

# Multiple Benefits of Living in a Blue-Green City



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Image source: Arup

[bluegreencities.ac.uk](http://bluegreencities.ac.uk)

**EPSRC**  
Pioneering research  
and skills

 Environment  
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 RIVERS  
Agency

 NATIONAL SCIENCE  
FOUNDATION

EPSRC Grant EP/K013661/1

 blue  
green  
CITIES

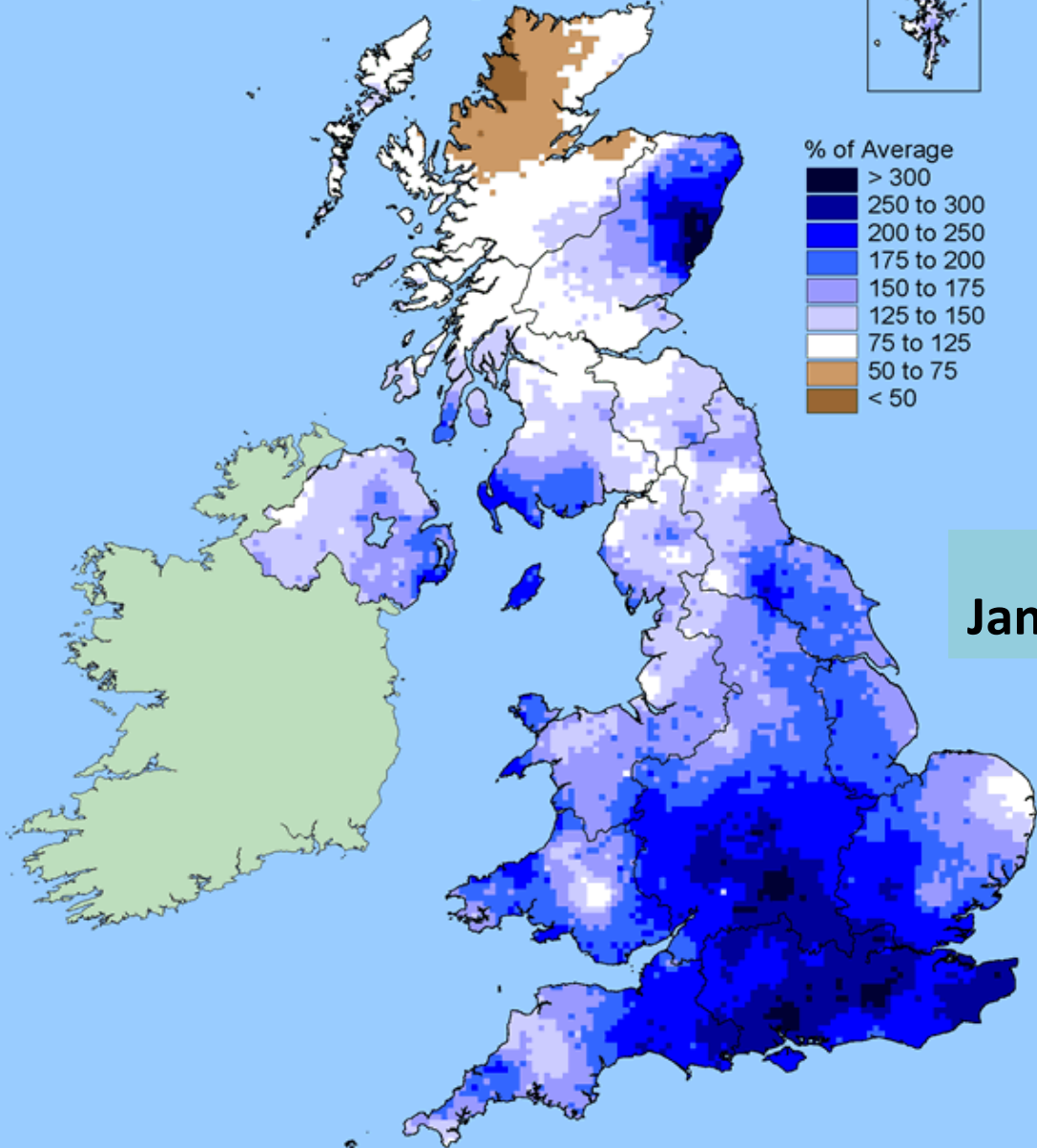
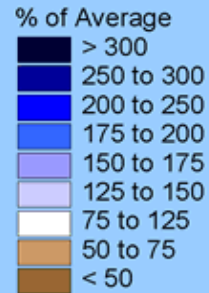
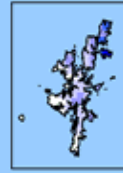


