Making Space for Water

Groundwater flooding records collation, monitoring and risk assessment (reference HA5)


The UK Groundwater Forum, London May 23rd 2007
(Climate change: the future for groundwater management)

Overview of Presentation

- Making Space for Water
- Definitions and sources of groundwater flooding
- Mechanisms of groundwater flooding from Chalk
- Data collection, mapping and risk management
- Potential changes driven by climate change
- Possible direction for the strategic overview role of the Environment Agency

Making Space for Water

- Initial Government consultation in 2004
- First Government response in 2005 setting out how new strategy was to be implemented
- However, further consultation/work was necessary to refine details which resulted in 25 projects
- Projects due for completion Autumn 2007
- One theme is Holistic Approach to managing flood and coastal erosion risk (HA)
- HA5 project is considering future collation of groundwater flooding data
- Linked projects considering groundwater flooding include
  - HA4a: hazard mapping of ‘other’ sources
  - RF5: expanding flood warning service

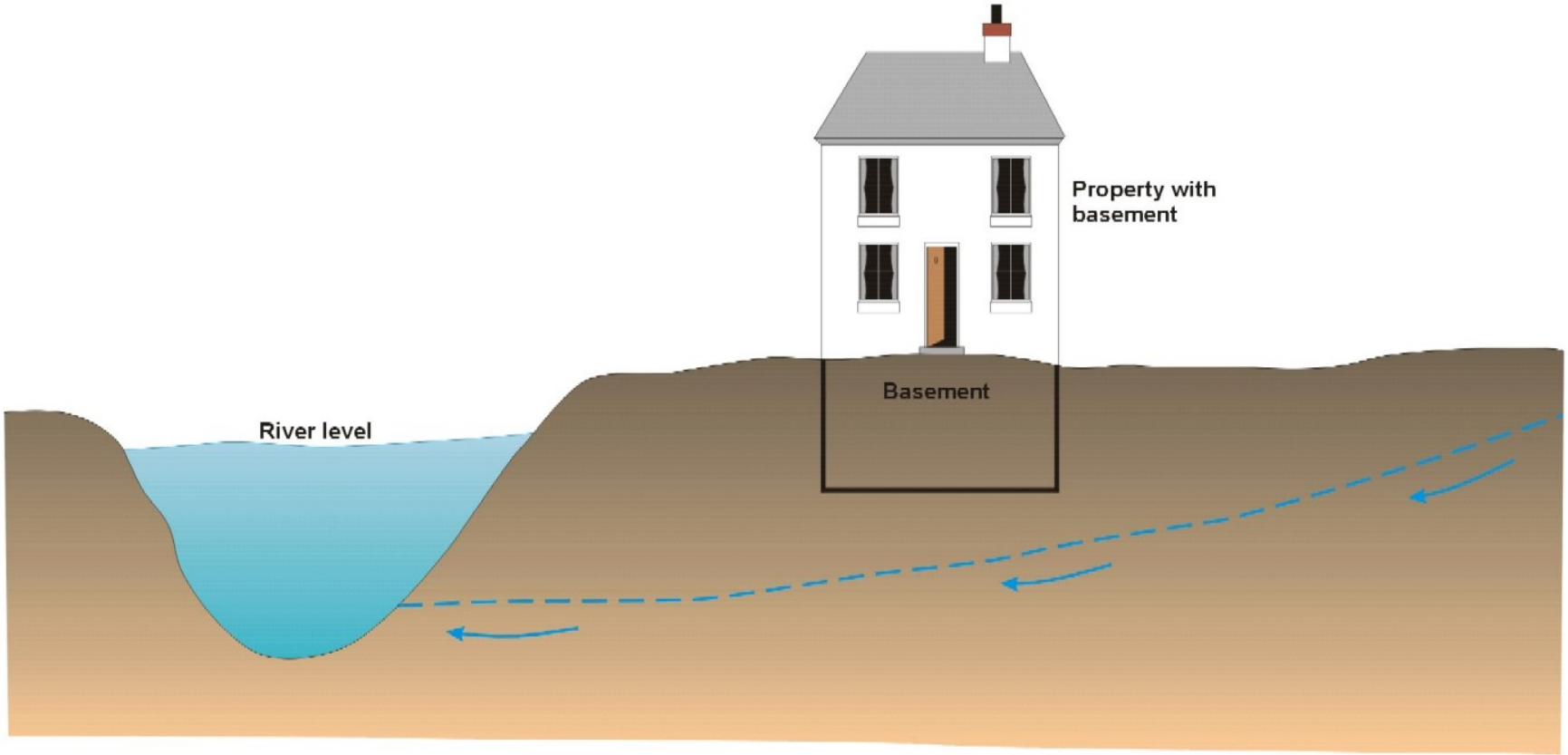
Definition and Sources

- **Groundwater Flooding** can be caused by the emergence of water originating from sub-surface permeable strata. The groundwater may emerge from either point or diffuse locations.

  - Response to **extreme rainfall** events
  - High in-bank **river levels**
  - Urban or Mining Groundwater **rebound**
  - Ground **subsidence**
  - **Leaking** sewers, drains and water supply mains
  - Upward leakage driven by **artesian heads**
  - **Artificial** obstructions or pathways

