ROYAL HASKONING

consultants architects engineers

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Outline of presentation

- Flood Resilience and Protection – WHAT? WHY? HOW?
- Role within sustainable flood risk management
- Some examples and hierarchy
- Planning and Design Issues
- Case study

Some flood risk statistics

- 22 million households in England
- Housing growth at 223k / annum
- 2.1 million properties (4-5 million people) in England at risk of flooding
- Climate change will increase probability and severity of flooding
- Growth will increase probability and consequence of flooding
- Large percentage of key infrastructure we depend on are susceptible to flooding
- Remember! UK is an Island

Flooding is real

- Last 3-4 years:
  - Carlisle 3 deaths, 30,000 homes affected
  - Boscastle, significant property damage and 150 people dramatically rescued by helicopter

- In the last 1-2 years:
  - Summer 2007, Gloucestershire, Yorkshire, Lincolnshire, Thames Valley – 13 deaths, 55,000 properties, major infrastructure systems, 200,000 insurance claims
  - Over 4000 yet to return to their homes a year on.
  - East of England near miss – Winter 2007
  - Oxford, January 2008

- It's not all UK:
  - 200 major floods In 2007, affected 200 million people, caused over 8000 deaths

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Where have we come from?

- Historically communities have developed along watercourses, coastal areas and on flood plains
- Last half century has seen more intensive agricultural land use
- Flood defence measures targeted at areas at risk e.g.
  - Upstream storage or detention
  - Watercourse or drainage improvement
  - Flood walls
  - Diversion
- land under-drains, drainage pumps and irrigation

Where are we going?

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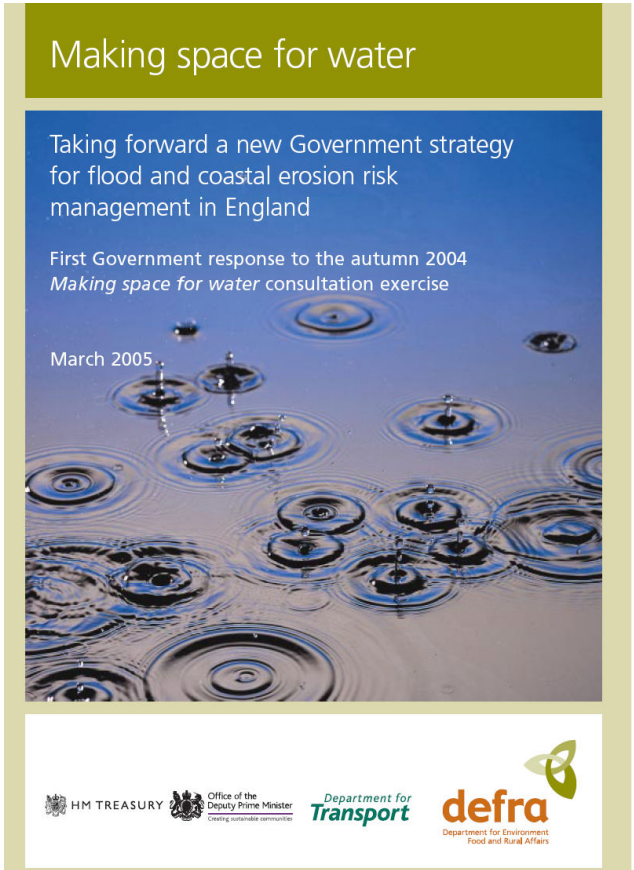
- **FROM DEFENCE TO RISK MANAGEMENT**
- **A more holistic approach:**
  - Climate change adaptation
  - Whole catchment approach
  - Partnership working
  - Economic, social & env. balance
- **Better Risk Management:**
  - Source, pathway, receptor approach
  - All sources of flooding
  - Whole life asset management
- **Portfolio of flood risk measures:**
  - Land use planning
  - Integrated urban drainage
  - Coastal flood risk management
  - **Resilience and resistance**
  - Warning and emergency response
  - Rural flood risk management



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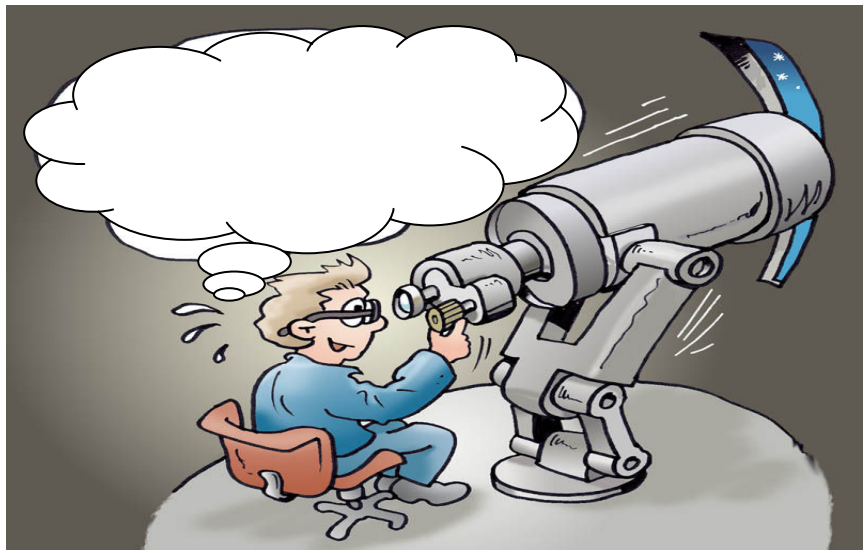
Role within Flood Risk Management

Making space for water

- Sustainable flood risk management requires a wider consideration of probabilities and consequences of flooding
- Appropriate suite of measures are required to manage all levels of flood risk through their sources, pathways and receptors
- “Novel solutions that extend the range of solutions available for flood mitigation, that might otherwise be uneconomic or environmentally unacceptable, or that were regarded previously as insoluble problems” (MSFW Background paper)

