- **A**brasion (corrasion) - when bits of load crashes into bed and banks, causing pieces to break

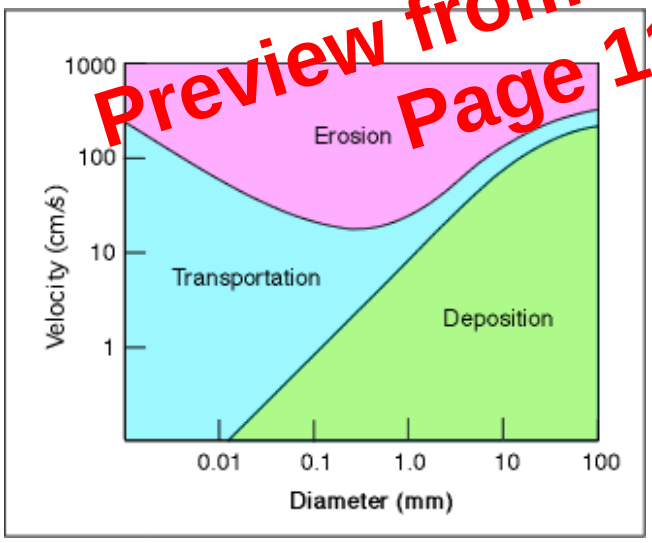
Factors affecting erosion

- Load - the heavier and sharper the load, the greater potential for erosion
- Velocity and discharge
- Gradient
- Geology - soft rocks (sand/gravel) are easily eroded
- pH - rates of solution are increased when the water is more acidic
- Human impact - deforestation, dams and bridges interfere with the natural flow of a river

Types of transportation

- Suspension - small particles of load being carried in a rivers flow (turbulent flow)
- Saltation - load that is bounded along the bed of the river
- Solution - dissolved particles transported in a solution
- Traction - large load that is rolled along the bed of a river
- Flotation - materials (twigs/branches) carried on the surface of a river

The processes of erosion and transportation make a rivers' load smoother and rounder as it is transported from the source to the mouth. The relationship between river velocity and particle size is shown by the Hjulström curve when looking at a rivers' ability to erode, transport and deposit.
The smallest and largest particles require high velocities to lift.



Higher velocities are required to lift up the load than to transport it

When velocity falls below a certain level, particles are deposited

It takes more energy to erode some of the smallest particles because clay and silt stick together to form strong bonds

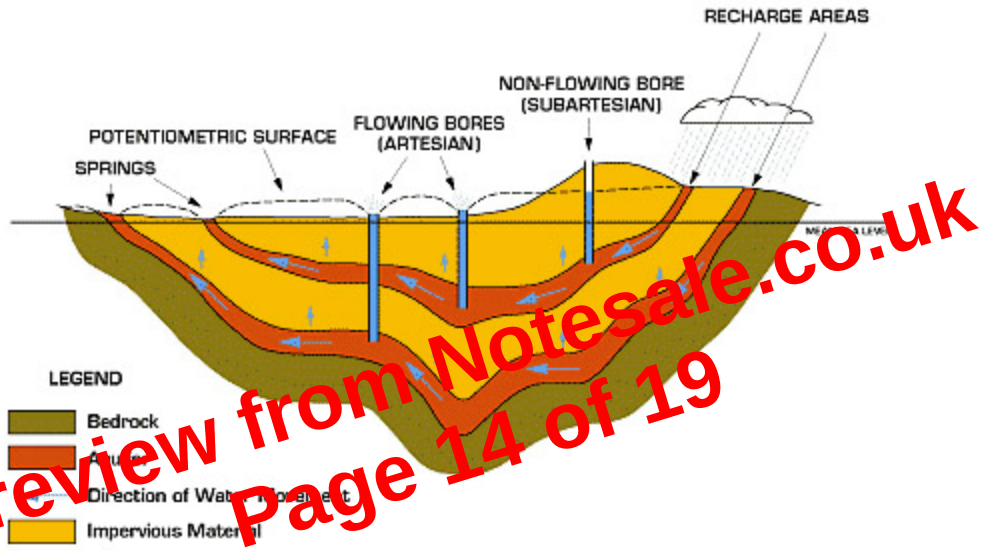
Capacity: the largest amount of debris a stream can carry
Competence: diameter of largest particle that can be carried
Critical erosion velocity: the lowest velocity at which grains of a given size can be moved