The Challenge: unprecedented rainfall

**THE FLOODS OF 2013/14 AND 2015**



January 2014  
Rainfall Amount  
% of 1981-2010 Average



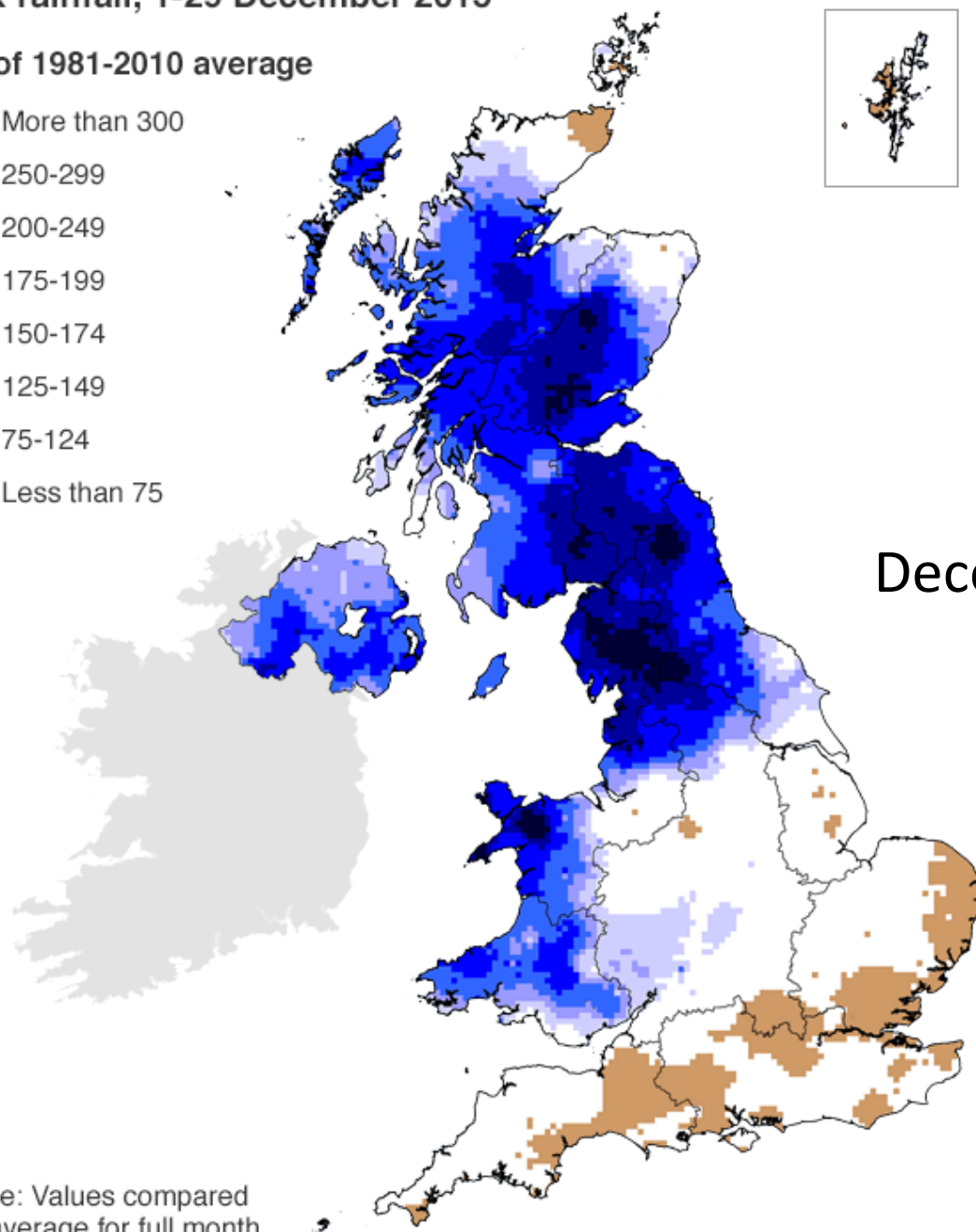
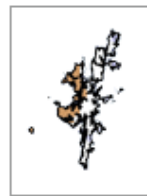
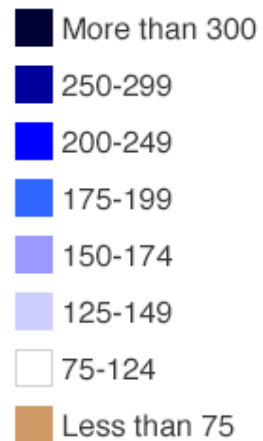
## January 2014 Rainfall Anomaly

Source:

<http://www.metoffice.gov.uk/climate/uk/summaries/2014/january>

# UK rainfall, 1-29 December 2015

% of 1981-2010 average



## December 2015 Rainfall Anomaly

Note: Values compared to average for full month

Source:  
<http://www.metoffice.gov.uk/climate/uk/summaries/2015/december>





## Datchet, Wraysbury, Shepperton - 2014

Source: <http://www.dailymail.co.uk/news/article-2555658/UK-weather-16-areas-South-warned-flooding-danger-lives-Armed-Forces-battle-save-homes.html>





