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How can we build reliable and resilient surface water flood management?

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Overview

1. Surface water flooding
2. Measuring reliability and resilience
3. Fast flood analysis to analyse urban resilience
4. Reliability and resilience in a UK case study

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1. **Surface water flooding**
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Surface water flooding in the UK costs 0.25 to 0.50 Billion GBP per year

Extreme surface water flooding is a global problem

EUROPEAN WATER ASSOCIATION

JSWA

Water Environment Federation®
the water quality people®

Future surface water floods are predicted to be **more likely** and **more extreme**

Many interventions exist, but current selection neglects extreme events

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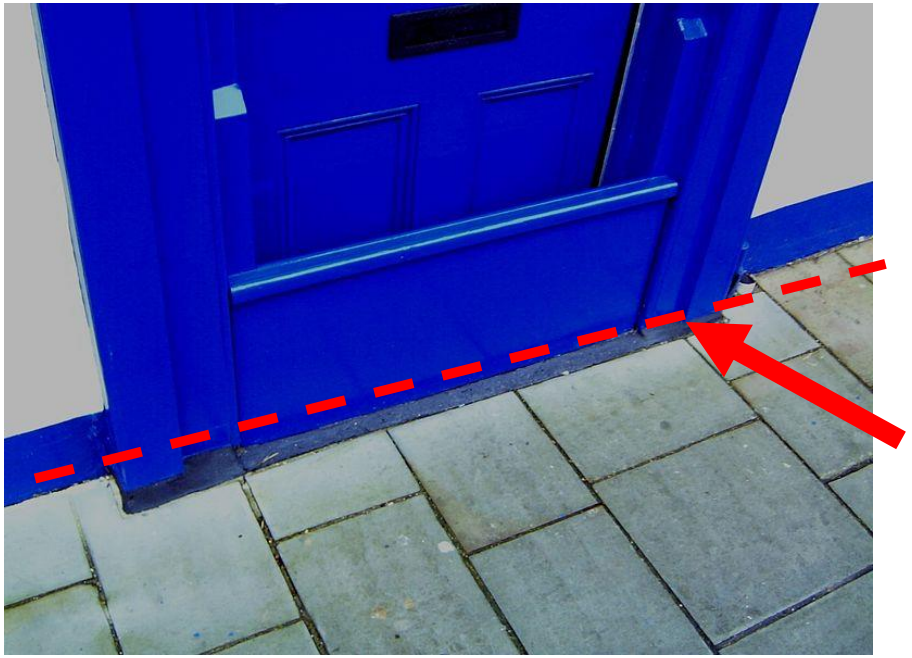
Current management techniques apply Reliability metrics to assess performance

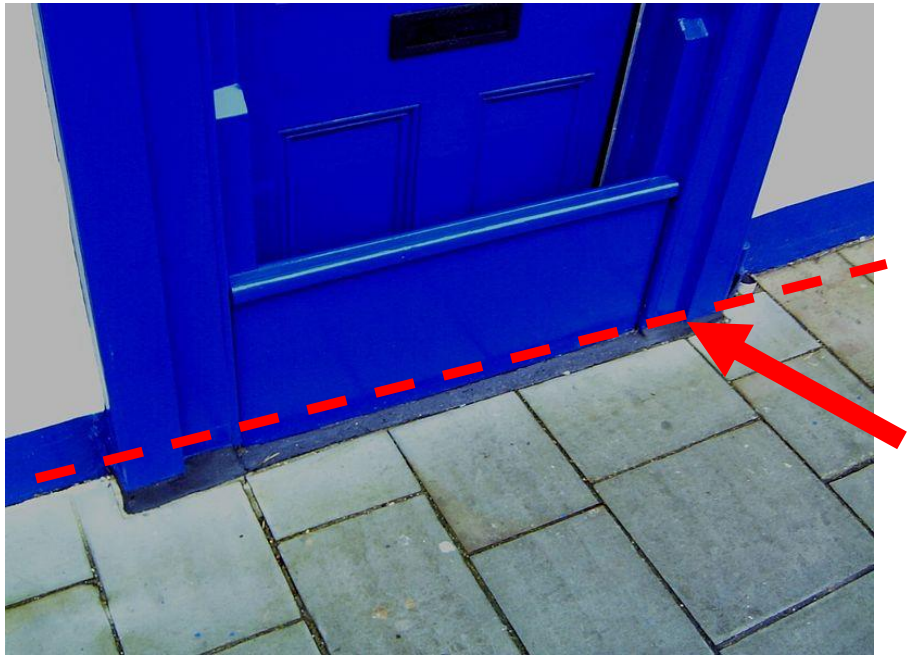
- Reliability aims *to minimise failures during normal (design standard) loading*.
- It is typically expressed in terms of failure probability.