Note: Exacerbation by Fluvial Defences

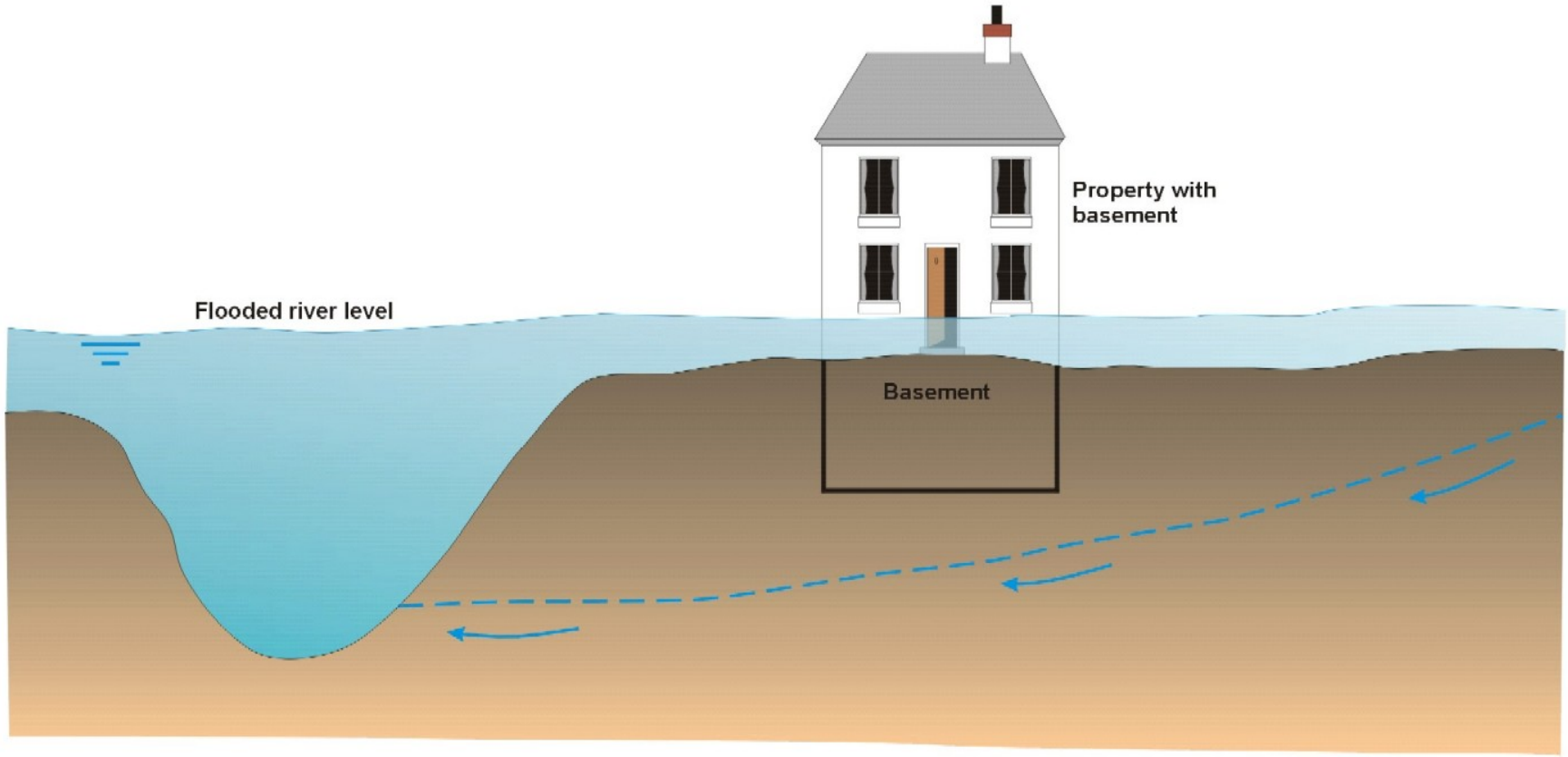
- Influence of climate change on fluvial flooding discussed elsewhere
- However, must note potential groundwater – surface water interactions:



JACOBS

Note: Exacerbation by Fluvial Defences

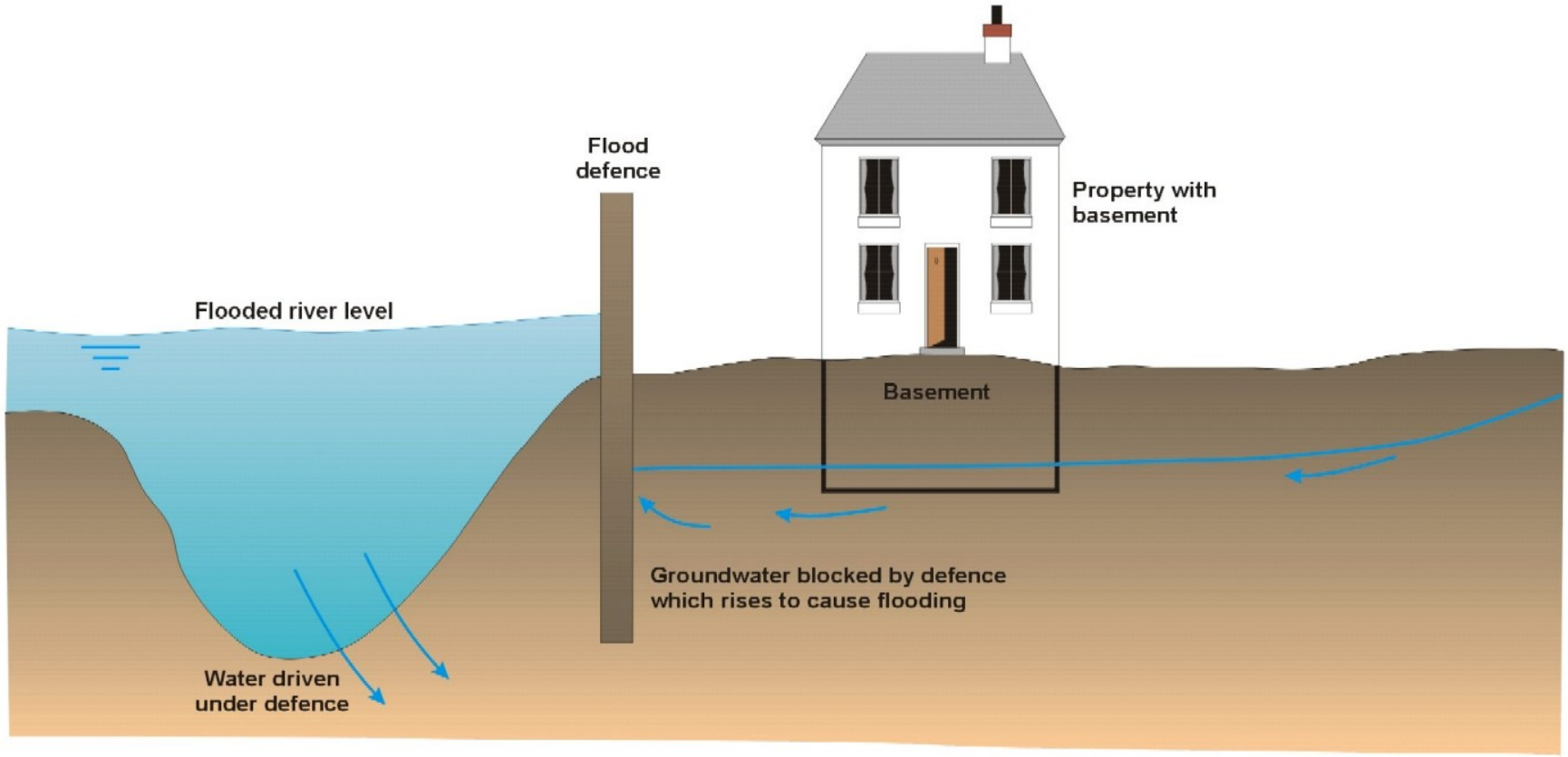
- Influence of climate change on fluvial flooding discussed elsewhere
- However, must note potential groundwater – surface water interactions:



