HR Wallingford
*Working with water*

# SuDS design criteria for catchment flood protection

## Are current criteria appropriate?

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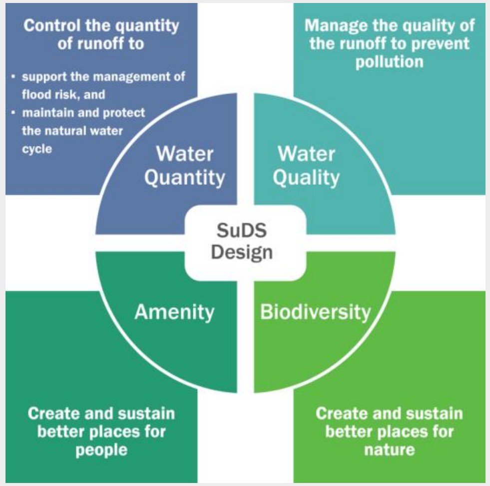
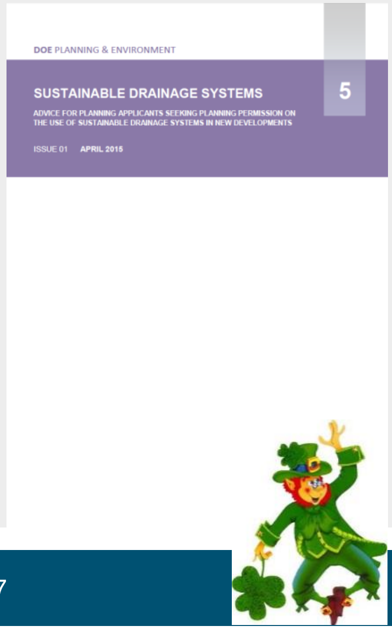
# Drainage design for catchment flood protection

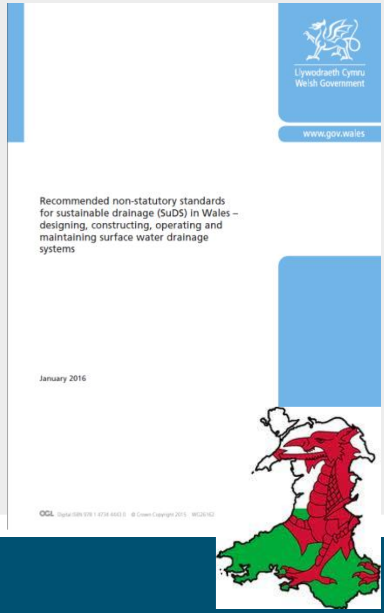
- All countries of UK (roughly) in alignment, BUT
  - Is it best practice?
  - Does it effectively protect against flooding?
  - Is it cost-effective?

# What about river morphology and pollution?

- Is the environment protected from urban pollution?
- Are we minimising water abstraction?





# Current practice

## Aligned (largely) with the SuDS Manual

- SuDS Non-statutory technical Standards LASOO (2015) - England
- Water Assessment and Drainage Assessment Guide (2015) - Scotland
- Interim standards for sustainable drainage systems (SuDS) (2016) – Wales
- SUDS: Advice for planning….. (2015) DoE N. Ireland.

## Surface water attenuation volume

- Peak flow control:
  - Option A) 1:1yr, 1:100yr greenfield peak flow rate with
    - Volume control for 1:100yr 6hr Greenfield volume,
  - Option B) Qbar (minimum 2l/s/ha)
- Volume control (morphology / pollution):
  - Interception (no runoff for 5mm rainfall)
- Climate change: 20% to 40%
- ➢ Critical storm duration ~24+ hours (100 – 150mm)

# Cost overview

## Current national cost of storage

- Large developments
  - 10 – 15$m^3$ / house
- Small developments
- ~ 5$m^3$ / house
  - (due to minimum flow rate / throttle size)
- COST
  - @£500 / $m^3$/ house @ 200,000 houses / yr = £1000M/yr!!

