

# Design and Analysis of a Dual Purpose Rainwater Harvesting System: A Pilot Study

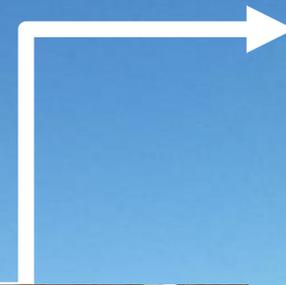
Peter Melville-Shreeve, Sarah Ward, Virginia Stovin, Raziye Farmani and David Butler

**Peter Melville-Shreeve**  
Research Fellow, University of Exeter  
[pm277@exeter.ac.uk](mailto:pm277@exeter.ac.uk)

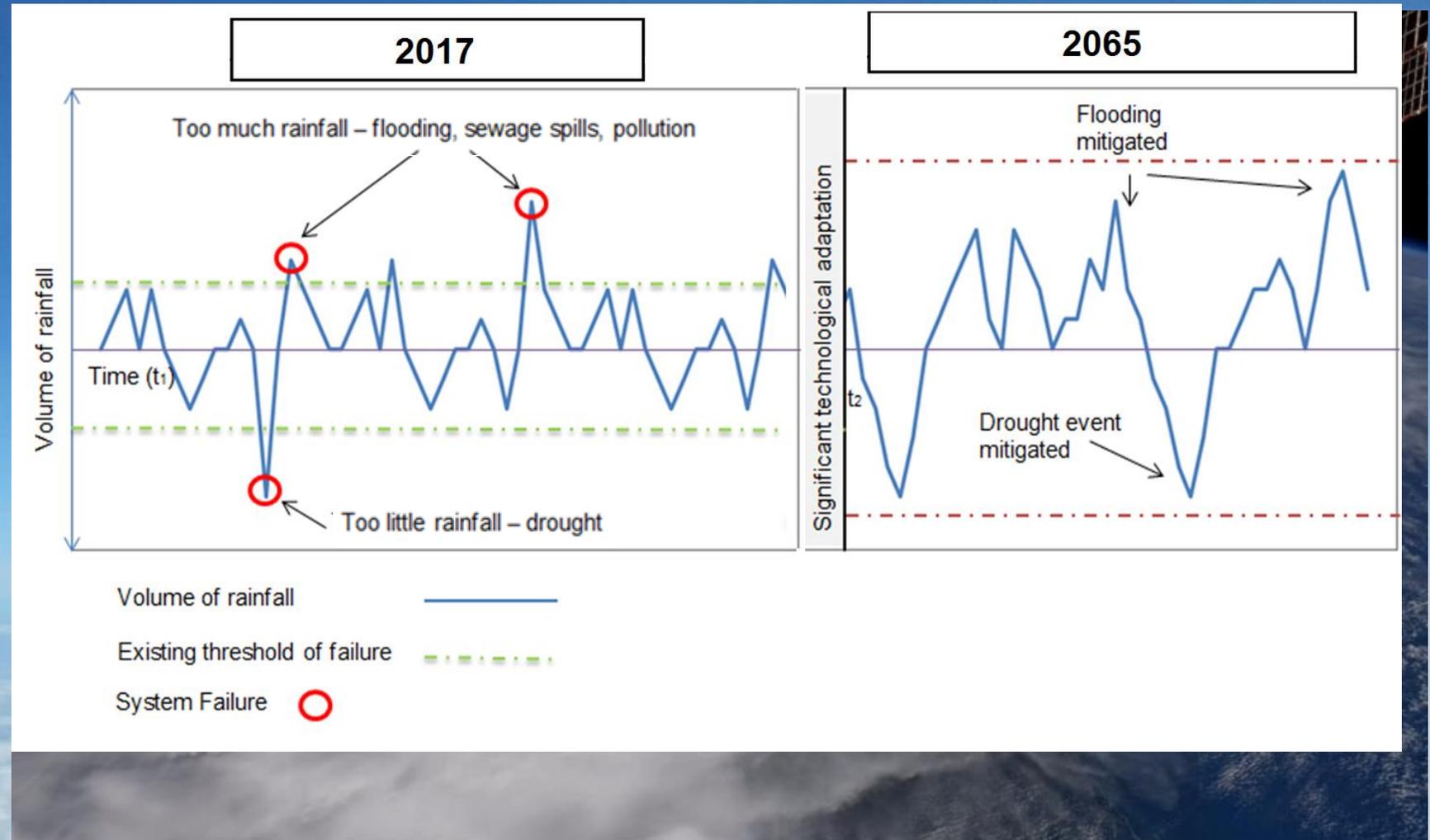
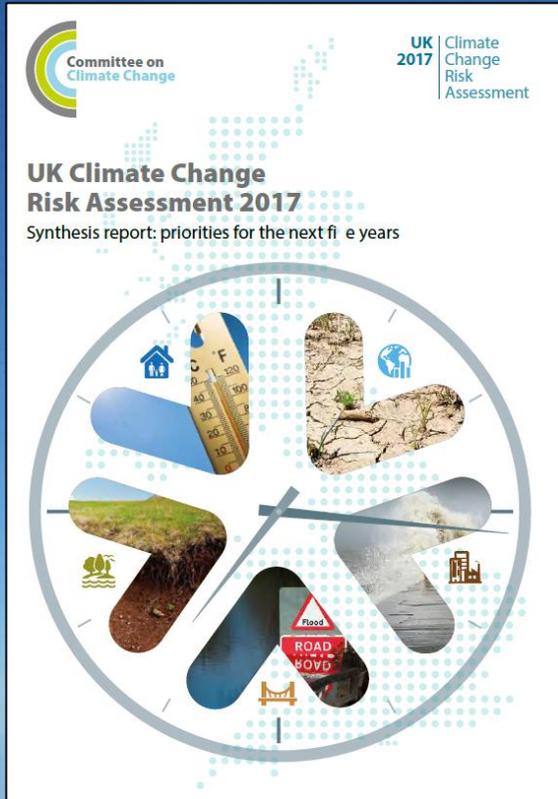
# Rainwater Harvesting at a Household Scale