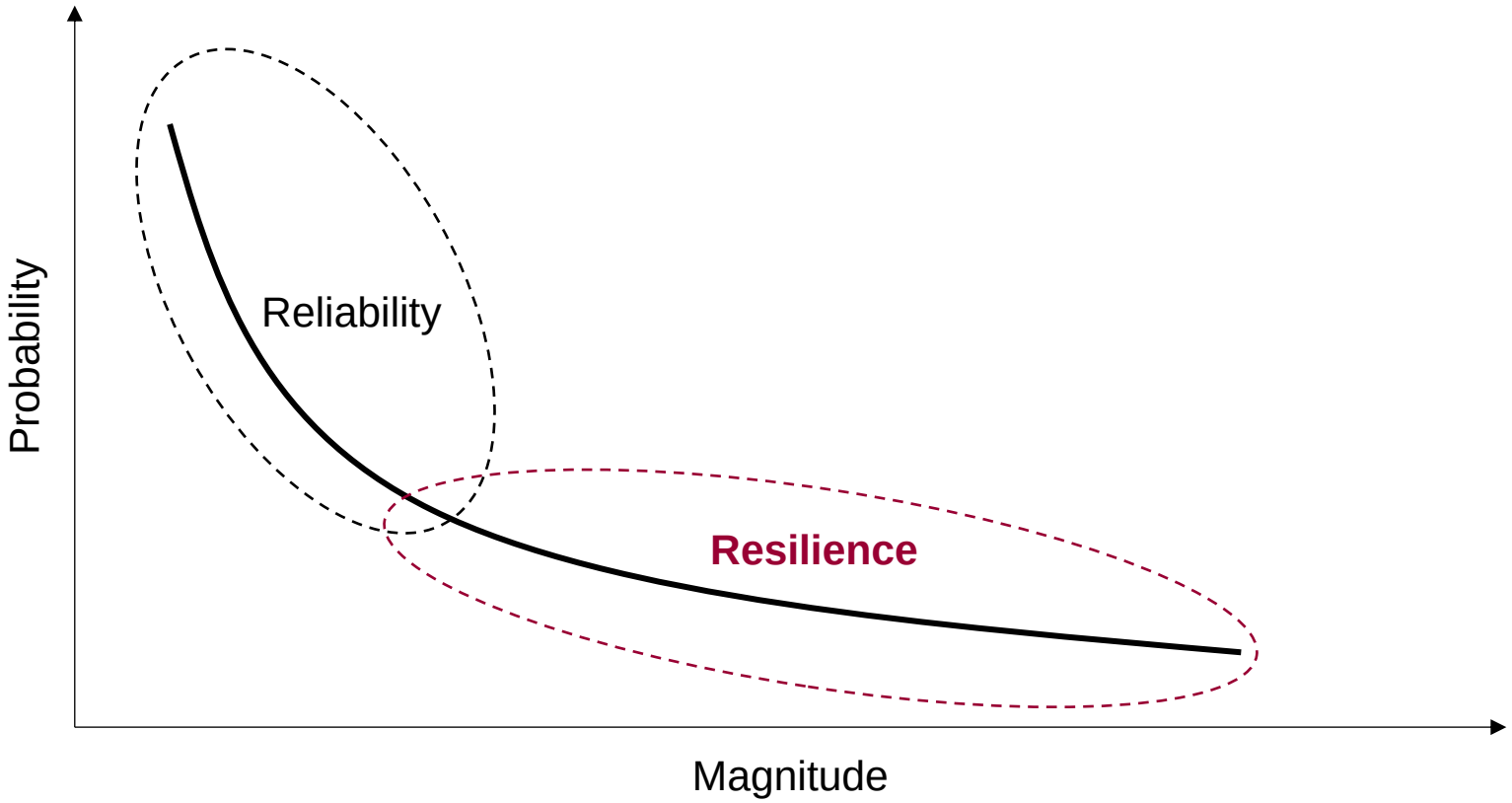
Reliability describes minimising failure across a **specified design standard**

Measuring Reliability

- Reliability is typically described as up to a design standard threshold.
- For example a ‘*1 in X year*’ event.



