Assessing the water quality impact of the UK winter (2013/14) floods on contrasting urban catchments

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Project Background

- The POLLCURB project aims to assess how water **poll**ution can be related to **c**hange in **urb**an areas, particularly in response to urbanisation.
- UK population to increase by 16% in 20 years.
- Particular pressures will be experienced in London and the south-east so focus is on Thames Basin (experimental sub-catchments in Bracknell (The Cut) and Swindon (The Ray)).
- Projections of future land-use change to determine impacts on hydrological dynamics and water quality and help inform decision making.

POLLCURB at BHS 2014

POLLCurb
Urbanisation and water security

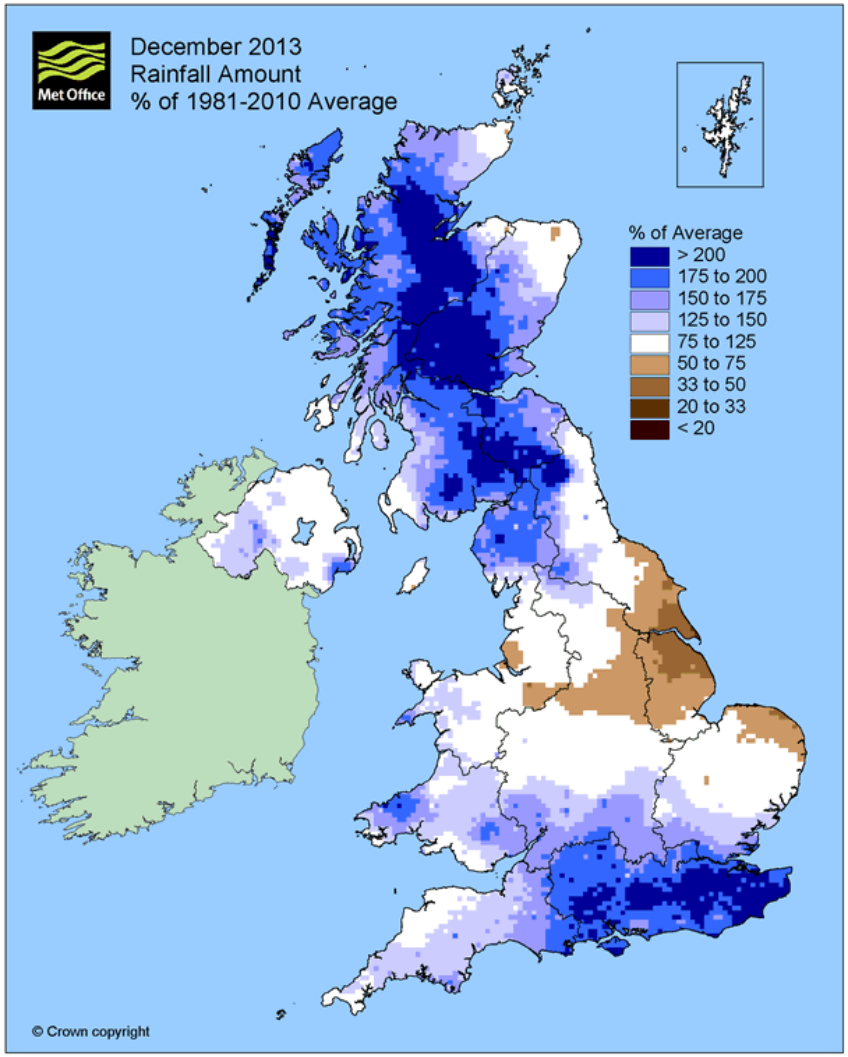
- 4-3(P): **Michael Hutchins**, Thomas R. Kjeldsen, Soon-Thiam Khu, Simon Dadson, James D. Miller, Clare Rowland, Scott J. McGrane, Matt Loewenthal, June Jones and Gianbattista Bussi – *Predicting future change in water flows and quality in the River Thames basin*

- 5-4(P) **James D. Miller** – *Impacts of urban land-use and imperviousness upon hydrological response – observations from field monitoring in two urbanised catchments*

- CEH POLLCURB exhibition – feel free to pop by and chat with one of us!