## Is this cost effective in protecting others from flooding?

- 40% uplift on rainfall due to climate change doubles the storage volume.

# So what's wrong?

## But if we are all agreed as to what we should do, why rock the boat?

- Are there inconsistencies in current design practice?
- What are the opportunities for improvement to this procedure?
- What obstacles are in the way of change?

## Our challenge is to exist in harmony with the natural environment by:

- Minimise eco-system impact
- Minimise resource consumption

But we must also focus on:

- Effective flood risk mitigation
- At minimum cost

# Greenfield runoff measurements

## FSR / FEH / ReFH

3 Approved methods for planning

- River-based analysis

## ReFH2 current research

- Plot scale and urbanised catchments
  - Limited details available

## ADAS 345 (MAFF 5) / Prudhoe and Young (LR565) and others

- Field drainage / Small catchments
  - Event duration based on site Gradient, Soil and Area

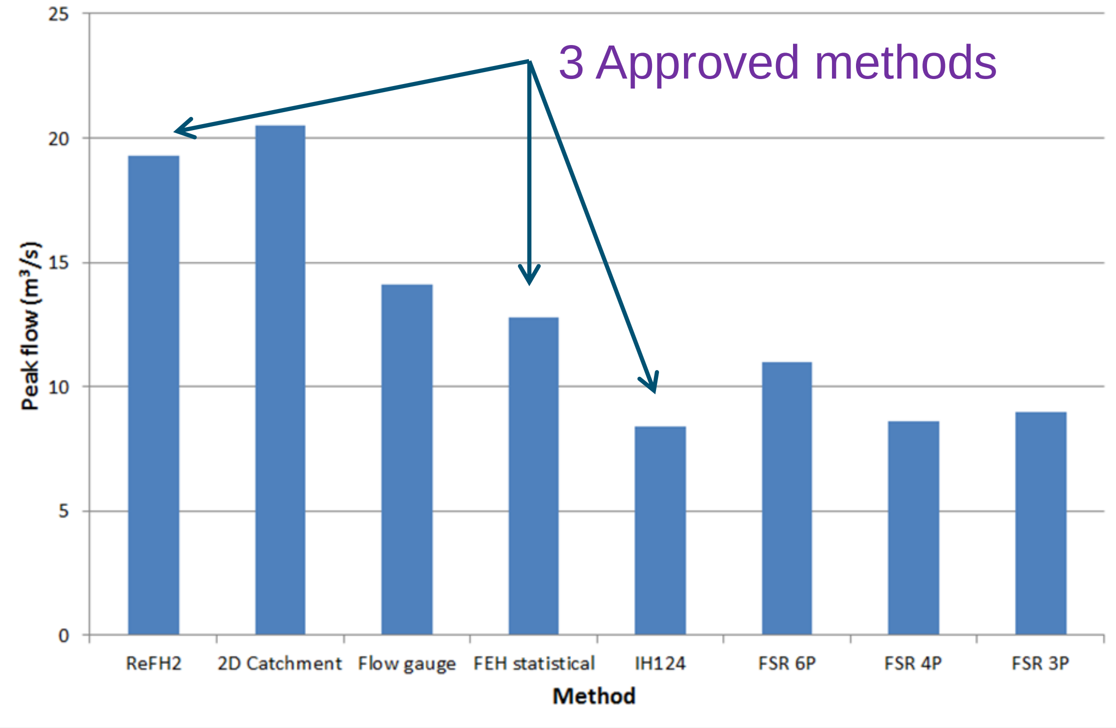
## Rodda & Hawkins

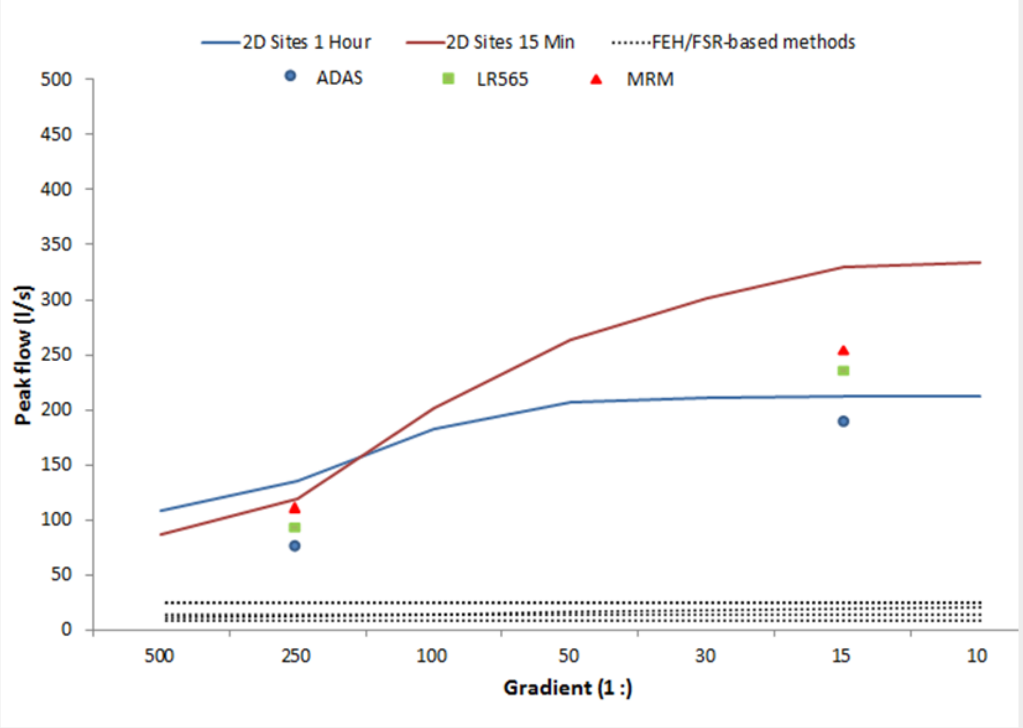
- *Testing greenfield runoff estimation techniques using high resolution field observations*
  - Journal of flood risk management (2012)

# ReFH2 - 2D study on Greenfield runoff linked to site gradient

## 2D ICM model of 8km² catchment

- Calibrated to ReFH2 on the catchment
- Then used for predicting 1ha plot scale runoff of different site gradients




