Belford: A case study of catchment scale flood management

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Newcastle University

Civil Engineering and Geosciences

in partnership with Environment Agency

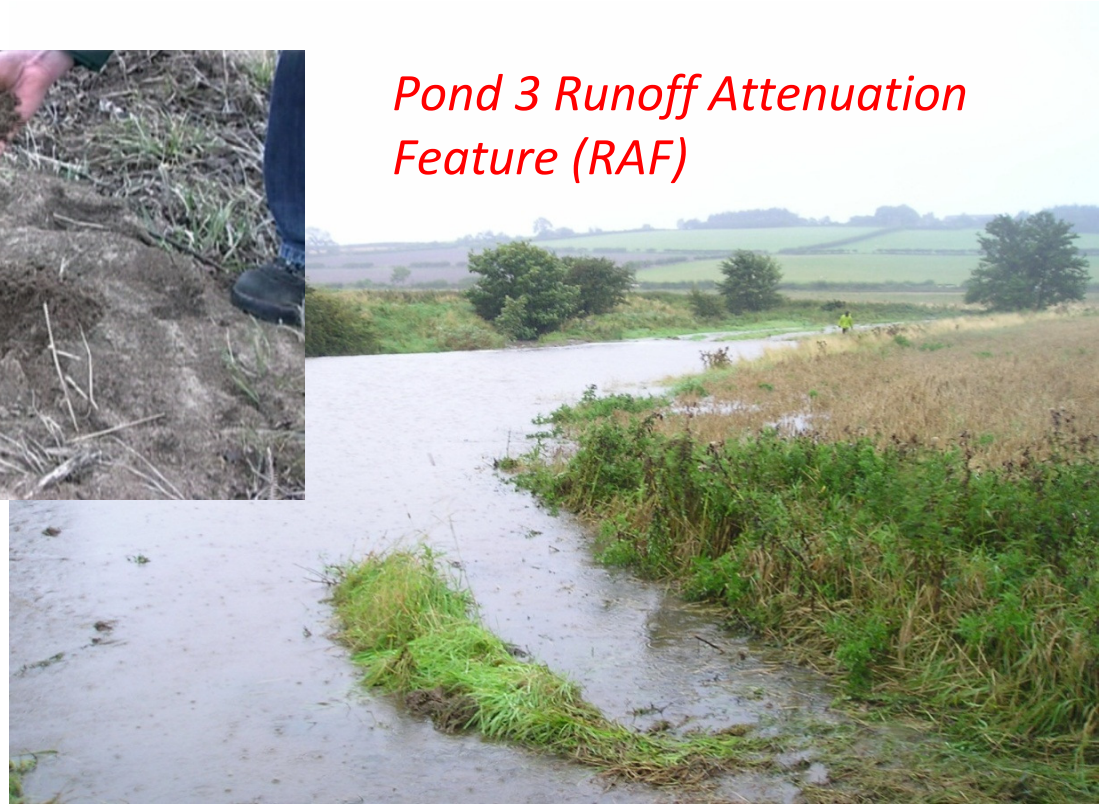
Introduction

There is great potential for agricultural management to become a major part of improved strategies for controlling runoff.

Catchment Systems Engineering

"Catchment Systems Engineering aims to sustainably manage water quantity and water quality at the catchment scale whilst not affecting agricultural productivity using an interventionist approach"

Pond 3 Runoff Attenuation Feature (RAF)



SLOW, STORE, FILTER --- For example, making buffer strips do more

Belford case study

The village of Belford, Northumberland, UK – Many flood events (6km^2 catchment)

Belford – Background

- Environment Agency looked at the feasibility of a traditional flood defence scheme for Belford
- High costs meant economics did not stack up
- Alternative approach of **managing runoff** in the catchment put forward
- The scheme was funded by the Environment Agency's North East Local Levy, raised by the Northumbria Regional Flood Defence Committee though Local Authorities

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Flood plan for town is approved

Flood prevention works costing £600,000 have been announced for the Belford area of Northumberland.

The Environment Agency says the works will include ways of preventing blockages in the stream which runs through Belford.