Background

- The 2013/2014 winter resulted in a sequence of intense storms across the UK.
- Record rainfall and few dry days resulted in saturated ground and responsive conditions.
- Rivers breached record levels, especially across the south-east and Thames basin.



(Met Office, 2014)

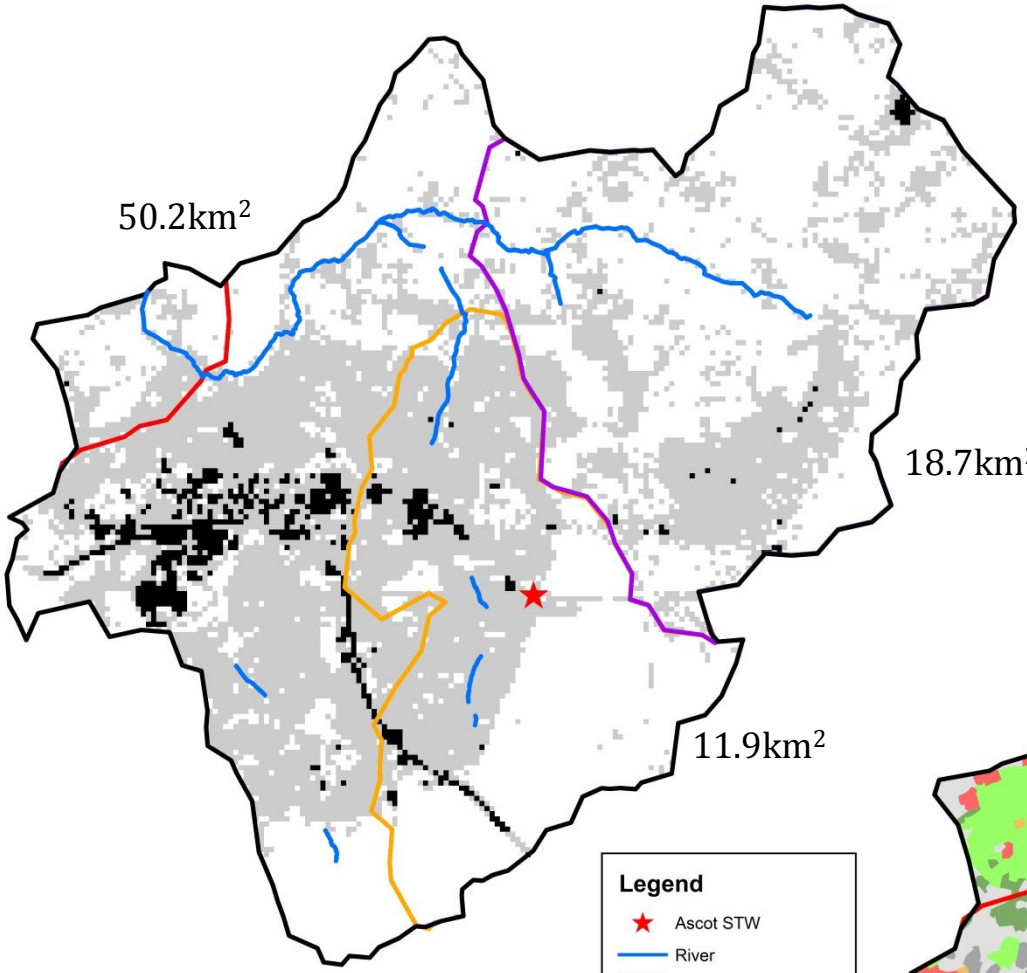
Farleigh Hungerford, Somerset (BBC News, 2013)

