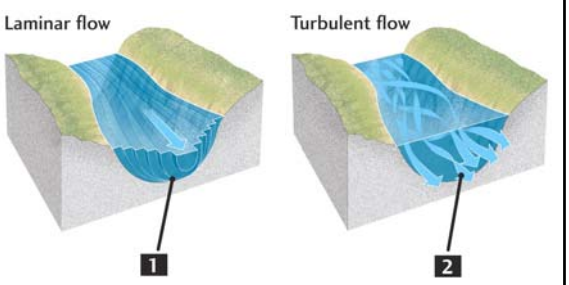
Streams: Big Ideas

- Humans affect the quality, availability, and distribution of Earth's water through the modification of streams, lakes, and groundwater
- Water's unique physical and chemical properties are essential to the dynamics of all of Earth's systems
- Earth's systems are dynamic
- Humans cannot eliminate natural hazards but can engage in activities that reduce their impacts by identifying high-risk locations



Streamlines flow parallel without turbulent mixing

Streamlines cross causing turbulent mixing

Figure 18.13

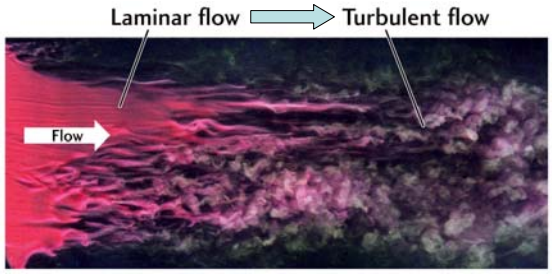


Figure 18.13

Whether Flow is Laminar* or Turbulent Depends On:

- **flow velocity**
- **geometry** (primarily depth)
- **viscosity**
  (a measure of a fluids resistance to flow)

*** note: laminar flow almost <u>never</u> exists in surface water flows**

Types of Sediment Transport

- **Suspended Load**
  - Fine-grained sediment transported in suspension due to turbulence
- **Bed (or traction) Load**
  - Coarser-grained sediment transported on the bottom of the stream bed by rolling and sliding
- **Saltation**
  - Sediment transported by intermittent jumps - a transitional state between bed load and suspended load.

Saltation (intermittent bouncing)
a transitional state between bed load and suspension

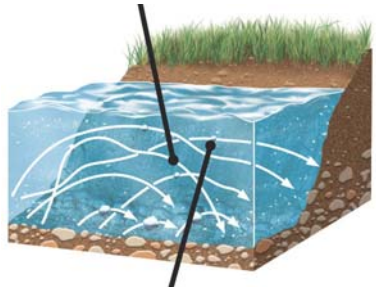


Figure 18.14

Measures of a Streams Ability to Transport Sediment Include:

Competence: A measure of the maximum size particle a stream can transport

Capacity: A measure of the total volume of sediment stream can transport

Increased velocity increases suspended load and increases bottom shear stress, increasing bed load

Clay particles tend to be cohesive and stick together….

…making clay relatively harder to erode than coarser silt and fine-grained sand!

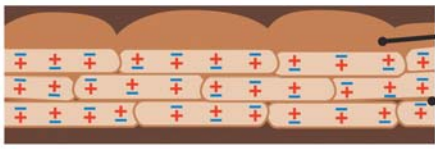
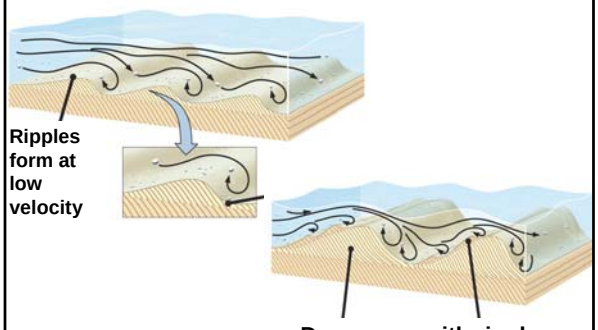
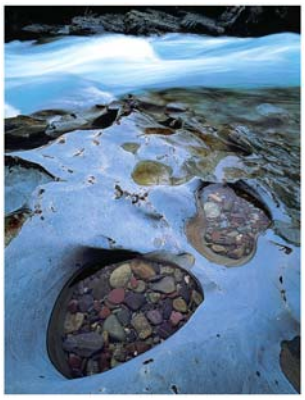


Figure 14.3

Ripples & Dunes





Potholes form by pebbles and gravel grinding inside eddies

Figure 18.11

Waterfall formed by headward erosion

Figure 18.12

Two Main Types of Channel Patterns on Floodplains are:

- **Meandering Streams**
  - have a single channel with a sinuous pattern
  - are the most common pattern on floodplains
- **Braided Streams**
  - have an interlacing network of channels
  - are relatively uncommon

Meandering River in Alaska

Figure 18.3

Lateral migration of meandering streams…

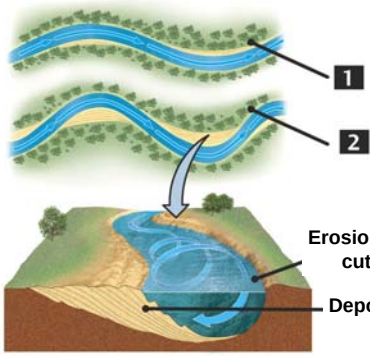


Figure 18.3

Meandering Rivers Gradually Change Their Course by Lateral Migration

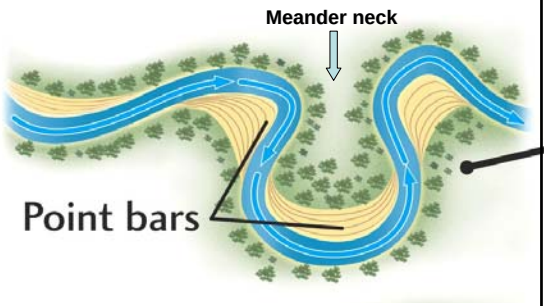


Figure 18.3

Meandering Rivers Abruptly Change Their Course by Meander Cutoffs During Major Flood Events

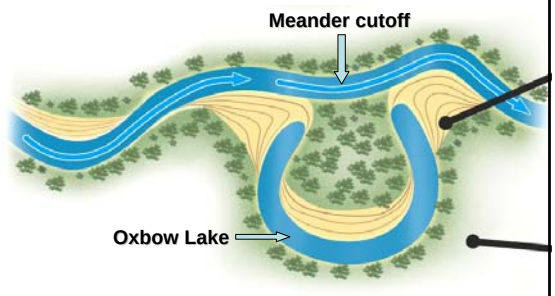


Figure 18.3

Braided River in Alaska

Figure 18.3

Variables that Encourage Channel Braiding Include:

- highly variable water discharge
- large sediment load
- easily eroded bank material

Low Discharge Period (e.g. summer)

High Discharge Period (e.g. spring snowmelt)

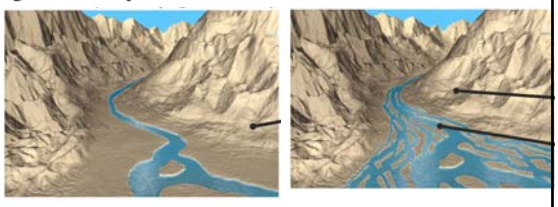


Figure 18.3

River valleys are built by two processes

- **Lateral accretion:** by the lateral migration of bar deposits (mainly sands and gravels).
- **Vertical accretion:** by the deposition of natural levee and flood basin deposits on the ***floodplain*** during periods of overbank (flood) flow (mainly silts and clays).

