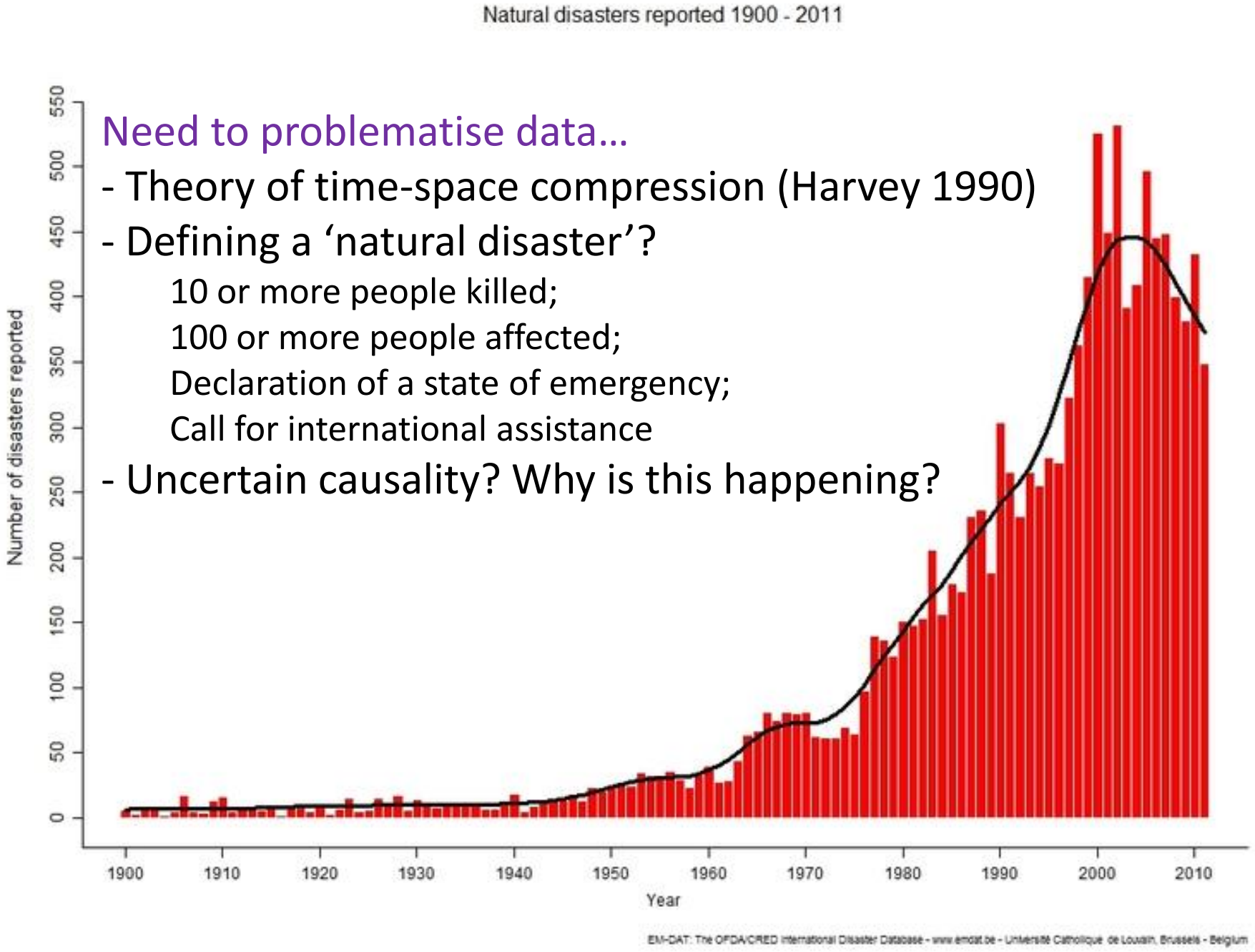
Planning for Resilient Cities

Professor Iain White
University of Waikato, New Zealand
iainw@waikato.ac.nz

Topics

1. The rise of ‘Natural’ Disasters
2. The rise of the resilience agenda
3. Flood resilient *buildings*
4. Flood resilient *cities*