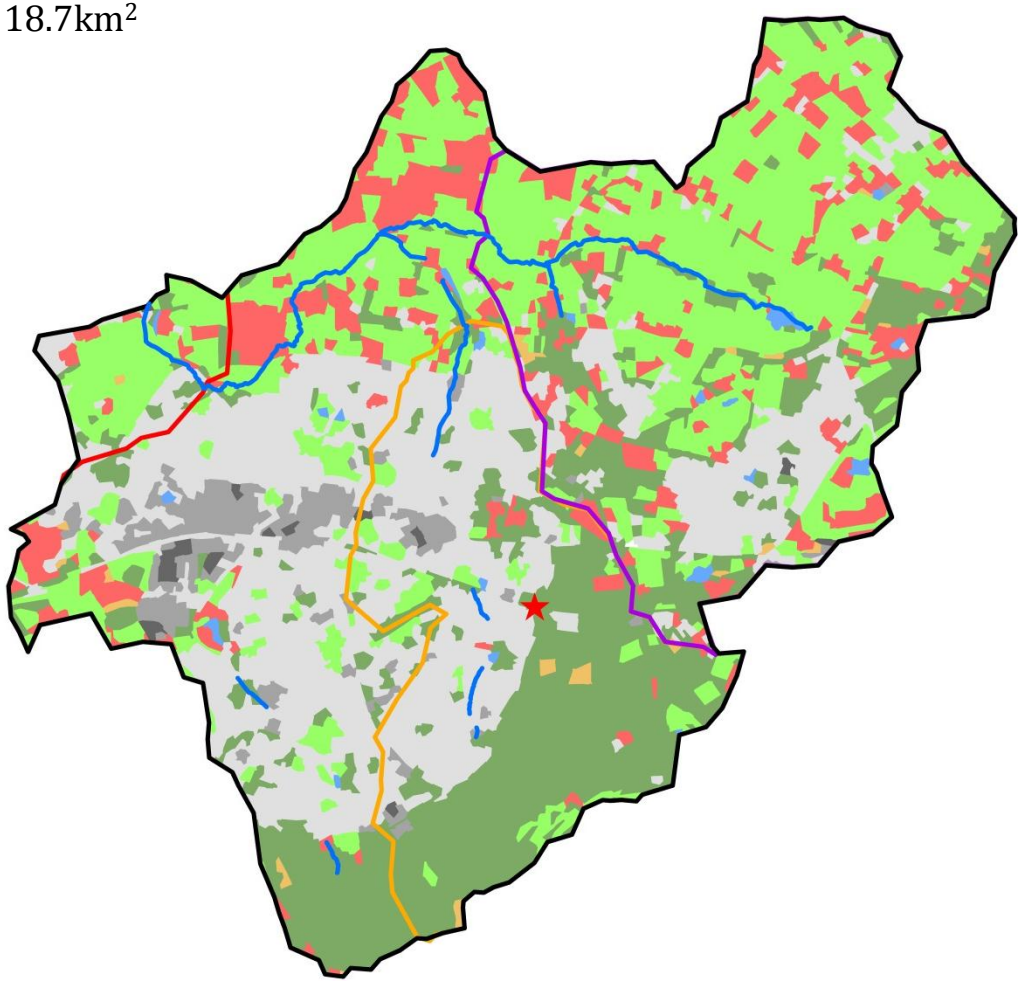
Leatherhead, Surrey

Ironbridge, Shropshire (ITV News, 2013)

Guildford, Surrey

The Cut (Bracknell)