30% water demand  
Is used in WC flushing



# Rainwater Harvesting for Climate Change Adaptation



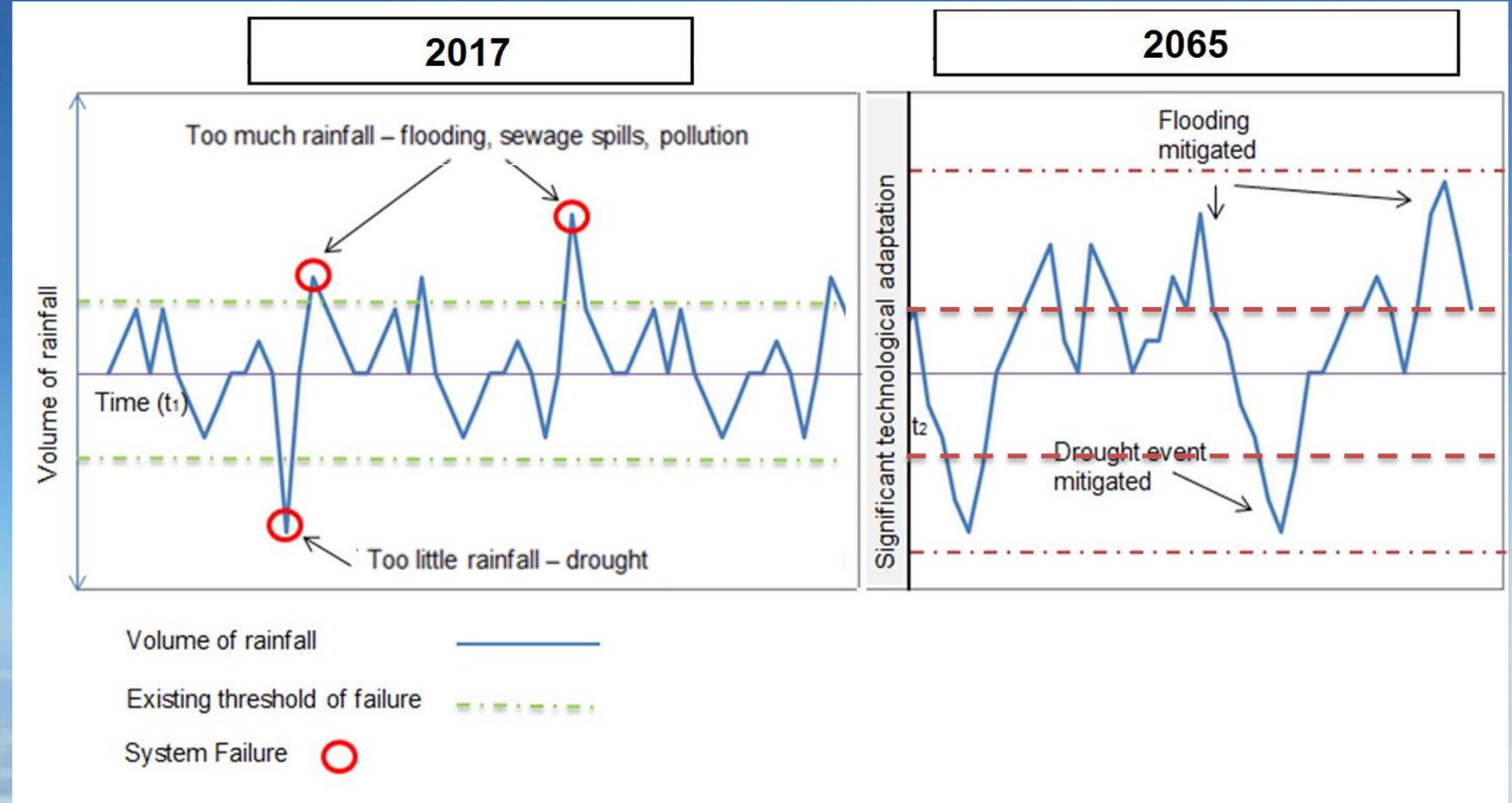
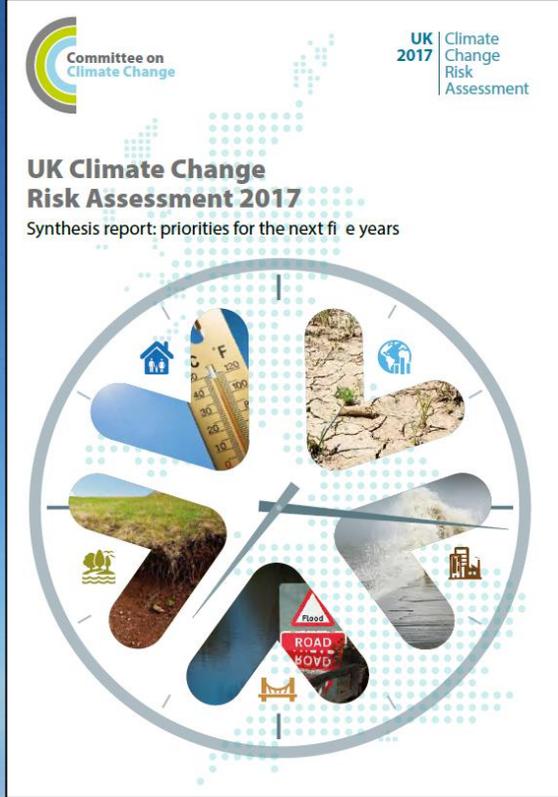
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<http://bgr.com/2017/09/11/irma-from-space-hurricane-iss-astronauts/>  
<https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change>  
Melville-Shreeve, P. 2017, Rainwater Harvesting for Drought Mitigation and Flood Management. Eng D. Thesis. University of Exeter.