Resilience aims to manage extreme events



Resilience minimises failure **magnitude and duration** of **extreme events**

Measuring Resilience

- Resilience is measured through calculating the magnitude and duration of failure across extreme events.
- Measuring resilience requires an approach capable of analysing high magnitude events,
- Simulating extreme rainfall this can be very computationally demanding.

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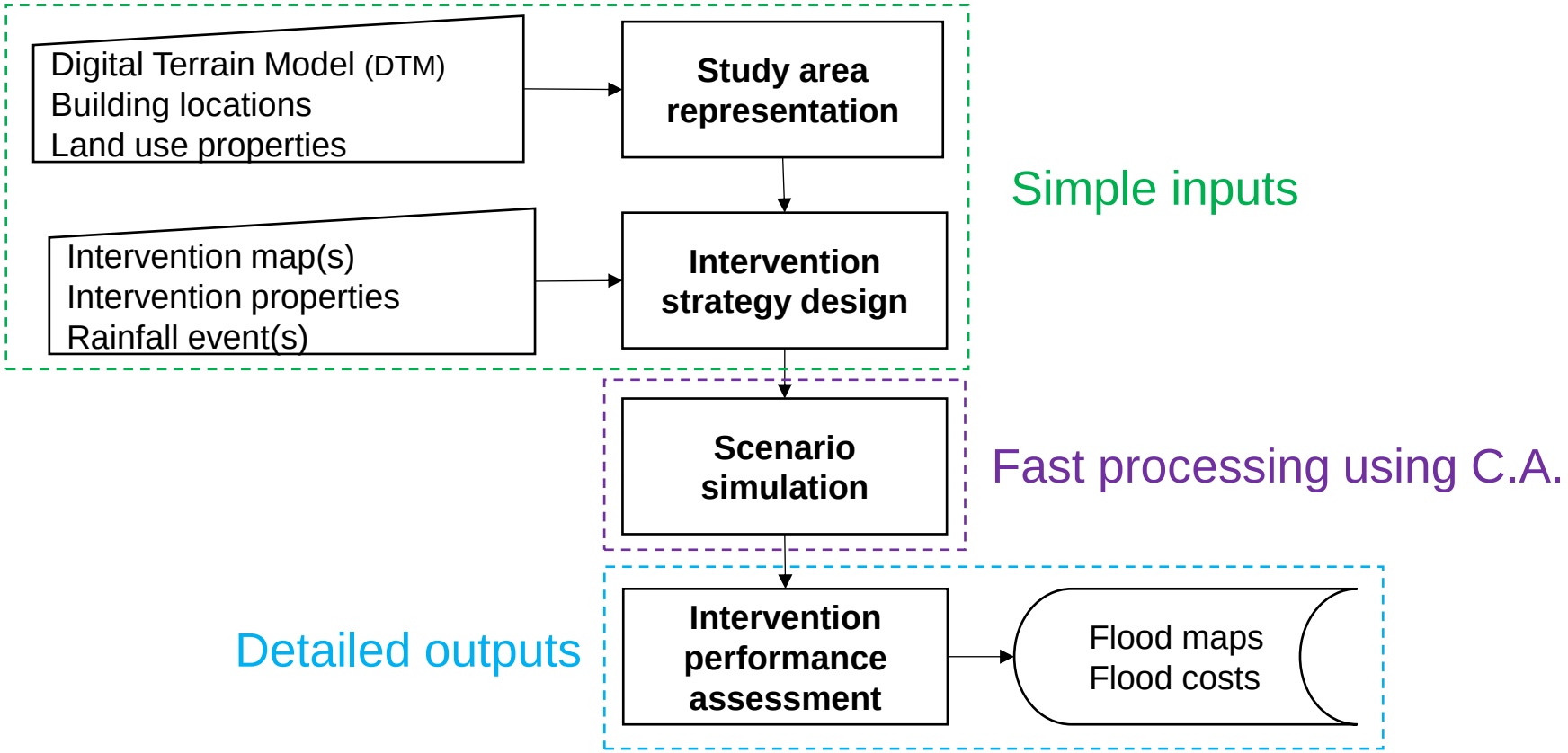
Fast Flood Assessment for analysing resilience