## Carlisle 2015



**York 2015**

**Any other UK city *could* be next**

Source: <http://www.bbc.co.uk/news/uk-england-york-north-yorkshire>



# A Grey Future: *Bigger pipes, more pipes, a huge pipe*



# A Grey Future: *Higher walls and deeper channels*





# A Grey Future: *Higher walls and deeper channels*



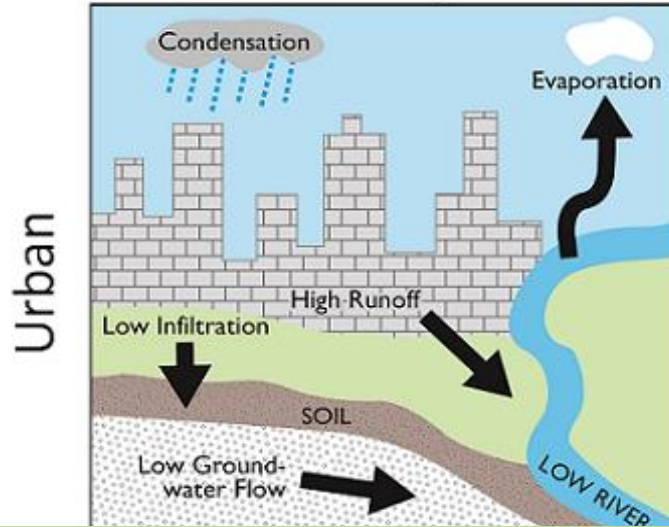


*A different Water Future for UK Cities*

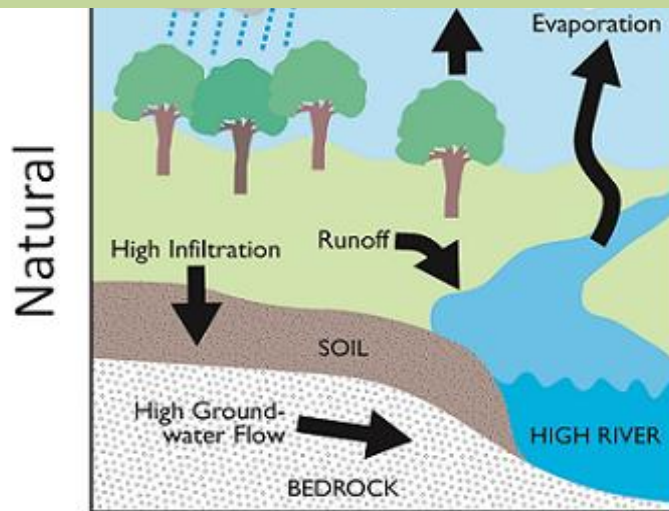
**BUT WHAT IS A BLUE-GREEN CITY?**

# Water Cycle

# Streetscape



[http://en.wikipedia.org/wiki/Blue-Green\\_Cities](http://en.wikipedia.org/wiki/Blue-Green_Cities)



