Floods

- Discharge Q exceeds capacity of the channel.
- Banks overflow into floodplain - temporary storage.
- Excess water prior to overflow is accommodated by increasing both Area and Velocity.
- Rivers approaching flood stage have very high load capacity = high erosion potential.
- Most of the work performed by streams occurs during floods.
- As a flood subsides, velocity and discharge decrease, sediment load is dropped and stream channel aggrades back to pre-flood level.
- Water stored in floodplain evaporates and / or is gradually fed back into stream system.

Prior to flood

![Diagram of floodplain, channel, and thalweg]
Bank-full stage

- Discharge and velocity greatly increased
- River is below capacity and erodes its channel

Flood

- Excess water is temporarily stored in the floodplain
- Discharge and velocity return to pre-flood level
- Above capacity river deposits sediment and aggrades channel

Major Floods in US History

Upper Mississippi River
Summer of 1993
Upper Mississippi River
Summer 1993

- Excessive rainfall during spring and summer - double normal amounts in some regions of Iowa and Missouri.
- Flooding on upper river but not on lower Mississippi - due to lower than normal discharge coming from the Ohio River.
- 48 fatalities, $20 Billion in damages.
Mississippi River - pre-1993 flood

Mississippi River - 1993 flood - water in storage on the floodplain.

Mississippi River - 1993 flood
Downtown St. Louis, MO

This perimeter levee surrounding the Clarence Cannon National Wildlife Refuge, Mo., damaged during the 1993 flooding, allowed excessive water to enter the refuge. (Photograph courtesy of U.S. Fish and Wildlife Service.)
Big Thompson Flash Flood

- July 31, 1976 - Big Thompson Canyon, Colorado
- In two hours, the Big Thompson Canyon flood killed 145 people (including six who were never found)
- destroyed 418 houses and damaged another 138
- destroyed 152 businesses
- caused more than $40 million in damages
Flood Prediction

- Floods are a stochastic phenomenon - cannot be predicted.
- Probability of a flood can be measured given historical data on peak flood size per year.
- Flood frequency is expressed as a **recurrence interval** (T) = average # years between floods of a given size.
- To compute T:
  - Rank all peak flood data from largest to smallest (largest flood has rank m=1).
  - Count n = total number of years
  - T (recurrence interval for flood of size m) = (n + 1) / m
  - P (probability of exceeding that flood size) = 1 / T
  - q (probability of a flood of T occurring or being exceeded within the next n years) is: q = 1 - (1 - 1/T)^n
Old River Control Mississippi River

• Built to keep the Mississippi River from changing course - avulsion to the Atchafalaya River.
• Provides a safety valve during flooding - excess flow can be diverted through the Atchafalaya basin.