

Types of erosion	
The break down and transport of rocks – smooth, round and sorted.	
Attrition	Rocks that bash together to become smooth/smaller.
Solution	A chemical reaction that dissolves rocks.
Abrasion	Rocks hurled at the base of a cliff to break pieces apart.
Hydraulic Action	Water enters cracks in the cliff, air compresses, causing the crack to expand.

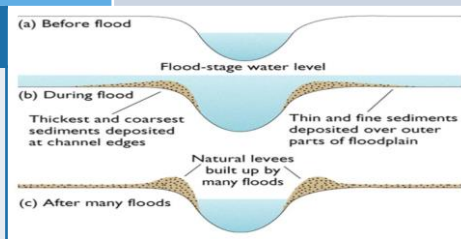
Types of transportation	
A natural process by which eroded material is carried/transported.	
Solution	Minerals dissolve in water and are carried along.
Suspension	Sediment is carried along in the flow of the water.
Saltation	Pebbles that bounce along the sea/river bed.
Traction	Boulders that roll along a river/sea bed by the force of the flowing water.

Water Cycle key terms	
Precipitation	Moisture falling from clouds as rain, snow or hail.
Interception	Vegetation prevent water reaching the ground.
Surface Runoff	Water flowing over surface of the land into rivers
Infiltration	Water absorbed into the soil from the ground.
Transpiration	Water lost through leaves of plants.

River management schemes	
Soft Engineering	Hard Engineering
Afforestation – plant trees to soak up rainwater, reduces flood risk. Demountable Flood Barriers put in place when warning raised. Managed Flooding – naturally let areas flood, protect settlements.	Dam/reservoir construction – holds back water. Straightening Channel – increases velocity to remove flood water. Artificial Levees – heightens river so flood water is contained. Deepening or widening river to increase

Formation of levees & floodplains- lower course of a river

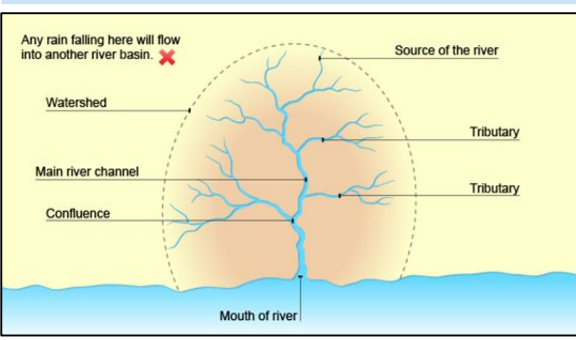
- 1) A levee is formed over many years in the lower profile of a river. When a river floods, it loses velocity due to friction between the water and the land. This causes the river to deposit sediment either side of the river. These mounds of material are called levees.
- 2) The largest (heaviest) material is deposited first nearer to the river bank and the smaller (lighter) material such as clay and sand are deposited further away.
- 3) Over many years of flooding, the natural levees build up and often act as new river bank when sediment is deposited on the river bed over time.
- 4) A floodplain is formed either side of the river where the land is flat.



- #### Key terms
- **Drainage basin** - the area of land drained by a river.
 - **Watershed** - the edge of highland surrounding a drainage basin. It marks the boundary between two drainage basins.
 - **Source** - The start of a river.
 - **Confluence** - the point at which two rivers or streams join.
 - **Tributary** - a stream or smaller river which joins a larger stream or river.
 - **Mouth** - the point where the river comes to the end, usually when entering a sea.
 - **Main river channel** - the largest river, (where all the tributaries join).
 - **Long profile** - A 'model' that shows how a river changes from its source to its mouth.
 - **Discharge** - The amount of water flowing through a section of the river over a certain amount of time.
 - **Velocity** - the speed (& direction) of water in a river.
 - **Sediment/load** - the material that a river erodes and transports e.g. rocks, pebbles and mud.
 - **Width** - How wide the channel is.
 - **Depth** - How deep the channel is.
 - **Gradient** - The steepness of the river profile.