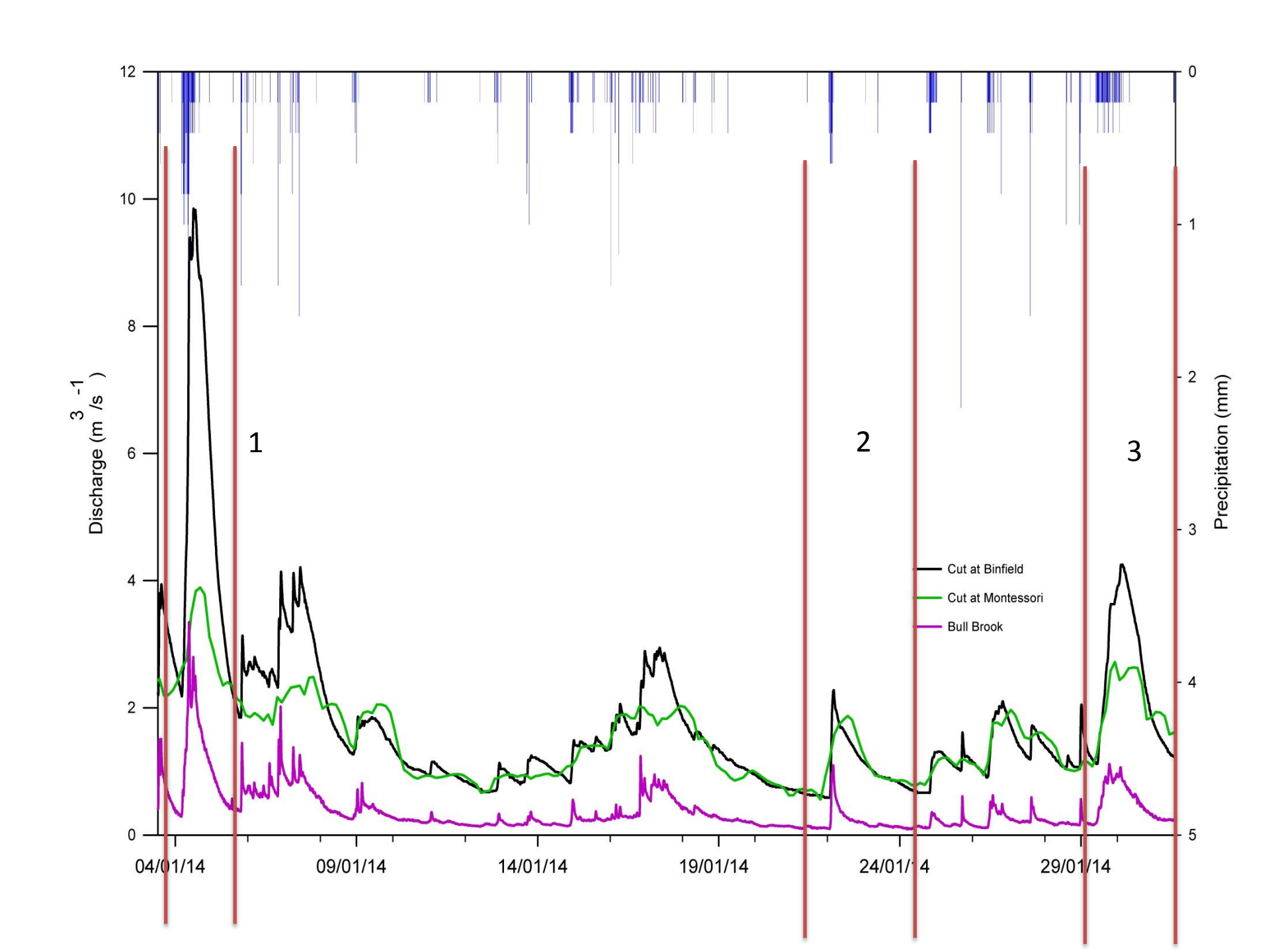
Legend

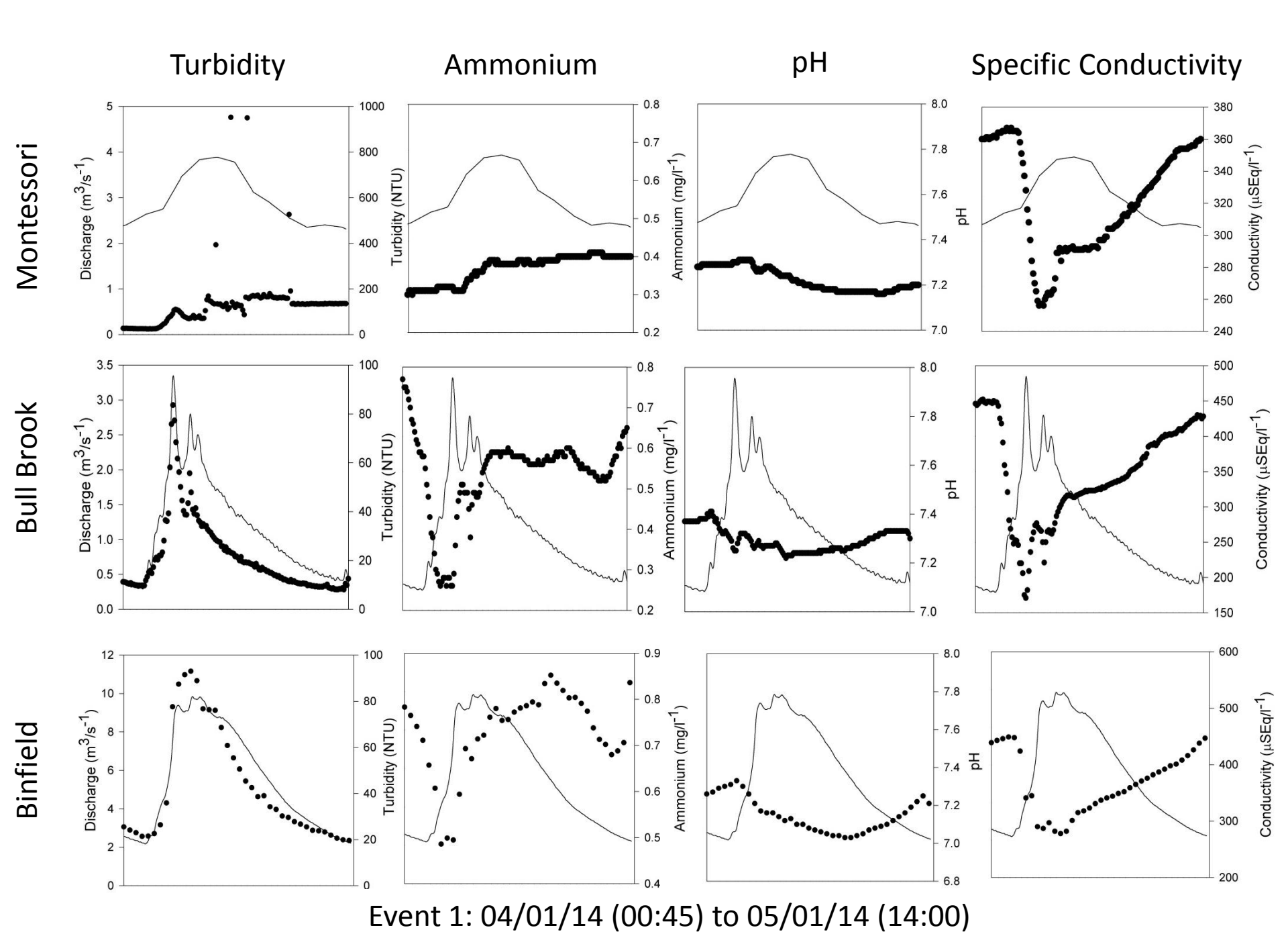
- Ascot STW
- River
- The Cut
- Montessori
- Triple Bore
- Bull Brook

