

## Unit 7

# River profiles

### EXAM TIP

You could be asked about the gradient of a river, base levels and the cross profile of a river in the mapwork examination. Remember to look at the contour patterns to assist you with this interpretation.

- ▶ The **longitudinal profile** of the river shows the length of a river's course from its source in the mountains to its mouth at sea level. This profile indicates the gradient down which the river flows.
- ▶ The **transverse or cross profile** shows the shape of the valley at an imaginary line drawn across the river valley.
- ▶ There is a link between the cross profile of the river and the longitudinal profile of the river. Where the gradient is steep as indicated by the longitudinal profile, the valley shape is a narrow V-shape. Where the gradient is gradual as indicated by the longitudinal profile, the valley shape is an open V-shape.
- ▶ The course of the river is divided into different stages:
  - ▶ the upper course in the mountains
  - ▶ the middle course as the river flows off the mountains onto a more gradual gradient
  - ▶ the lower course where the river is flowing on a very gentle gradient close to sea level.

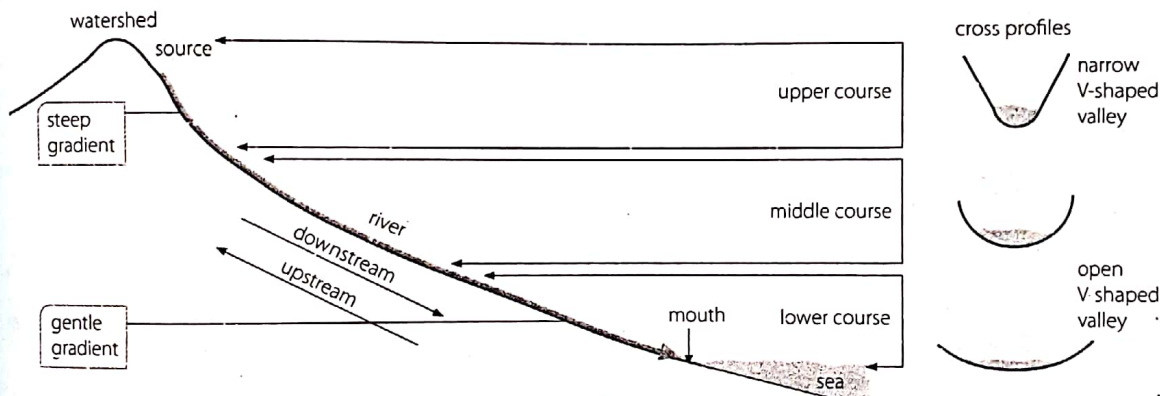


Figure 3.18 Profiles of a river

## The transverse or cross profile of a river valley

- ▶ Factors that influence the cross profile of a river valley include:
  - ▶ A deep, narrow, steep-sided profile will form if the river has a lot of energy to erode downwards. This is usually found in the upper course, where there is a steep gradient and much bedload to cause vertical erosion on the bed of the river.
  - ▶ A river can have different cross profiles along its course, depending on the climatic and geological conditions of the area through which it is flowing. For example, steep-sided canyons form in arid areas; in areas of very resistant rock, the valleys are also steep and narrow.
  - ▶ A river in the middle course has a more open V-shaped profile, as hydraulic action and abrasion have resulted in lateral erosion and undermining. Sheetflow and mass wasting have lowered the valley sides.
  - ▶ A river in the lower course has a very flat, open V-shaped valley, called the flood plain.
  - ▶ A river that has a straight course will have a symmetrical cross profile.
  - ▶ A meandering river will develop an asymmetrical cross profile. This is because the erosive force of the water tends to be stronger on the outside of the meander.

**Fast forward** ▶▶  
In order to cross  
a river, a meandering  
river will have a greater  
width on the outside  
of the meander. See page 26 for  
more information.

# Identification and description of fluvial landforms

Fluvial means 'relating to a river'.

