Chapter 11
Streams and Flood Processes

Introduction
* Floods account for 25% to 35% of annual dollar loses
* Floods account for 80% of annual deaths from geologic hazards
* The logged forests, road building, and paved city areas have increased water runoff increasing the magnitude and chance for floods

Stream Flow and Sediment
* Drainage basin (watershed) –
  * _______________ – total volume of water flowing past a point per unit time
    * Measured by an Acoustic Doppler Current Profiler
    * Floods increase discharge which involves:  
      • An increase in water velocity
      • Water depth affects the stream depth
      • Stream width
  * A stream floods when it rises above its “bankfull channel width”
  * Sediment transports with streams
    * When water rises it moves faster and can carry more sediment
    * Large boulders can bounce along the stream bottom during large floods creating more erosion
    * Streams create “natural levees” as they deposit more sediment on their banks

Stream Types
* Meandering Streams –
  * Sediment deposited on inside bends creating a “point bar”
  * Erosion occurs on the outside bends
  * “_____________” form as the meanders often merge to make the stream more straight
* Braided Streams – streams that are overloaded with sediment requiring the water to shift in numerous locations
  * Often produces “alluvial fans” at the base of mountain slopes

Measure of Water
* _______________ – plot of the volume of water in a stream versus time
  * Heavy precipitation creates rapid runoff on land called “overland flow”
* Stream order – classifies streams based upon the numbers of tributaries feeding the stream
  * 1\(^{st}\) order streams – no real tributaries
    •
  * 2\(^{nd}\) order streams – created by 1\(^{st}\) order streams that joined
  * 3\(^{rd}\) order streams – joined by 1\(^{st}\) and 2\(^{nd}\) order tributaries
    • A lag exists between when the storm and the flood occurs
    • Floods typically last longer
* Floods on Frozen or Saturated ground
Heavy fresh snowpack followed by warm conditions and heavy rains lead to destructive floods

“____________” set up when rivers melt and ice gets dammed at constricted points in the river
- Red River, North Dakota 1997
  - South to north flowing rivers have particular problems with ice jams
  - The flood lasted for almost 2 months

**Flood Frequency**
* Recurrence interval –
  * Larger floods have longer intervals

* \( T = \frac{n+1}{m} \)
  - \( T \) = recurrence interval
  - \( n \) = number of years in record
  - \( m \) = rank of flood (based upon river discharge amounts)

* Problems with recurrence intervals
  - Interval times and amount of discharge change with more data input
  - Paleoflood data can alter recurrence intervals
  - Entire watershed must remain consistent, but this is impossible considering building throughout an entire watershed
  - Data sets are too small and period of record too short

**Floodplains**
* Floods are designed to flood their flat plains
* People inappropriately use floodplains for building structures
* Since 2002, most mortgage companies require the residence to be surveyed to see if it is in a floodplain, and if it is, the owner must purchase flood insurance

**Flood Insurance**
* National Flood Insurance Program (NIFP) – established to provide protection against floods
  
  \( \text{___________} \) – includes stream channel and its banks
  - Construction is prohibited in these areas
* Flood fringe – farther from the stream and usually includes backwater during a flood

*End of Chapter 11*

*Streams and Flood Processes: Rising Waters*