Role within Flood Risk Management

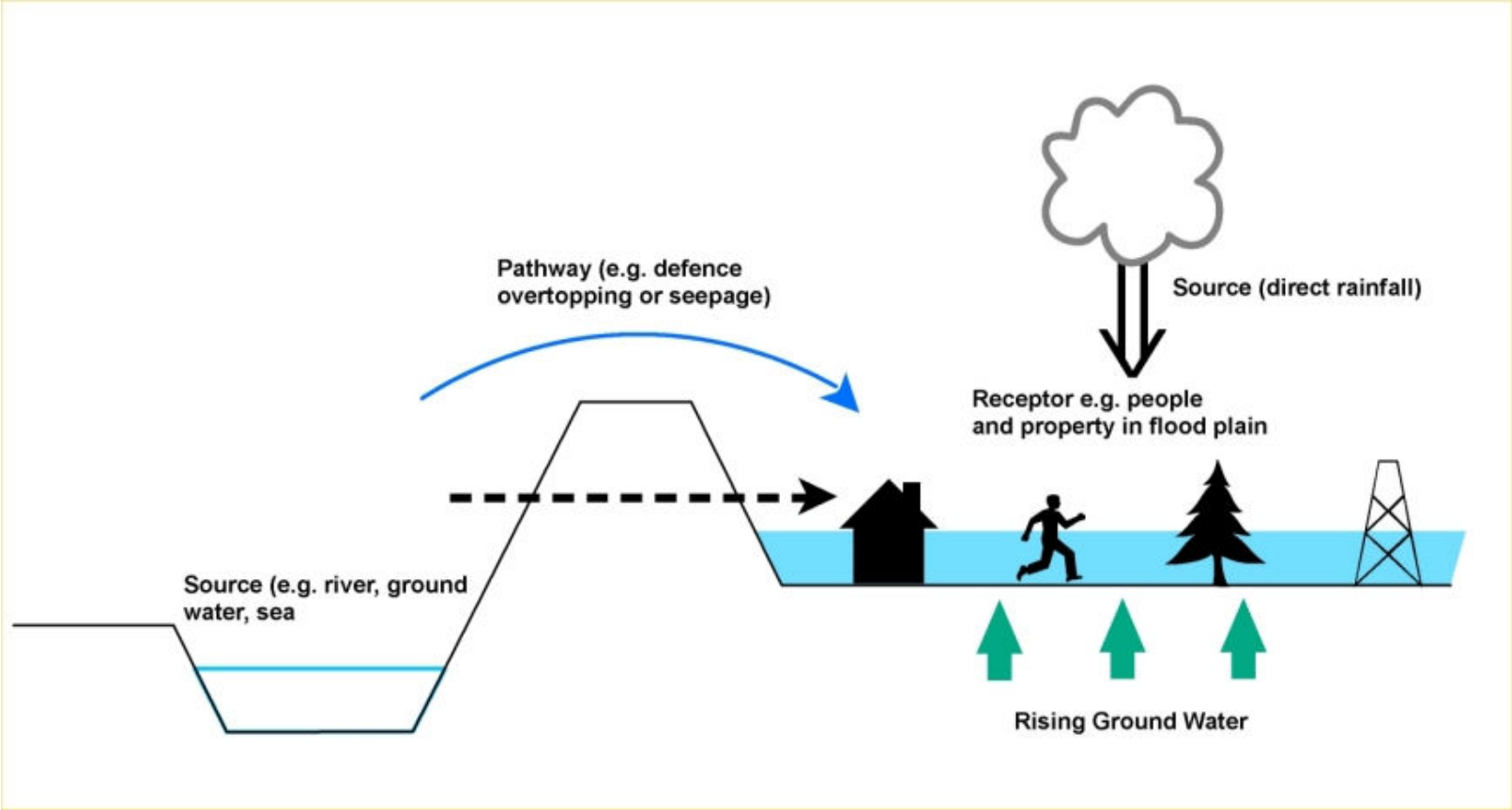


- More flexible and adaptable approaches are required to manage the consequences of climate change

- For all four future scenarios, resilience and protection systems were assessed as having major or marked potential for the following:
  - real-time event management
  - River defences
  - Flood proofing

Wider context

- Property level protection or resilience needs to link to the wider whole systems risk management



Property Flood proofing

- Definition:
- “Any combination of structural and non structural changes and adjustments incorporated into the design, construction or alteration of individual properties that will reduce flood damages”
- Source – Flood proofing performance (USACE 1998)

Flood proofing

- Elevation
- Location of property on ground higher than set flood level
- Locally raised building or floor levels to a level higher than some set flood level
- Sloping adjacent land away from buildings

- Flood protection (dry-proofing)
- Measures to keep water out of a building
- Includes temporary blockage of all entry routes including through openings, floor, walls and joints

- Flood resilience (wet-proofing)
- Measures to minimise the effect of flooding when it occurs and to facilitate its recovery
- Includes form of construction/material and layout

Flood Defence Structure

- A flood defence structure is made up of:
- Superstructure
- Foundation or bedding structure
- seepage cut-off (if applicable)
- Seals and joints within structure
- Interaction with adjacent structure/subsoil

FOR PROPERTY PROTECTION/RESILIENCE, BUILDING BECOMES THE FLOOD DEFENCE STRUCTURE

Why?

- Conflicting user needs (e.g. access and defence)
- Unacceptable visual impact of strategic protection
- Management of extreme events
- Strategic solution not feasible technically or economically
- Local sources of flood risk e.g. local drainage or rising ground water

When?

