

## Rivers

Remember the types of erosion:  
Attrition, Abrasion, Hydraulic action, solution

### Landforms and characteristics of different stages of the river

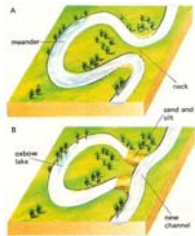
#### Upper stage (River start - source)

Upland area  
Fast flowing water  
Vertical erosion  
Waterfalls  
Rapids  
V shape valleys  
Narrow river  
Large, angular load



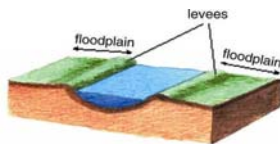
#### Middle stage

Meanders & oxbow lakes  
Wider valley



#### Lower stage (river end – mouth)

Lowland area  
Slower flowing water  
Wider river  
Deposition  
Levees  
Flood plain  
Estuary



### Floods - Causes

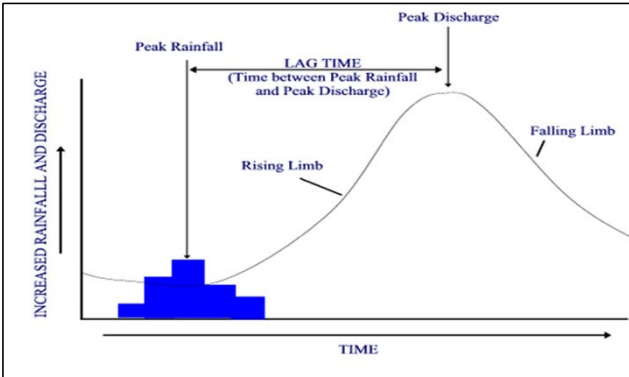
1. Large storm
2. Saturated ground
3. Snow melt
4. Storm surge
5. Urbanisation
6. Deforestation

### Flood - defences

1. Dams
2. Flood barriers, sandbanks, levees
3. Diversion channels / spillways
4. Afforestation
5. Floodplain zoning

### Storm hydrographs

A Storm Hydrograph tells you the amount of discharge (measured in cumecs) in a river after a rainfall event and the likelihood of flooding



### Factors that affect lag time

1. Steepness of slope
2. Rock type – impermeable or permeable
3. Amount of vegetation
4. Level of urbanisation
5. Antecedent conditions (saturation of soil, previous rainfall)

### Tewkesbury, Gloucestershire Flood 2007 - case study

#### Causes - Physical

1. Flood plain, low lying and flat land
2. Confluence of two rivers
3. Drainage basin has steeper mountainous land
4. Geology is impermeable clay
5. 3 times normal rainfall between May and July

#### Causes - human

1. No permanent flood defences
2. Town growth - more impermeable surfaces



### Response to Tewkesbury flood

'HARD' solutions are structures built to defend areas from floodwater  
'SOFT' solutions adaptations to flood risks

#### Hard solutions

1. Levees – Expensive, increases flood risk down stream
2. Dredging – Needs to be done yearly
3. Flood Relief Channels – expensive £14 million per km
4. Flood walls – Poor habitats for wildlife.

#### Soft solutions

1. Spillways – allow flooding on park land or grass fields. Cheap.
2. Restrict planning permission for buildings on flood plains. Very cheap but could mean housing shortages
3. Afforestation - may result in the loss of grazing land