**BLUE**

**GREEN**

# Blue-Green Cities Research Approach

Model Existing  
Flood Risk  
Management

Understand  
Citizens'  
Behaviours

Evaluate  
Multiple Flood  
Risk Benefits

City Authority  
and Community  
Communications

Options for  
Hard/Soft  
Measures

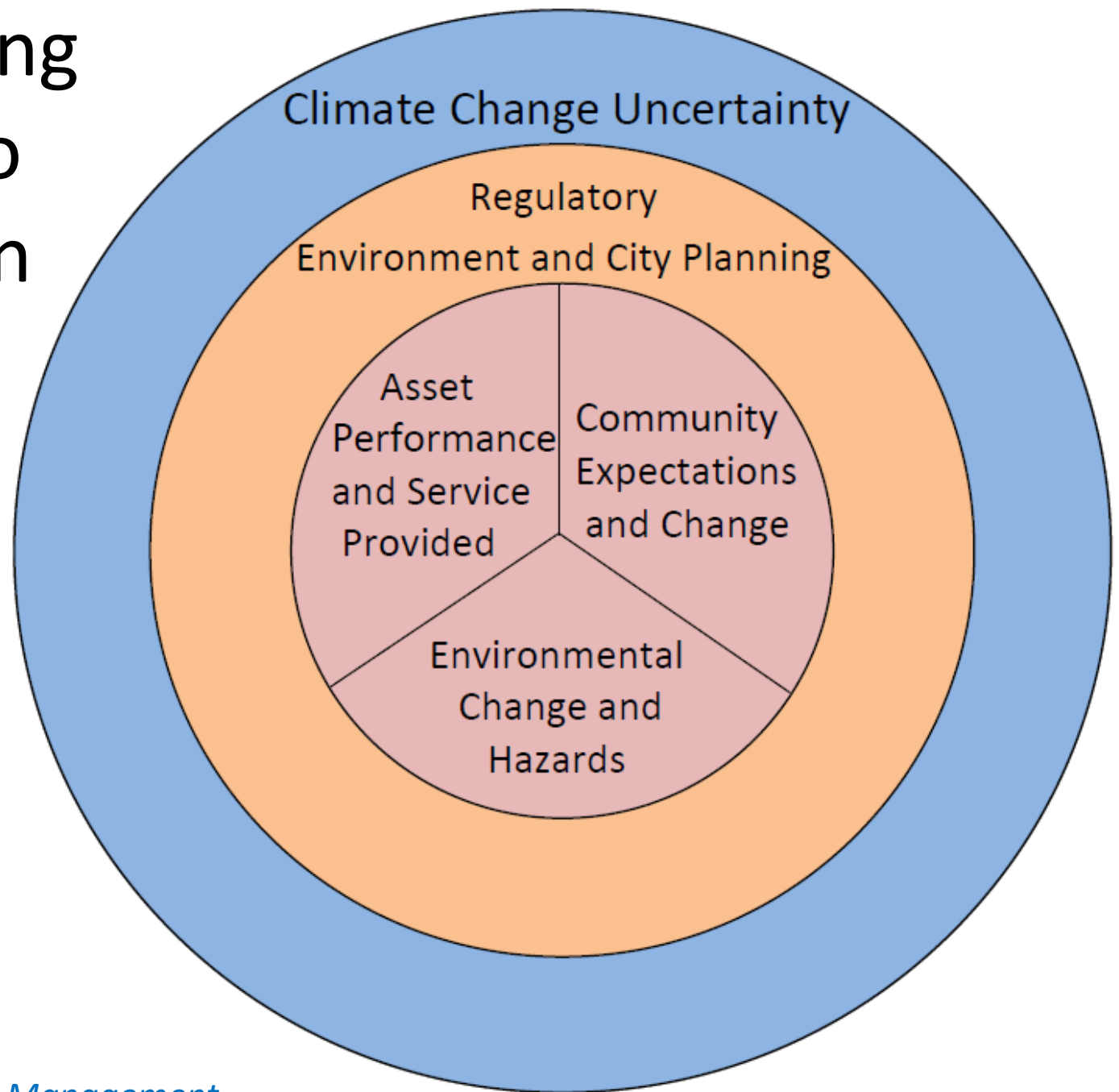
Newcastle  
upon Tyne





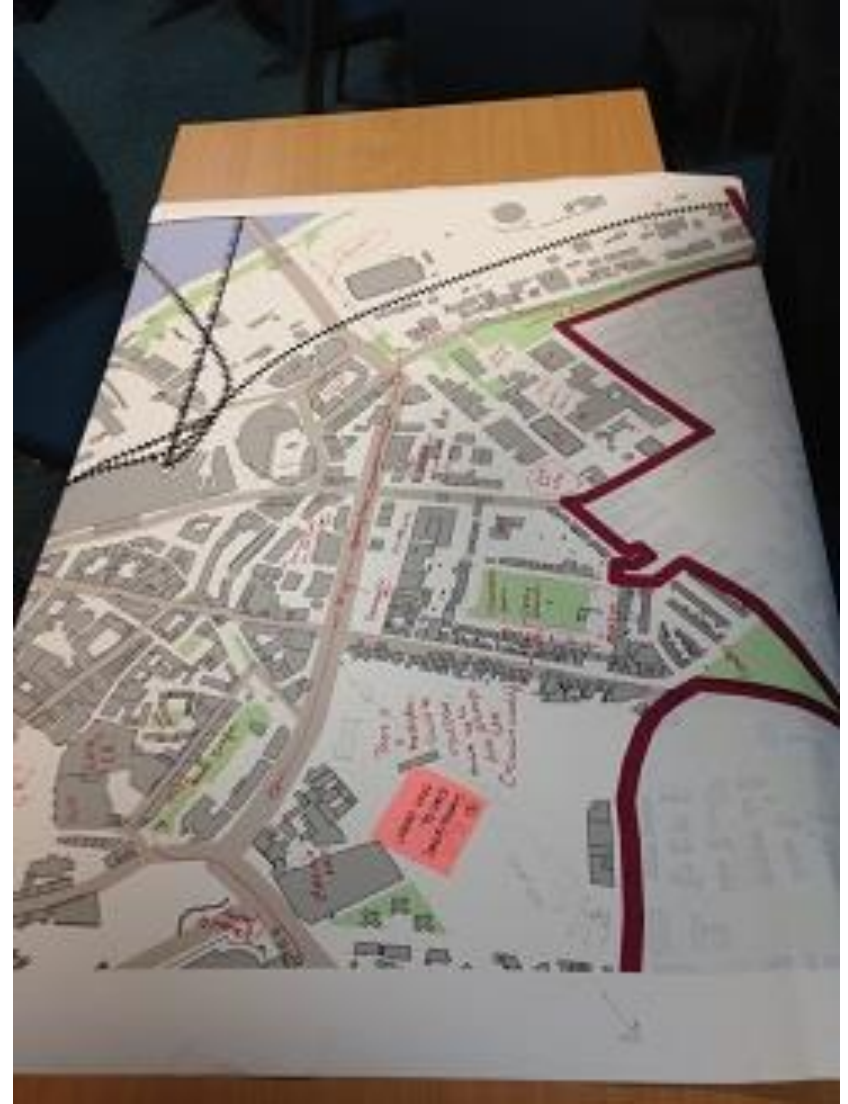
City Authority  
and Community  
Communications