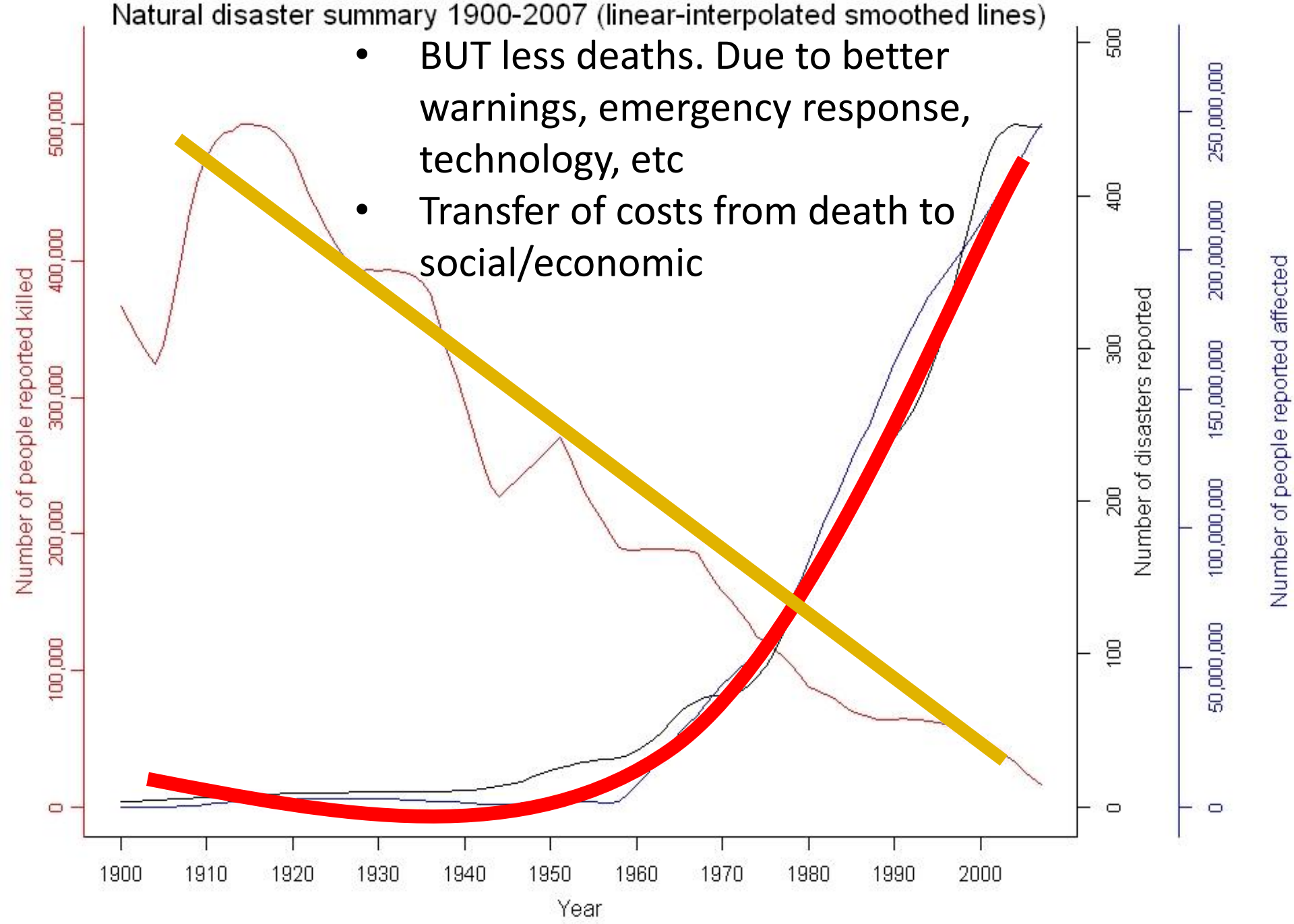
Need to problematise data…

- Theory of time-space compression (Harvey 1990)
- Defining a ‘natural disaster’?
  - 10 or more people killed;
  - 100 or more people affected;
  - Declaration of a state of emergency;
  - Call for international assistance
- Uncertain causality? Why is this happening?

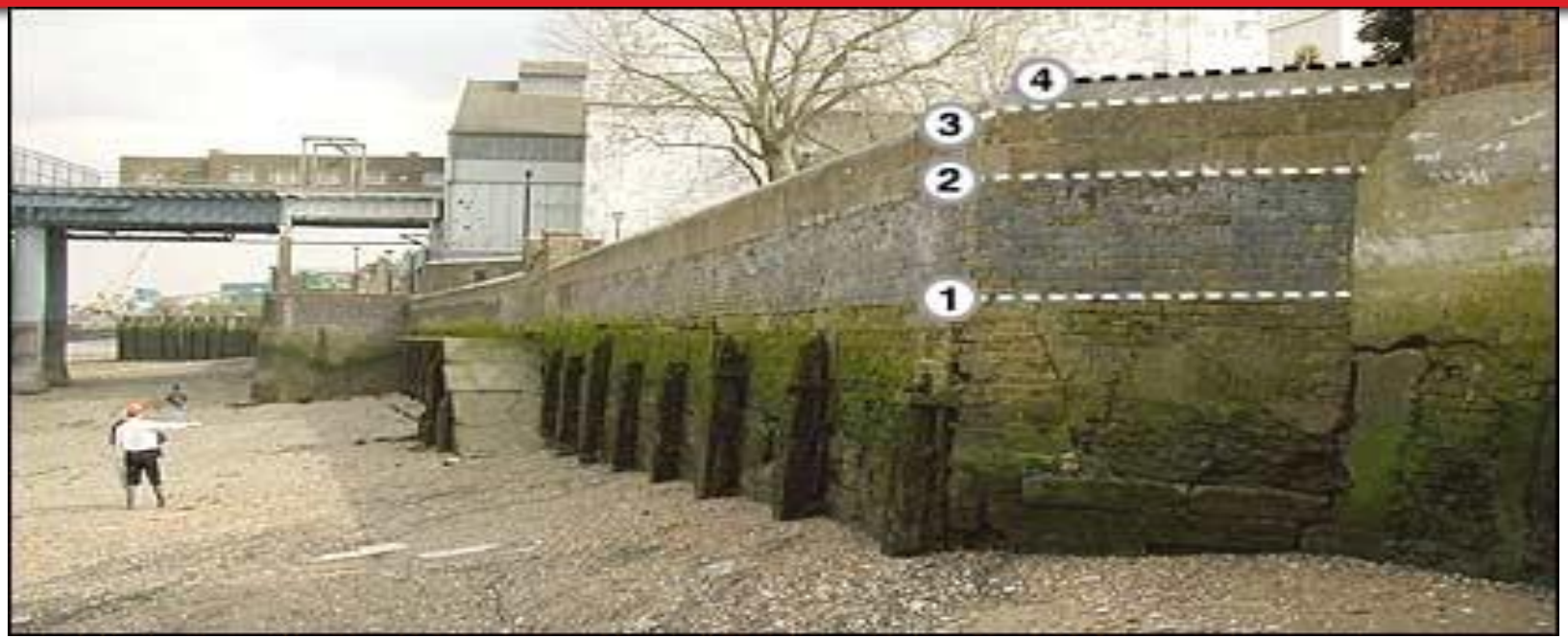
‘Natural’ Disasters...