Fast flood assessment is applied as a screening method for decision support

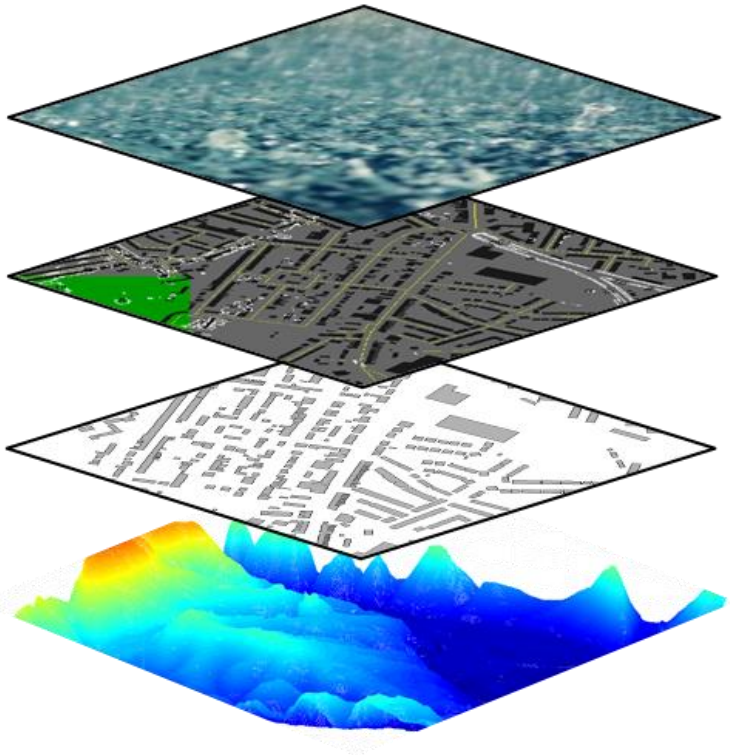
1. Simple inputs to represent urban area