8km² steep catchment
5.5hr critical duration

1ha site
15 mins and 1 hour events

# Rodda & Hawkins

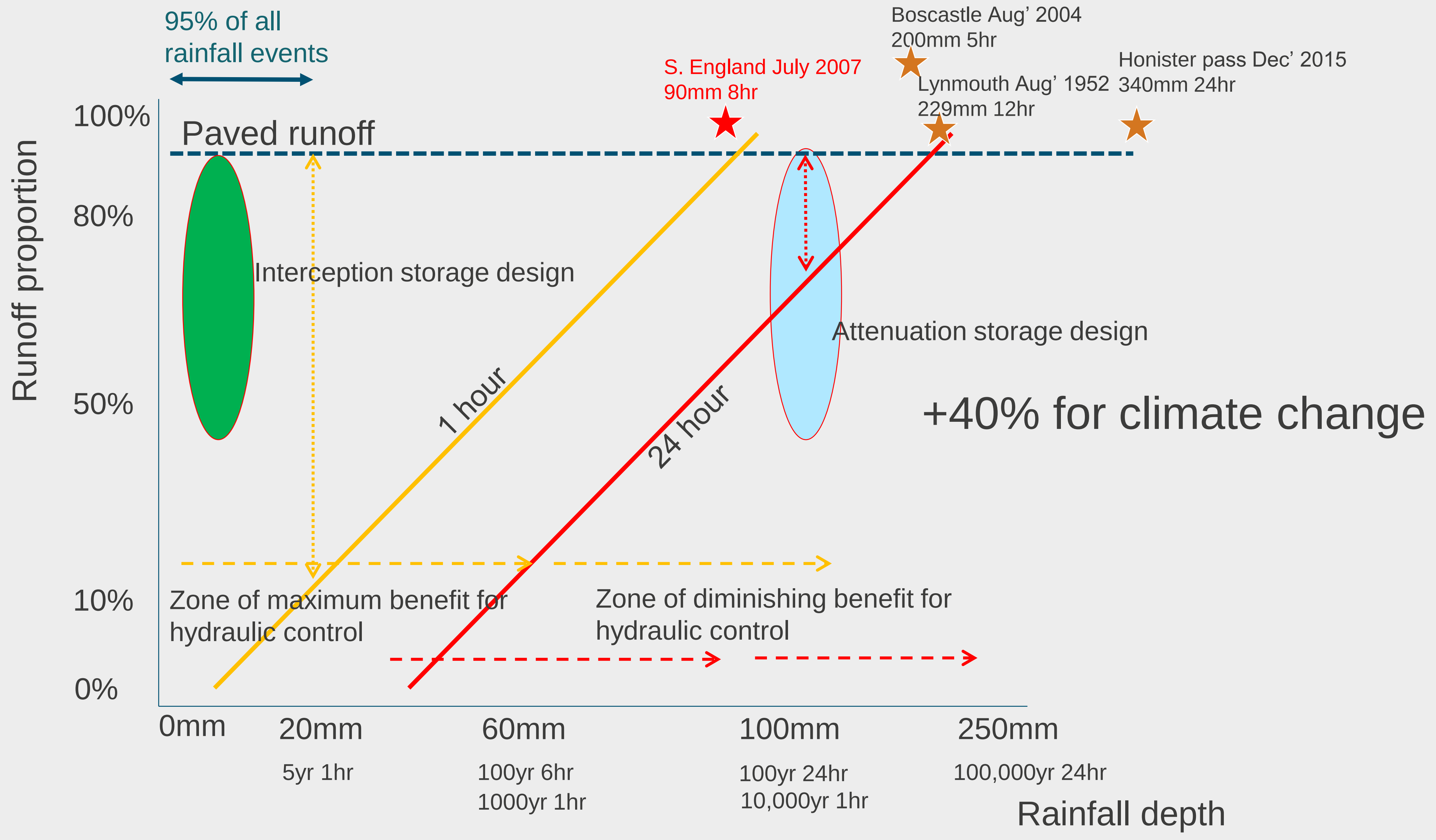
## Rowden drainage experiment

- Fourteen 1 ha plots monitored 9/2006 – 12/2008
- 5 – 10% gradient
- Clayey catchment
  - IH124 predicted 1:100 yr peak flow of 18.9l/s
    - exceeded by 6 of the largest 10 peak flow events
  - ADAS 345 predicted 1:100 yr peak flow of 69.2l/s
    - exceeded by 2 of the largest 10 peak flow events