1. There is a rise in the severity of natural patterns of extreme events;
   - e.g. Climate change, but hard to prove link to disasters.
2. Societies may play a role in amplifying the hazard;
   - e.g. Urbanisation, poor governance/management processes
3. People are increasingly exposed to risks from extreme events;
   - e.g. Rapid expansion of cities, less ‘safe’ areas, more people
4. People are more vulnerable to experiencing the effects
   - e.g. Less able to autonomously adapt or be ‘resilient’

- Wider social, economic and political factors influence the risk, so it is difficult to clearly say disasters are natural
- The techno-economic orientated development approach perpetuates inequalities and normalises environmental concern and risks
- “*disasters are essentially historically and spatially specific outcomes of the process of contemporary capitalism*” (Wisner *et al* 2004: 321)


Natural disaster summary 1900-2007 (linear-interpolated smoothed lines)
BUT less deaths. Due to better warnings, emergency response, technology, etc
Transfer of costs from death to social/economic
Number of people reported killed
0
100,000
200,000
300,000
400,000
500,000
Number of disasters reported
0
100
200
300
400
500
Number of people reported affected
0
50,000,000
100,000,000
150,000,000
200,000,000
250,000,000
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Year
EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.be - Université Catholique de Louvain, Brussels - Belgium

Urban Flooding: The 'Growing' Problem



Historic reliance on engineering solutions and bigger defences

Supported by: tech developments in construction and engineering; scientific advances in probability and modelling; expert knowledge; dedicated agencies; massive financial investment (**elements of flood governance**)

Given these advances you would expect that we would manage flooding to a high degree and experience less flooding over time...

Thursday, September 01, 2005

THE Sun 30p

LOST CI

New Orleans to be al

Thousands may be dea

Armed looters on the

HURRICANE DISASTER SPECIAL PAGES 2 & 3 &

Daily Mail

PLUS FREE DANIELLE STEEL HARDBACK

FREE DANIELLE STEEL DVD

PICK UP FROM WHSMITH OR WE CAN POST YOU THE WHOLE SET

PLAIN CRAZY

As the rains wreak new havoc, why do we build ever more houses on flood plains?

FULL STORY PAGES 12 & 13

Changing knowledge: properties in England at risk of flooding from different sources

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Year	Estimated properties at risk by source (23m in 2011 census)				Total
	Rivers and Sea	Surface Water	Groundwater	Reservoir Failure	
2001					
2004					
2009					
2011					

(National Audit Office 2001; Evans *et al*. 2004; Jacobs 2004; Environment Agency 2009; 2011)

Changing knowledge: properties in England at risk of flooding from different sources

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Year	Estimated properties at risk by source (23m in 2011 census)				Total
	Rivers and Sea	Surface Water	Groundwater	Reservoir Failure	
2001	1,724,225	0	0	0	1,724,225
2004					
2009					
2011					

(National Audit Office 2001; Evans *et al*. 2004; Jacobs 2004; Environment Agency 2009; 2011)

Changing knowledge: properties in England at risk of flooding from different sources

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Year	Estimated properties at risk by source (23m in 2011 census)				Total
	Rivers and Sea	Surface Water	Groundwater	Reservoir Failure	
2001	1,724,225	0	0	0	1,724,225
2004	1,740,000	80,000	1,700,000	0	3,420,000
2009					
2011					

(National Audit Office 2001; Evans *et al*. 2004; Jacobs 2004; Environment Agency 2009; 2011)

Changing knowledge: properties in England at risk of flooding from different sources

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Year	Estimated properties at risk by source (23m in 2011 census)				Total
	Rivers and Sea	Surface Water	Groundwater	Reservoir Failure	
2001	1,724,225	0	0	0	1,724,225
2004	1,740,000	80,000	1,700,000	0	3,420,000
2009	2,400,000	3,800,000	1,700,000	0	6,800,000
2011					

(National Audit Office 2001; Evans *et al*. 2004; Jacobs 2004; Environment Agency 2009; 2011)

Changing knowledge: properties in England at risk of flooding from different sources

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Year	Estimated properties at risk by source (23m in 2011 census)				Total
	Rivers and Sea	Surface Water	Groundwater	Reservoir Failure	
2001	1,724,225	0	0	0	1,724,225
2004	1,740,000	80,000	1,700,000	0	3,420,000
2009	2,400,000	3,800,000	1,700,000	0	6,800,000
2011	2,400,000	3,800,000	1,700,000	1,100,000	7,900,000

(National Audit Office 2001; Evans *et al*. 2004; Jacobs 2004; Environment Agency 2009; 2011)

Broad Issues

- Huge increase in houses at risk – now 1 in 3 of all houses
- More data = more evidence = **but less confidence**? Shift from precise to fuzzy data
- Move from **easy** to predict to **hard** to predict sources – the data has been proved **wrong** again and again
- What would be the impact in Taiwan if the same shift in risks happened? – this information only emerged **after** the event
- Inability to manage this within existing governance structures
- Shift from Flood Defence to Flood Risk Management – including the rise of flood resilience

Analysis of Key Trends

1. Overall ***risk*** is increasing
2. Overall ***sources*** of flooding are increasing
   - E.g. 2/3rds of those flooded in 2007 were officially not 'at risk from flooding'.
3. Flaws in the scientific and managerial approach
   - Over reliance on probability x consequence. Engineering and quantification worked with river floods, but surface water risks are applied within a highly dynamic environment that resists measurement
4. Information for decision making has proved unreliable
   - Can give a false degree of certainty and help immunize decision making from failure...
   - How do you 'defend the line' when the line is unreliable?
   - How do we include other professions and disciplines to help reduce risks?
5. How do we make decisions when we don't know for sure?
6. Do we need to be more resilient – to cope with unexpected change?