JACOBS

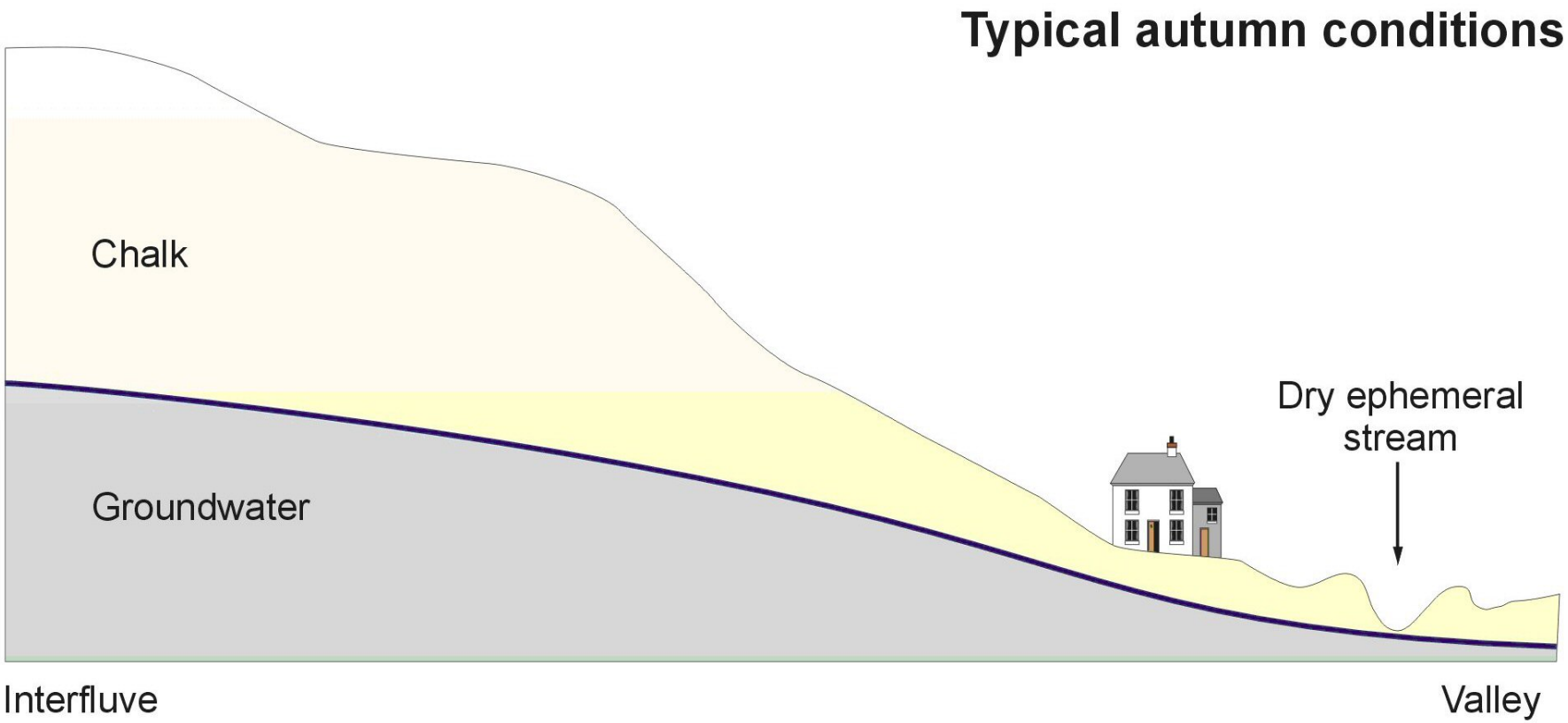
Note: Exacerbation by Fluvial Defences

- Influence of climate change on fluvial flooding discussed elsewhere
- However, must note potential groundwater – surface water interactions:



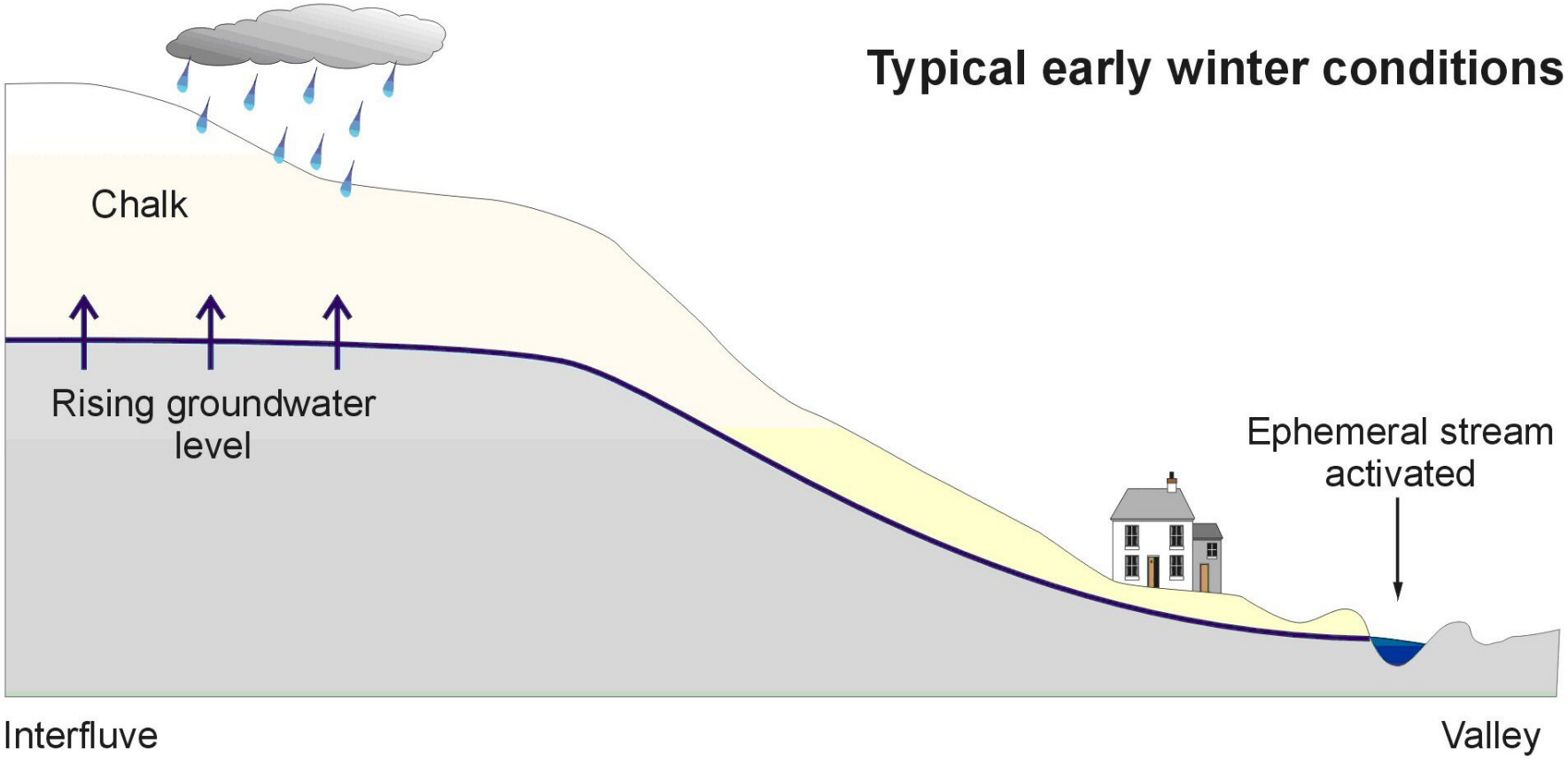
JACOBS

Mechanism Operating in the Chalk



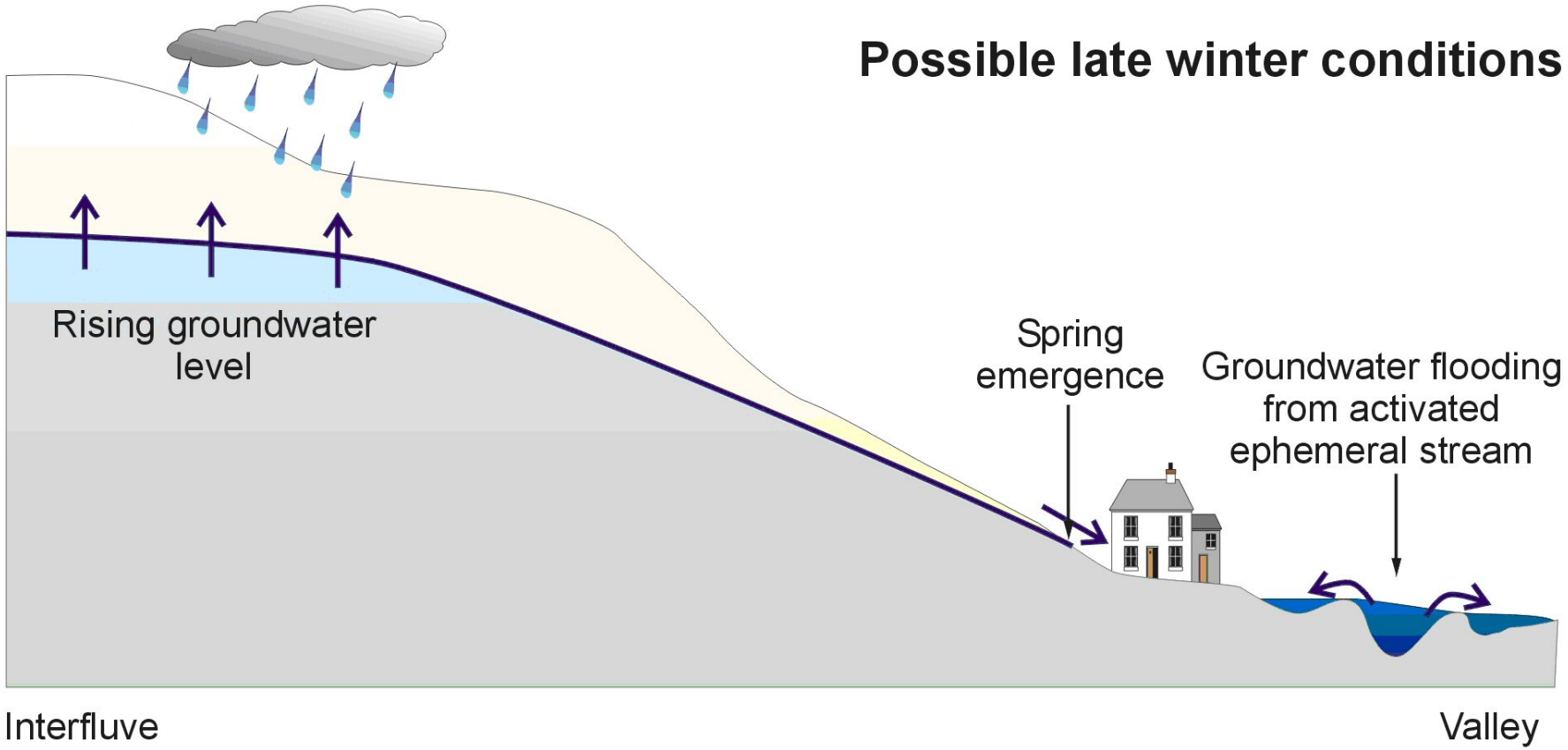
JACOBS

Mechanism Operating in the Chalk



JACOBS

Mechanism Operating in the Chalk



JACOBS

Mechanism Operating in the Chalk

Photo courtesy of CEH Wallingford

JACOBS

Mechanism Operating in the Chalk

JACOBS

Data Collation

- Valuable data include
  - hydrometric measurements;
  - photography;
  - occurrences of flooding; and
  - local knowledge.
- Data are held by various bodies, e.g.
  - Environment Agency;
  - BGS;
  - Fire & Rescue Services;
  - Local Authorities; and
  - Local Interest Groups.

Data Collation

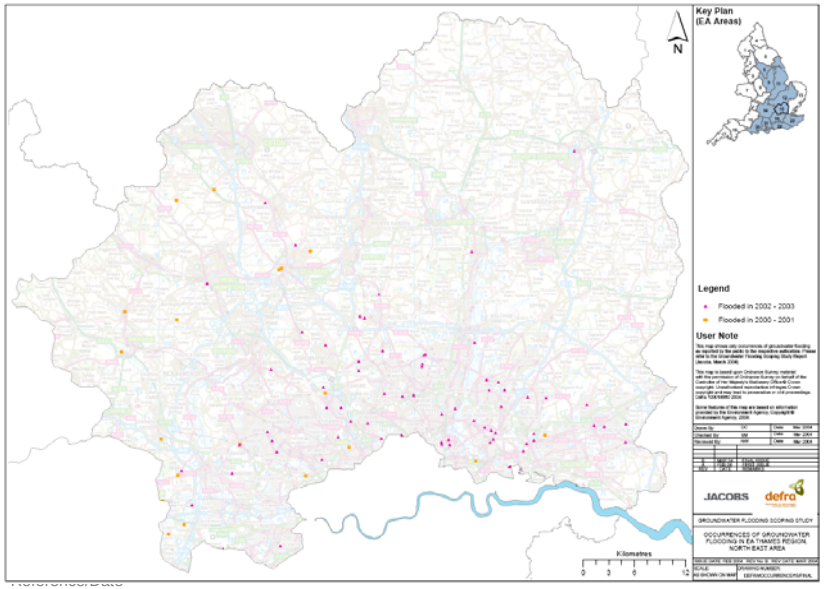
- **Chalk:** a **large volume** of valuable data has been collected over recent groundwater flooding events, and is archived from historic flood events
- **Other aquifers**: a **limited volume** of valuable data has been collected, fewer groundwater specific events
- **Pre-2000:** less widespread flooding and data collected and typically **stored non-electronically**
- **Post-2000:** more coordinated collation and more generally in **electronic databases** in response to significant flooding
- All **data are stored informally** and are **vulnerable** to being neglected over time or lost.

