

Sustainable Runoff Management Strategies for Flooding and Water Quality Control: example case studies from Belford, Northern England

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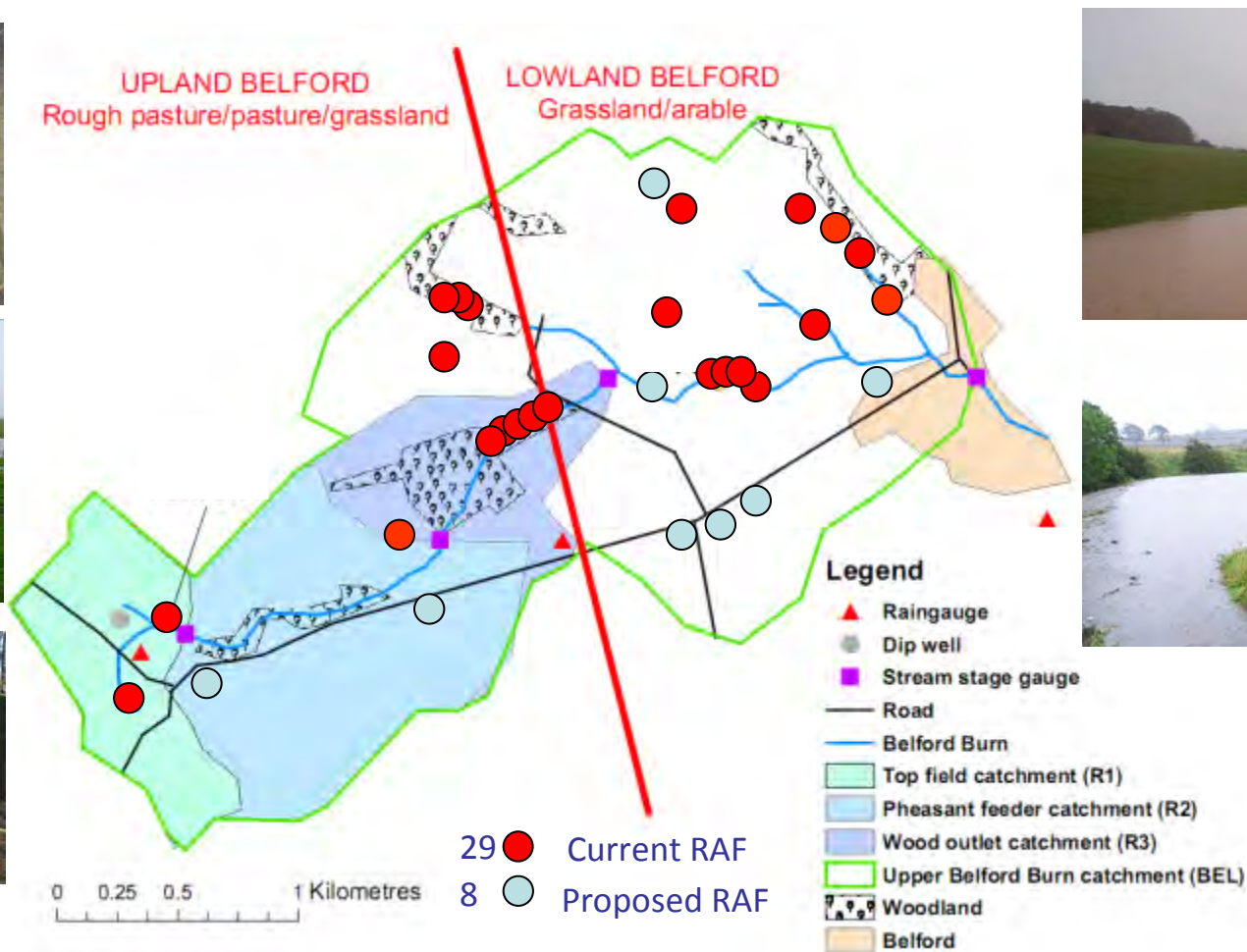
Case study – Belford catchment

- The village of Belford, UK: Many flood events (6km² catchment)
- Susceptible to flooding from intense periods of rainfall during multiday events.
- Alternative approach of **managing runoff** in the catchment put forward