Change in Approach

living with t

The floods in Boscastle and North Cornwall 16 Augu

Making space for water

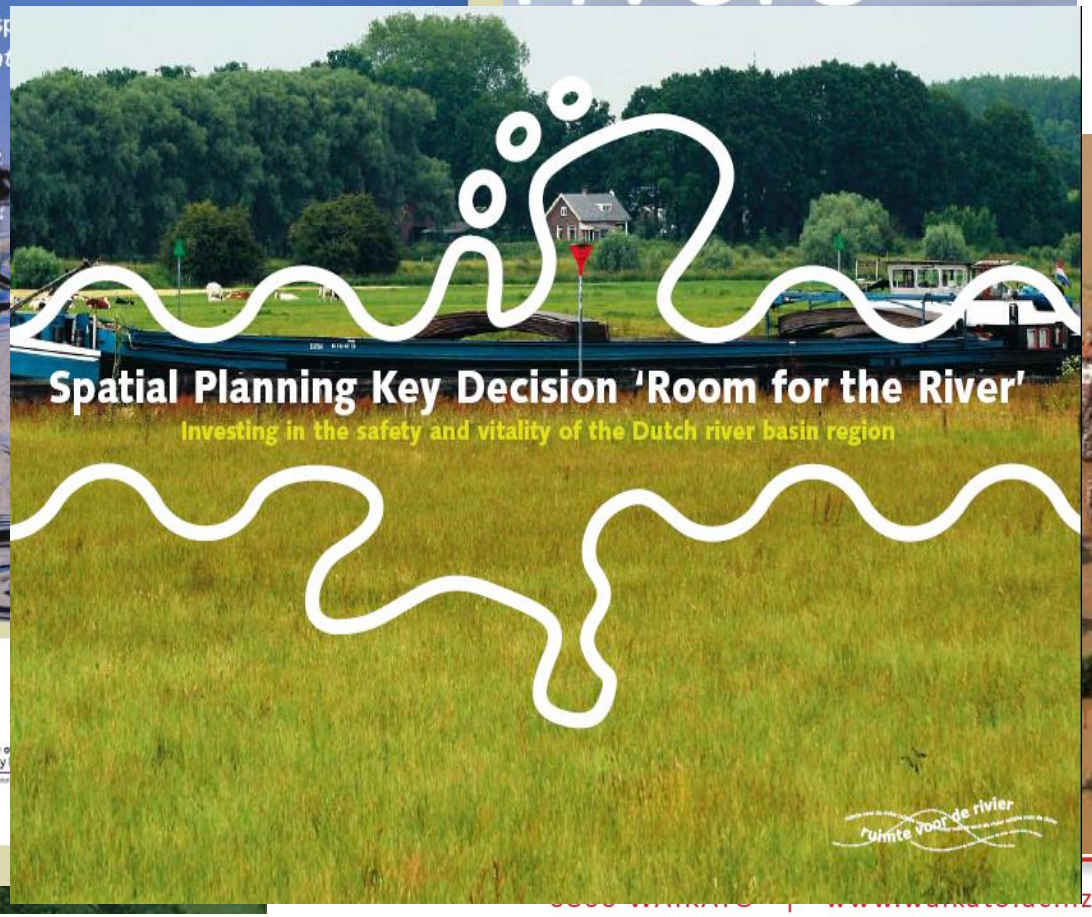
Taking forward a new Government strategy for flood and coastal erosion risk management in England