## Fluvial landforms formed by erosion

### The river valley

- ▶ Vertical erosion deepens the valley.
- ▶ The river may twist and turn round obstacles of hard rock. As this happens **interlocking spurs** are formed.
- ▶ As the gradient becomes gentler, lateral erosion occurs and the spurs are eroded to form **truncated spurs**.
- ▶ Lateral erosion gradually widens the valley floor.

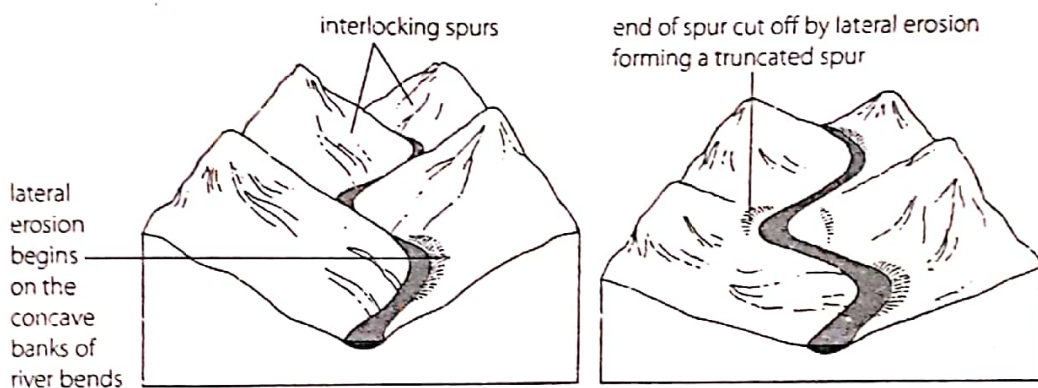


Figure 3.22 Interlocking and truncated spurs

### Gorges and canyons

- ▶ A **gorge** is a very deep, steep-sided valley formed by an energetic river in a humid environment.
- ▶ A **canyon** is a very deep, steep-sided valley formed by an exotic river in an arid environment. A canyon is found in an area composed of horizontal strata that is of varied resistance to erosion. The Fish River Canyon in Namibia and the Grand Canyon in the United States are examples of canyons.

### Waterfalls and rapids

- ▶ A resistant layer of rock across the course of the river can lead to a sharp change in the gradient and the formation of either a **waterfall** or **rapids**.
- ▶ The angle at which the resistant rock layer dips determines whether a waterfall or rapids will form.
  - ▶ A waterfall across a river's course is found where there is a large change in gradient.
  - ▶ Rapids are found if the gradient change along the river's course is not too great. If the resistant layer dips downstream the gradient will not be as steep and rapids will result.
- ▶ The resistant layer is called the **fall-maker** or **lip of the waterfall**.
- ▶ Undercutting of the softer rock beneath the lip causes the lip to collapse and the position of the waterfall to move upstream. This headward erosion results in the formation of a deep gorge downstream of the waterfall.