- Only consider property resilience and protection if:
- Options for protection away from properties is not feasible or has been exhausted
- There
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- There
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- Exhau

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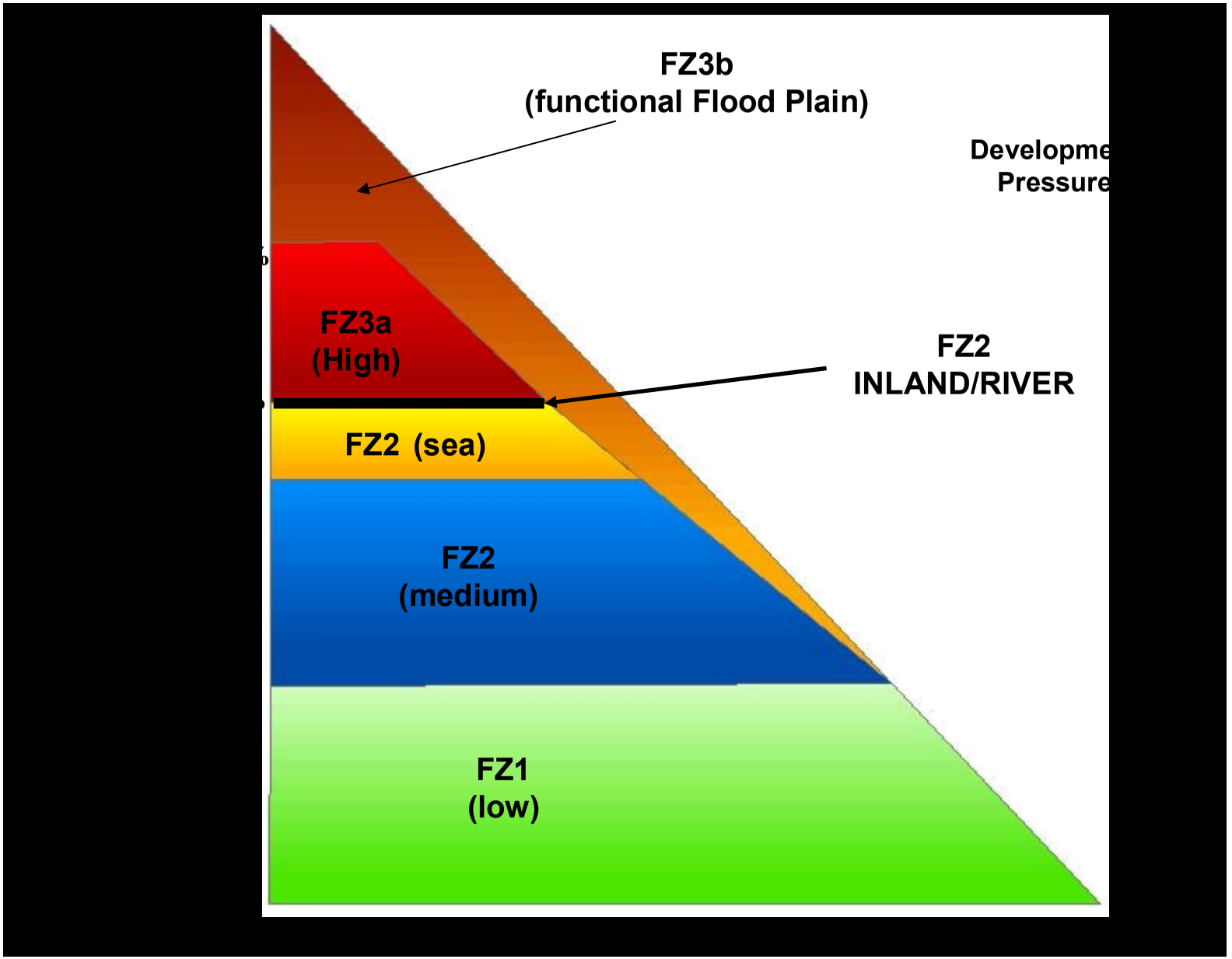
Hierarchy: Avoid! locate on high



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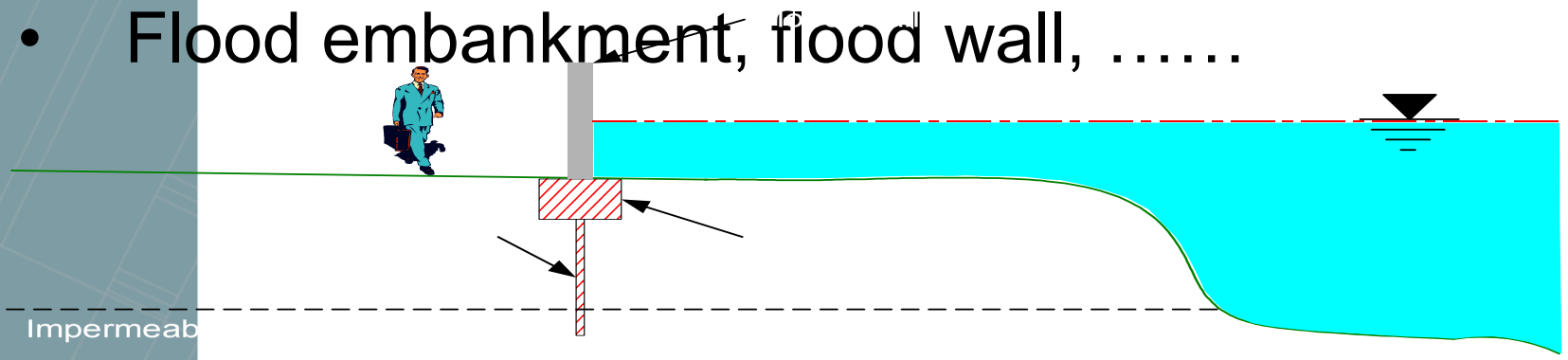
Permanent Flood Defence – away from properties

- Always in place
- Requires no operation
- Flood embankment, flood wall, ……



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Automatic demountable flood defence