First Government resp
Making space for wat

March 2005

HM TREASURY

Learning TO LIVE WITH rivers



Shift in management

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Flood Defence

Integrated Flood Risk Management – *everyone* is a flood manager

Building and raising dikes and walls

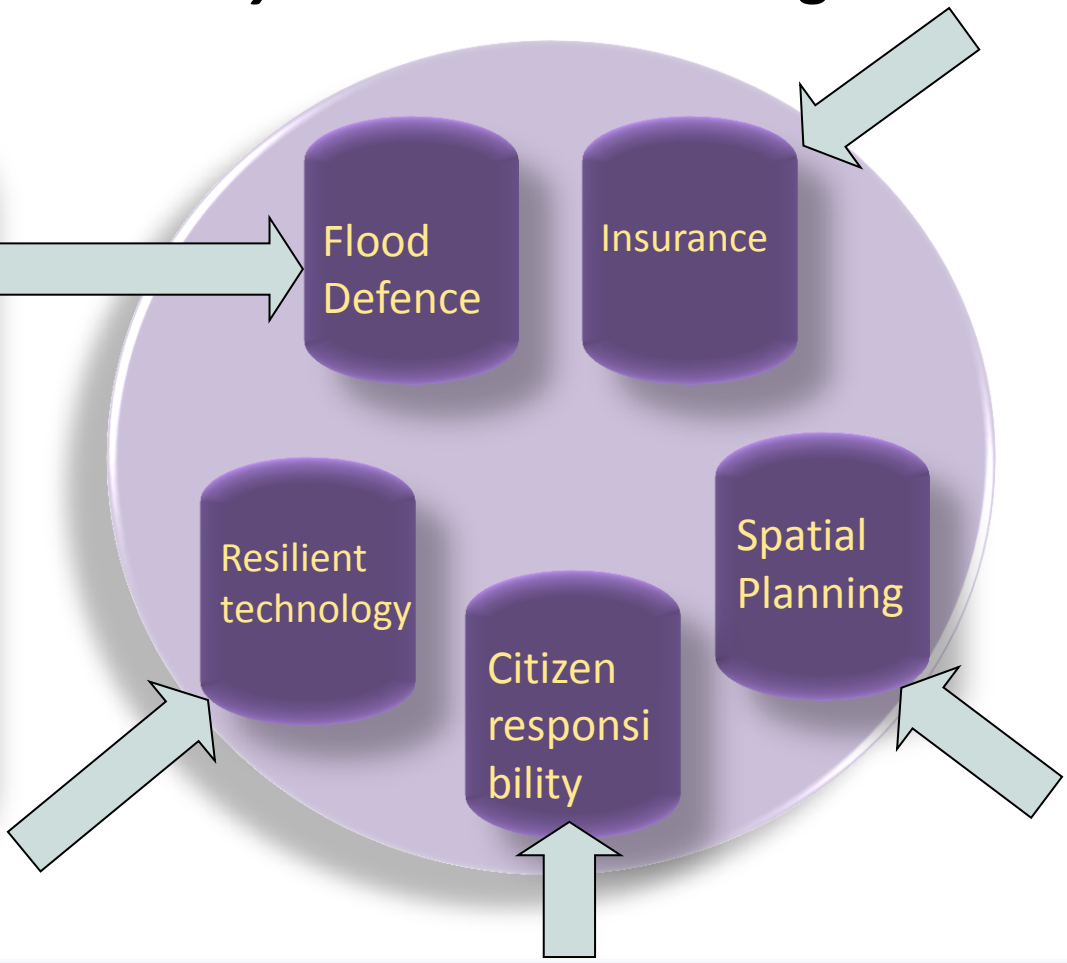
"Levee effect"

Cost intensive solution

Conflict with spatial & urban planning

Entrapment effect

"Silo thinking"



Flood Resilience at the Building Scale

Property and Community Level Protection

Smartest project – 4.8m Euros.

Examining the road to market for flood resilient technology

Building Aperture Technologies

These are designed to fit over any potential openings in a building envelope. These can be temporary or permanent.

- Preinstalled Building Aperture Barriers (automatic flood doors, autoatic flood gates)
- Demountable Building Aperture Barriers (temporary flood gates)
- Temporary Building Aperture Barriers (door guards; absorbent sandbags, flood gates, air brick covers; anti-flood air brick replacements.)

Perimeter Technologies

These are "systems" designed to help protect an entire structure or groups of buildings

- Demountable barriers
- Self-closing, automatic barriers
- Free standing barriers
- Building skirt systems

Building Technologies

These are often necessary and complementary to Building Aperture Technologies

- Non-return valves, back flow valves, toilet bungs
- Wall sealents; rendering (to reduce water penetration and cover cracks)
- Warning systems (e.g. telemetry systems)

8 Case studies across Europe

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Manchester, UK
Pluvial flooding, strategic planning at conurbation level.
Fragmented responsibility for FRM

Rotterdam
Large city, mostly located below sea level.
Combination of pluvial, fluvial and estuarine flooding.
Strong tradition of building flood defences

Paris
Fluvial and Pluvial Floods;
Strategic Planning of a large area

Hamburg
Low lying city located on the coast where estuarine and pluvial floods interact.

Dresden
City in mountainous region, historic instances of riverine flooding from the Elbe

Cyprus
Flash flooding,
Concentrated Population Densities, Weak FRM

Valencia
City on an estuary with mountainous areas.
Historic flooding in the Ribera del Jucar.
Lack of coordination across various administrations.