Instrumentation and mitigation

- Monitor effects of NFM (Runoff Attenuation Features: RAFs)
- A multi-scale nested monitoring platform installed Jan 2008





Belford proactive flood solutions



Belford proactive flood solutions



Belford proactive flood solutions



Feature type	Number built	Typical min, max storage m ³ / feature	Estimated cost
Overland flow interception	5	300-1000	1K-5K
Online ditch features	10	50-150	1K-3K
Offline ponds	5	200-3000	2K-6K
Large woody debris	12	50-150	1K-3K
Opportunistic RAF sites	3	1000-3000	1K-10K
TOTAL	35	Estimate for Belford 9000-10000m³	£70K-100K

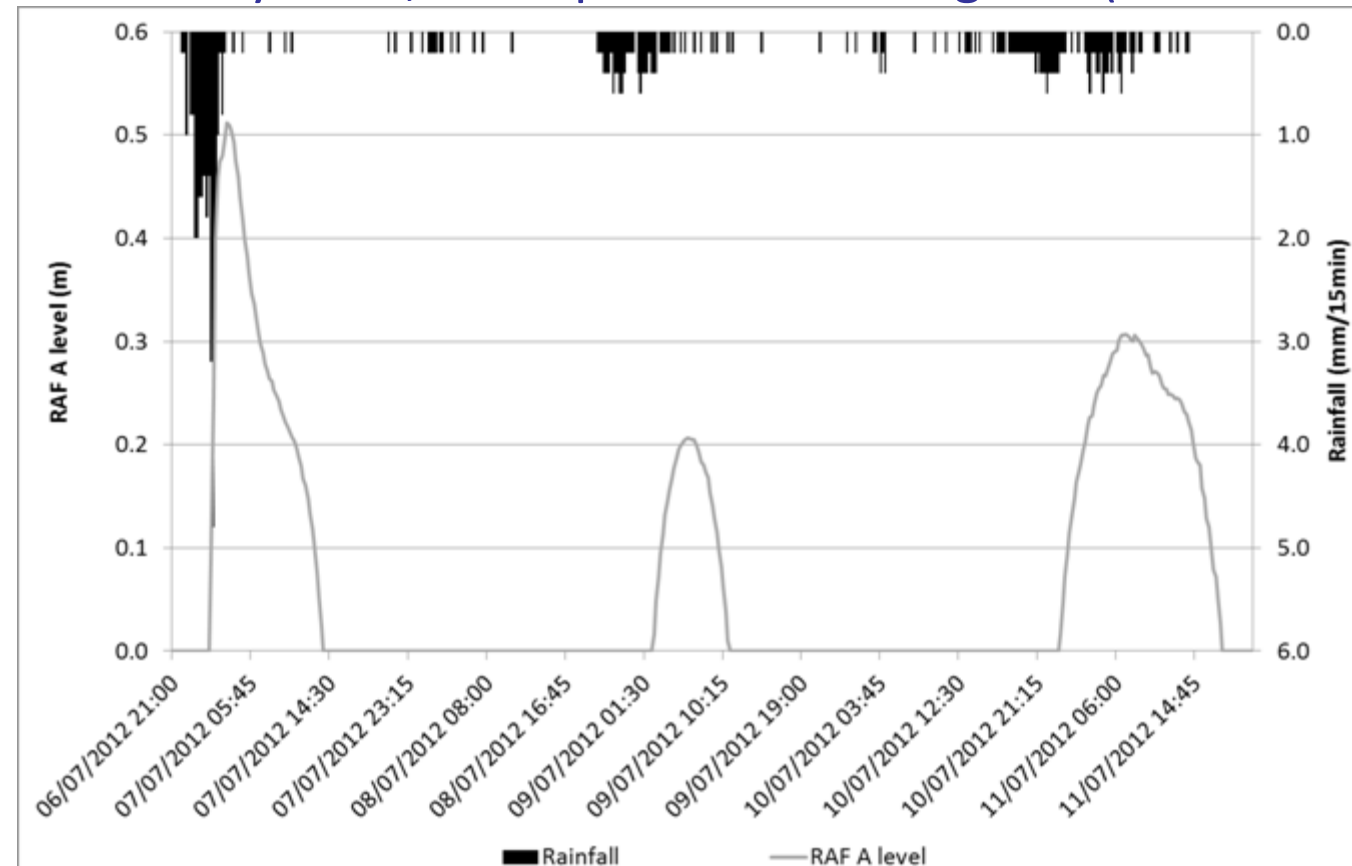


Belford proactive flood solutions

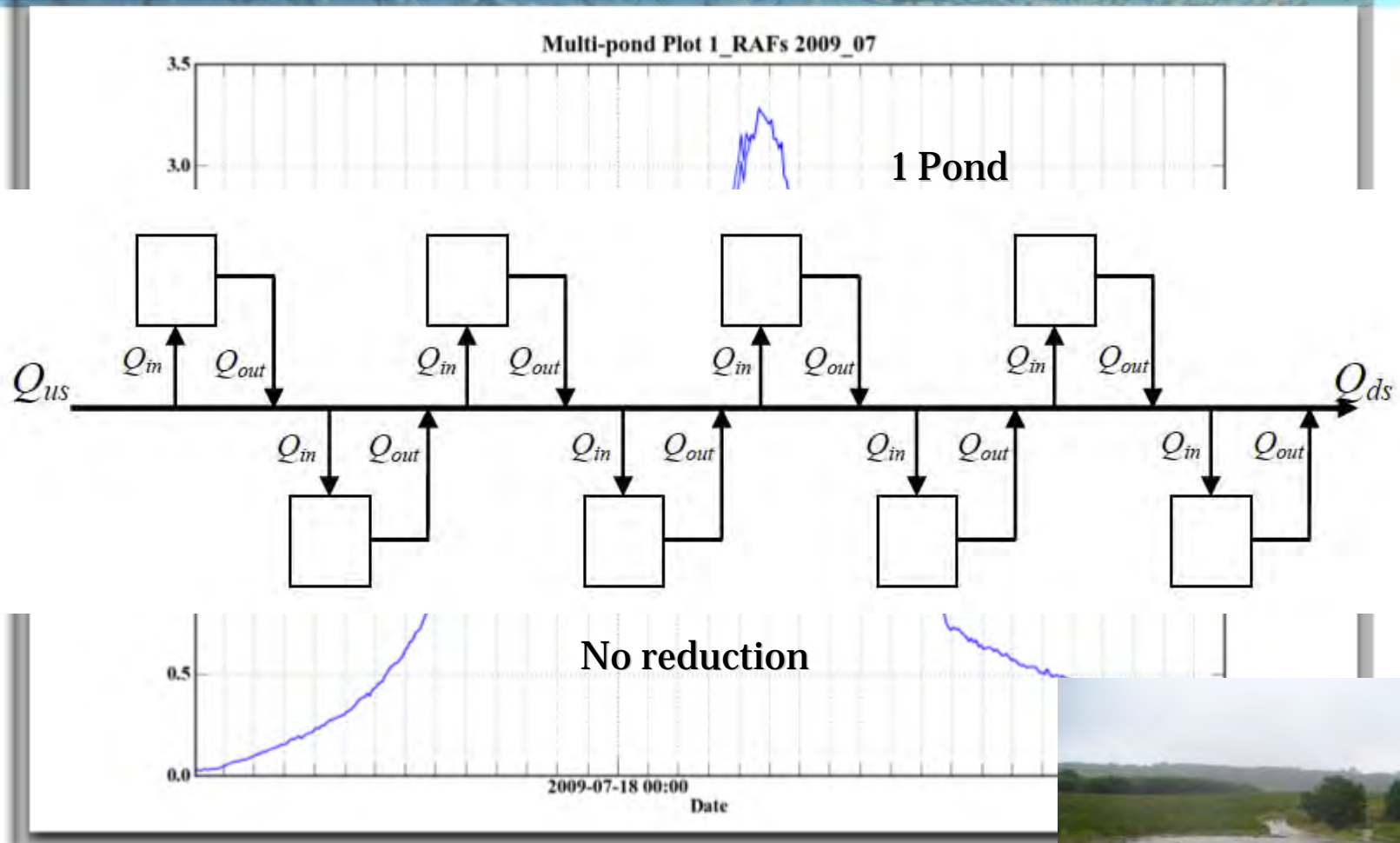


Pond performance during intense convective event

- RAF (490m³) disconnecting rapid runoff in steep arable field (0.12km²)
- **7 July 2012: 27mm in 1.5 hours: 2 hours pond reached peak level**
- 0.99 tonnes of sediment were retained in feature during an event on 11th January 2011, the equivalent of 91 kg ha⁻¹ (Palmer 2012).