Staff will also work with local farmers so fields upstream of Belford can act as wet areas to allow surface water to drain away.

Work is expected to begin on initial phases of the project later this year.

An Environment Agency spokesman said: "Our climate is changing, which means that extreme weather will become more frequent in the future.

"We need to find new ways of dealing with our streams and rivers rather than only trying to wall up the water with flood defences.

"The innovative improvements will help to strengthen flood protection in the town. However flooding will become more of an issue in the future and everyone needs to take steps now to protect themselves."

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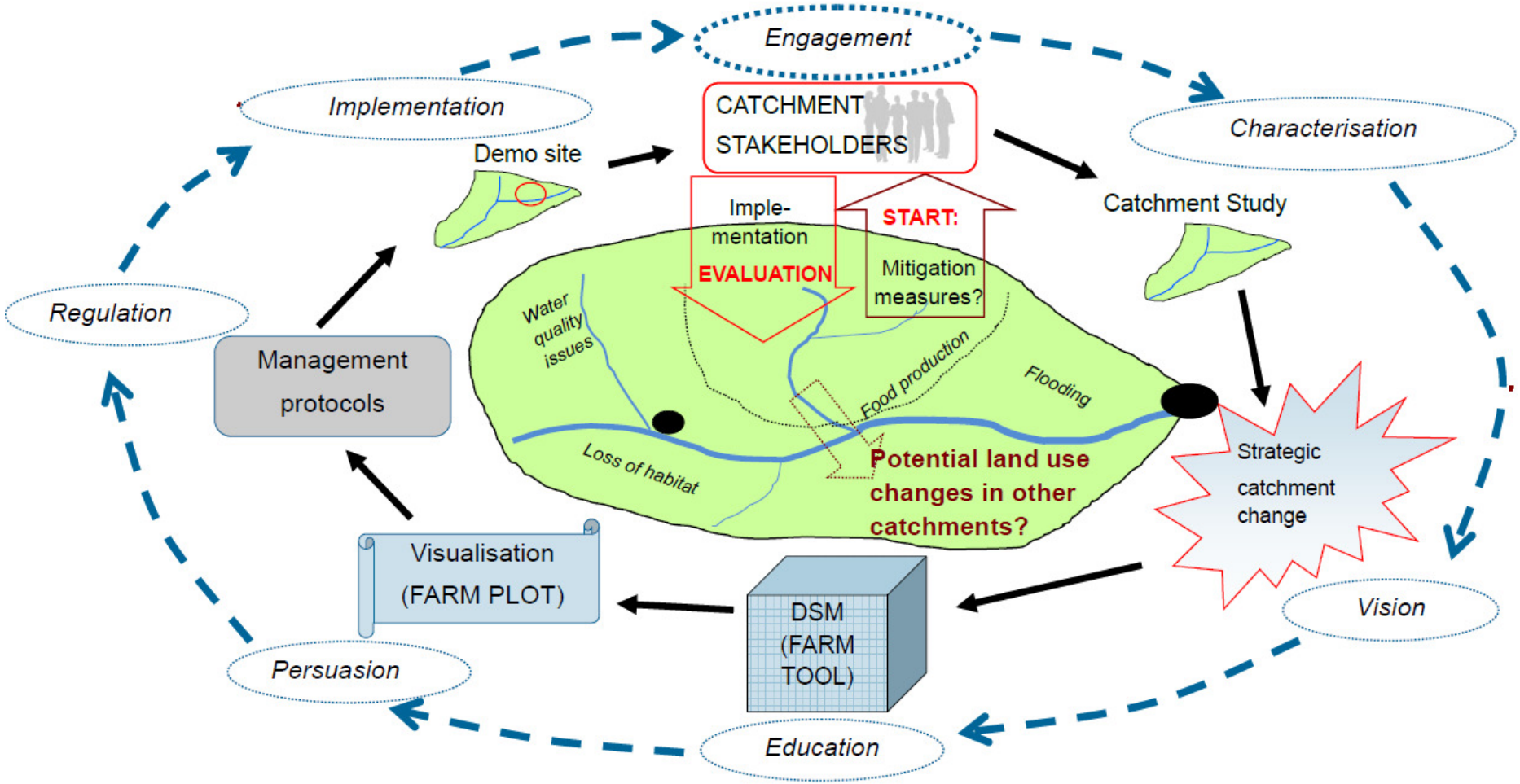
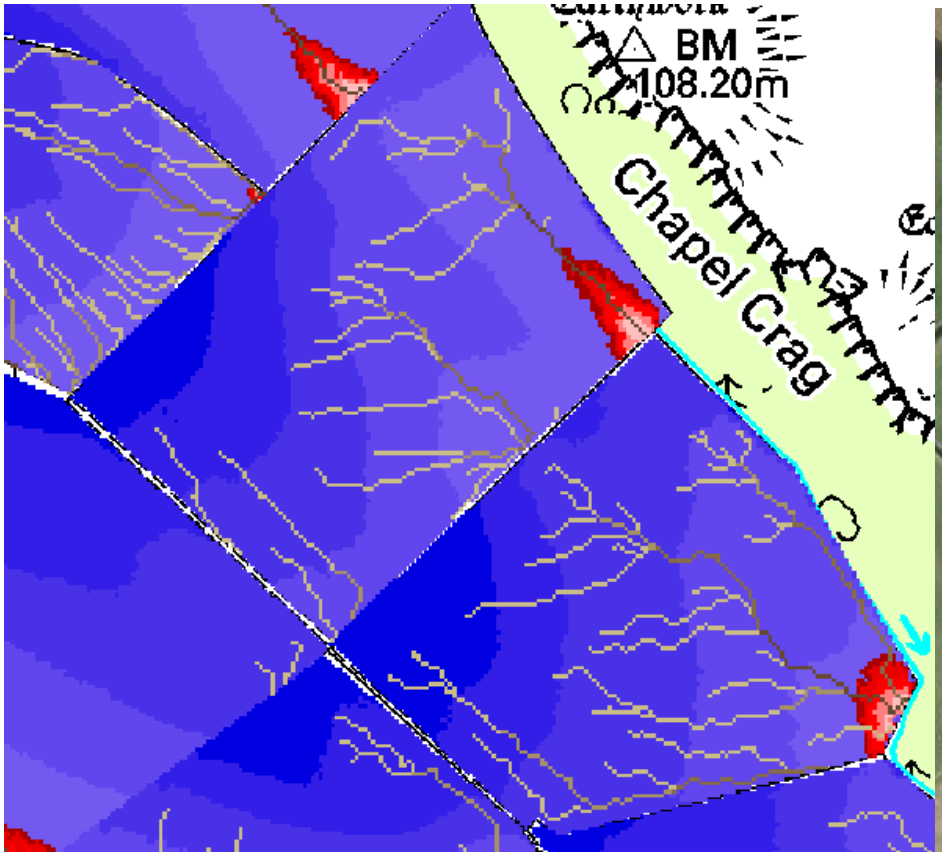
Belford – The catchment engineering toolkit