What is deposition?

When the sea or river loses energy, it drops the sand, rock particles and pebbles it has been carrying. This is called deposition.



Paper 1: River landscapes & processes

Physical and human causes of flooding.

Physical: Prolong & heavy rainfall Long periods of rain causes soil to become saturated leading runoff.	Physical: Geology Impermeable rocks causes surface runoff to increase river discharge.
Physical: Relief Steep-sided valleys channels water to flow quickly into rivers causing greater discharge.	Human: Land Use Tarmac and concrete are impermeable. This prevents infiltration & causes surface runoff.

Upper course of a river

Near the source, the river flows over steep gradient from the hill/mountains. This gives the river a lot of energy, so it will erode the riverbed vertically to form narrow valleys.

Formation of a waterfall

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- 1) River flows over alternative types of rocks.
 - 2) River erodes soft rock faster creating a step.
 - 3) Further hydraulic action and abrasion form a plunge pool beneath.
 - 4) Hard rock above is undercut leaving cap rock which collapses providing more material for erosion.
 - 5) Waterfall retreats leaving steep sided gorge.

Middle course of a river

Here the gradient get gentler, so the water has less energy and moves more slowly. The river will begin to erode laterally making the river wider.

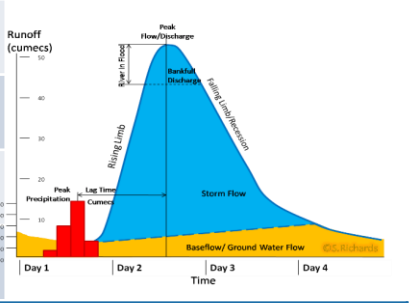
Formation of meanders & ox-bow lakes

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| Step 1 | Step 2 |
| Erosion of outer bank forms river cliff. Deposition inner bank forms slip off slope. | Further hydraulic action and abrasion of outer banks, neck gets smaller. |
| Step 3 | Step 4 |
| Erosion breaks through neck, so river takes the fastest route, redirecting flow | Evaporation and deposition cuts off main channel leaving an oxbow lake. |

Hydrographs and river discharge

River discharge is the volume of water that flows in a river. Hydrographs who discharge at a certain point in a river changes over time in relation to rainfall

1. **Peak discharge** is the discharge in a period of time.
2. **Lag time** is the delay between peak rainfall and peak discharge.
3. **Rising limb** is the increase in river discharge.
4. **Falling limb** is the decrease in river discharge to normal level.



Mass Movement- the downwards movement of rocks under the influence of gravity

- **Slumping**: After a period of rainfall, the permeable rock (absorbs rainfall) becomes heavy, and can slip at the point where it meets an impermeable rock (doesn't absorb rainfall), often in a rotational manner
- **Rockfall**: sudden fall of rock often due to weathering from above or erosion of slope/cliff face by river.
- **Sliding**: Similar to slumping, but occurs along a flat surface, usually a bedding plane.

Case Study: The River Dee- located example

Source on the slopes of Dduallt in the mountains of Snowdonia in Wales, 4660 metres above sea level. Length 110 km.

Upper -Average annual rainfall 3000mm, high run off due to hard igneous rock, which is resistant to erosion. Channel narrow and shallow. V shaped valley.

Middle - Valley becomes wider & flatter, river erodes sideways creating meanders & ox-bow lakes. Flood plain areas created.

Lower - Average annual rainfall 750mm. River flows over softer rocks e.g. sandstone. Lateral erosion causes a wide valley. High velocity to size of channel increasing. River mouth in the Irish Sea between Wales & the Wirral Peninsula.

Management
1732, 8km was channelised to improve navigation for ships. This increased discharge and velocity but made the river look artificial. Reservoirs were built to store drinking water and prevent flooding such as Llyn Celyn. 1972-76 more channelisation took place in Chester which changed the course of the river, preventing the river from meandering over its flood plain. Levees were built along the middle course of the River Dee to protect agricultural land from flooding. These have also prevented the flood plain from growing naturally.