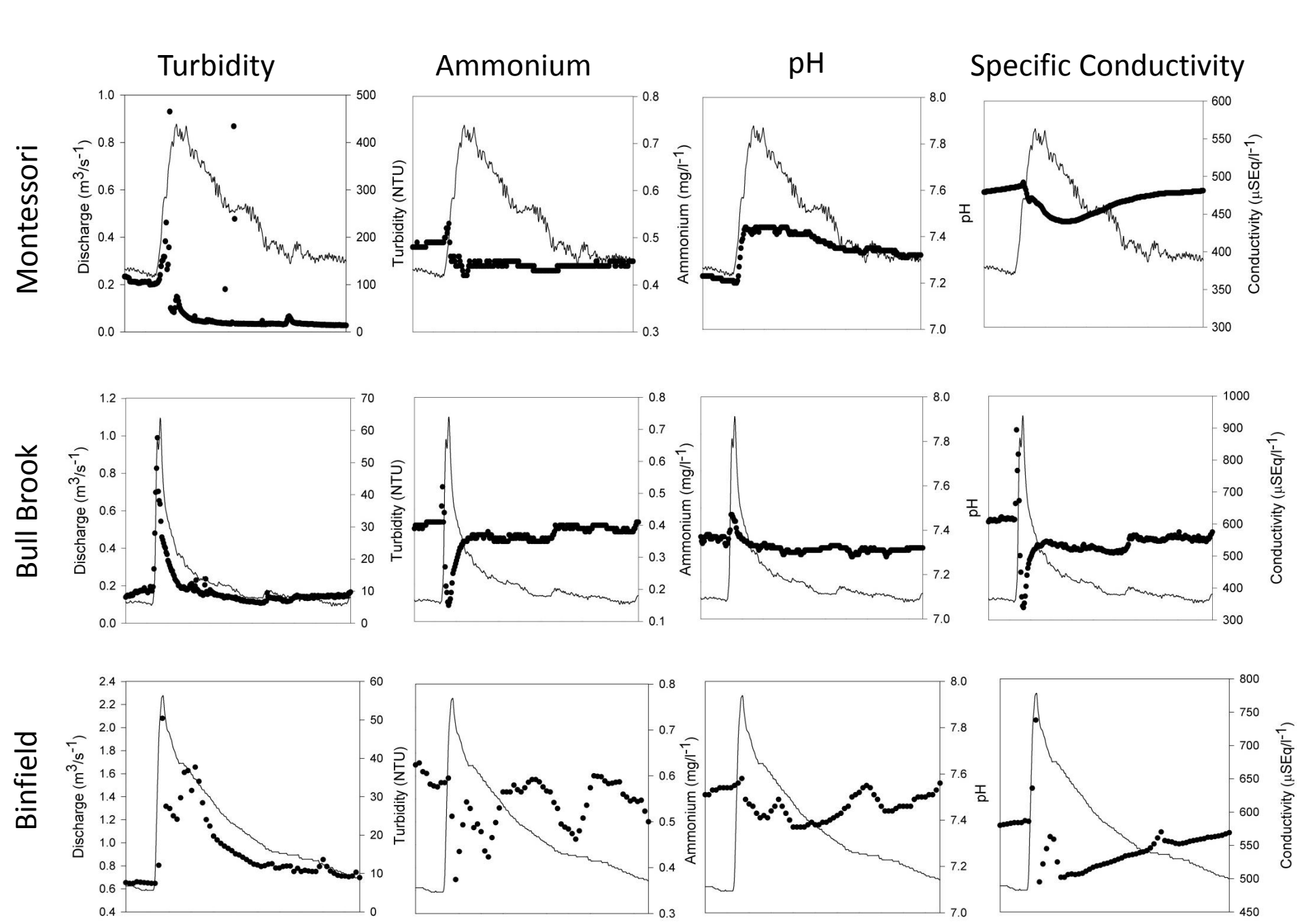
- Arable
- Bare, Despoiled Land
- Forestry
- Grassland
- Water
- Suburban
- Urban
- Urban industrial