Impact of a Runoff Attenuation Feature

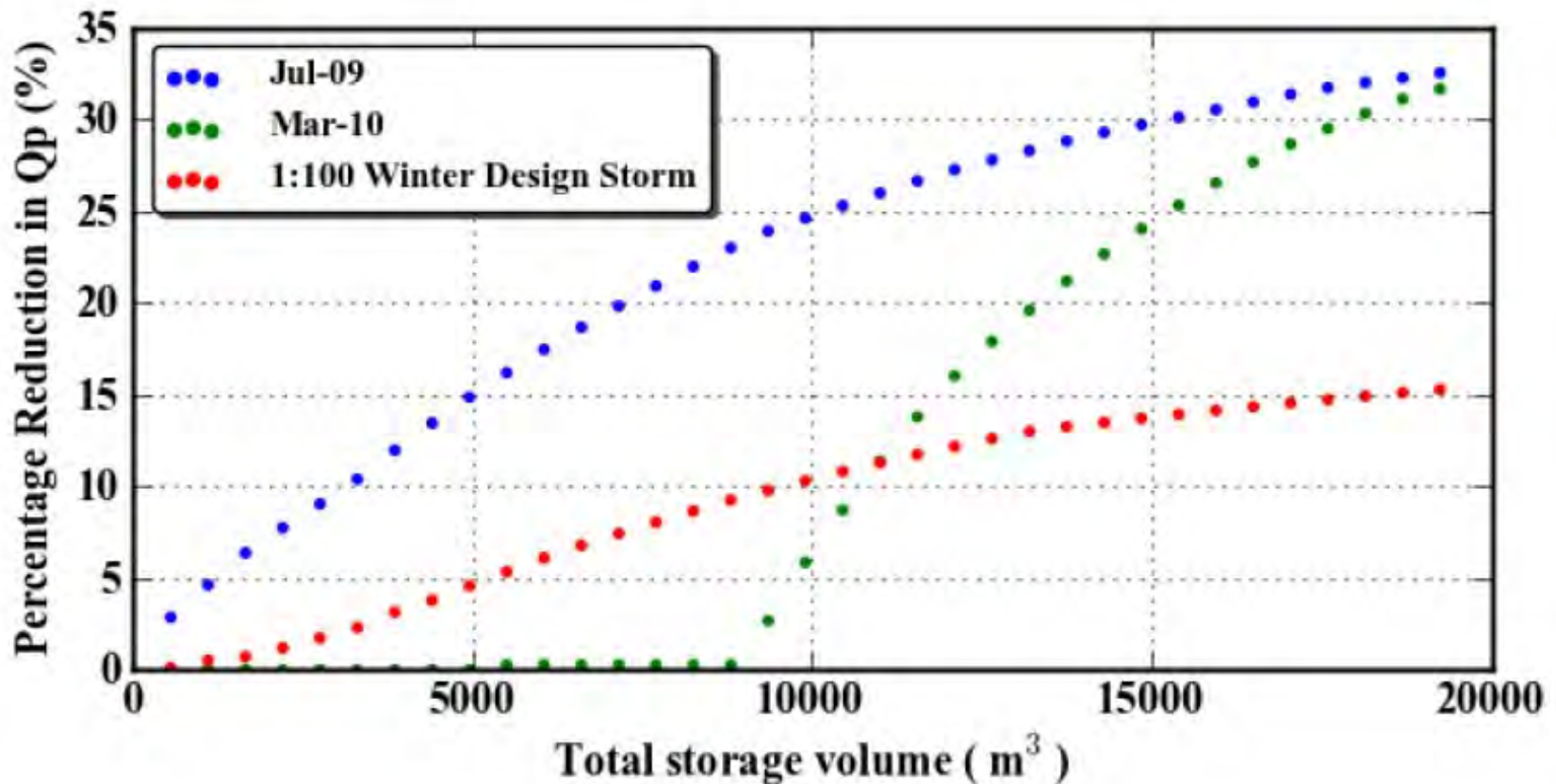


- Volume capacity = 560m³
- Inlet height = 0.55m

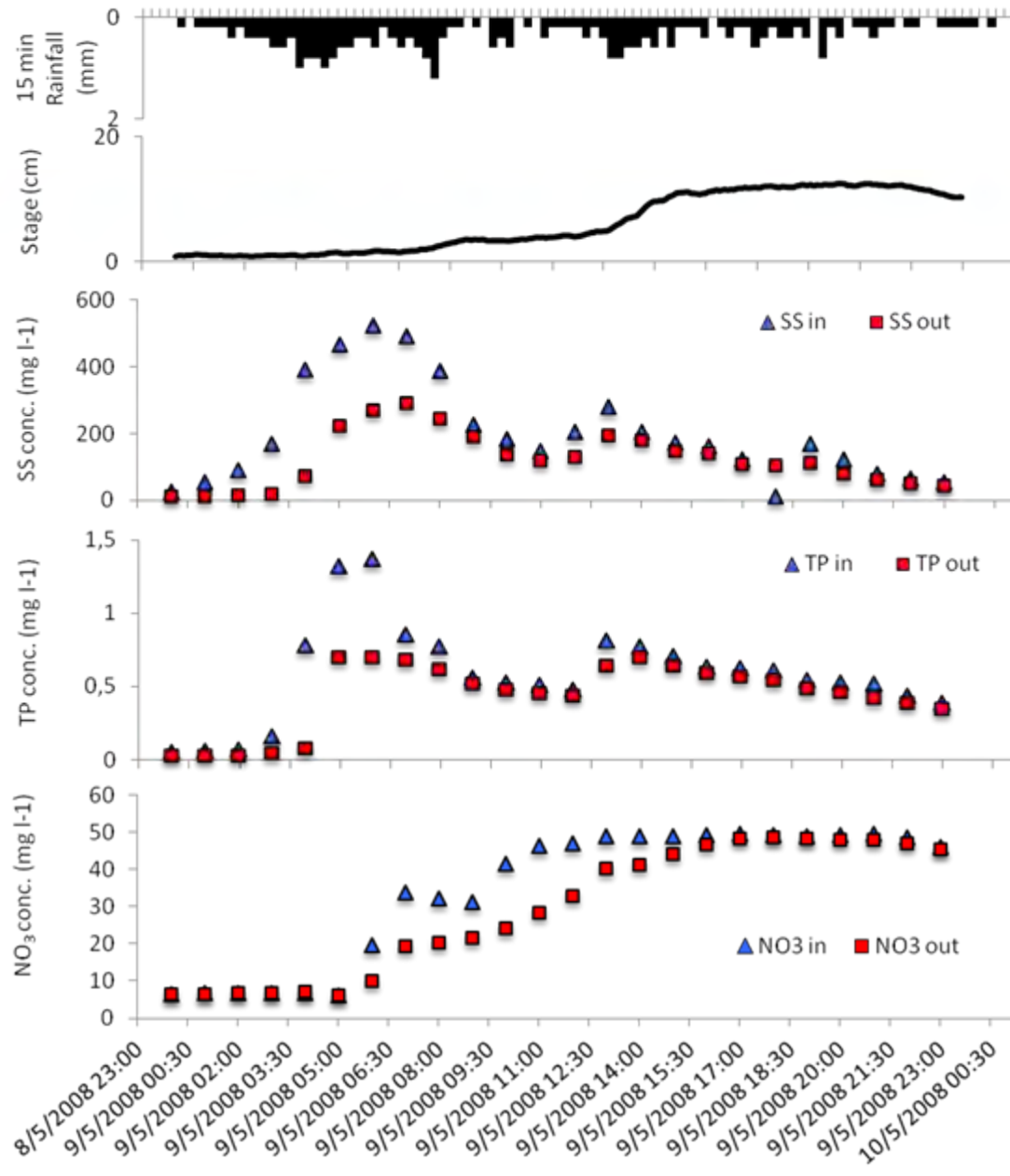


Impact of a pond

- Discharge reduction $\sim 30\%$ for 35 RAFs at scale of 3.5km^2 : Effective volume required $20,000\text{m}^3$ which is large.
- Assumes you have sufficient land to do this