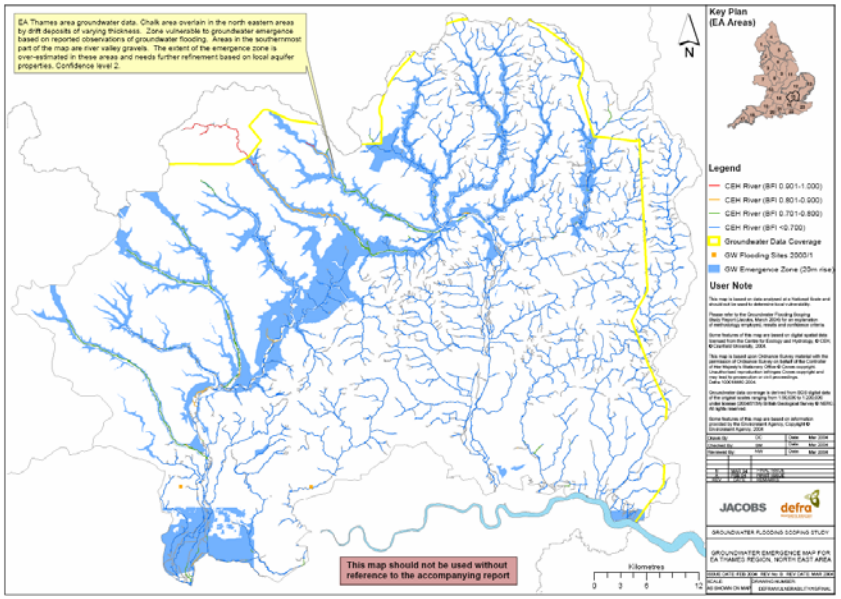
Data Collation: Recommendation

- Ultimate aim for holistic flood risk management is to have a **single national database** which captures information on **flooding from *all* sources**, including groundwater.

Groundwater Flood Hazard/Risk Mapping

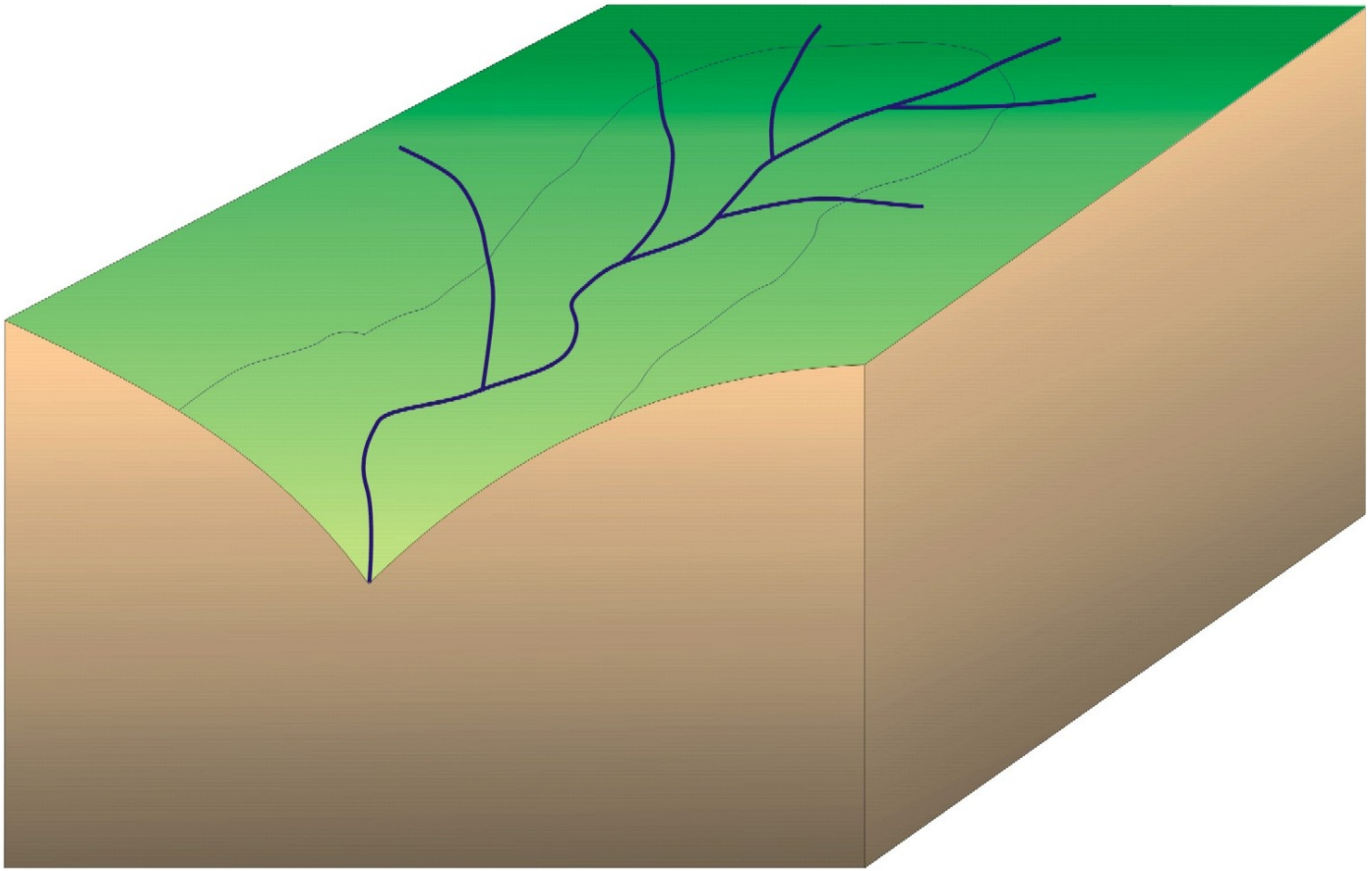
- Successful regional-level attempts to map hazard and risk have been hampered by
  - a paucity of data (levels, observations);
  - lack of understanding of mechanisms;
  - difficulties assigning probabilistic information; and
  - highly heterogeneous nature of Chalk geology.