Building a Floodplain, One Flood at a Time

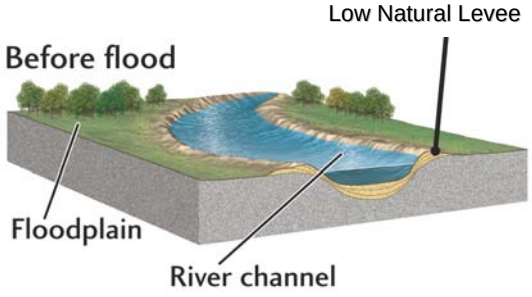


Figure 18.4

Building a Floodplain, One Flood at a Time

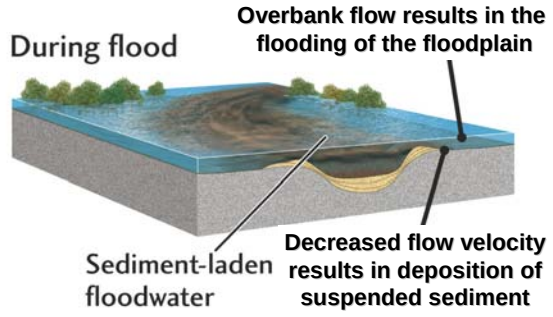


Figure 18.4

Building a Floodplain, One Flood at a Time

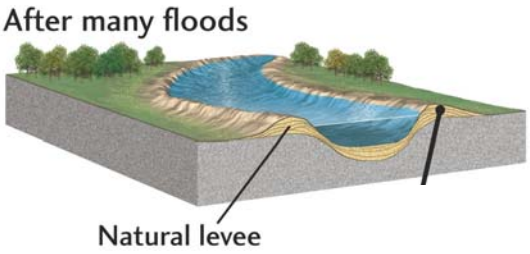


Figure 18.4

Former Channels

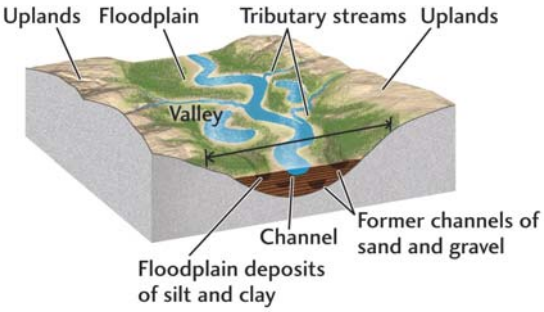
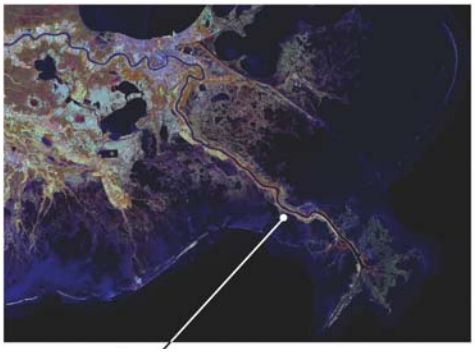


Figure 18.1



Natural Levee Along the Mississippi River Figure 18.4

Terraces (e.g., Highland Road)

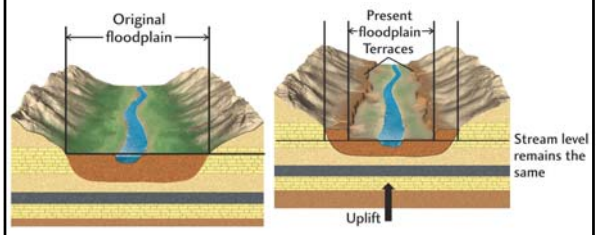


Figure 18.26

Uplift can also result in the entrenchment of meandering streams, forming "incised meanders"

Figure 18.2

Discharge = water cross section (width x depth) x velocity (distance/time)

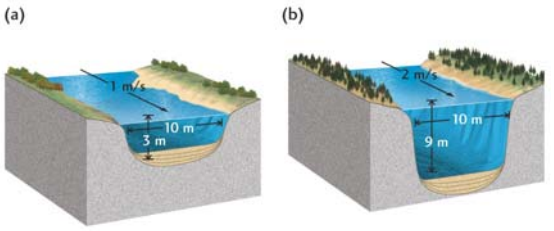


Figure 18.20

Life on the Floodplain!

Box 18.1

Small Floods more common than Big Floods

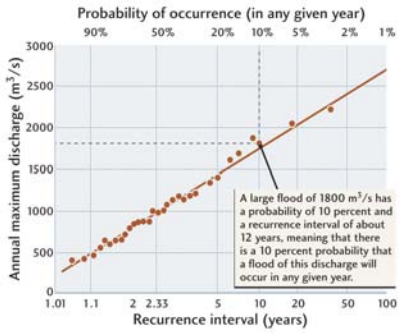


Figure 18.21

The dynamic equilibrium of a stream system is controlled by:

- **Topography** (including slope)
- **Climate**
- **Streamflow**
- **Resistance** of underlying bedrock

