice Holt Lodge, Farnham, GU10 4 LH

**Acknowledgements Supervisors:** Ruth Evans (UoR), Hilary Geoghegan (UoR), **Technicians & Design** (UoR): Andrew Lomas, Cahyo Leksmo, Arnaud Duranel **JBA Consulting:** Steve Rose, Ryan Jennings **PVFF:** Kay Lacey, Clive Loveridge, Piers Allison, Brian Connorton **Englefield Estate:** Richard Edwards, Liz Mattison, Richard Benyon **Environment Agency:** Ali Love **Thames Water:** Andrew Hagger

**Funding:** NERC Landwise, ESRC Twenty65 and University of Reading