Athens
Torrential, Flash Flooding

www.smartfloodprotection.com

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Flood door and guard

Non-return valves

Mobile inflatable barrier

Mobile inflatable barrier

Automatic dam

Temporary guard

Images courtesy of the Building Research Establishment


ON04 MZU

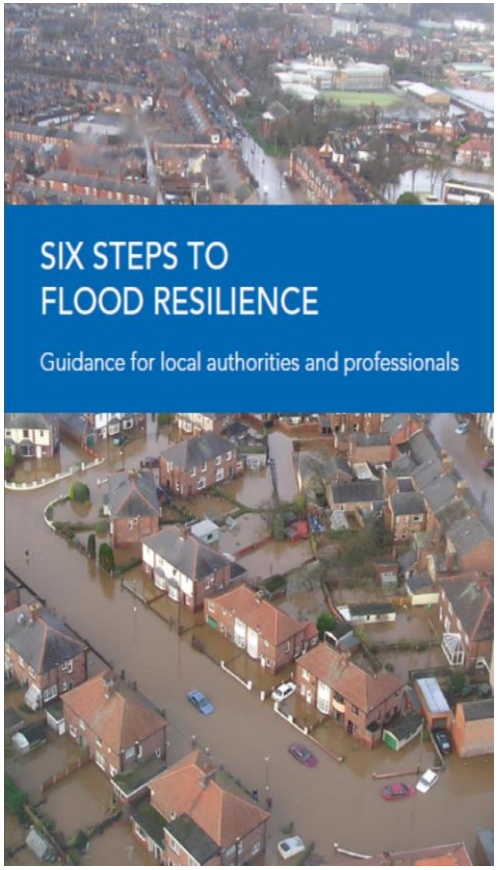
Barriers to Resilient Buildings

- **Sector**: emergent sector made up of small businesses – requires support at all 'road to market' stages
- **Public:** lack confidence in technology and manufacturers and are not sure how to go about installing
- **Decision-makers:** lack knowledge and capacity to support uptake – difficult to compare products, companies and results. What is the best practice process?
- **Insurers:** need info on performance, standards and how to price it.
- Some excellent products, some very good companies, but need to elevate rest of industry to those high standards
- '**Trust**' is a key theme of many barriers; from the market in general to performance to installation to its effect on your insurance premium
- There is consensus that a '**Best Practice**' document could mitigate many barriers. It would be welcomed by all stakeholders.

SMARTeST

www.smartfloodprotection.com

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato



STEP 1: UNDERSTANDING THE RISK

- A full flood risk mitigation survey should be performed by an independent surveyor who will recommend the FRe technologies that may be employed .

STEP 2: PLANNING A SCHEME – FIRST CONSIDERATIONS

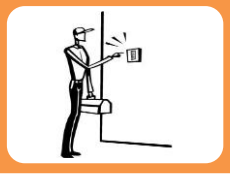
- The pros and cons of various products should be weighed up including ease-of-use, performance specification, cost, and so on.

STEP 3: SURVEY

- Manufacturer(s) will need access to the site to fully measure it in order to design the products and to undertake an assessment of its current state .

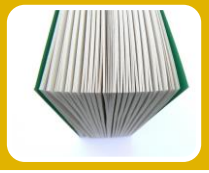
STEP 4: DESIGN AND SPECIFICATION

Manufacturer(s) will design the FRe technologies with the end-user in mind. Materials will be cleared with the end-user. The FRe technologies will be clearly specified with an indication of when they will not work.



STEP 5: INSTALLATION

Manufacturer(s) will provide installers with a clear set of instructions. The installer will need access to the site. All work shall be signed off by the initial surveyor, the site/property owner and the manufacturer.



STEP 6: OPERATION AND MAINTENANCE

Manufacturer(s) and/ or installers will train the end-user on how to operate equipment in the event of a flood. A manual with clear maintenance and operation instructions will be presented to the end user. End-user is responsible for maintenance .

More resilient cities...