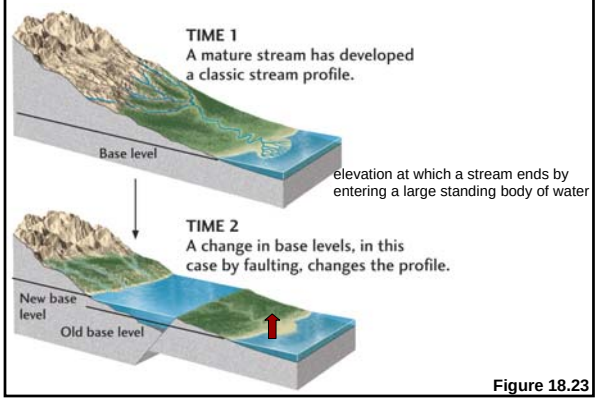


Figure 18.23

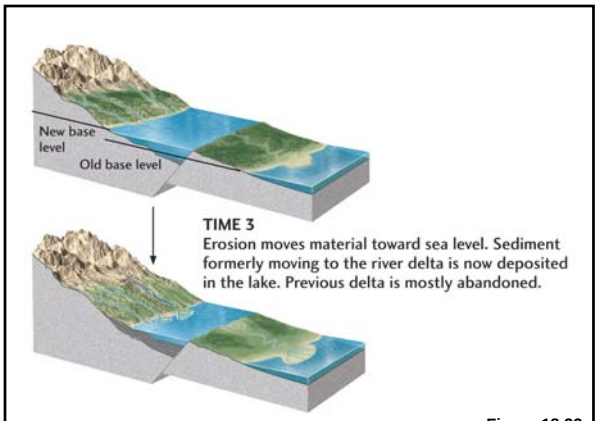


Figure 18.23

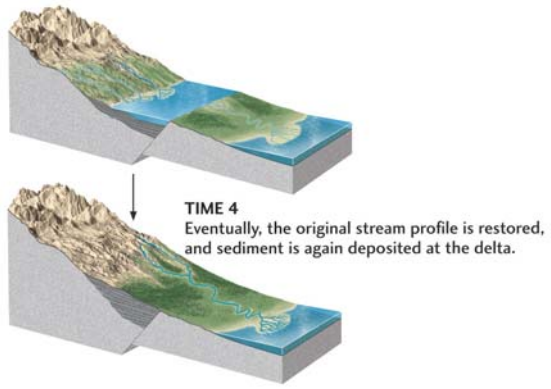


Figure 18.23

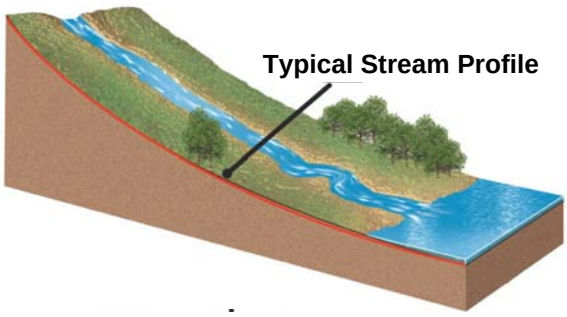


Figure 18.24

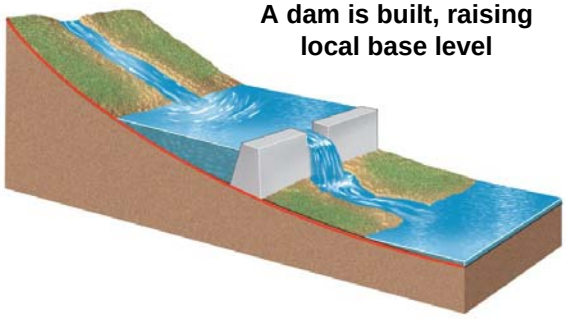


Figure 18.24

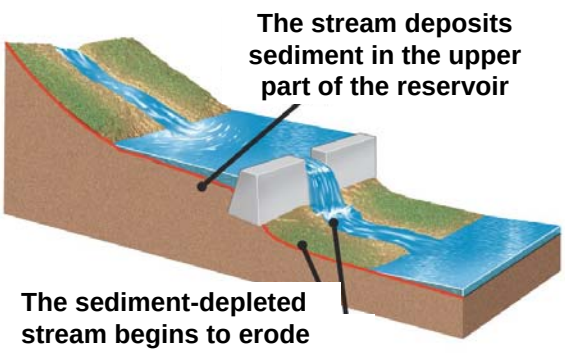


Figure 18.24

Alluvial Fans:

accumulations of sediment formed where streams widen and slow down suddenly at the base of a mountain

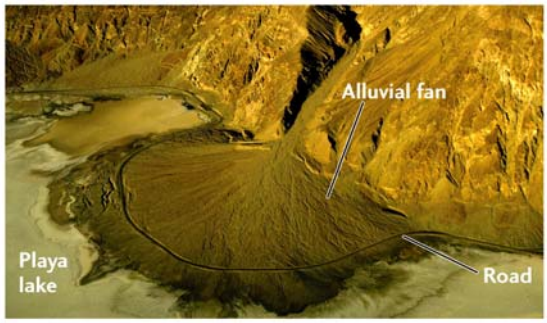
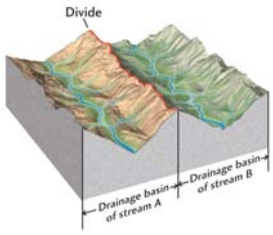


Figure 18.25

Drainage Basin

- An area of land that funnels all water that fall on it into a network of streams
- The boundaries of the drainage area are called **divides**