# Overcoming barriers to Innovation

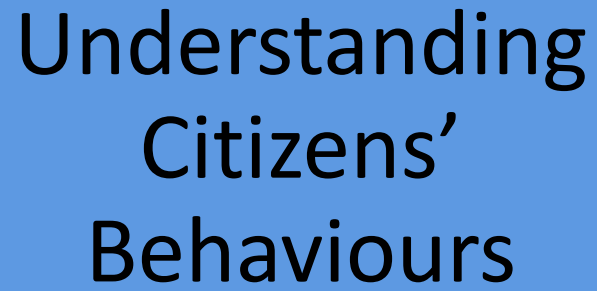


# The Newcastle Learning and Action Alliance

*'Blue-Greening' the urban core – a master-planning workshop*





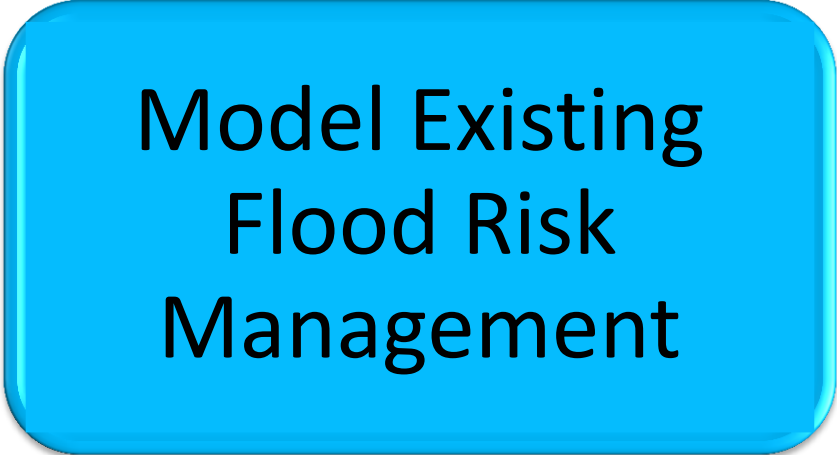


Understanding  
Citizens'  
Behaviours

# ***Local people and communities:***

- Local People are the local experts - with useful knowledge
- People value Blue-Green assets - if they understand them
- People will help maintain the Blue-Green assets they value
- People need to feel *ownership* to make B-G solutions work
- ***People must be engaged prior to and throughout implementation of B-G***