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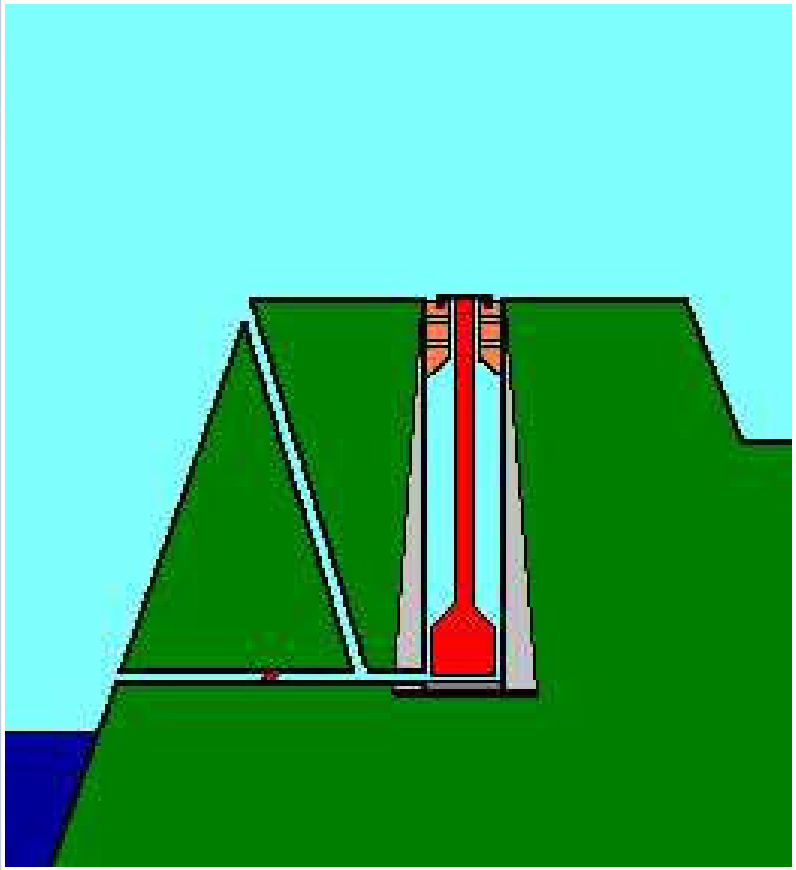