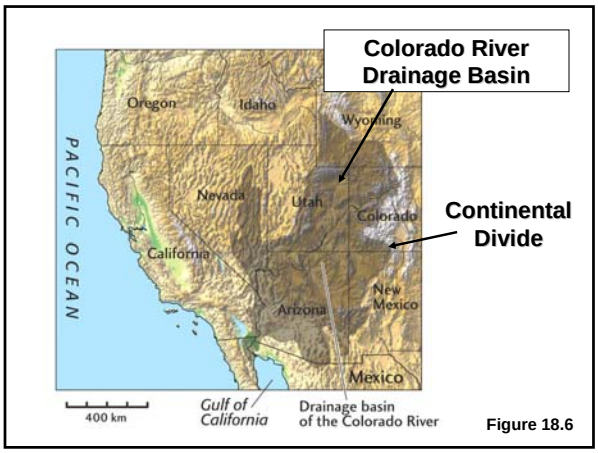


Figure 18.6

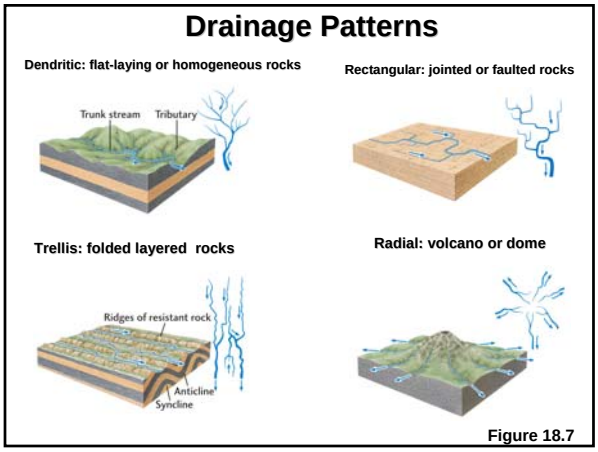


Figure 18.7

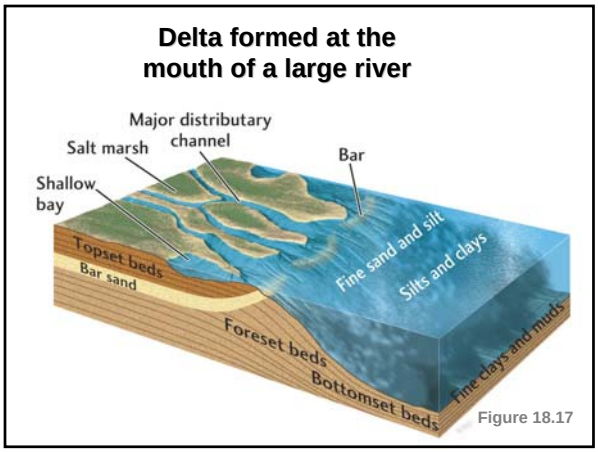


Figure 18.17

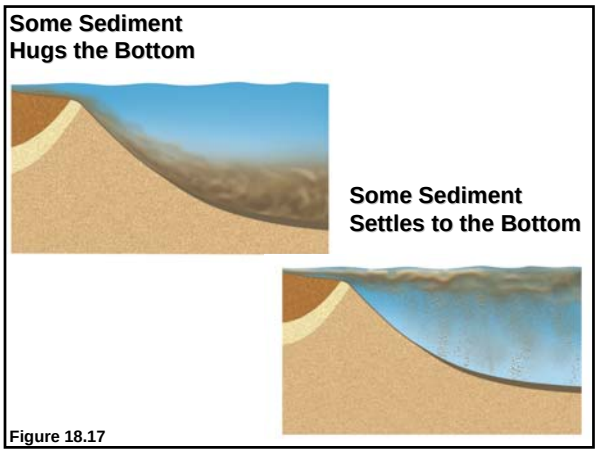


Figure 18.17

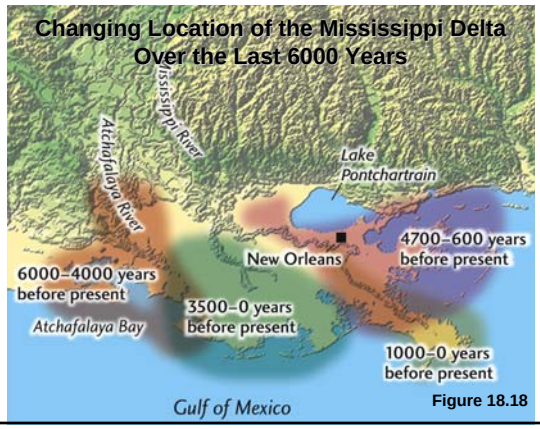


Figure 18.18

Figure 14.24c