Rainfall hyetograph

Land use classification

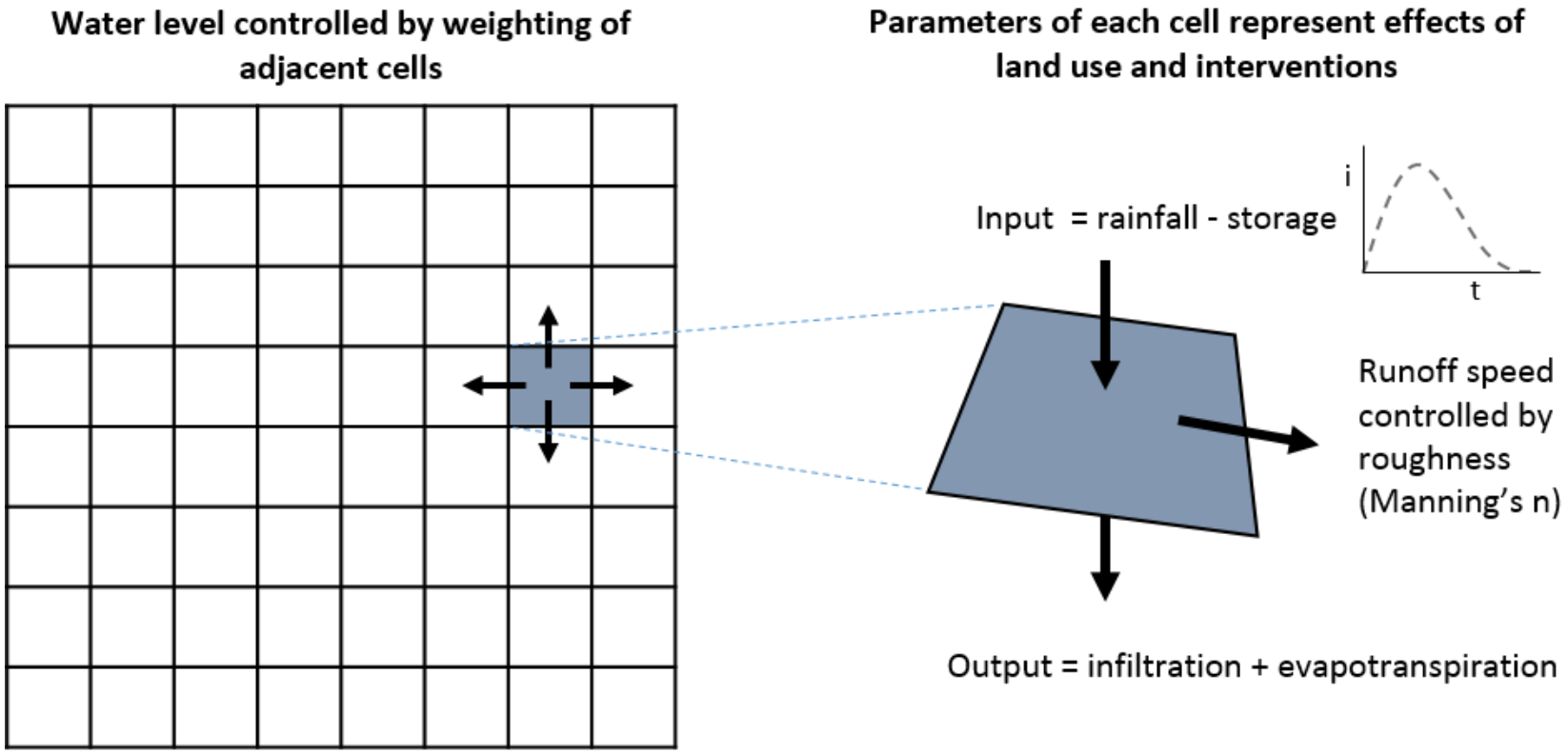
Building polygons

Digital elevation model



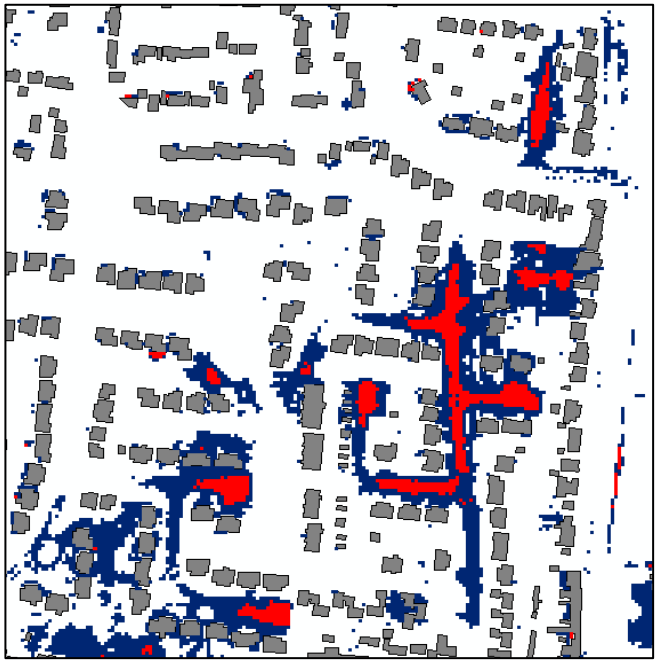
Urban catchments are represented using simple, **easy to access data**