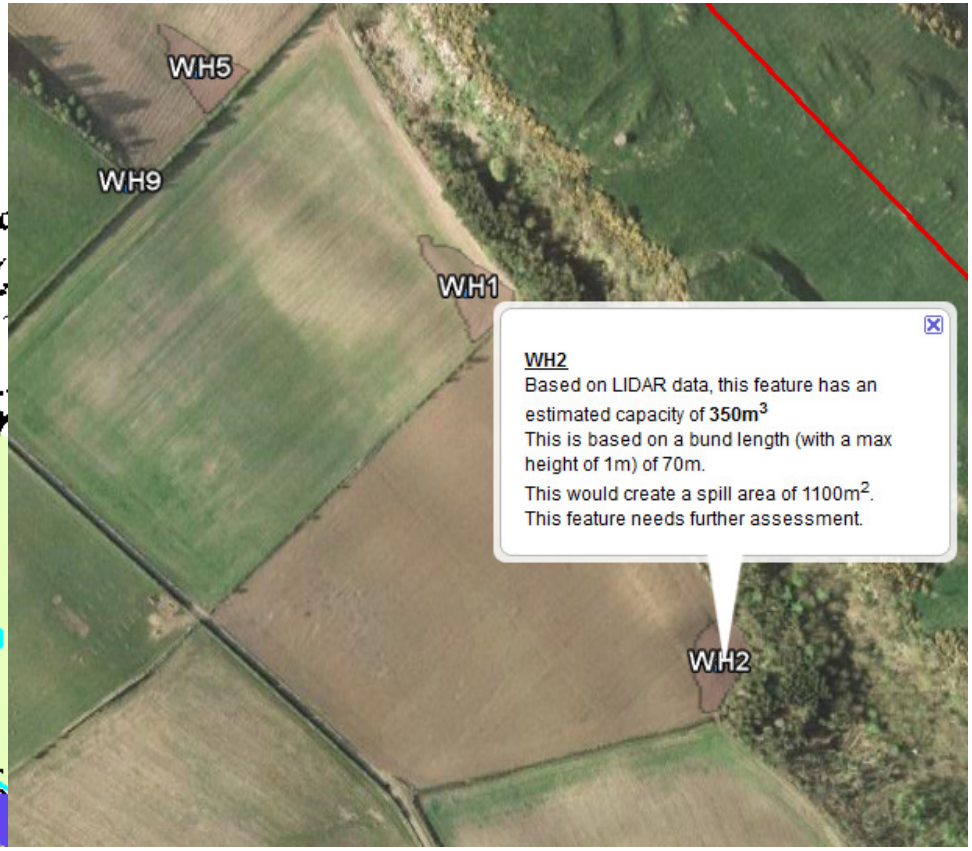


Stakeholder engagement

Stakeholders have been consulted with throughout the project and are a vital part in the delivery of the project

Farm Pond LOcatation Tool (Farm PLOT)





- Use of Lidar data: locate flow pathways and potential storage areas
- Export information to Google Earth