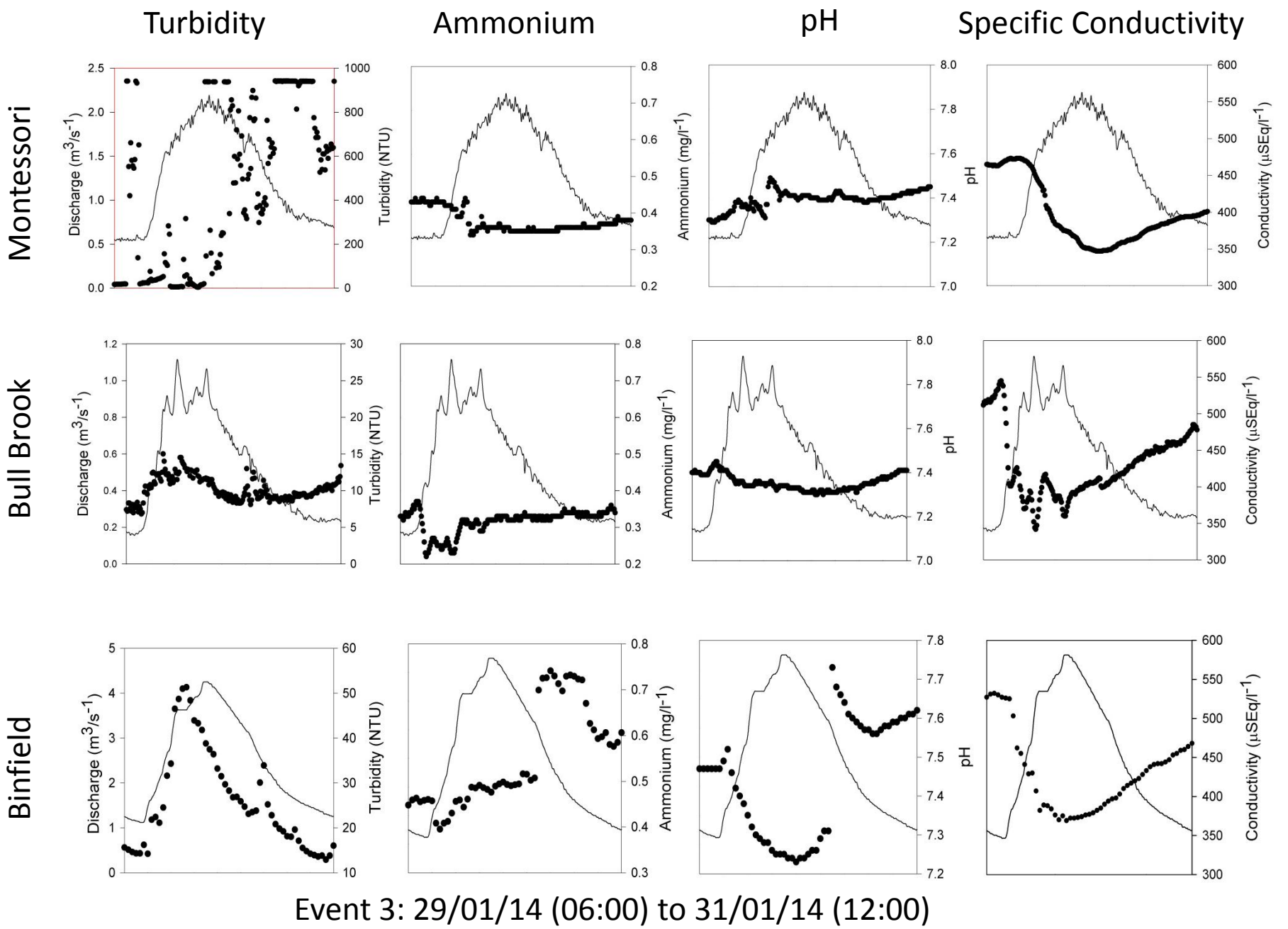
Data and Observation Methodologies

- **Precipitation** – several tipping bucket gauges deployed across catchment area capturing at 5-minute intervals.
- **Discharge** – Unidata Starflow devices installed across the catchment and monitoring 15-minute resolution flow.
- **Water Quality** – 4 deployed YSI 6600 Multiparameter sondes capturing a suite of WQ metrics (pH, temperature, dissolved oxygen (% saturation and mg/l^{-1}), ammonium, turbidity and specific conductivity) at 15-minute resolution and a 1-hour permanent fixture at outlet.
- **Land Use Data** – LCM2007 dataset (for now) 2m LiDAR data.