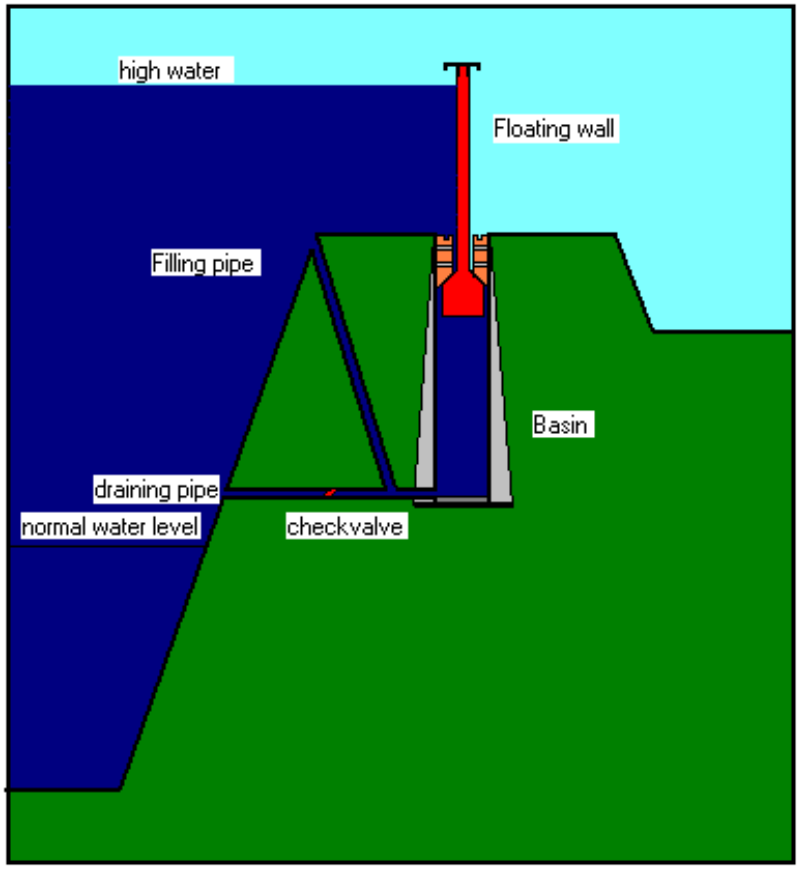

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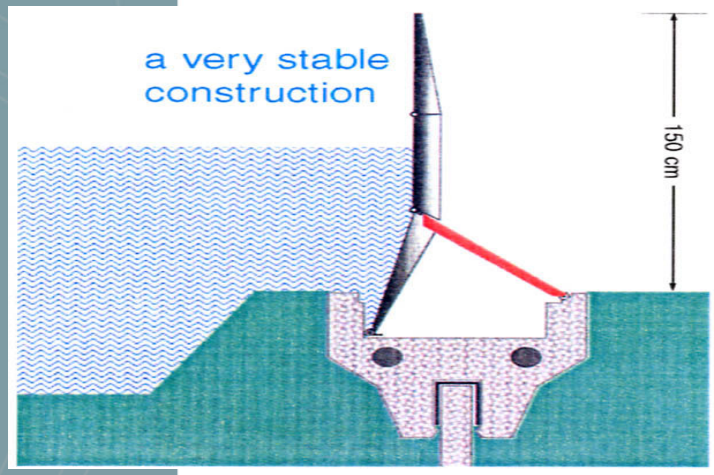
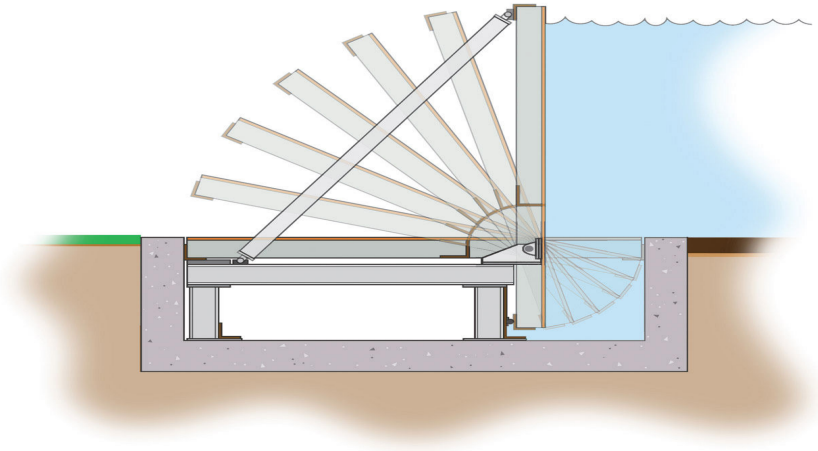
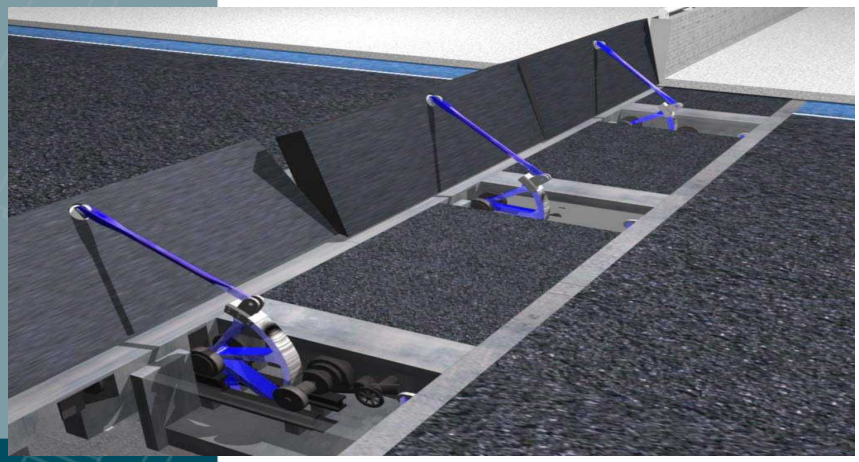
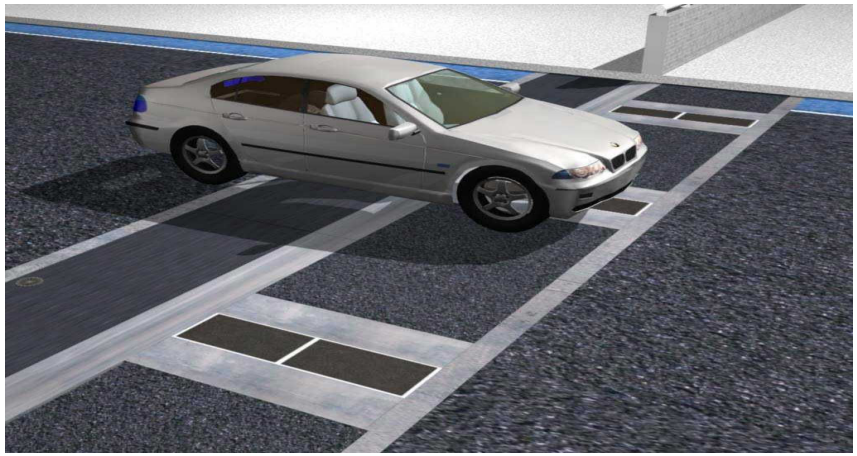
Demountable requiring only closure









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Demountables requiring part installation & closure

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Temporary (Upton)

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Infrastructures?

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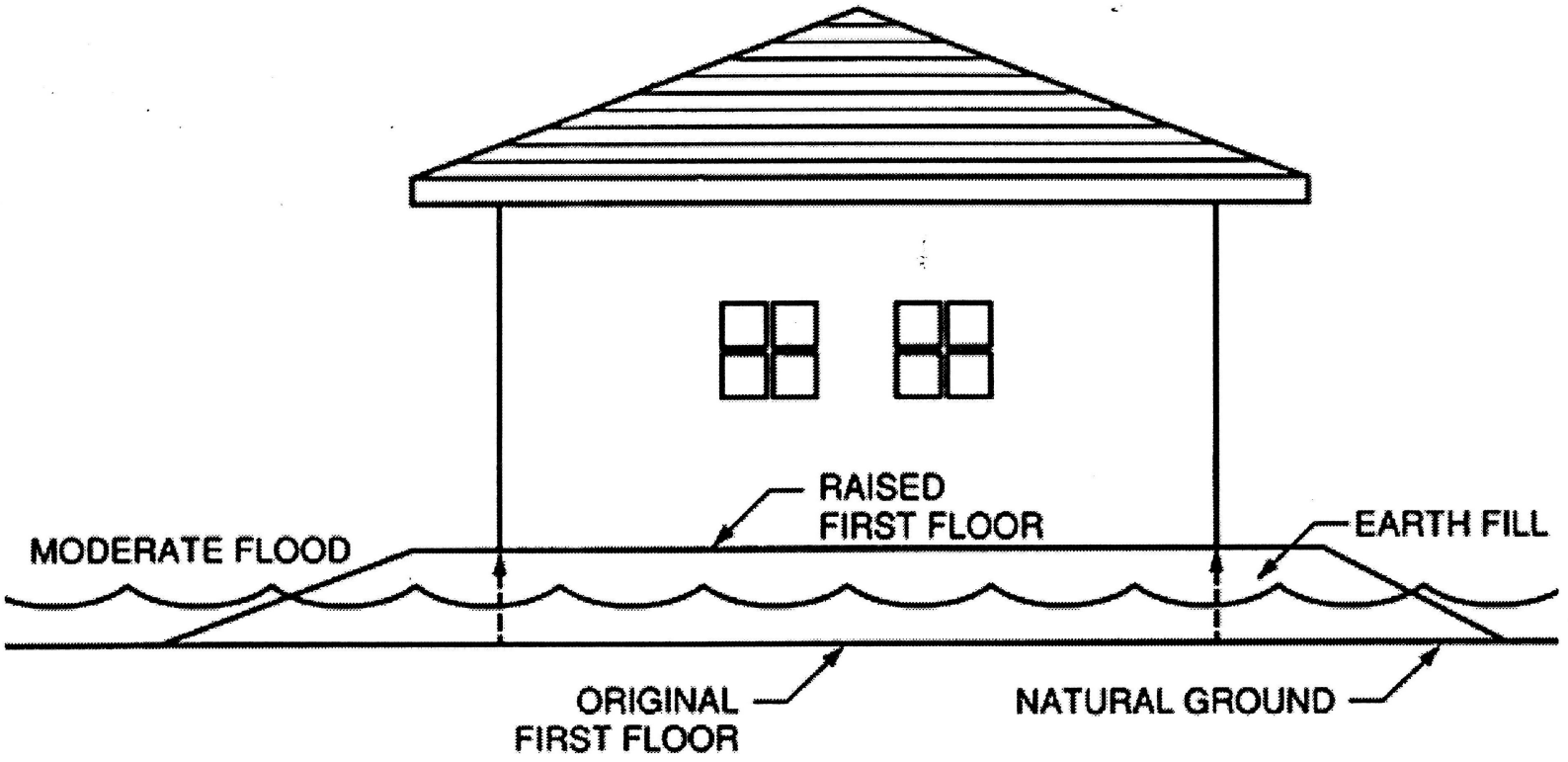
Local elevation