Urbanisation Changes Hydrology

Differences between *Undeveloped* and *Developed* runoff behaviour

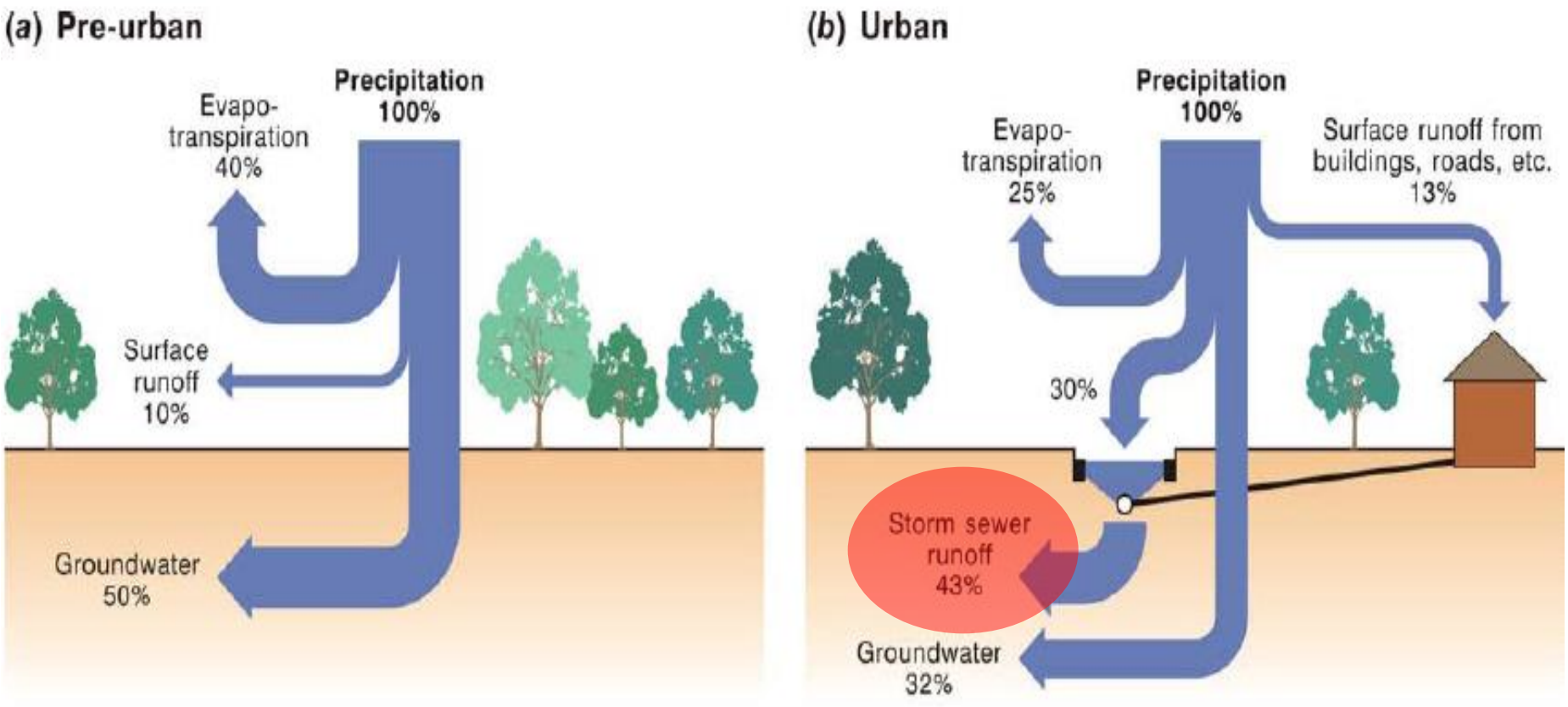
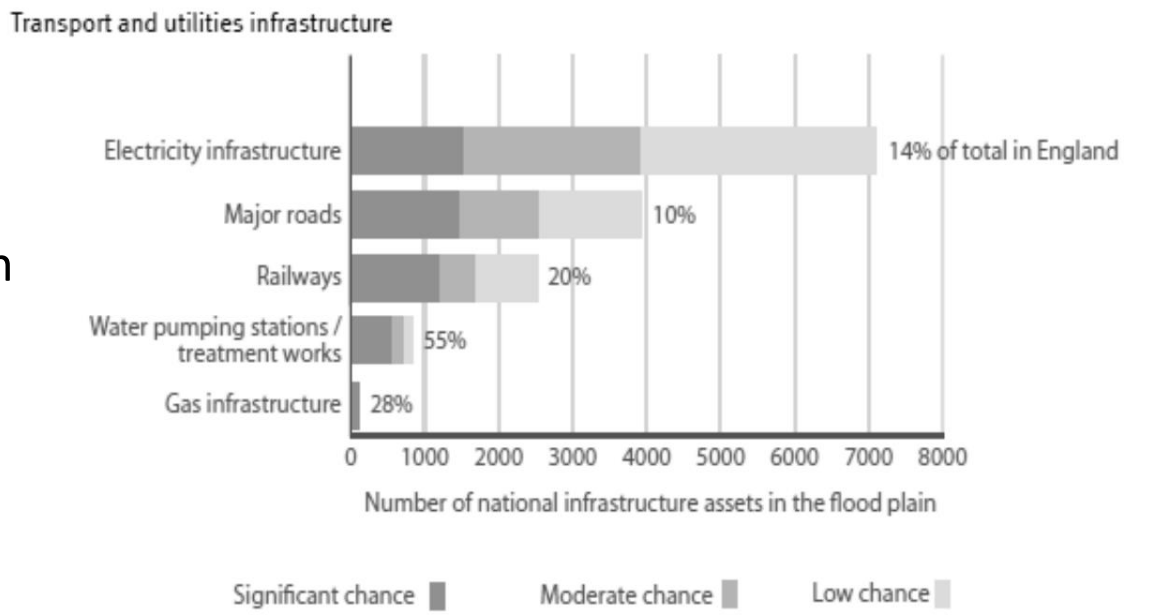
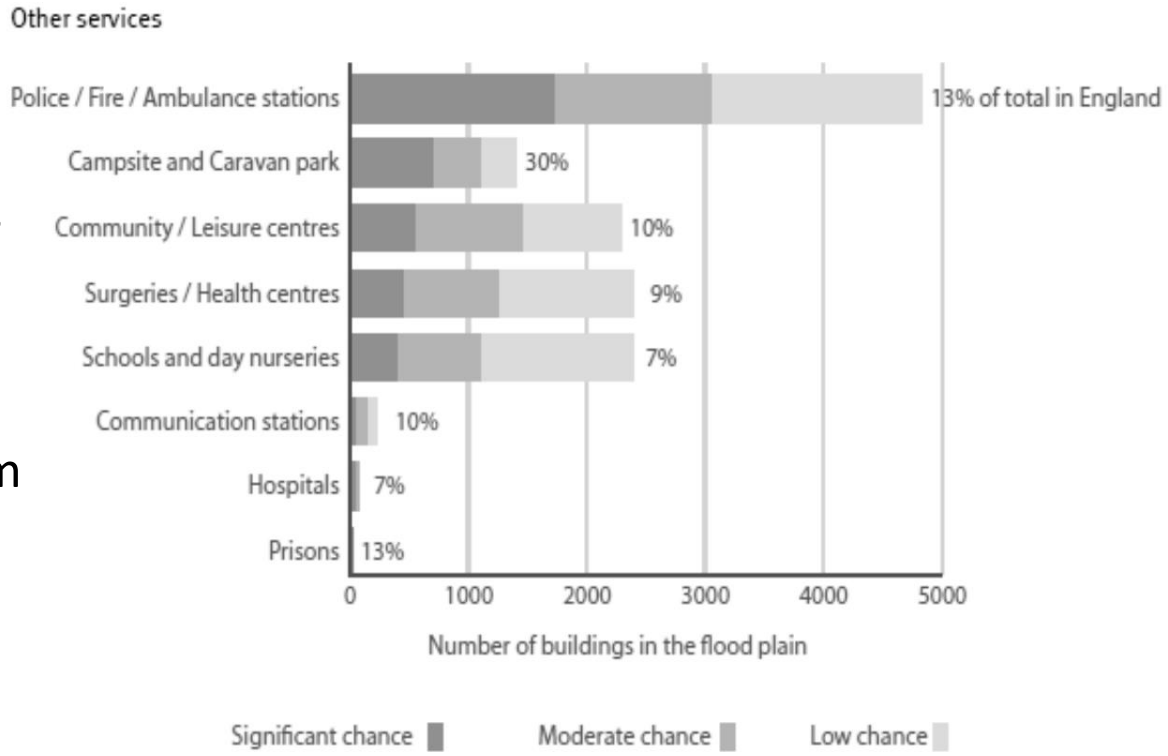


Figure 1: Contrast between natural and urban runoff pathways.