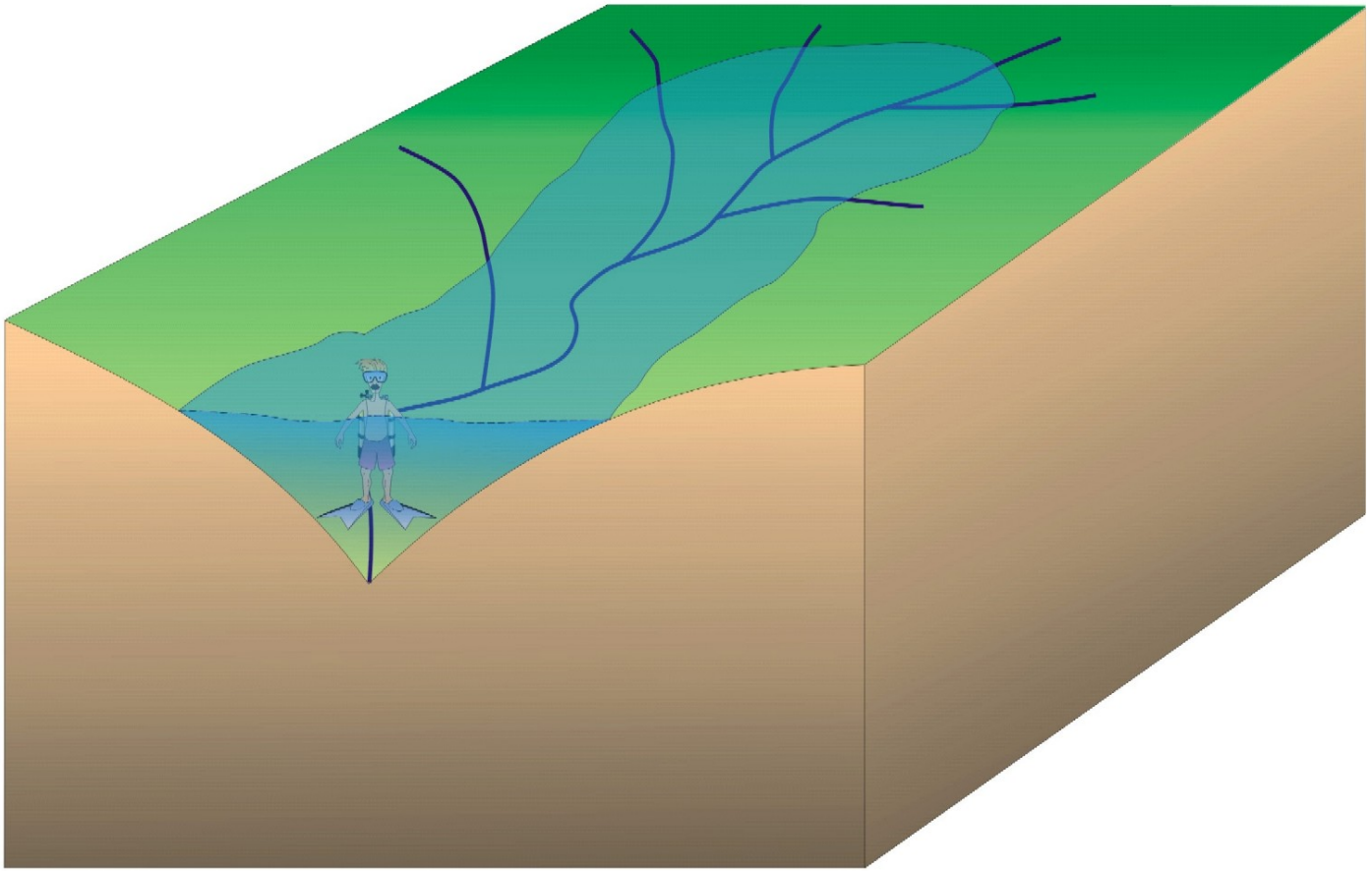
Groundwater Flood Hazard/Risk Mapping

- Major differences between fluvial and groundwater hazard mapping



Groundwater Flood Hazard/Risk Mapping

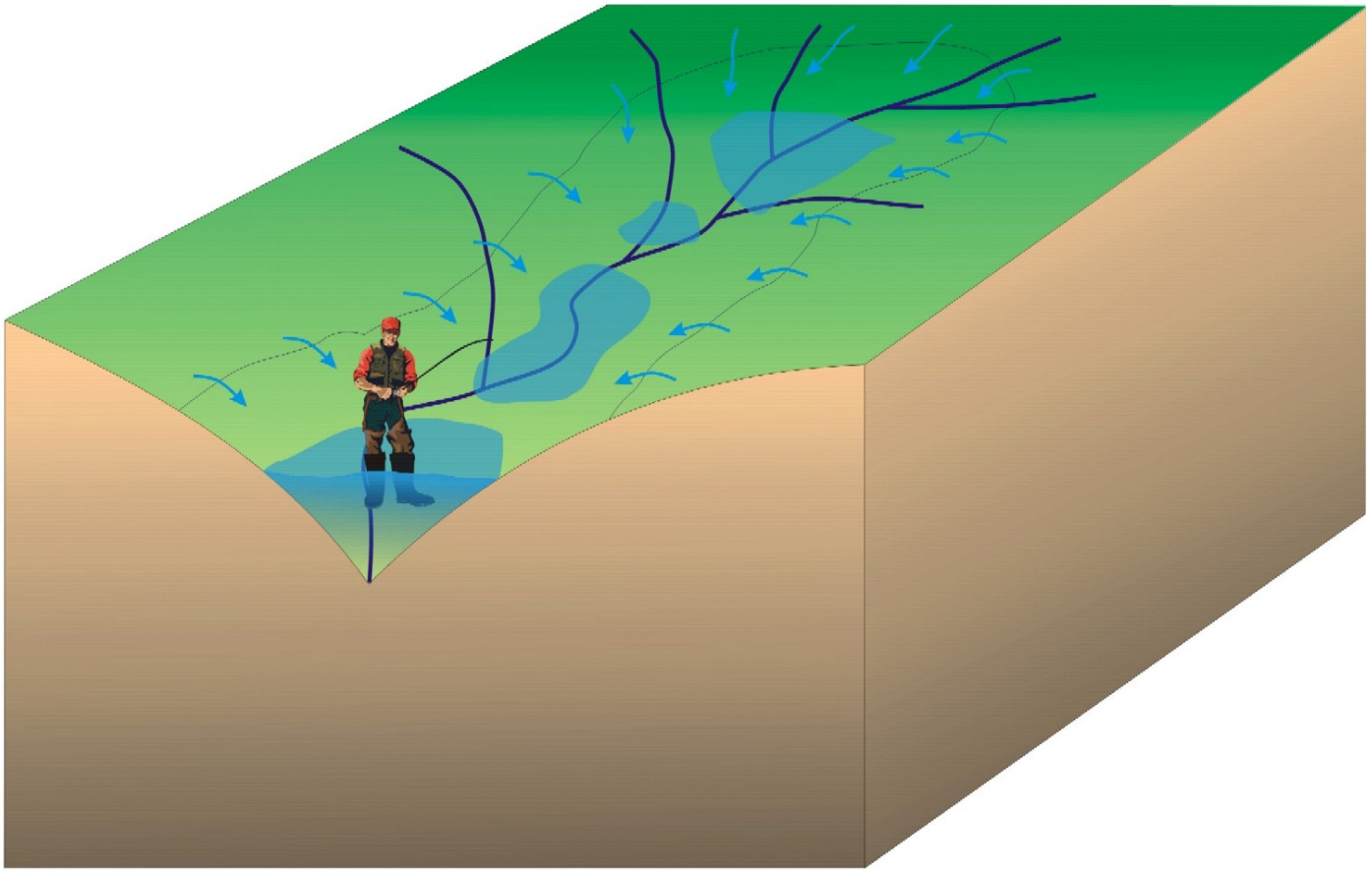
- Major differences between fluvial and groundwater hazard mapping