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# Rainwater Harvesting for Climate Change Adaptation



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# Beyond Rainwater Harvesting? Achieving Rainwater Management

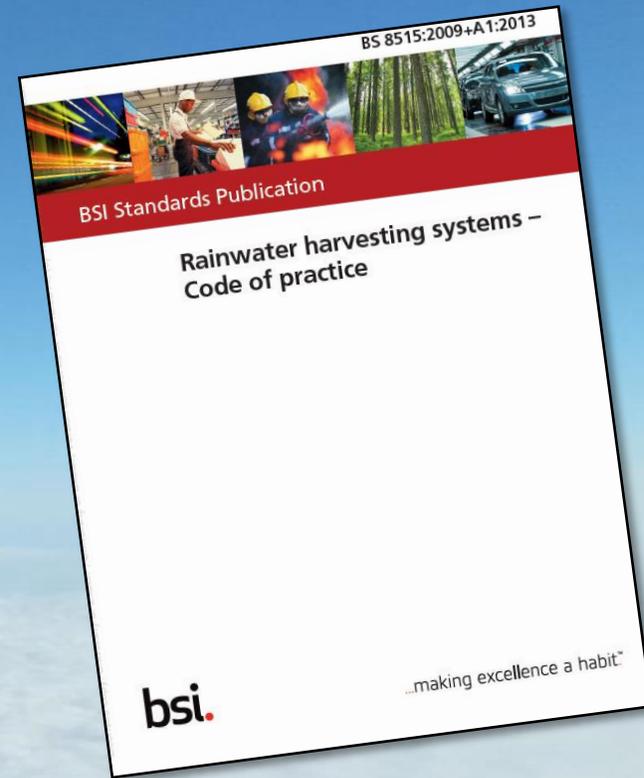
Site Location?

Storm  
Duration?

Intensity?

Return  
Period?