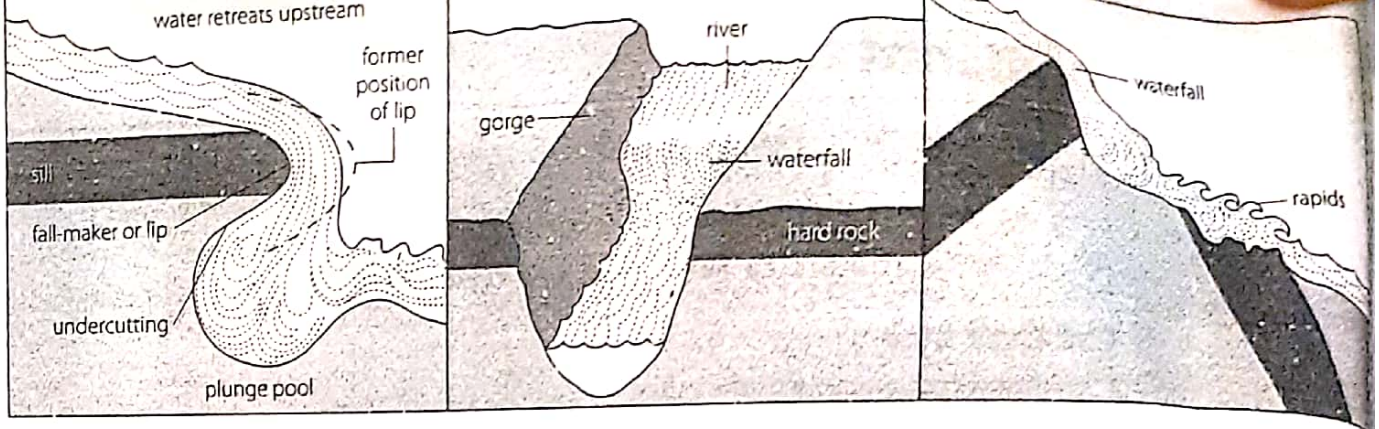


Figure 3.23 Base levels of erosion

### Potholes

- ▶ Potholes are deep, circular depressions or hollows on the bed of a river.
- ▶ Potholes are formed when pebbles collect in depressions on the bed of the river. These swirl around the hollow, and through abrasion and pothole scouring, the depressions become deeper.

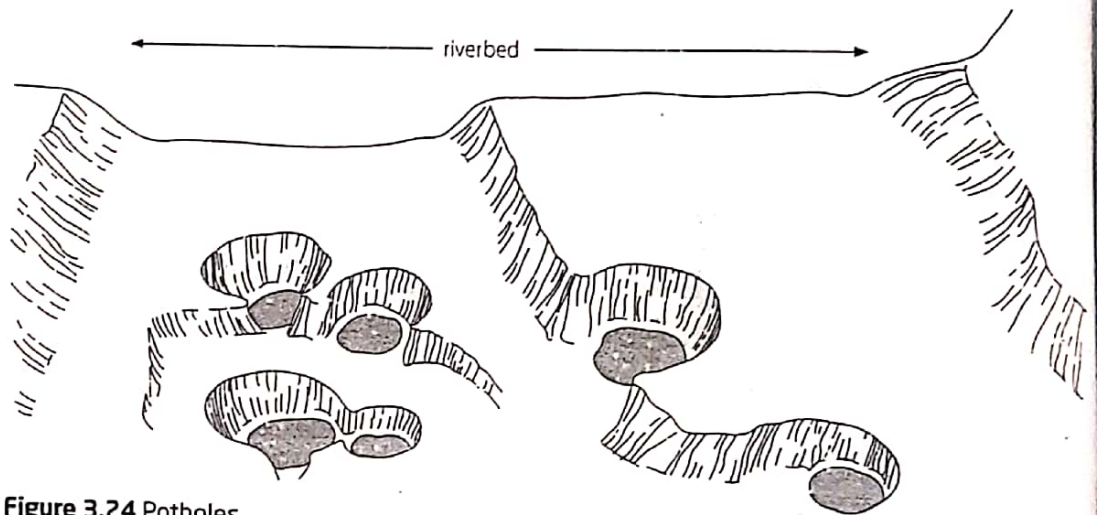


Figure 3.24 Potholes

### Fluvial landforms formed by deposition

The river will deposit its load as it begins to lose energy and to slow down. This can occur in the following situations:

- ▶ when the speed at which the water is flowing decreases due to a reduction in the gradient, for example as the river flows off the mountain onto the plain downstream
- ▶ when the volume of water in the river decreases, for example as floodwaters recede after rain
- ▶ when the channel of the river becomes wider, for example as a river in its lower course overflows its banks and the water flows onto the flat floodplain
- ▶ when the load of the river increases; for example deforestation may cause increased erosion of topsoil in the drainage basin, and this topsoil is carried into the river.
- ▶ The fertile material deposited by a river is called **alluvium**.