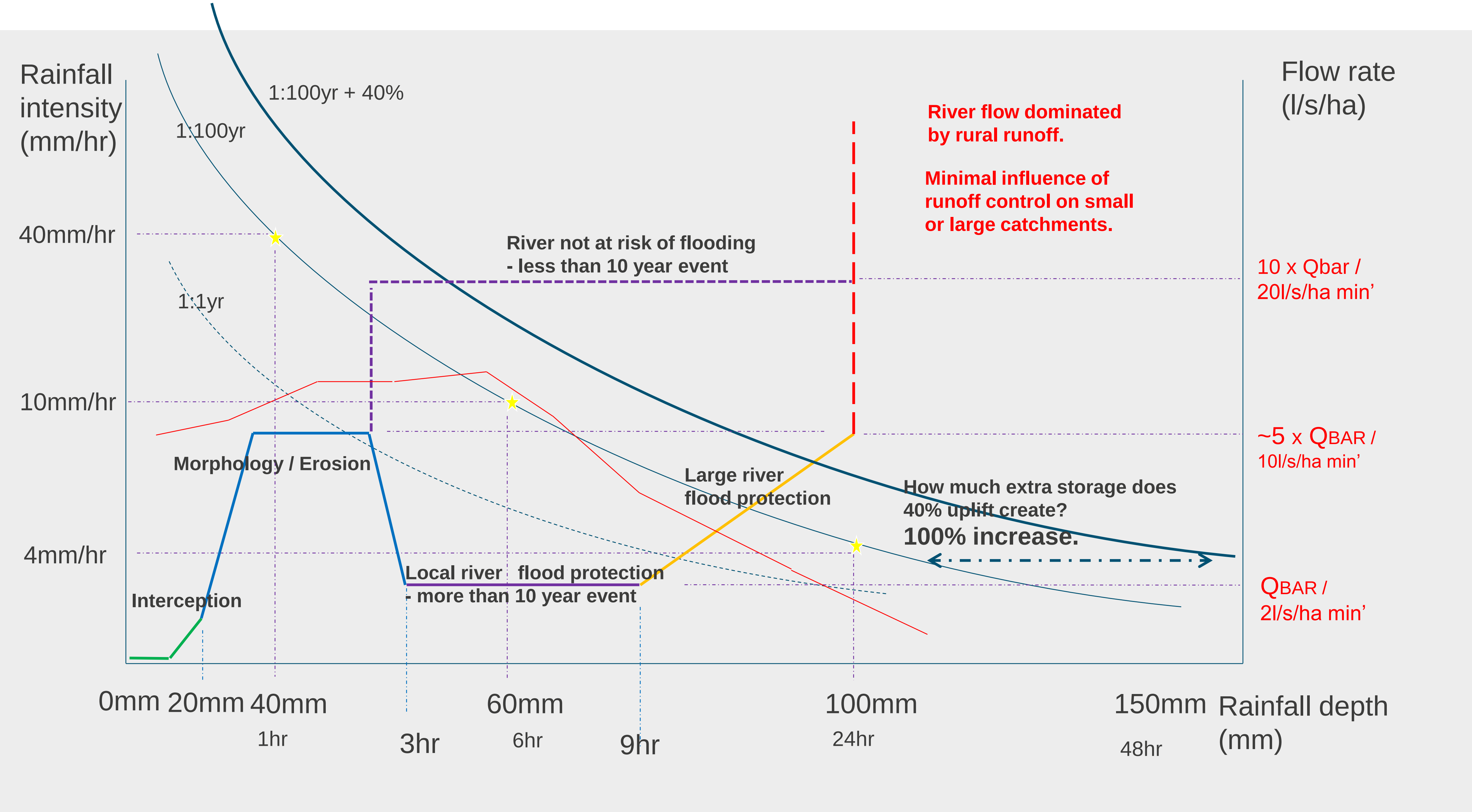
## Conclusion

- Greenfield runoff rates used for planning are all (probably) wrong
- HOWEVER - using a much faster greenfield runoff rate is not necessarily appropriate for protecting downstream areas.

# Reducing benefit of controlling runoff



# Receiving river control rule strategy?



# Weaknesses of current approach

- There are three “approved” methods for setting limiting discharge rates
  - FSR, FEH and ReFH2
- Discharges are not focused at catchment specific requirements.
  - Perhaps 90% of developments will be discharging to small streams / rivers
- No account is taken of diminishing proportion of additional runoff for extreme long duration events and catchments in flood from rural runoff
- There is little interest (yet) in applying volumetric rules on runoff
  - Flooding
  - Morphology
  - Pollution prevention
- Technology has yet to be used to obtain efficiencies in reducing storage volumes.

# Questions?