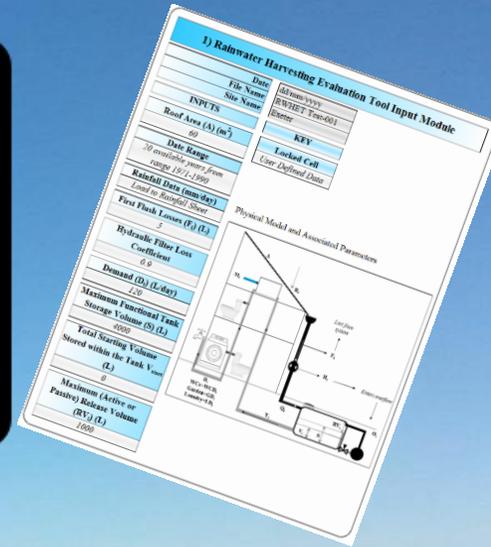
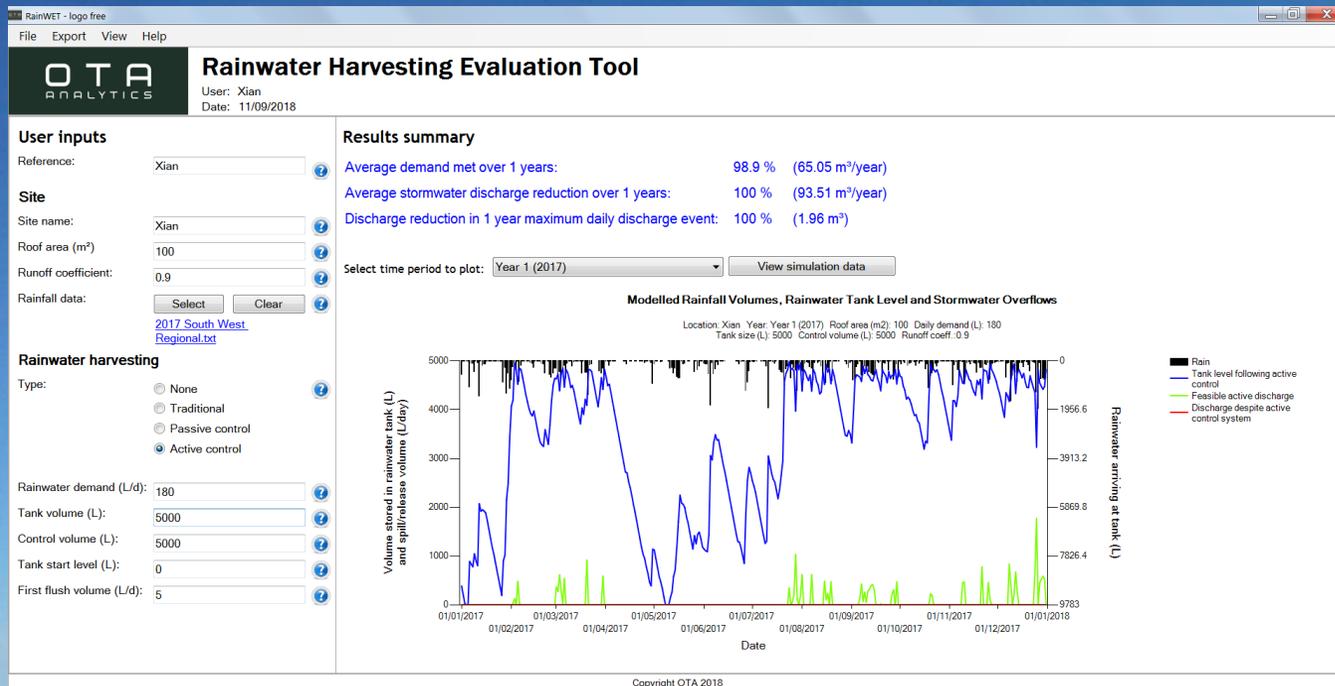
User  
behaviour?  
(flush  
frequency)



# Designing Multi-objective Systems?



# Design Tool: RainWET



## Features:

- Time Series Analysis.
- Passive and Active Rainwater Management Systems can be designed, evaluated, controlled & monitored.