Elevation – The Dutch Way !

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Property skirt

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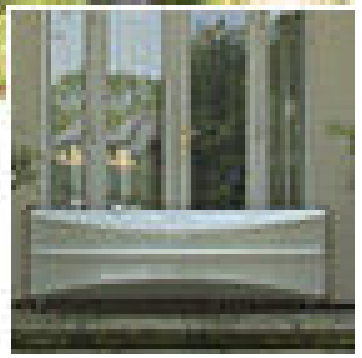
Walls, floors and openings



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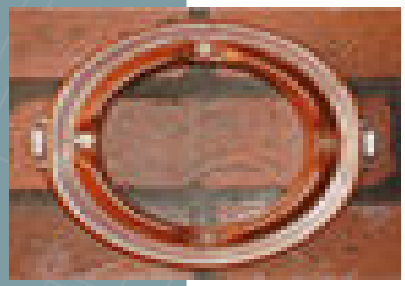
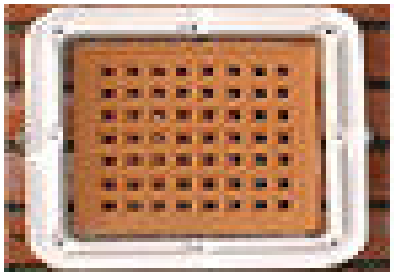
Air-brick and flue covers





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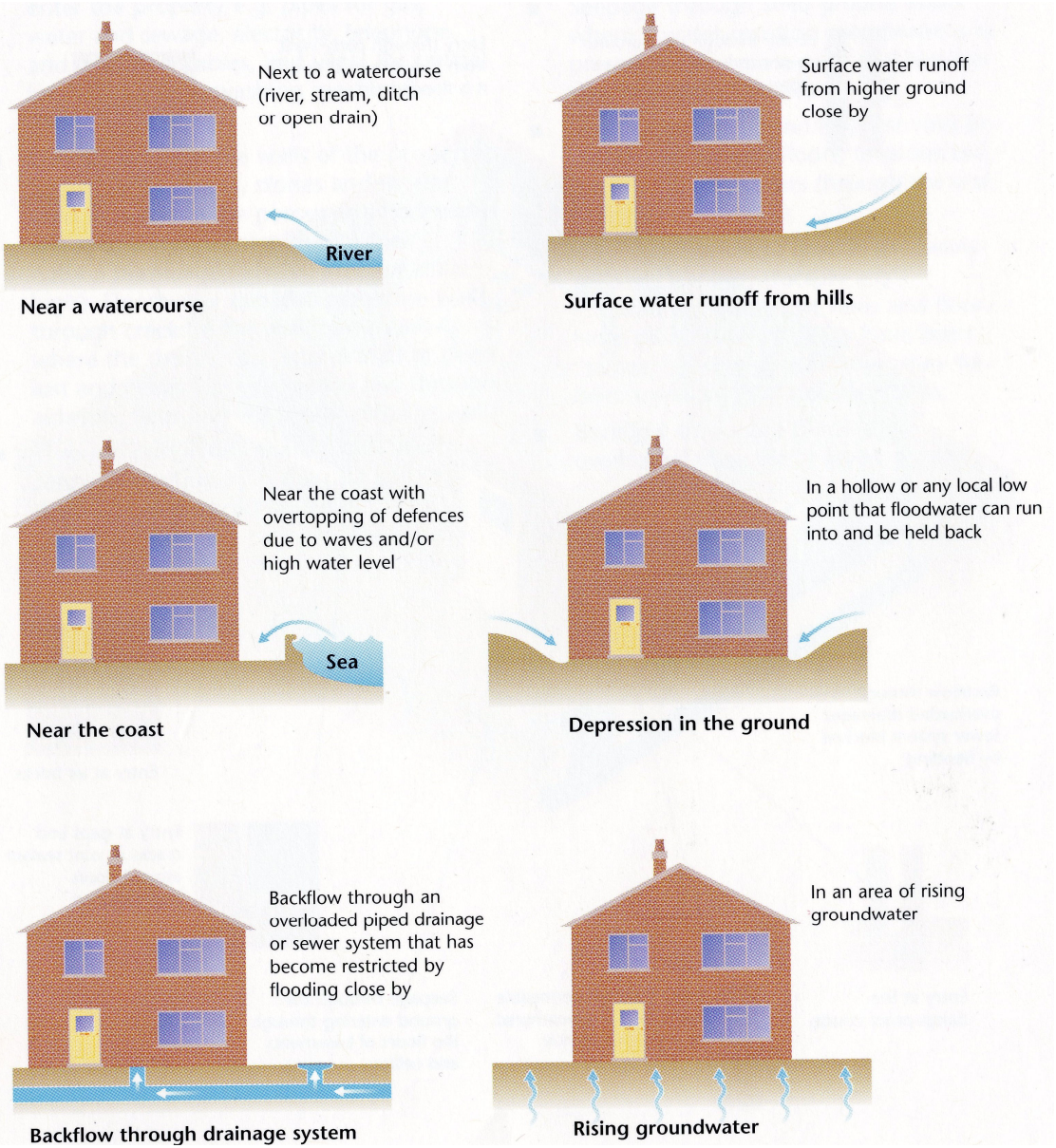
Design process