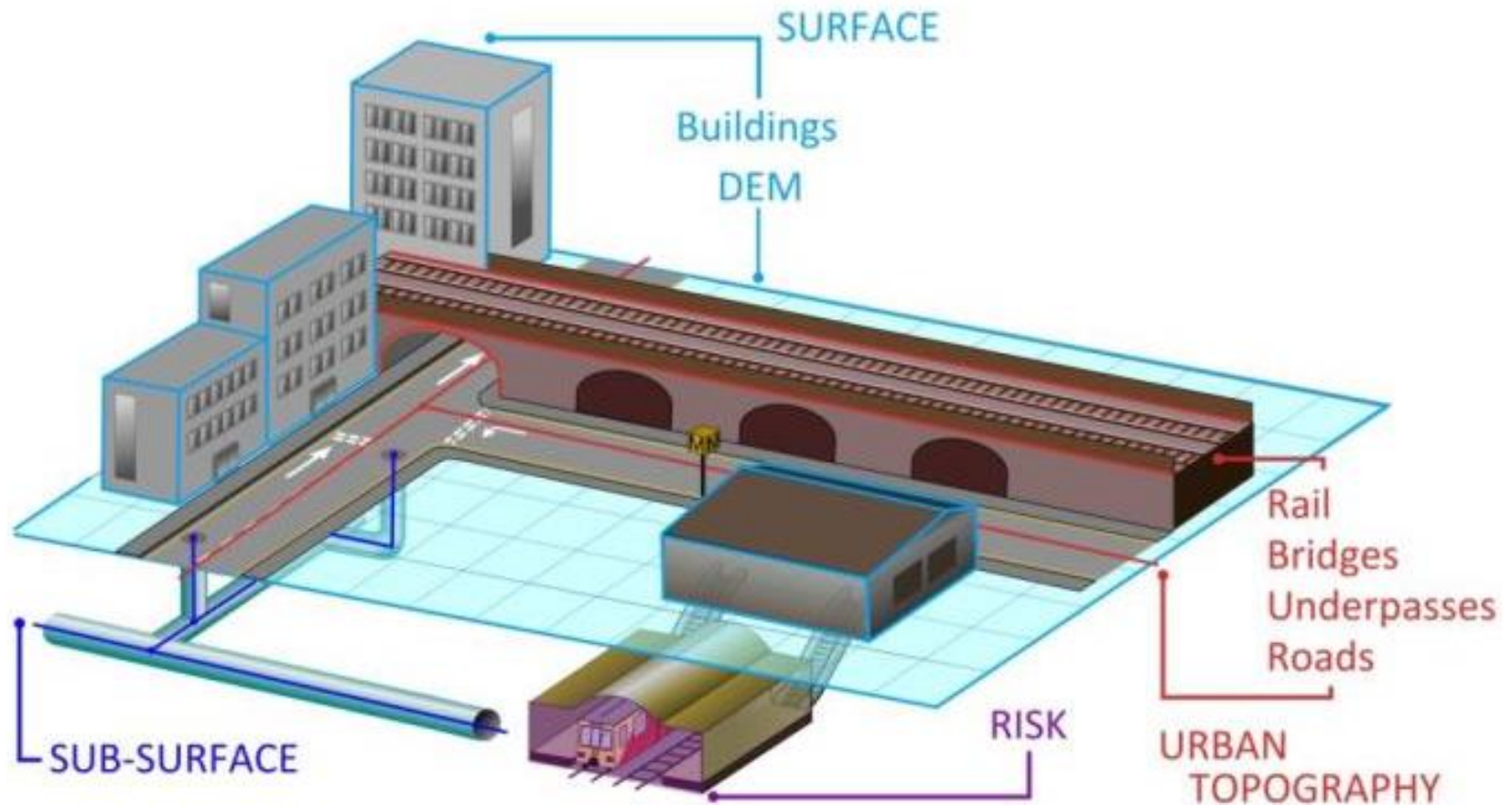


Model Existing  
Flood Risk  
Management

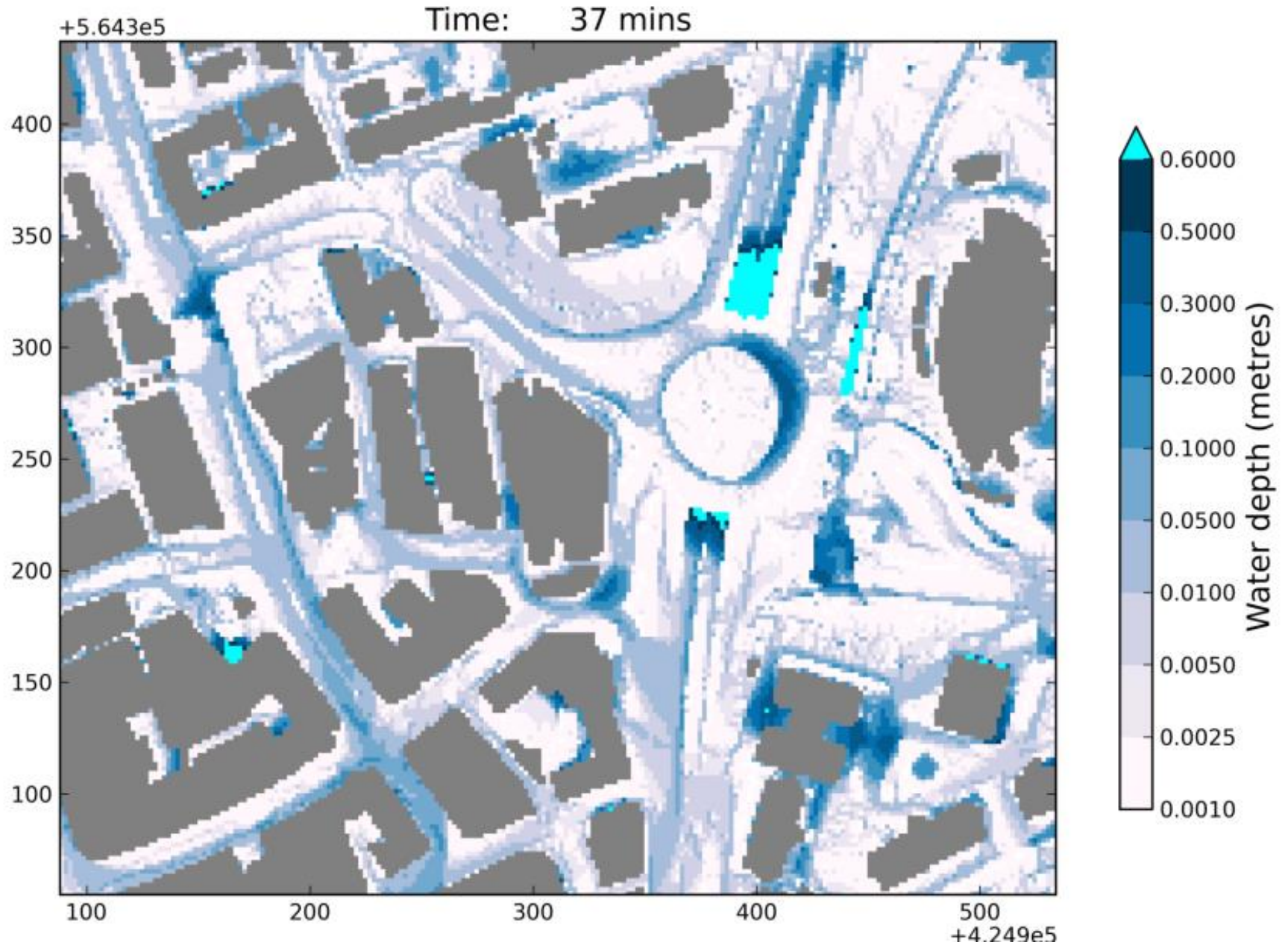



# CityCAT: Combined sewer and surface water flood model

Simulates surface + subsurface urban drainage networks



# 2012 - flooded intersection paralyses rush hour traffic





Options for  
Hard/Soft  
Measures



# Blue-Green Options: *Environmental performance*



BRUNTON PARK FLOOD ALLEVIATION SCHEME - LANDSCAPE PROPOSALS  
MMD-277830-L-CR-00-0001 P03



Common Reed

PROPOSED REEDBEDS



PROPOSED SPECIES RICH GRASSLAND



Hazel



Deer



Garden Rose



Redcurrant

WCT WOODLAND SPECIES



Marsh Marigold



Greater Pond Sedge



Brook Thistle



Fuchsia

PROPOSED MARGINAL SPECIES



Willow



Norway Spruce



English Oak



Common Alder



Silver Birch



Bird Cherry



European Holly

PROPOSED TREE SPECIES

Source: [www.nwl.co.uk](http://www.nwl.co.uk)