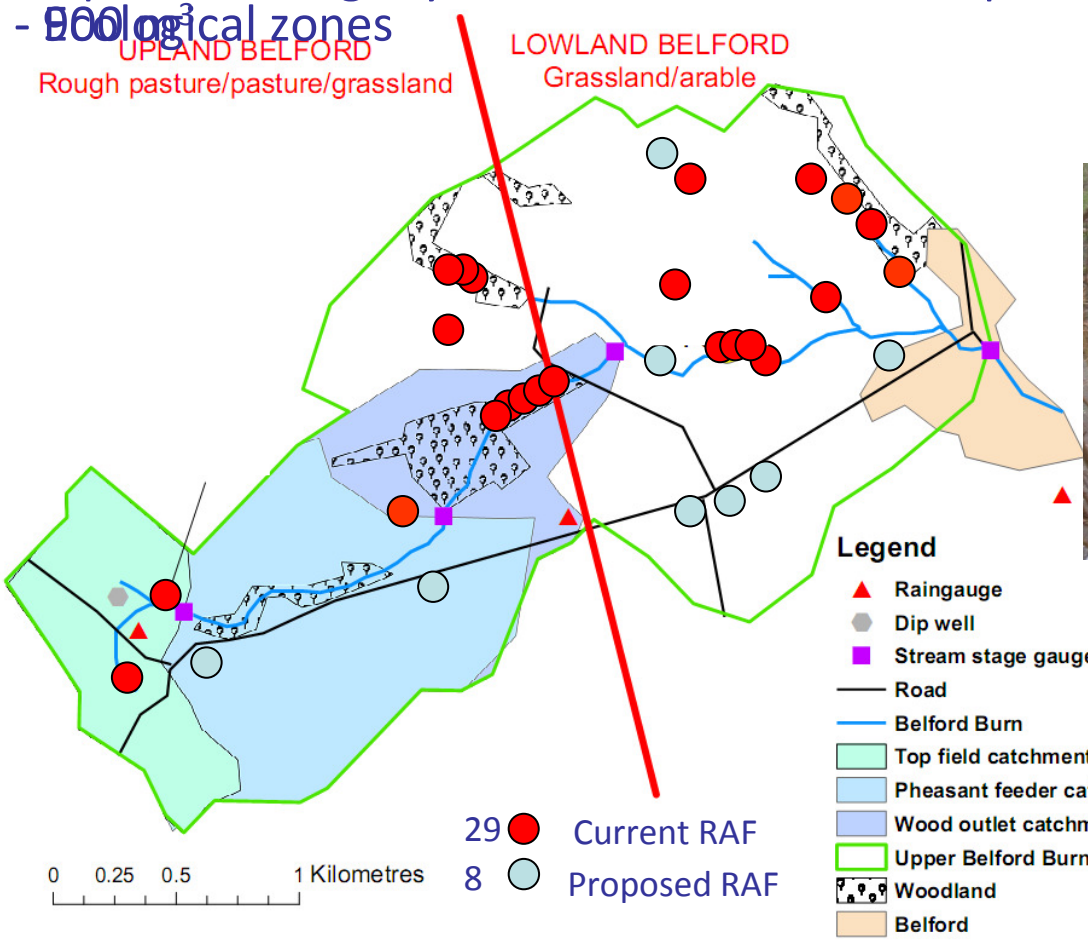
Instrumentation and mitigation

Ponds

Ladys Well RAF: A RAF that collects surface runoff

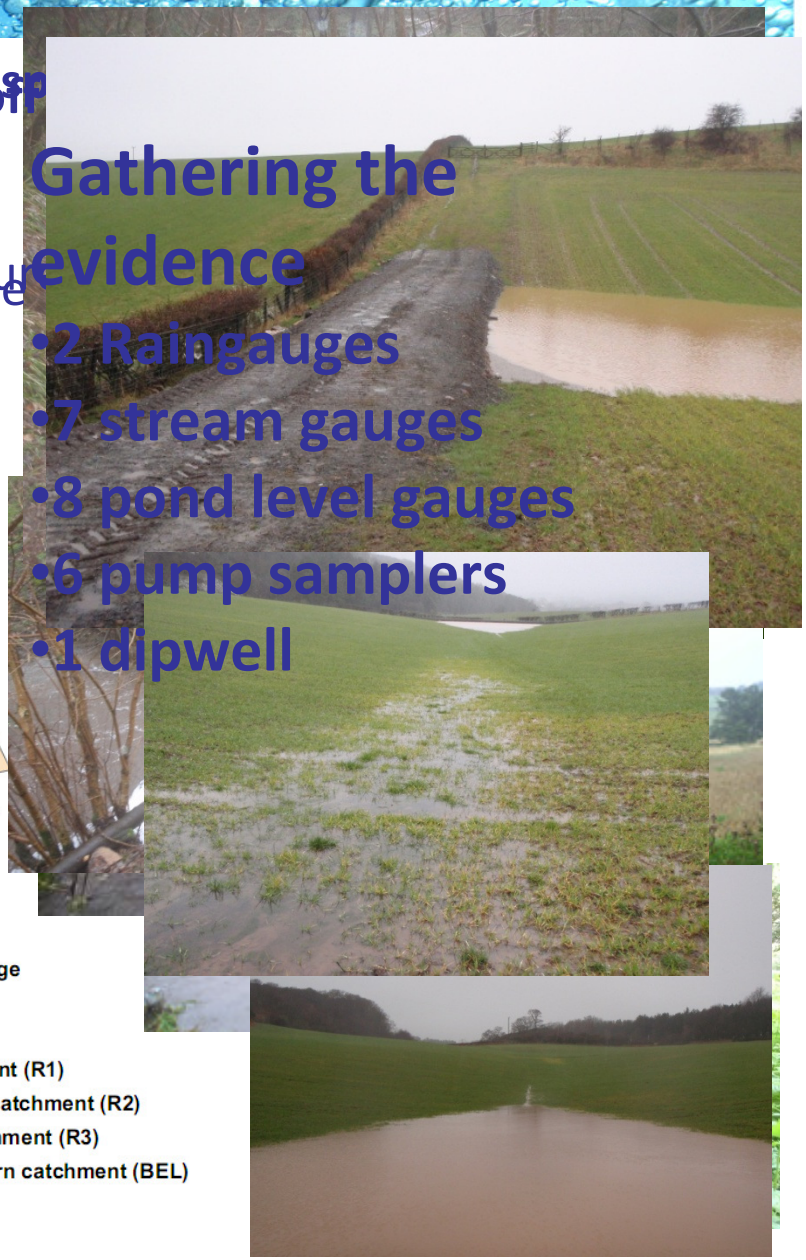
- Collects overland flow in steep sided field
- Acts as road over low point
- Pipe raised slightly to allow for sediment capture