Discharge (m3/s-1)
Precipitation (mm)
12
10
8
6
4
2
0
0
1
2
3
4
5
1
2
3
Cut at Binfield
Cut at Montessori
Bull Brook
04/01/14
09/01/14
14/01/14
19/01/14
24/01/14
29/01/14

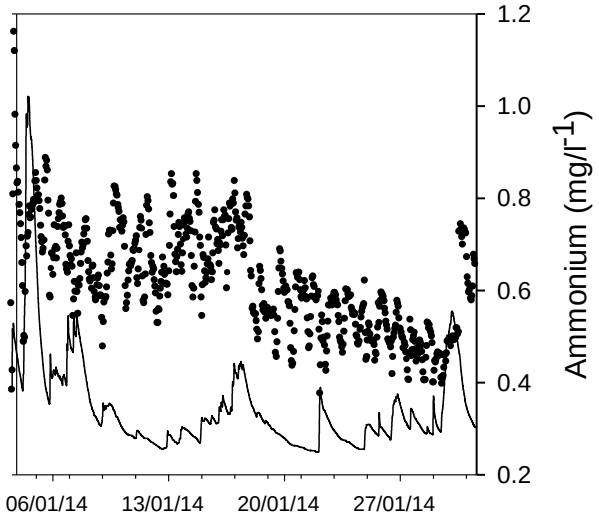

Turbidity
Ammonium
pH
Specific Conductivity
Montessori
Bull Brook
Binfield
Discharge (m3/s-1)
Turbidity (NTU)
Ammonium (mg/l-1)
pH
Conductivity (µSEq/l-1)
Event 1: 04/01/14 (00:45) to 05/01/14 (14:00)

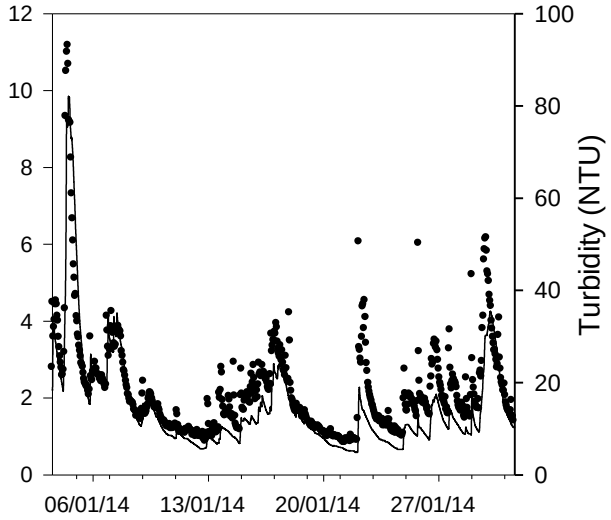

Turbidity
Ammonium
pH
Specific Conductivity
Montessori
Bull Brook
Binfield
Discharge (m3/s-1)
Turbidity (NTU)
Ammonium (mg/l-1)
pH
Conductivity (µSEq/l-1)
Event 2: 21/01/14 (18:00) to 24/01/14 (10:00)


Turbidity
Ammonium
pH
Specific Conductivity
Montessori
Bull Brook
Binfield
Discharge (m3/s-1)
Turbidity (NTU)
Ammonium (mg/l-1)
pH
Conductivity (µSEq/l-1)
Event 3: 29/01/14 (06:00) to 31/01/14 (12:00)

Future Work

- Longer-term context – first flush vs constant events.
- Expansion of analysis to River Ray and subcatchments – similar land-use classifications.
- Derivation of suitable water quality model structure relative to land-use metrics.
- Future land-use change scenarios.
- Future climate change scenarios.





Conclusions

- Storm events resulted in unprecedented hydrological conditions and created unique opportunity to characterise land-use response.
- Marked contrast between water quality and land-use.
- Rural problems with sediment and siltation with continual fluxes.
- Urban signal much more responsive to storms.
- Much work still to do!

Acknowledgements

With thanks to: Natural Environmental Research Council (NERC); Mr Matthew Loewenthal (Environment Agency); Ms June Jones (Environment Agency); Bracknell Forest Council, Swindon Borough Council and Thames Water UK

NERC SCIENCE OF THE ENVIRONMENT

Environment Agency

Thames Water

Bracknell Forest Council

Swindon Borough Council