# Case studies using a bottom-up Approach



# This study: Pilot System at a House

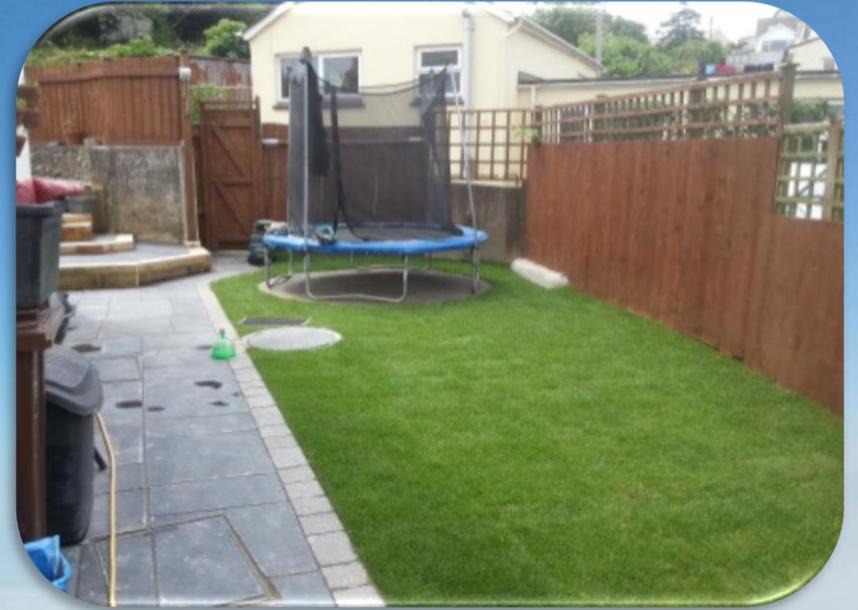


**Stage 1 - Lab:** Hydraulic model and empirical lab work used to design configuration.

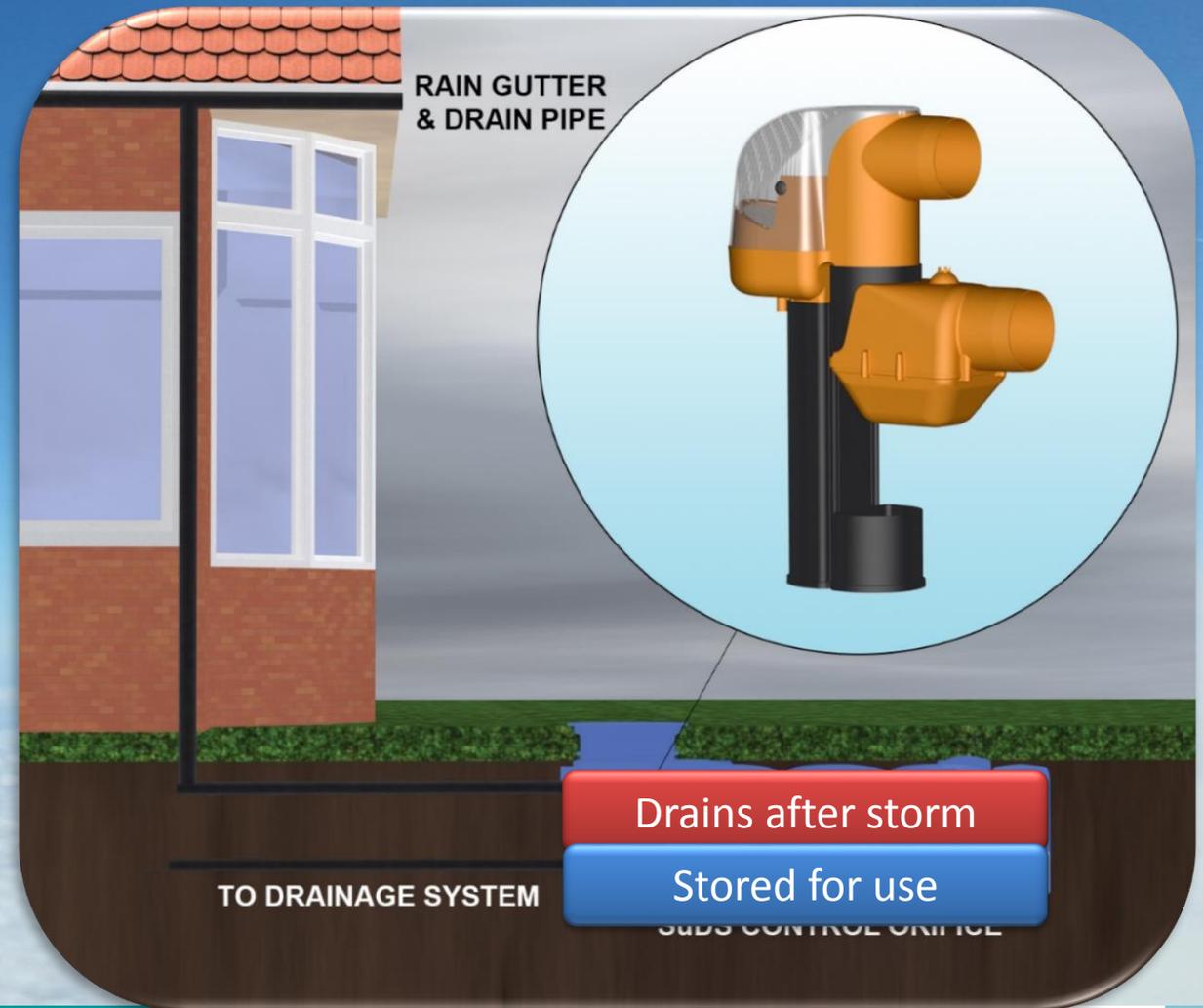
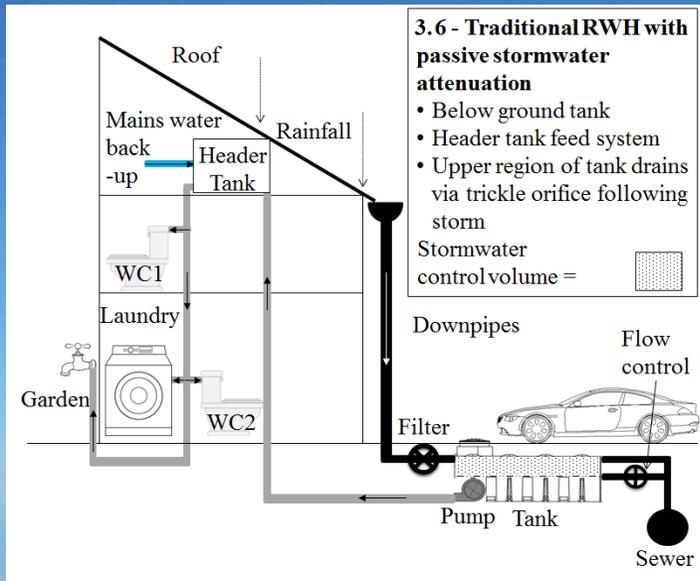
**Stage 2 – Monitor System in Property**

- ▶ **Water Demand (15min)**
- ▶ **Tank Levels (1min)**
- ▶ **Local Rainfall (15min)**
- ▶ **... to enable analysis using mass balance model**