## Alluvial fans

- ▶ **Alluvial fans** form at the base of mountains when a river that is carrying a lot of sediment flows onto the flatter plain.
- ▶ The sediment is deposited in the shape of a fan and the river splits into **distributaries** (smaller streams leading from the main stream) to flow round the deposited material.

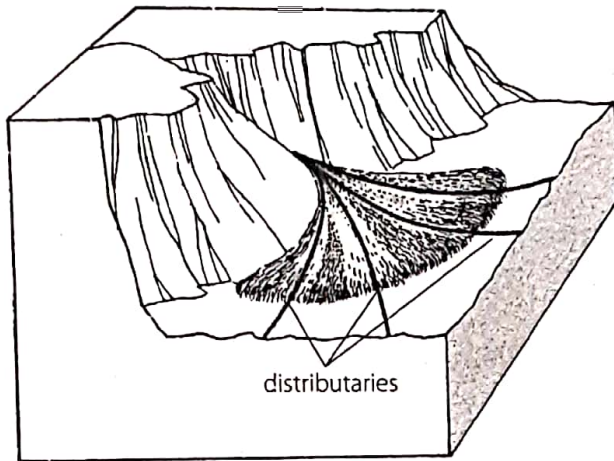


Figure 3.25 Alluvial fans

## Floodplain

In the lower course of the river, the river valley becomes a wide, flat floodplain with a very gentle gradient. Numerous depositional landforms can be found on the floodplain as shown in Figure 3.26.