When the river velocity falls, its energy also falls. Therefore its capacity and competence decreases, causing it to deposit its load. Deposition occurs when:

- River flows across a desert where there is a high rate of evaporation, hence not enough water
- Water infiltrates into permeable rocks, hence not enough water
- Sudden change in gradient

Flood storage reservoirs- reservoirs/lakes storing excess water	• Remove pressure off main channels • Can become habitats • Can serve multiple purposes e.g. leisure, drinking water	• Building dams are expensive • Involve flooding areas of land or displacing populations for land

Groundwater management	Explain the functioning and management of artesian basins and aquifers, distinguishir between natural and artificial recharge. Examine the environmental impacts of groundwater abstraction



OPERATION OF AN ARTESIAN BASIN

Aquifer: Rocks that can hold water
Aquitard: A layer of rock that restricts the flow of groundwater from one aquifer to another
Artesian basin: A confined aquifer (aquifer between two aquitards) containing groundwater under positive pressure, causing water to flow upward through a well (artesian well) without pumping

Natural recharge: Groundwater naturally infiltrates into the ground from rain/seepage from lakes and recharges the groundwater
Artificial recharge: Humans artificially recharges the groundwater from irrigation channels, reservoirs or diverting water from river basins and pumping it into aquifers

At the recharge areas of the artesian basin, permeable rocks are exposed and water can naturally sink in and is stored to the point of hydrostatic equilibrium (balance between pressure on the aquifer and pressure from the aquifer).

Humans extract water through artesian wells/boreholes for domestic, industrial and agricultural use. Water is restored from water transfer, either naturally or artificially.

Case Study: THE GREAT ARTESIAN BASIN - NE AUSTRALIA

- Formation and Location:
  - Located at Cape York and covers ¼ of Australia
  - The water is collected in sandstone (permeable) when it rains, and also from previous ice ages
  - There are 65,000 megalitres of water stored
  - It was formed from the ocean flooding a natural dip in Australia, leaving clay and silt to form impermeable clays (the aquitard) and sand and gravel to form sandstone (permeable), making an aquifer
- Dependency:
  - Huge numbers of people are reliant on the basin
  - It has sustained the needs of ⅕ of Australia's landmass
  - It has sustained the indigenous people over thousands of years, so has many environmental, cultural and heritage values
  - The first artesian bore was drilled in the late 1980s and people have relied on it for economic and social well-being
- Why management is needed:
  - In Australia's arid environment, there are few alternatives for freshwater
  - Artesian pressure allows low extraction costs
  - There has been a continuing decline in artesian pressure due to long-term overextraction
  - As the water is depleted, the land could undergo subsidence (the land sinks)
- Economic and environmental impacts of groundwater extraction
  - Free flowing bores bring water to the surface only to be evaporated, causing widespread salinisation of topsoils
  - Less vegetation can be grown causing a loss of crops
  - Watery bores are full of plants (for medicine/food) and are habitats for wildlife
  - Mining and agricultural chemicals contaminate the water
  - Water for tourism enables tourist industry to survive but wastes water

Environmental impacts of groundwater abstraction

- Salinisation of soils
- Saltwater intrusion of the groundwater
- Drought
- Subsidence
- Pollution due to agriculture, industry and sewage

Freshwater wetland management	Describe the role of wetlands as a water resource. Evaluate the effectiveness of the management strategies that have been adopted in a major wetland