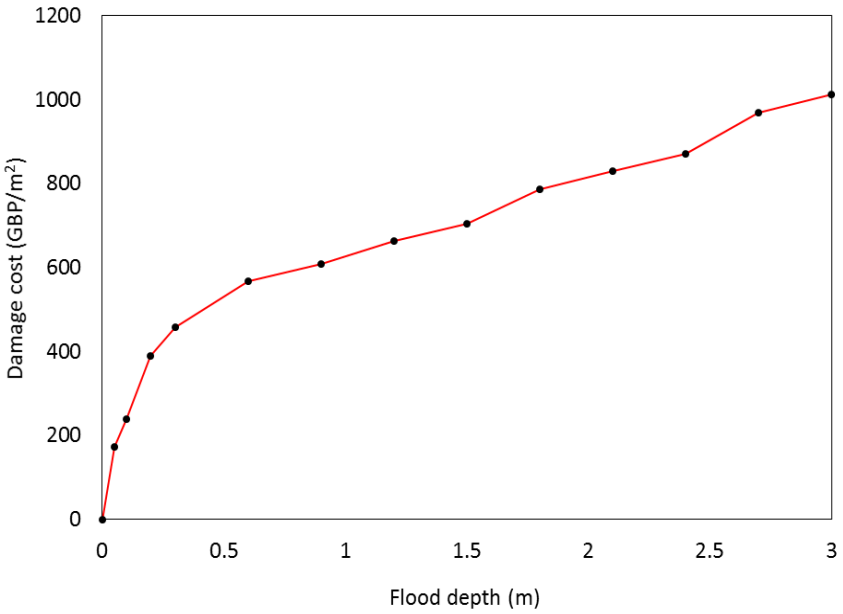
2. Fast analysis using cellular automata models



