

Streams and Running Water

Streams are part of the hydrologic cycle (Figure 10.1)

Stream: body of running water that is confined in a channel and moves downhill under the influence of gravity.

Cross-section of a typical stream (Figure 10.2)

1) Channel Flow

2) Sheet Flow

Drainage Basin: area of a stream and its' tributaries.

Tributary: small stream flowing into a large one.

Divide: ridge separating drainage basins.

Drainage Patterns

1) Dendritic: resembles tree branches

> occurs on uniformly resistant rock

2) Radial: streams diverge outward from a central point

> occurs on conic shapes, like volcanoes

3) Rectangular: streams have sharp bends

➤ due to presence of faulting, river follows the fault

4) Trellis: Parallel main streams with right angle tributaries

> occurs on valley and ridge geomorphologies

Factors Affecting Stream Erosion and Deposition

1) Velocity = distance/time

Fast = 5km/hr or 3mi/hr

Flood = 25 km/hr or 15 mi/hr

Figure 10.6: Fastest in the middle of the channel

a) Gradient: downhill slope of the bed of the stream

➤ very high near the mountains

➤ 50-200 feet/ mile in highlands, 0.5 ft/mile in floodplain

b) Channel Shape and Roughness (Friction)

> Figure 10.9

➤ Lots of fine particles – low roughness, faster river

➤ Lots of big particles – high roughness, slower river (more friction)

High Velocity = erosion (upstream)

Low Velocity = deposition (downstream)

Figure 10.7 > Hjulstrom Diagram

What do these lines represent?

Salt and clay are hard to erode, and typically stay suspended

2) Discharge: amount of flow

$Q = \text{width} \times \text{depth} \times \text{velocity} = \text{m}^3/\text{s} \text{ or } \text{cfs}$

➤ increases downstream

Why? 1) Flow out of ground via stream bed

2) Small tributary streams can be huge near the floodplain (Figure 10.10)

Stream Erosion

How?

1) Hydraulic Action (Figure 10.11)

2) Solution: dissolved in water- slow process

3) Abrasion: grinding away by friction – sand and gravel

➤ Potholes- formed by abrasive action

Stream Transportation of Sediment – Figure 10.13

- 1) Bedload – stream bottom load – big stuff
Moves by: 1) Traction- rolling, sliding, dragging
2) Saltation – bouncing
- 2) Suspended Load- light enough stuff to remain in moving water (silt & clay, sometimes sand)
- 3) Dissolved Load – soluble products of chemical weathering

Stream Deposition

Bars: ridge at sediment, usually sand (Figures 10.14, 10.15)

- Sand bars can migrate with floods

Figure 10.16 – Placer Deposits: found in streams where running water has mechanically concentrated heavy sediment

Braided Streams	>	Vs. Meandering Streams
Braided streams lots of sediment form	>	sinuous curves
Interconnected rivulets	>	faster velocities in center, slower to outside, promotes deposition (Point Bars)

Figures 10.18- 10.20- Meandering

Meanders typically produce erosion on the outside, and deposition on the inside of the stream. (Figures 10.19-10.20)

Meander Cutoff- typically occurs during flood stage (F. 10.18)

Oxbow Lake- Figures 10.21- 10.22

Flood Plains – broad strip of land built up in sedimentation on either side of a stream channel.

- Figure 10.24- various types of deposits
- Figure 10.25- Natural levees – low ridges of flood- deposited sediment

Deltas: body of sediment deposited at the mouth of the river, where the velocity decreases

Tide vs. Wave Domination

Alluvial fans are related to deltas, except for the stream is intermittent, and it opens into a dry valley.

Flooding

Recurrence Interval

Urban Flooding

Flash Flooding

Controlling Floods

Stream Valley Development

- 1) Downcutting (Fig 10.37) – upstream
- 2) Base Level- downstream
 - Lateral erosion

Stream Terraces – Figures 10.42- 10.43

Incised Meanders- 10.44

Superimposed Streams – 10.45