RAF performance – Ditch RAF



Retention (% concentration)

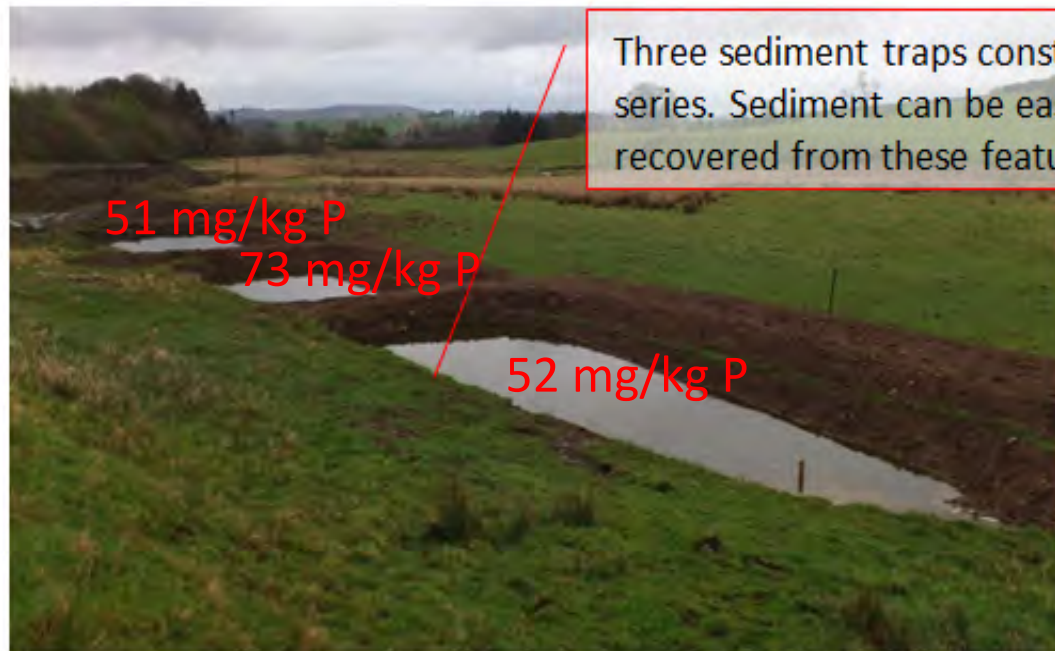
- SS: 12 – 88 (40% net retention)
- TP: 6 – 90 (25% net retention)
- NO₃: -6 – 49 (15% net retention)



Summary

- Working with catchment (Bottom up). It is a series of interested bodies.
- RAFs provide a means of head water catchment and many measures in

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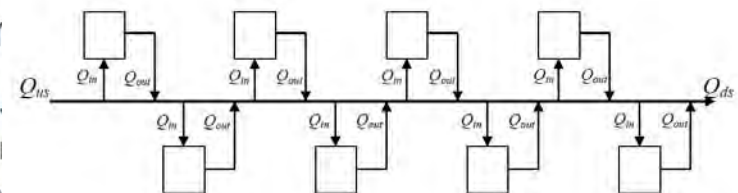


Three sediment traps constructed in series. Sediment can be easily recovered from these features.



Managing runoff and pollution
Catchment System

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Questions?

Acknowledgements

***Belford project:** Thanks to Phil Welton and Peter Kerr, Environment Agency for England and Wales: Belford Proactive Flood Solutions is an Environment Agency Project funded by the North East Local Levy, raised by the Northumbria Regional Flood Defence Committee through Local Authorities.*

[HTTP://RESEARCH.NCL.AC.UK/PROACTIVE](http://research.ncl.ac.uk/proactive)

- Papers/reports
 - Videos
 - Maps

Thanks to all the landowners in the catchments