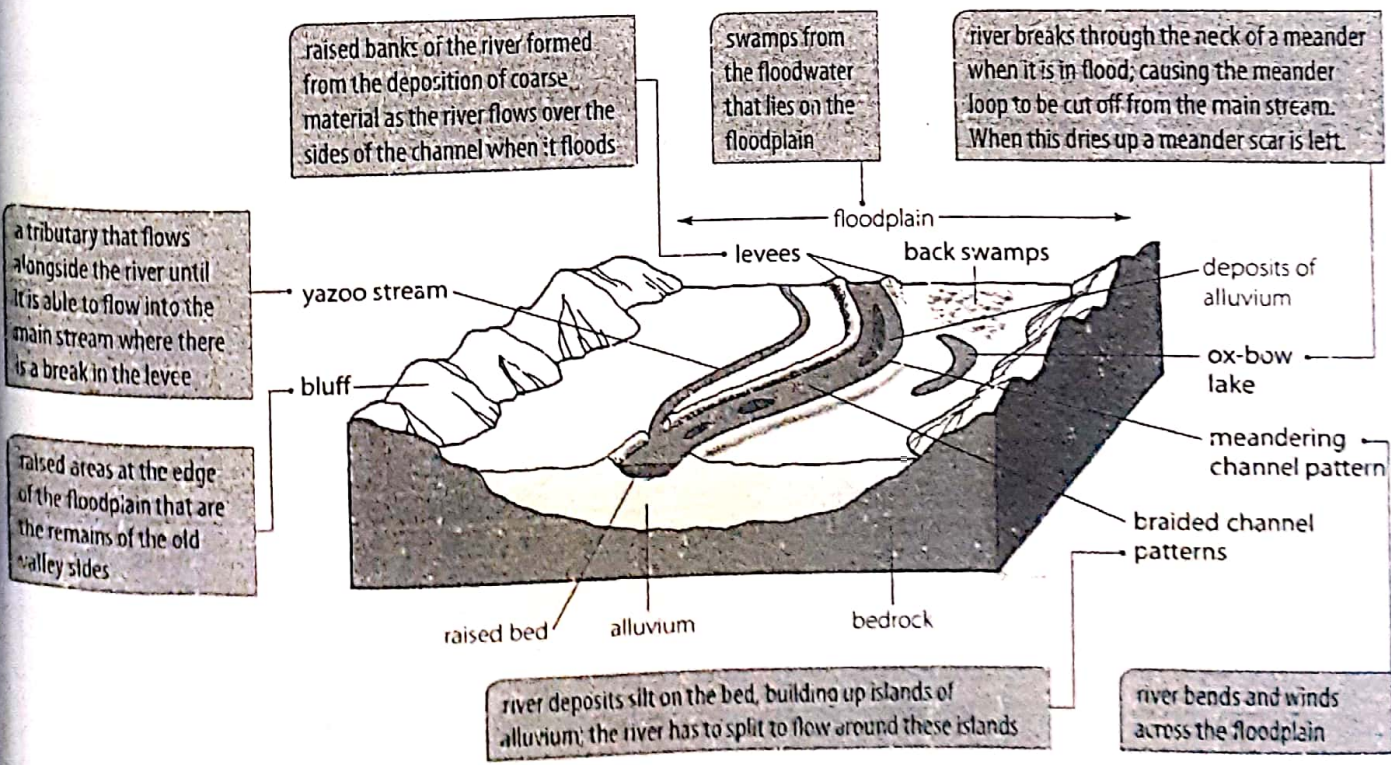
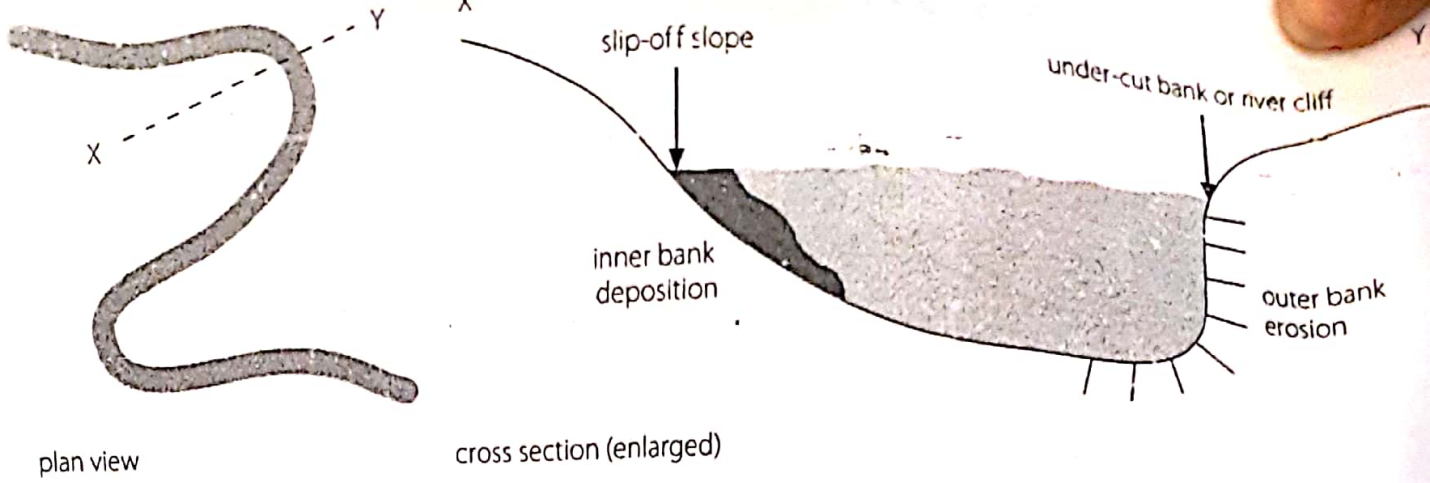
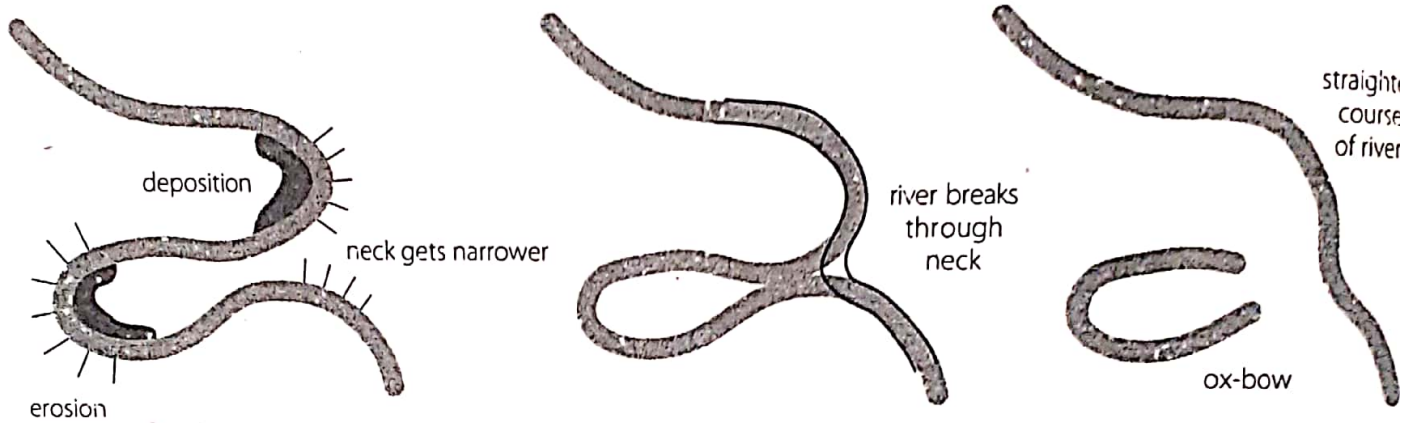