- Assess flood characteristics, lead time, warning systems and mechanisms of flooding
- Investigate options to address flood sources, pathways and receptors (hierarchy)
- If flood proofing is the preferred approach or part of?
- Assess characteristics of building – wall, floor, foundation and sub-soil types and materials (different for new build)
- Investigate all potential sources of flood water entry or propagation (including drainage)
- Develop solutions to combat the source(s) of entry and the impact of floodwater
  - Consider whole life operational management
  - Maximise passive systems
  - Consider the whole range of flood loadings

Local flooding and responses



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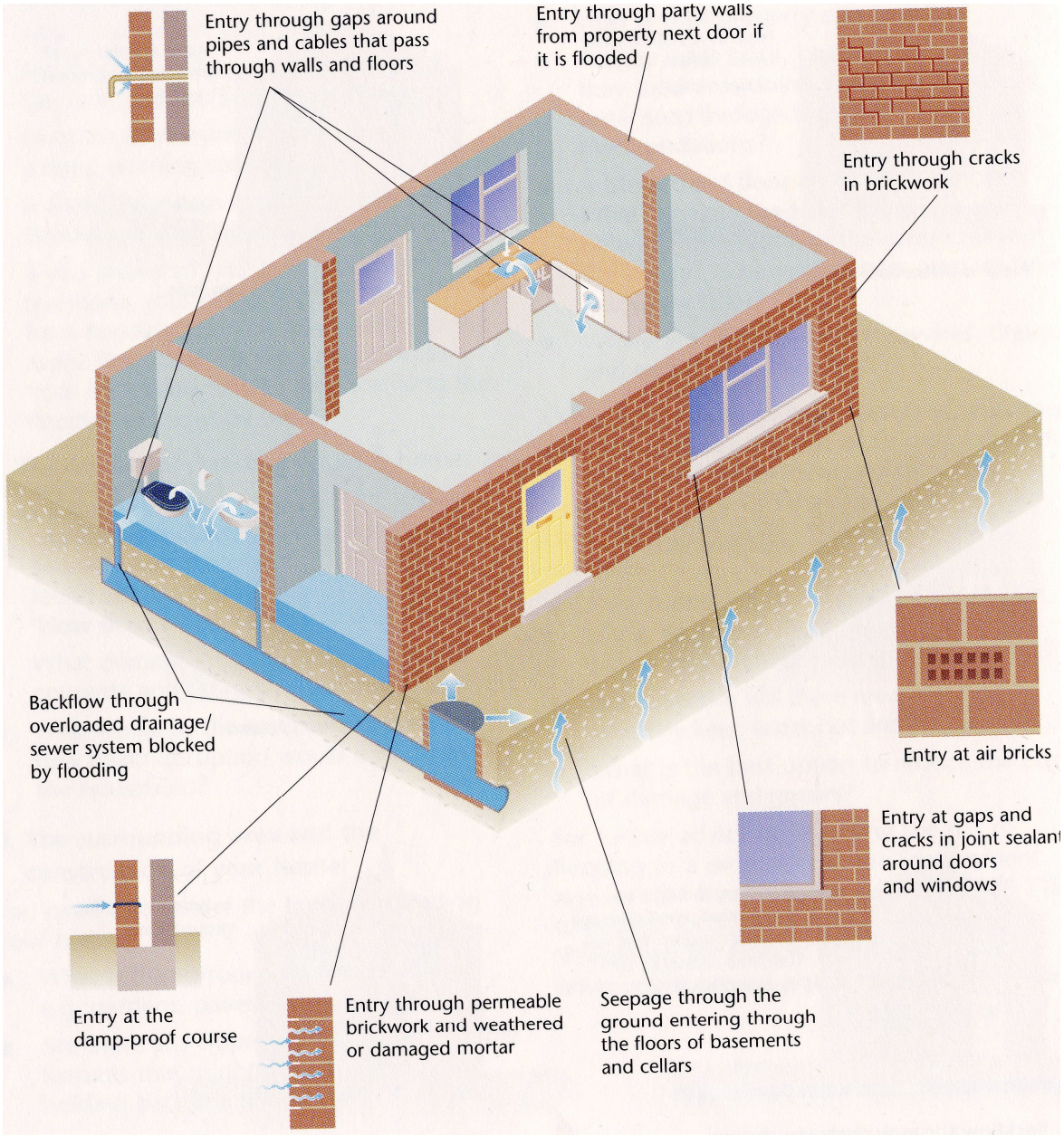
Individual property flooding and



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Cambourne Case Study

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Sustainable Drainage or SUDS is a new approach to managing rainfall by using natural processes in the landscape to reduce flooding, control pollution and provide amenity for the community.

Roofwater is collected in water butts, for use in gardens, or flows directly to grass channels called swales. Water travels onward to grass basins where it is stored before release to a local ditch. Rain falling on roads or paths will pass through block paving, where it is filtered and stored in the stone below, or can flow into grass channels that have a stone filter drain underneath before it joins the SUDS system. Usually there will only be water in the retention pond with a trickle of water flowing through the swales during gentle rain, but when it rains heavily the shallow basins fill with water for a short period to protect people downstream from flooding. Water is collected, cleaned and stored in the local landscape providing an attractive place for play and wildlife helping to restore a healthy environment for us all.