Simplified representation of options results in **very fast model speed**

3. Detailed economic analysis using GIS





Costs are calculated by overlaying **peak flood depth across properties**

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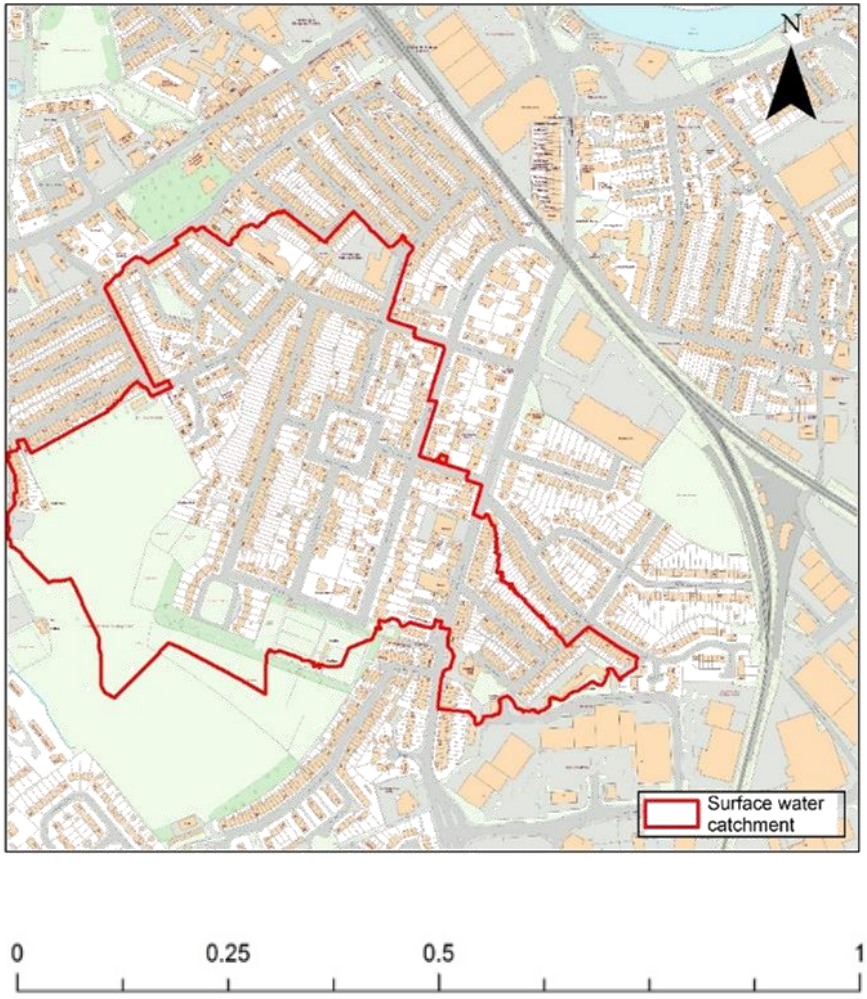
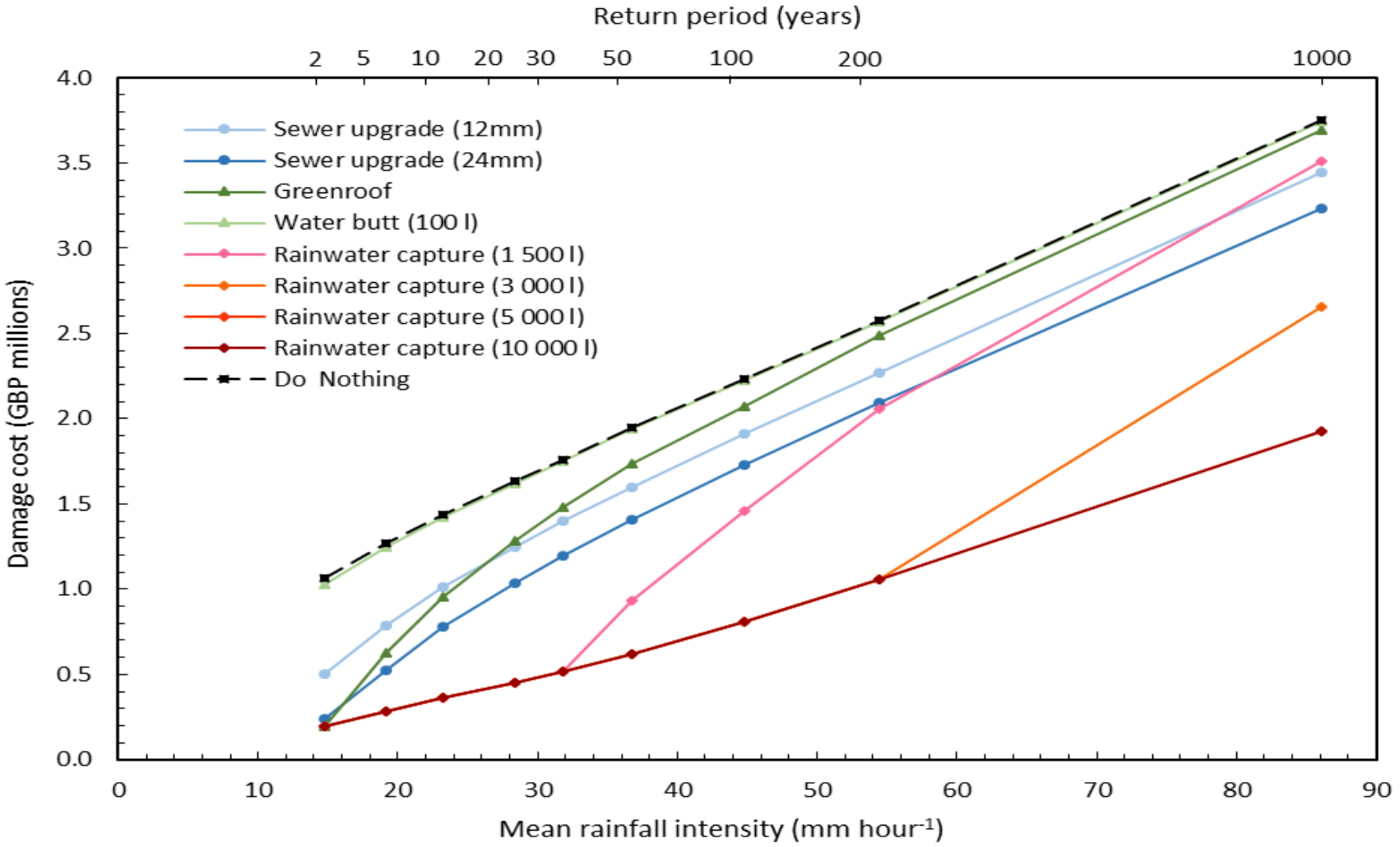
Reliability and Resilience in a UK case study



- 9 intervention strategies
- 2, 5, 10, 20, 30, 50, 100, 200 & 1000 year events
- Analysis of reliability and resilience through calculating failure cost (magnitude and duration) and likelihood.

Case study of a 1 km by 1 km UK urban catchment



Performance curves visualise many scenarios.

Current planning is generally insufficient for future challenges:

Performance during a high probability event is not an indicator of performance during extreme scenarios.

To build reliability and resilience we need to analyse the full range of future challenges and novel solutions:

Fast analysis techniques provide a method to include reliability and resilience in strategic design.

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