- 200m³



Gathering the evidence

- 2 Raingauges
- 7 stream gauges
- 8 pond level gauges
- 6 pump samplers
- 1 dipwell



Upland RAFs on peat soils and grassland with shallow soils


Belford proactive flood solutions


Belford proactive flood solu


Belford proactive flood solutions

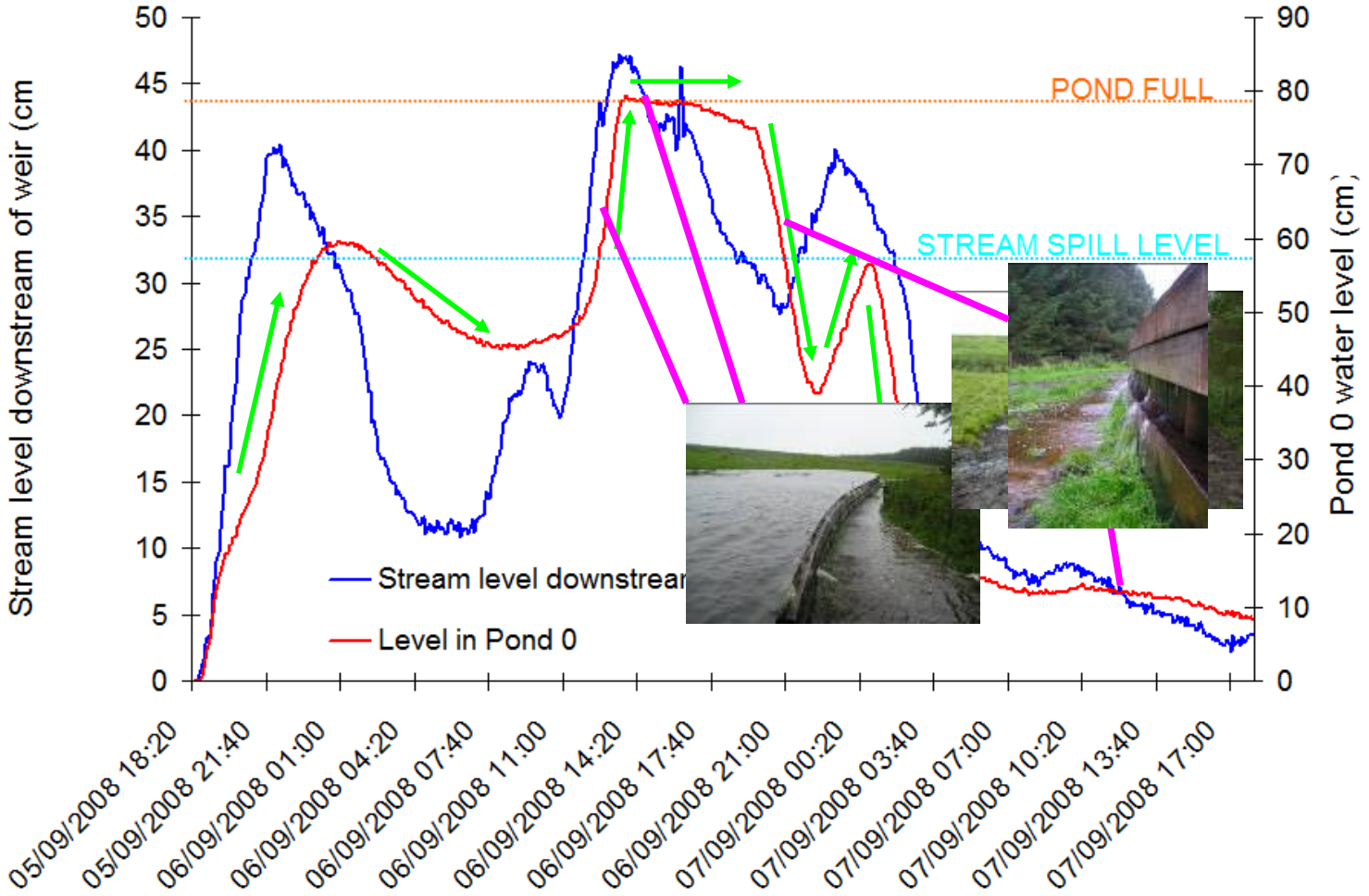

Belford proactive flood solutions

Storm information

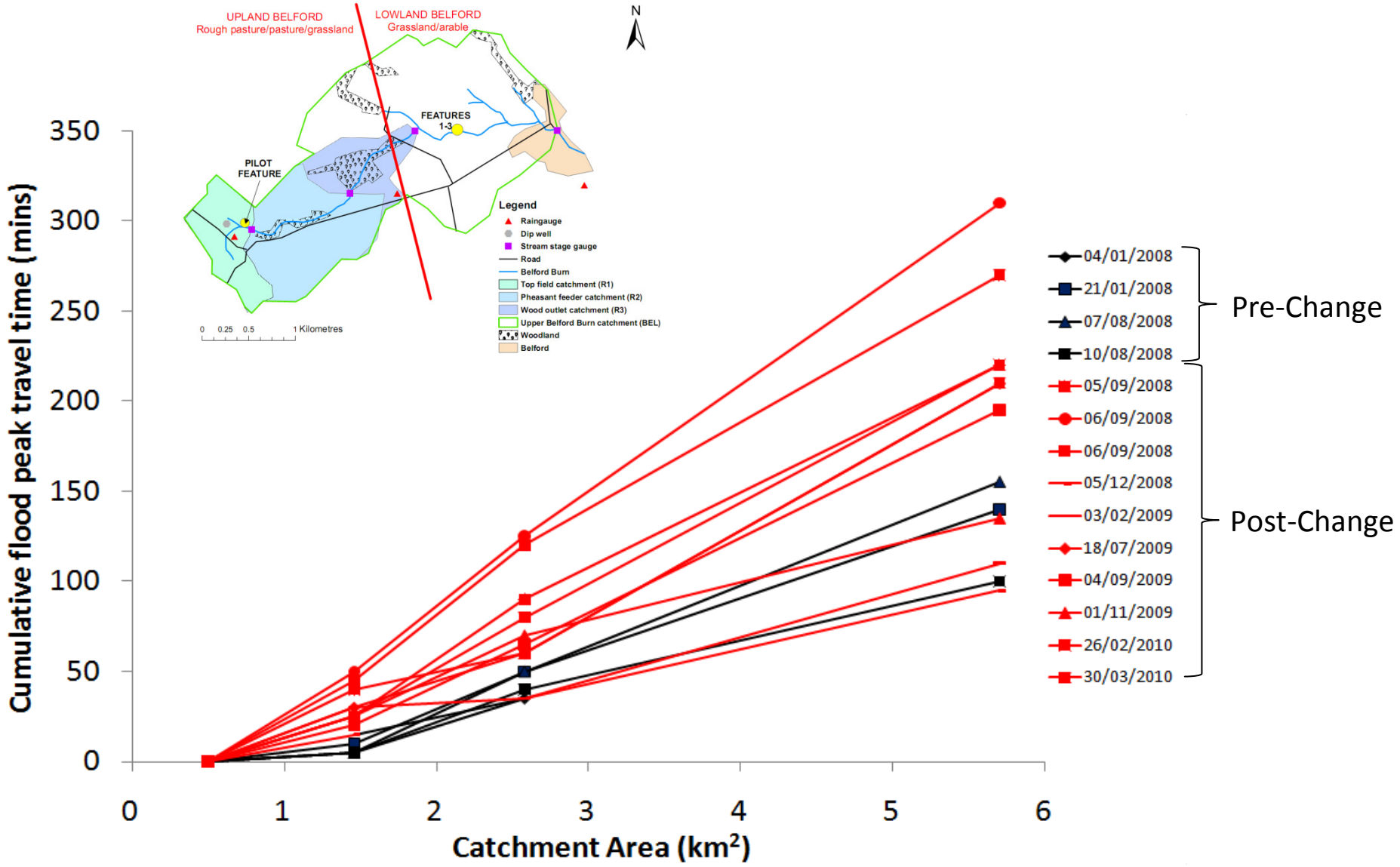
RANK	Name	Dates	Storm Duration	Rainfall (mm)	% of yearly average rainfall	BELFORD LEVEL
1st	**Mar-10**	29-30 Mar 2010	30	**62.4**	**9**	**1.54**
2nd	**Jul-09**	17th July 2009	43	**102.6**	**15**	**1.431**
3rd	**Sep-08**	5-7th Sept 2008	45	**99.6**	**14**	**1.375**
4th	**Jan-10**	16th Jan 2010	8	**12.4**	**2**	**1.32**
5th	**Nov-09**	1st Nov 2009	9.5	**32**	**5**	**1.075**
6th	**Sep-09**	2nd-4th Sept 2009	40	**65**	**9**	**0.865**
7th	**Feb-09**	3rd Feb 2009	17	**29.8**	**4**	**0.869**