JACOBS

Groundwater Flood Hazard/Risk Mapping

- Major differences between fluvial and groundwater hazard mapping



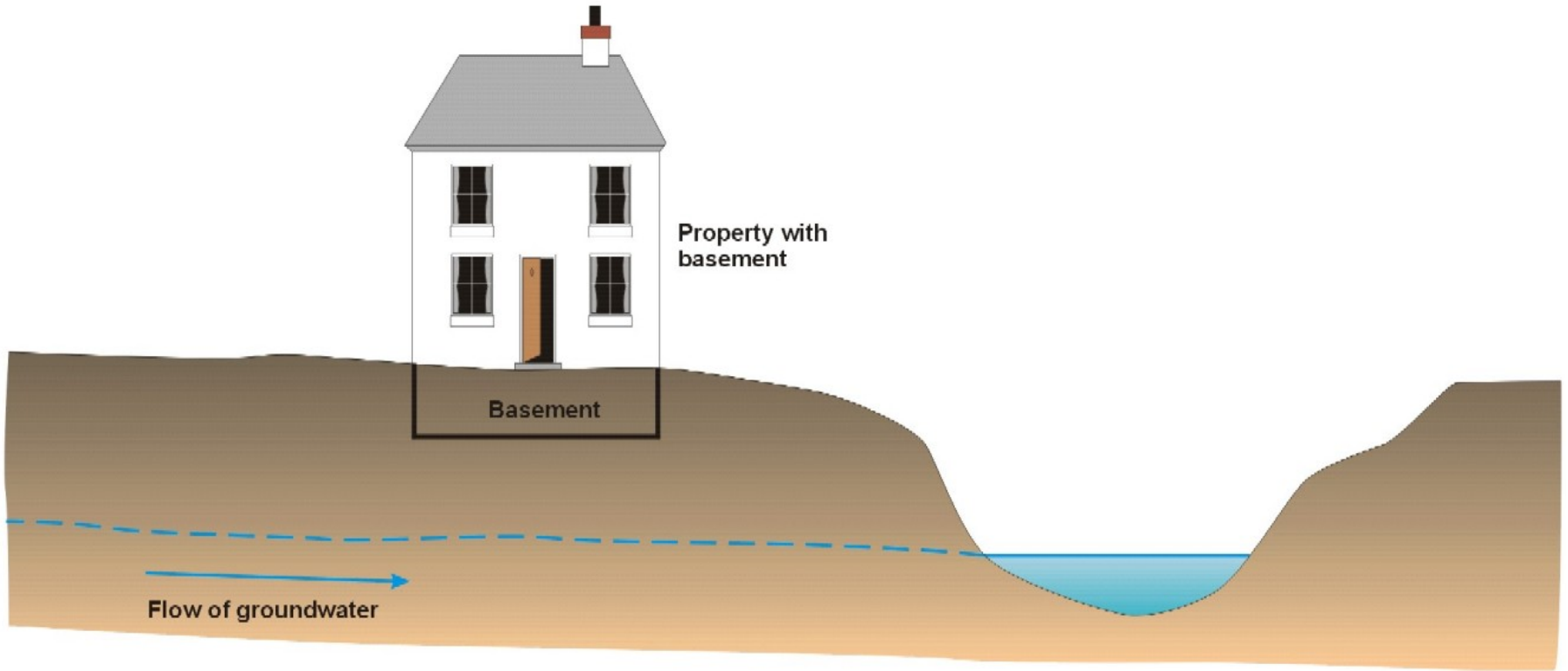
JACOBS

Groundwater Flooding Management

- Do nothing
- Reactive risk management:
  - traffic diversion and calming;
  - pumping of groundwater; and
  - evacuation of land and property.
- Proactive risk management:
  - controlling development in inappropriate locations;
  - protecting land and developments against groundwater flooding;
  - maintenance of drainage systems;
  - surface and sub-surface drainage improvements; and
  - managing public expectation.
- Flood warning