# Grey-Green Options: *Social performance*



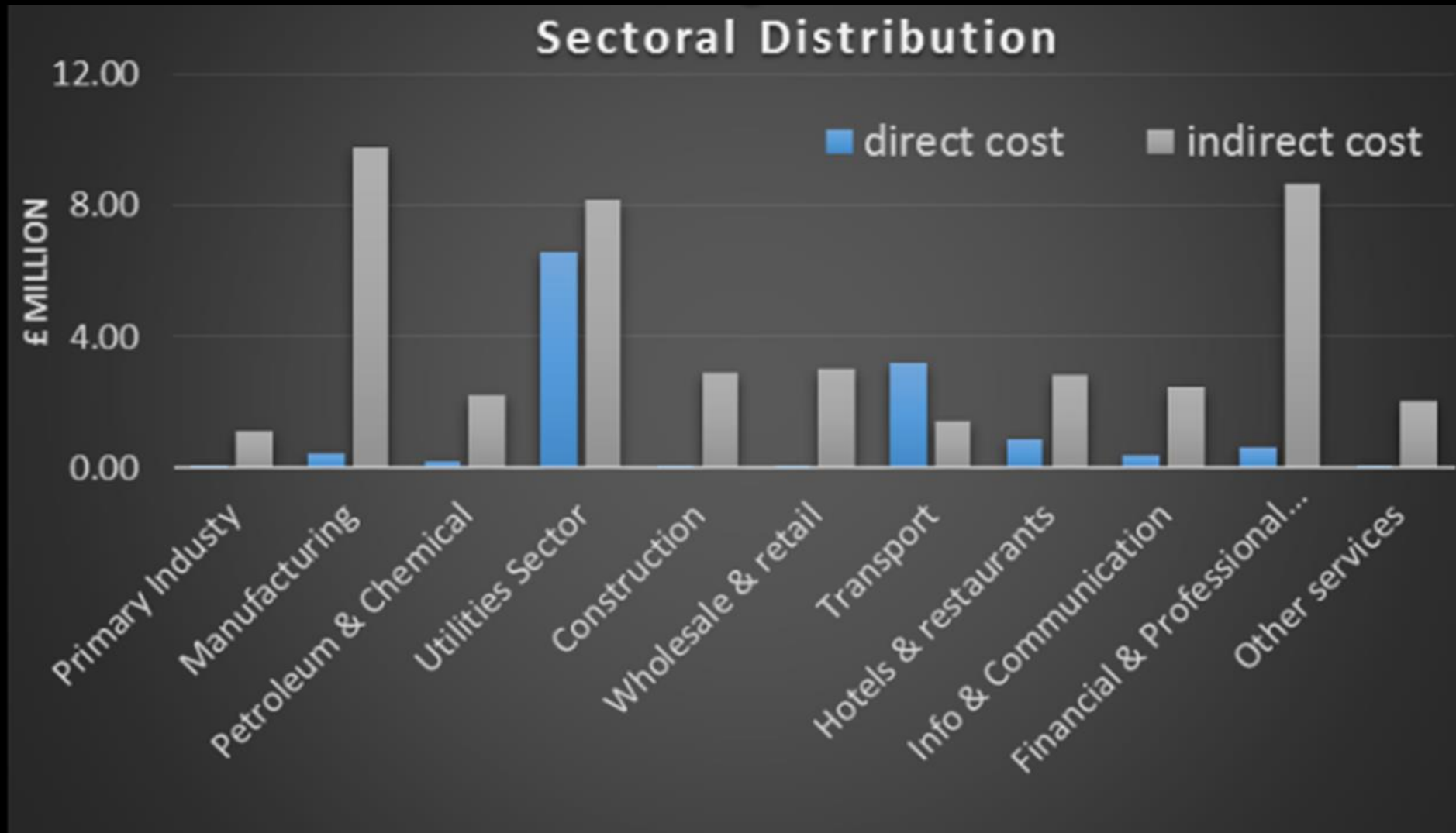
# Grey-Green Options: *Social performance*

Storm water as a resource  
(not just a hazard)