# Method: Install & Monitor Pilot System



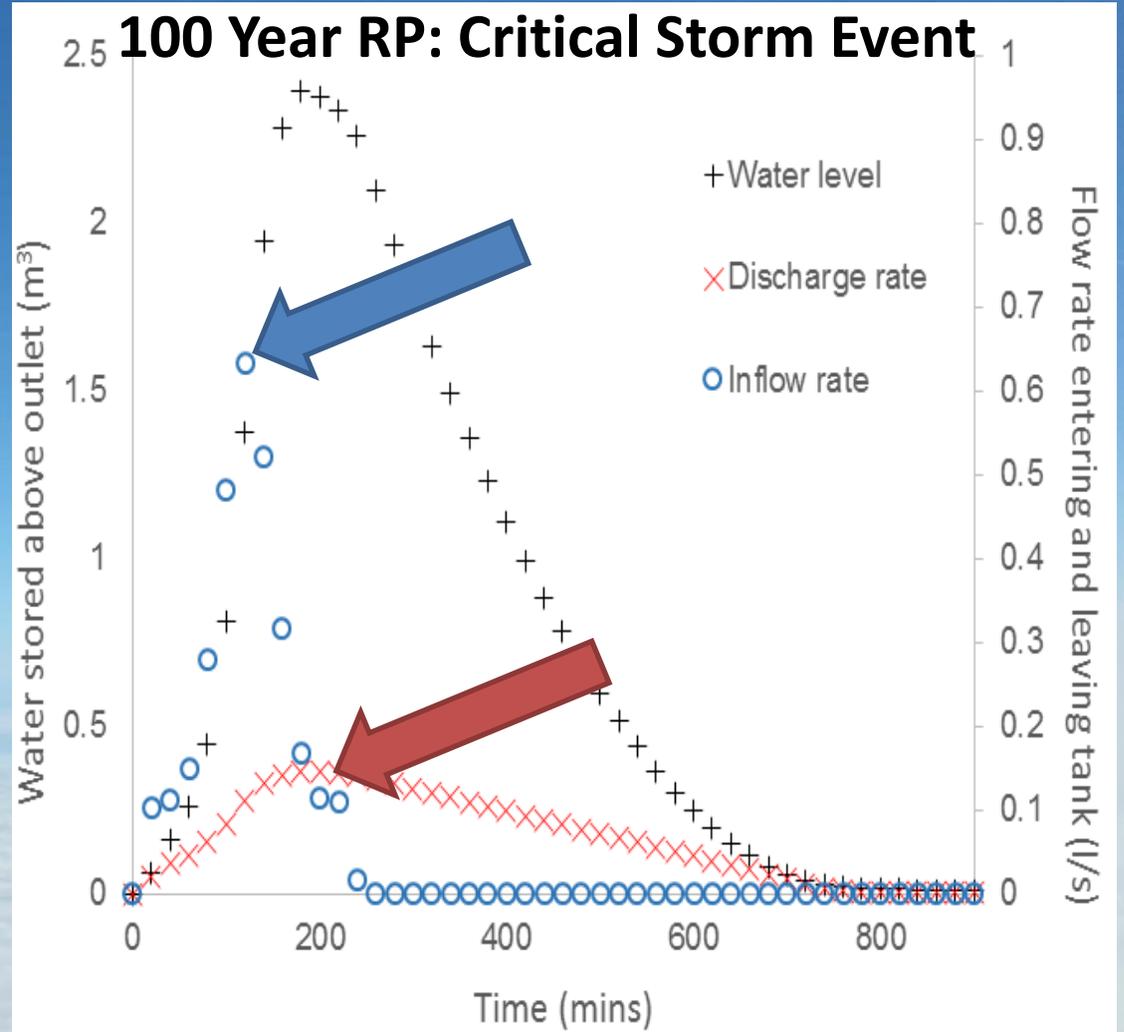
# Dual Purpose Rainwater Management Configuration