Figure 3.26 Floodplain





**Figure 3.27** Plan view and cross section of a river meander



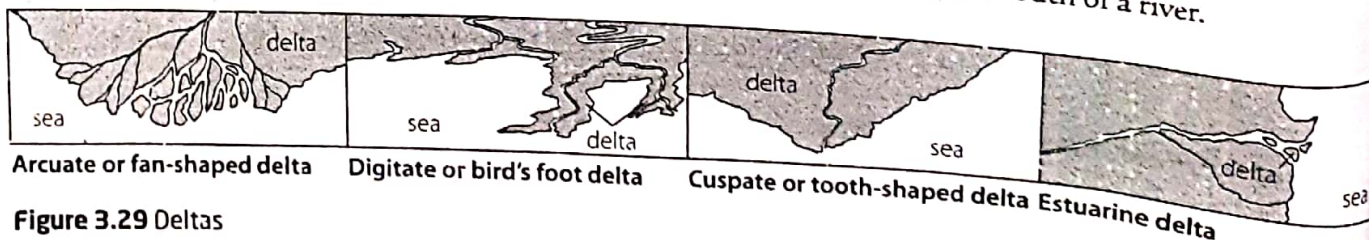
**Figure 3.28** Development of oxbow lakes

**EXAM TIP**  
Practise drawing and labelling a cross section of a meander.

Do not confuse drainage patterns with **channel patterns**. A channel pattern is the path made by a single channel, but a **drainage pattern** is the pattern made by the way in which individual channels join one another.

## Deltas

- ▶ The river slows down as it enters the sea and deposits its load at the mouth of the river. The heaviest particles are deposited first and the finer particles settle further out to sea.
- ▶ The deposited sediment at the mouth of the river builds up to form fertile, flat landforms called **deltas**. The river splits into distributaries in order to flow through the deposits and reach the sea.
- ▶ The deposited sediment builds up deltas of different shapes:
  - ▶ **Arcuate** deltas are shaped like fans.
  - ▶ **Digitate** deltas look like birds' feet.
  - ▶ **Cusate** deltas are shaped like the cusps of teeth.
  - ▶ **Estuarine** deltas are formed in the funnel-shaped mouth of a river.



**Figure 3.29** Deltas