Groundwater Flooding Management

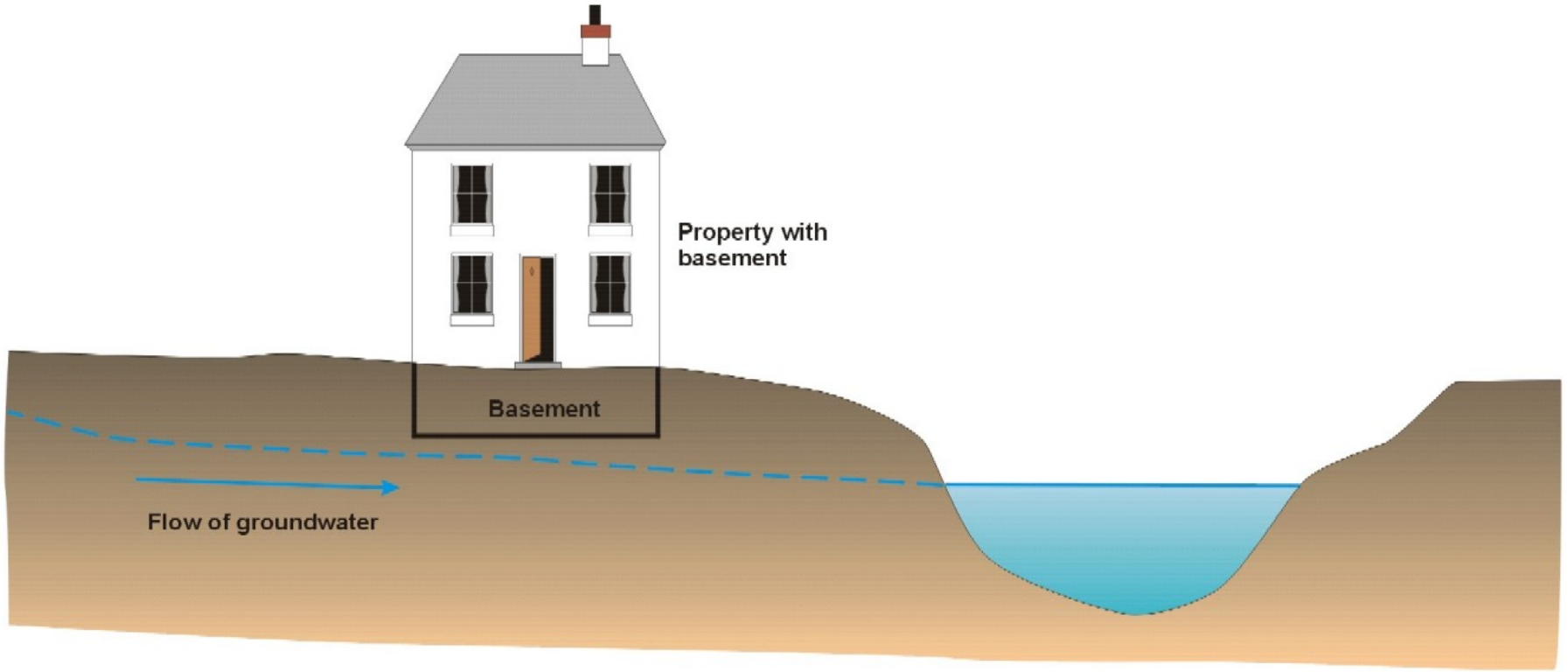
- Normal flow conditions



JACOBS

Groundwater Flooding Management

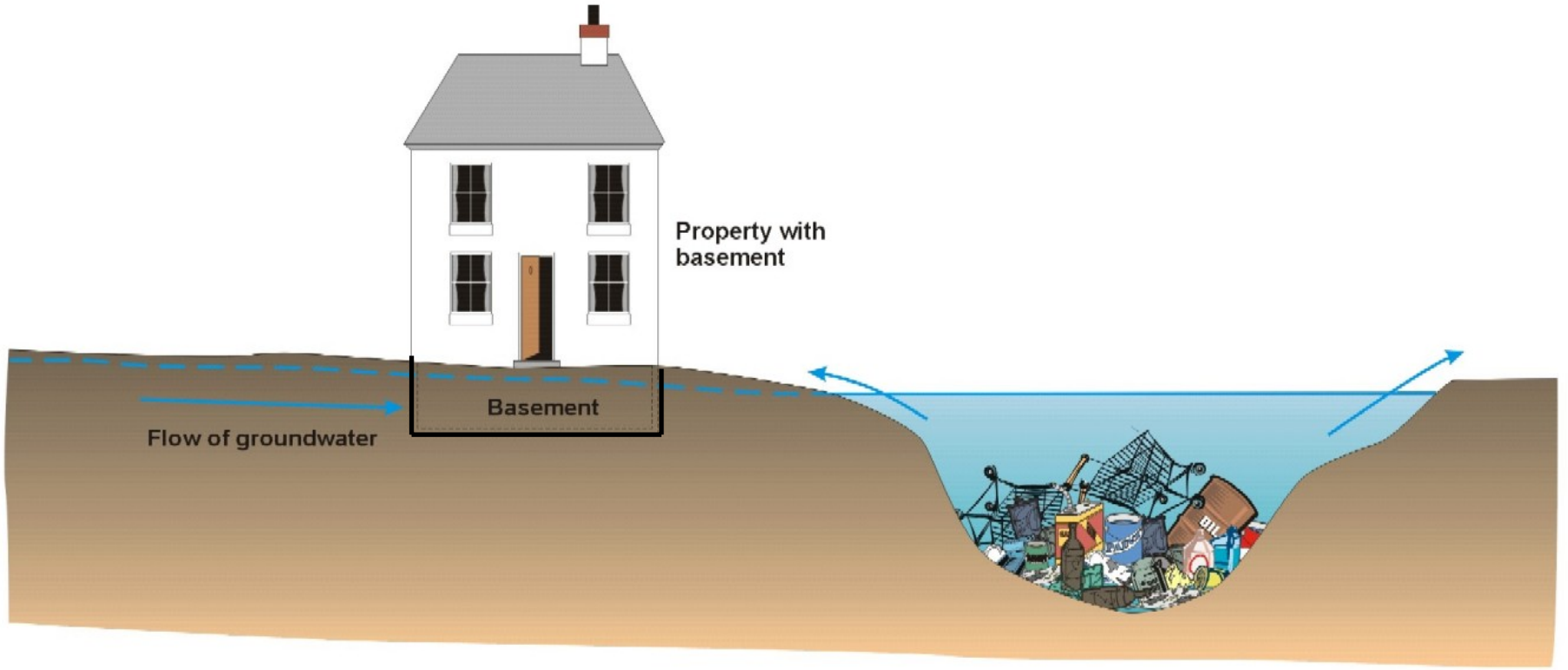
- Maintained ditch flood conditions



JACOBS

Groundwater Flooding Management

- Non-maintained ditch flood conditions



JACOBS

Possible Impacts of Climate Change

- Wetter winters, drier summers?
- Longer periods of soil moisture deficit, so shorter recharge period?
- Heavier rain during recharge period, but intense rain so more runoff?
- Generally less recharge, but more variability?
- Generally lower water levels, but more frequent extreme high levels?

Possible Impacts of Climate Change

- Greater Uncertainty!!!!!
- Maybe?!
- Greater need for a robust dataset

Environment Agency Strategic Overview

- MSfW First Government Response assigned to the Environment Agency a **strategic overview role** for monitoring groundwater flooding
- Although the role commenced in Spring 2006, the **extent** of the role and **legislative details** are currently **being clarified**

JACOBS

Environment Agency Strategic Overview

- Implementation (or continuation) of the following recommendations will ensure **better assessment and monitoring** of groundwater flooding in the future.
- Primarily, a **national database** should collate existing (and future) records of flooding from ***all*** **sources**, including groundwater.
- Additionally, the Environment Agency could…

Environment Agency Strategic Overview

- Locally **populate the database** to a national standard, according to the identified groundwater flood risk;
- Produce **groundwater flooding occurrence maps** and a detailed **groundwater level map** for peak levels during recent wet winters;
- Ensure hydrologists and hydrogeologists **understand the local mechanisms** of groundwater flooding;
- Commission **scientific research** as necessary, although resources should immediately be committed to **understanding existing records** and ensuring **adequate data are collected** in future;
- Routinely **survey stream sources**;

Environment Agency Strategic Overview

- Proactively **collect data** during a flood event, which will include alerting other organisations to the occurrence of flooding; and
- **Verify data** collected in order to assign a standard degree of confidence to each dataset.

The Future

- If adequate local drainage is ensured; and
- if planning permissions take into account groundwater flooding potential; then
- the impacts of Groundwater Flooding can be reduced in the future.