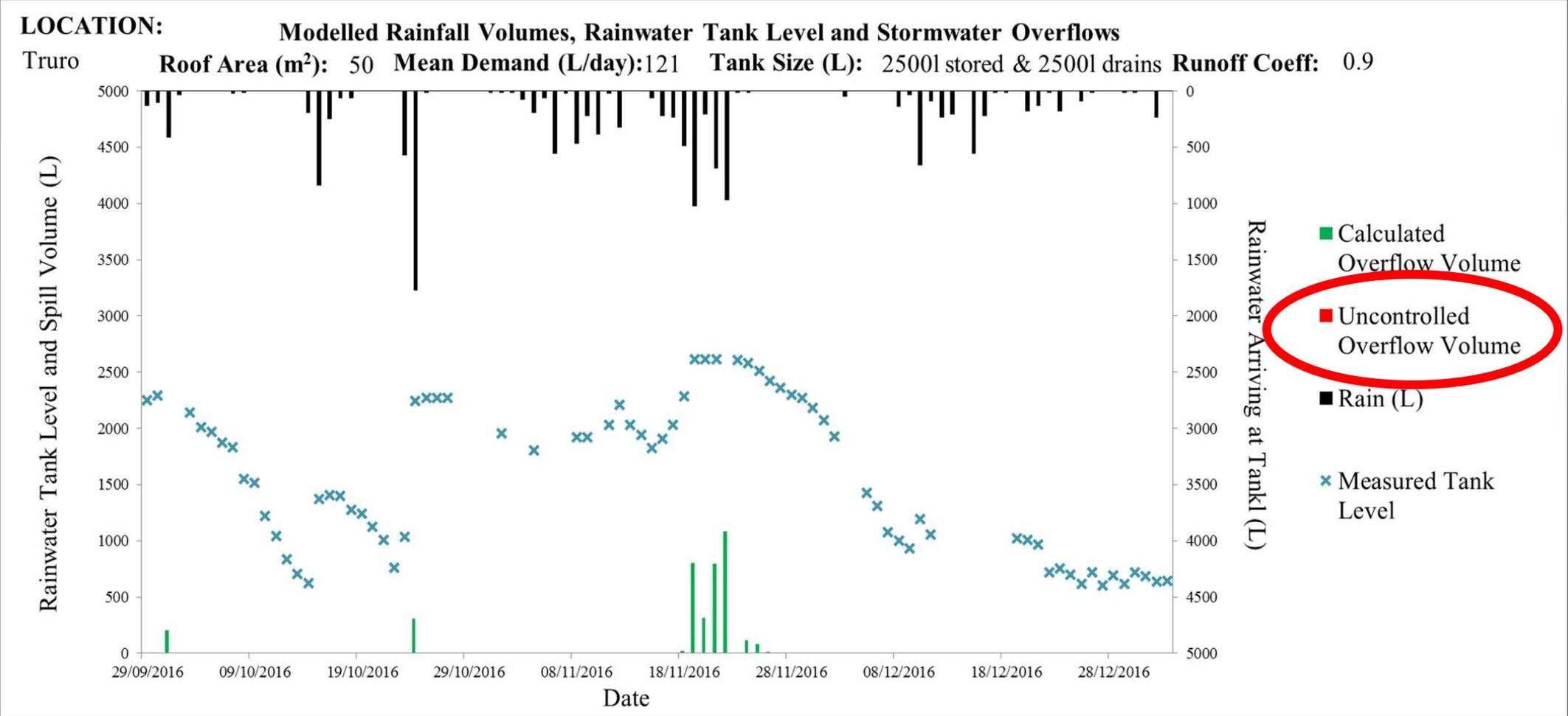
# Results: Simulation Data for System

## Model simulations:

- The tank can capture all storm durations for the 1 in 100 year event.
- Reduces peak discharge by up to 96% (15 mins event)



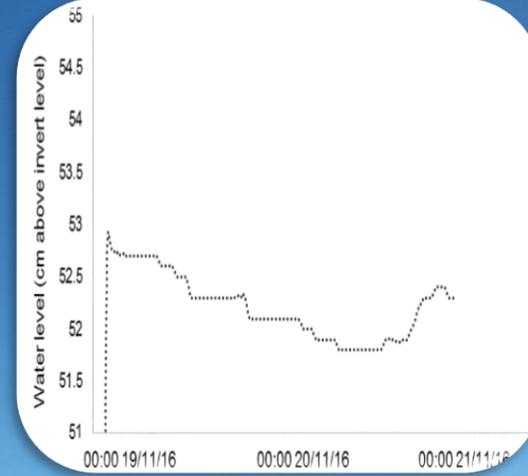
# Results Summary: System Performance Data



# Results: Measured Data for System

## Measured Data:

- Water demand at 121l/day
- Peak discharges did not exceed 0.02l/s (over 3 months).
- 93 % reduction in peak inflow during intense storm



# Acknowledgements

Thanks to support of Co-authors and collaborators.

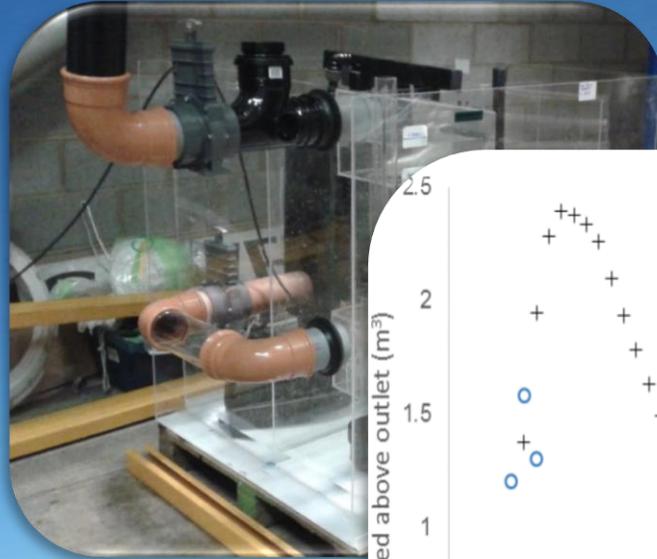
This study was conducted with the support of South West Water and Rainwater Harvesting Limited. Furthermore, the authors wish to thank the residents at the house monitored for their involvement. The research has been part funded by UK Engineering & Physical Sciences Research Council project: TWENTY 65 - Tailored Water Solutions for Positive Impact EP/N010124/1