We now find the use of return intervals inappropriate for this catchment

Pilot pond – Sept 2008 flood



Travel time of peak



The community feeling

After September 2008 floods – During construction

July 2007 – Before the project

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Councils

Belford flood scheme used as example

Posted by **The Journal** on Feb 1, 09 02:53 PM in **Councils**

Berwick MP Sir Alan Beith has met the Environment Agency to ask about improvements to flood defences in Northumberland.

He was hopeful that progress was being made. "The Agency is clearly very pleased with the work at Belford on catchment ponds and are now actively looking at developing similar schemes in other areas."

We'd like to hear from you.
Send your stories, pics and videos to **northumberland@ncjmedia.co.uk**

Uptake

Further sites in Northumberland taking the runoff management approach

cheviotfutures
united in a changing landscape

Netherton

NORTHUMBERLAND RIVERS TRUST

National Trust

Dyke Head

NATURAL ENGLAND

BELFORD

Powburn

Environment Agency

Hepscott

NAFFERTON FARM

FWAG

Summary

- **Hands on**, multi-objective work is a cost effective way to catchment management
- Different Runoff Attenuation Features (controlling fast runoff pathways, while tackling water quality and other issues) have been implemented in the catchment **in partnership with farmers and local landowners**
- Visual observations and preliminary data show the effectiveness of the features locally
- However, more data, data analysis and modelling are required to quantitatively assess the impacts of the features at the catchment scale

Year 5 begins today!

- **And finally, today is the 4th birthday of the monitoring network.**
- Happy Birthday!

LEVEL RECORDER	R1
Date/time	Corrected stage (m)
16/11/2007 13:30	-0.80599064
16/11/2007 13:35	-0.7979463
16/11/2007 13:40	-0.80492413
16/11/2007 13:45	-0.80407932
16/11/2007 13:50	-0.80312366
16/11/2007 13:55	-0.80810149
16/11/2007 14:00	-0.804168
16/11/2007 14:05	-0.80610149
16/11/2007 14:10	-0.80099064
16/11/2007 14:15	-0.80199064

Environment Agency

Civil Engineering and Geosciences
Newcastle University

Research.ncl.ac.uk/proactive/

Wilkinson ME, Quinn PF, Welton P. (2010)
Runoff management during the September 2008 floods in the Belford catchment, Northumberland. Journal of Flood Risk Management, 3(4),

Belford Proactive Flood Solutions is an Environment Agency Project funded by the North East Local Levy, raised by the Northumbria Regional Flood Defence Committee though Local Authorities.