SUDS and Flood Proofing

- SUDS - Source Control, Site Control and Regional Control
- Floodproofing - Elevation, Flood Resistance and Flood Resilience

Cambridgeshire County Council

Flood proofing

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Flood proofing measures - Elevation

- Finished floor levels raised at least 300mm above surrounding ground levels
- Finished walkway/garden sloped away from property
- Particular issue with wheelchair access

Elevation

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Flood proofing measures – Resilience

- Raised water sensitive items (boiler, utility meters etc.)
- Flood resistant materials/finishes (PVC skirting/treated wood)
- Removable partition wall panels for 1st 900mm of wall
- Use of dado rails as a visible but unobstructive indicator of flood protection level
- All internal electrical sockets/wiring above 1m and use of water resistant cables and wiring.

Flood proofing measures –

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Protection

- Raised service outlets, doorways, vents, flues etc.
- Non return valves / drain stops for drainage systems
- Water resistant building materials (engineering bricks, rendering and mortar for first 600-900mm of ext. wall
- Adequate drainage design for damp-proofing
- Sump/pump below ground floor
- Barriers/covers for external openings lower than 900mm from ground

Flood Resilience & Protection

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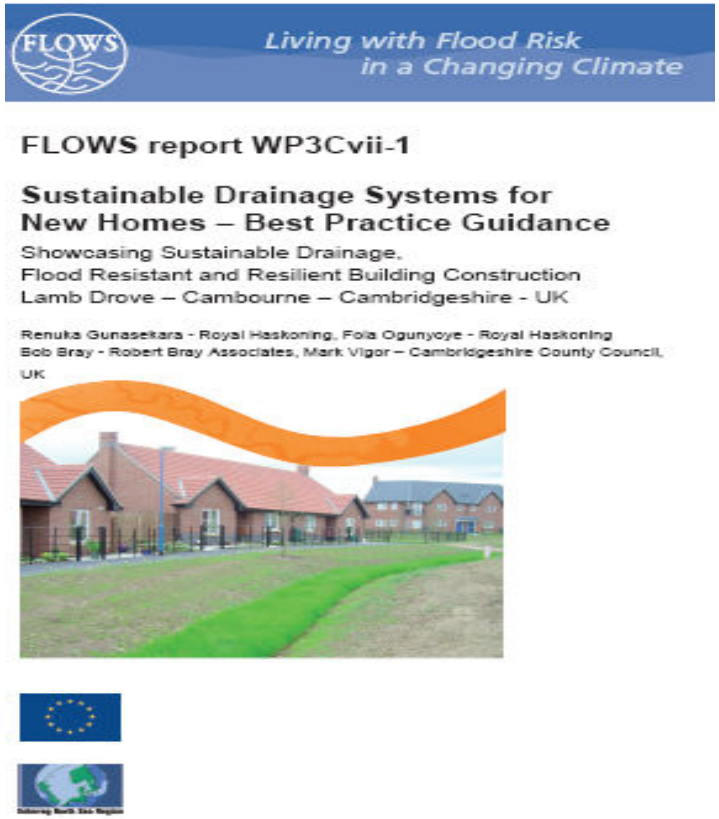
Key Outcomes

- Complete flood protection to site
- Flood risk reduction elsewhere
- Adaptation to climate change
- Best Practice Guidance



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Some challenges

- Upfront cost
- Quick and easy assess to information during and immediately after flood event
- Encouraging uptake
- Knowledge of available measures and effectiveness

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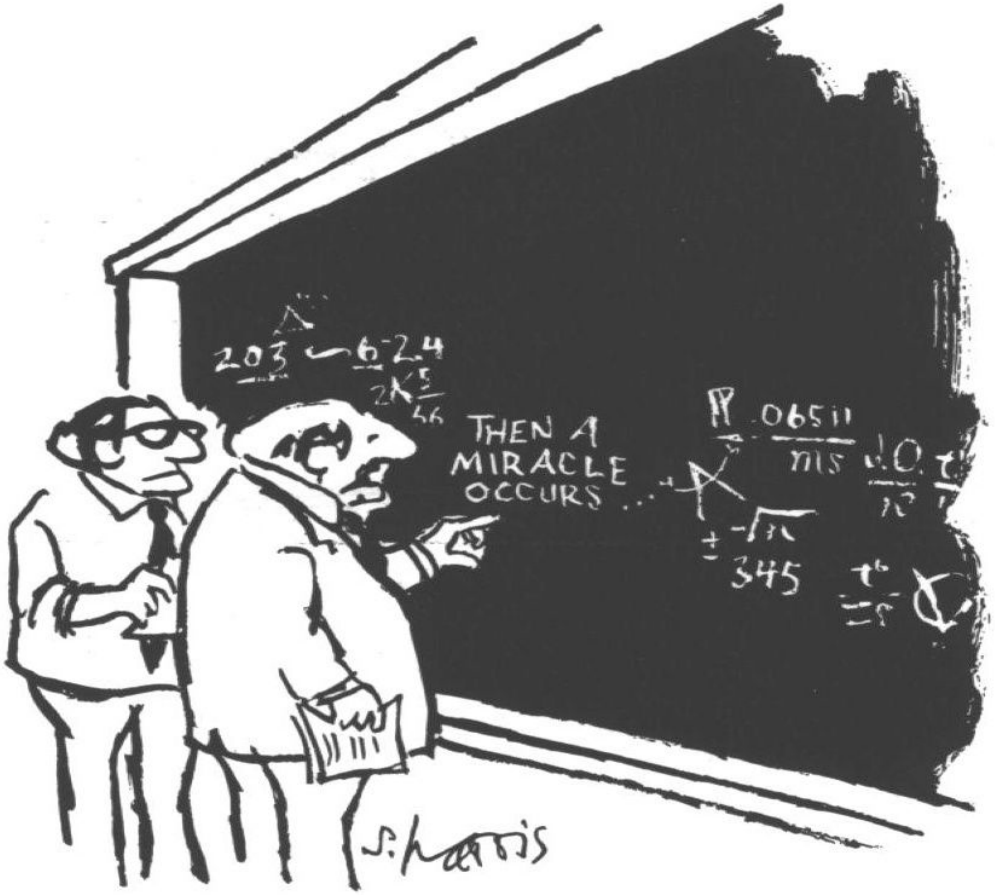
Questions?



"I think you should be more explicit here in step two."

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