**Peter Melville-Shreeve**

**Research Fellow, University of Exeter**

**pm277@exeter.ac.uk**

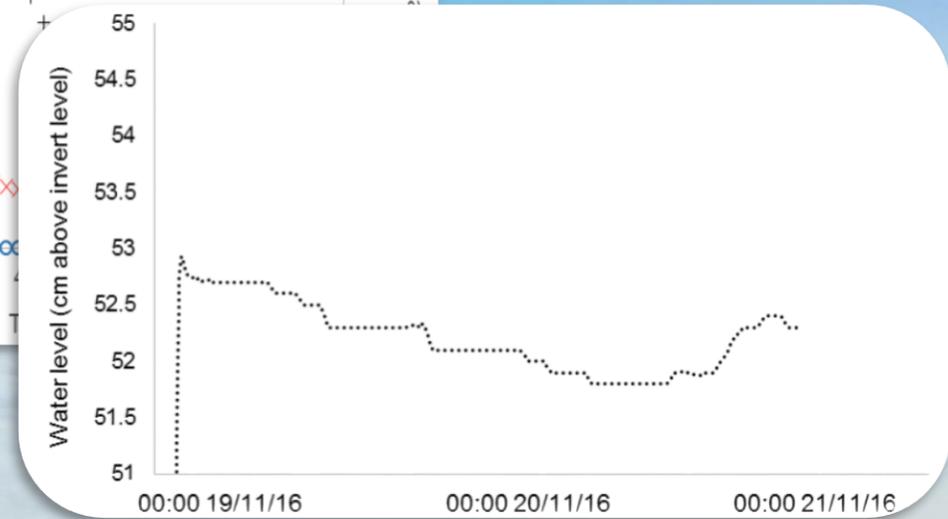
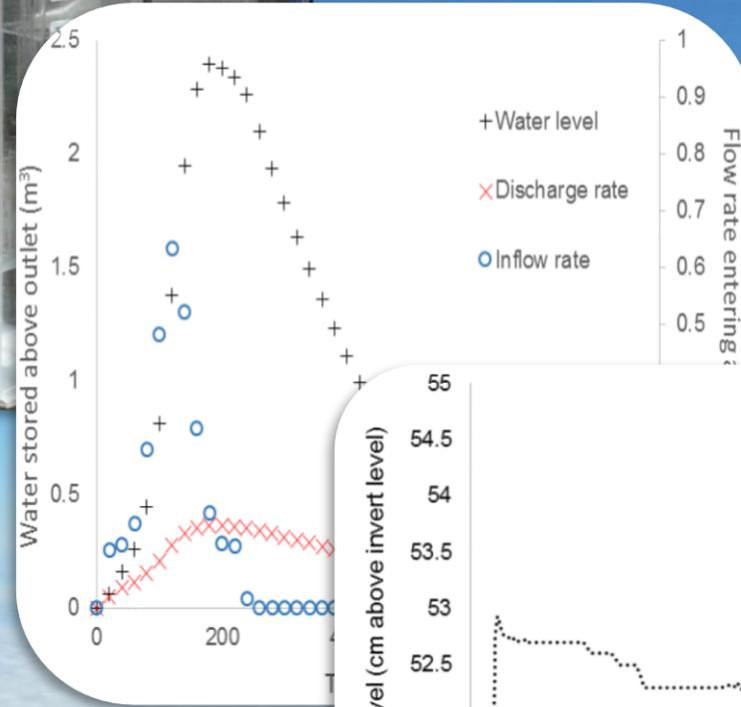
# Summary & Conclusions from Pilot



Lab

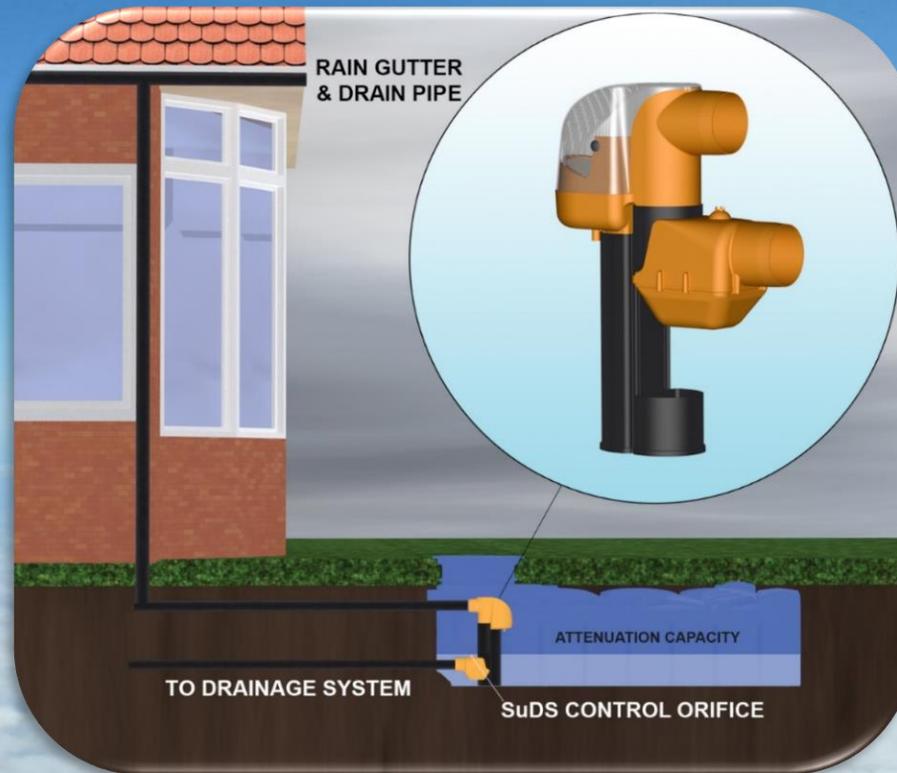
Model

Site



## RWH with Source Control

# Design and Analysis of a Dual Purpose Rainwater Harvesting System: A Pilot Study



# Where Next?

## IoT Enabled Rainwater Management Systems