Infrastructure...

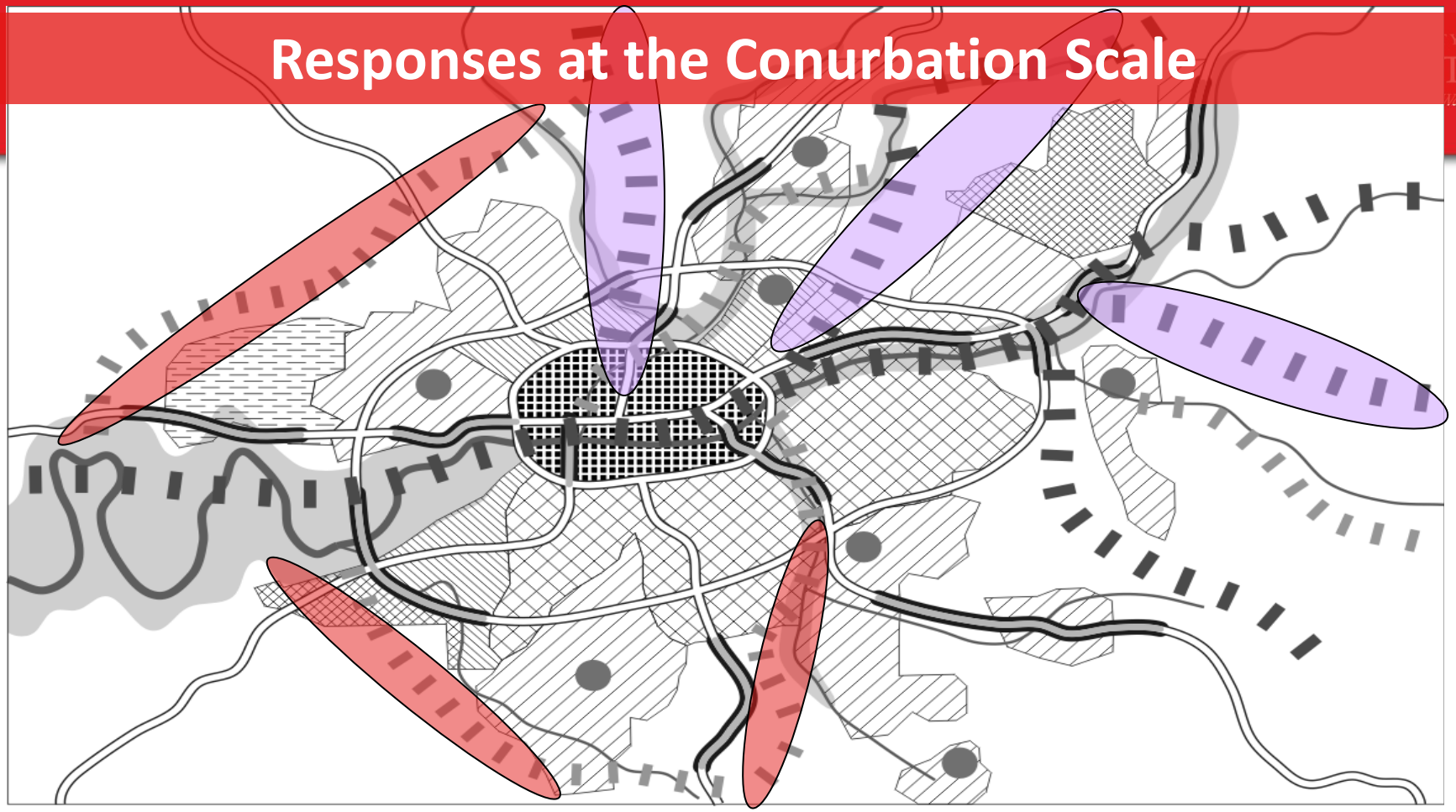
- Infrastructure at flood risk in England
- 2,358 schools
- 2,363 doctors surgeries
- 4,000km (10%) of roads
- 2,500km (21%) of railway;
- 55% of water treatment works and pumping stations
- 14% of all electricity infrastructure.
- Therefore can be at risk from the effects of flooding, even if not *exposed*





HafenCity Hamburg, Germany

Responses at the Conurbation Scale



Blue infrastructure – storage and recreation

Upstream storage

Green infrastructure on sandy soil – highly protected

Low quality green space on clay soil – earmarked for development

Transport corridors

Transport corridors identified for water storage

Densification area

Areas of vulnerable community and infrastructre

Areas for potential creation of new green space

Low density residential – restricted new development

Retrofit resilient design

Restricted development due to low sewer capacity

References

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Thanks for Listening!

White, I. (2014) 'Castles in Sand: The Shifting Sources of Flood Risk and the Implications for Governance', in Glavovic, B. and Smith, G. (eds) *Adapting to Climate Change: Lessons from Natural Hazards Planning*, Springer

White, I. (2013) Water and Spatial Planning - 'If we want things to stay as they are, things will have to change...', *Town and Country Planning Association Journal*, October, 82 (10): 422-425.

White, I. (2013) 'The more we know, the more we don't know: Reflections on a decade of planning, flood risk management and false precision, *Planning Theory and Practice* 14 (1): 106-114.

White, I. (2010) *Water and the City*, Routledge: London.