Evaluate Multiple  
Flood Risk  
Benefits

# 2012 Flood Footprint: Total damage = ~£78 million



Direct Damages = ~£34 M

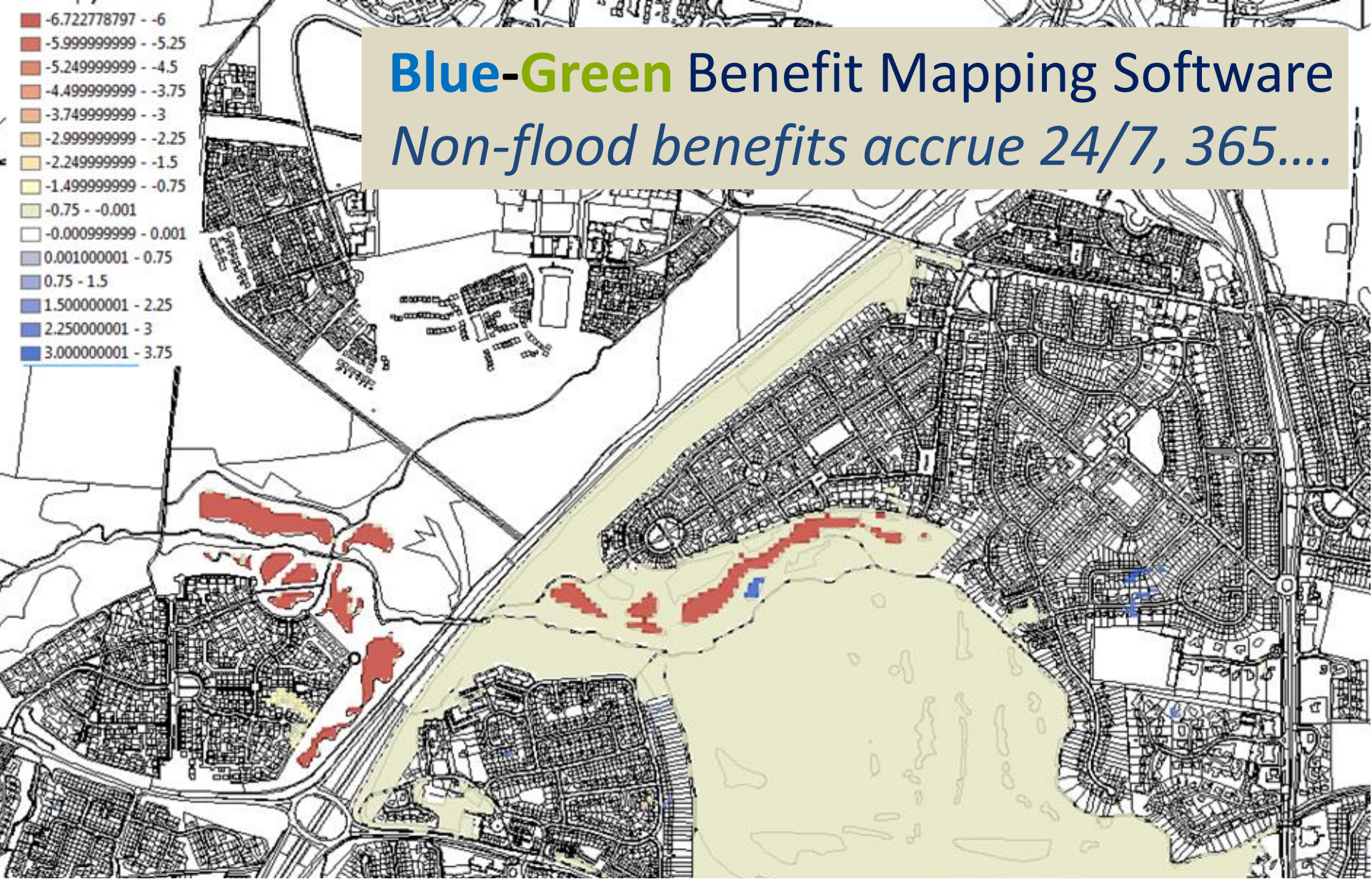
Indirect Damages = ~£44 M

Manufacturing, Utilities and Business sectors most affected



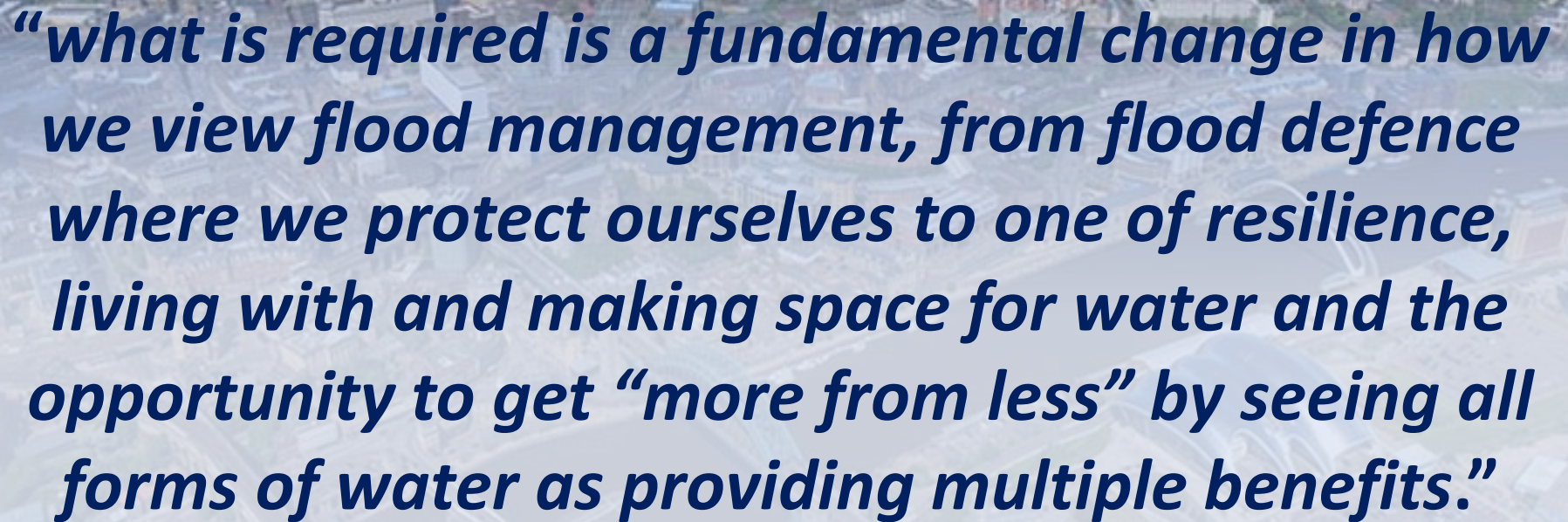
# Blue-Green Benefit Mapping Software

*Non-flood benefits accrue 24/7, 365....*



Flood Reduction and Carbon Storage benefits of  
**Blue-Green** Infrastructure at Brunton Park, Newcastle





*“what is required is a fundamental change in how we view flood management, from flood defence where we protect ourselves to one of resilience, living with and making space for water and the opportunity to get “more from less” by seeing all forms of water as providing multiple benefits.”*

## *Take Home Message*

Commission of Inquiry into flood resilience of the future titled ‘Living with water’, March 2015. All Party Group for Excellence in the Built Environment, House of Commons, London SW1A 0AA: p. 32, para. 3.

# The **Blue-Green** Cities Research Consortium has been supported by:

- **Engineering and Physical Sciences Research Council**
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- **Newcastle City Council**
- **Northumbrian Water Limited**

