Computing Discharge

Rating Curves

How do we get there from here?

Greg McCombs

Information and visuals provided by the U.S Department of the Interior, National Weather Service, K. Michael Noland, Jeff M. Philips, E. J. Kennedy, D. Evans, M.S. Griffin

U.S. Geological Survey

Department of the Interior

What is a Streamgage?

A streamgage is a structure located beside a river or stream that contains instrumentation designed to measure and record the water level (gage-height) in the river. Gage-height data is collected every 5 to 60 minutes and transmitted back to the USGS office via satellite on 1-4 hour intervals. When the data are received, a "rating curve" is used to correlate the gage height data to streamflow, which is measured in cubic feet per second ("cfs").

USGS personnel visit each streamgaging station about every 6-8 weeks to measure the flow directly and service/calibrate the equipment.

The streamflow data and water level information are made available to the users and the public over the Internet (http://water.usgs.gov/nwis/).

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Radar Level Sensor

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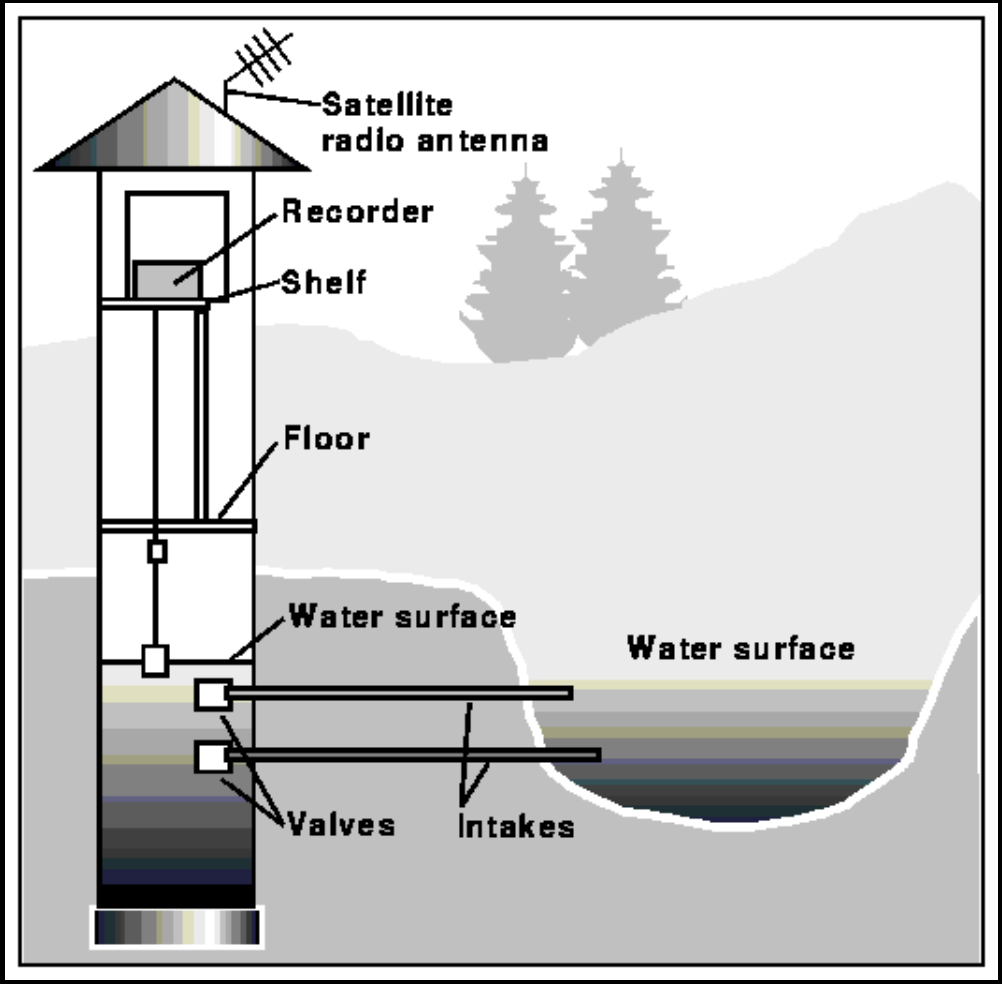
Stage can be sensed using STILLING WELLS



KY River @ Lock 4

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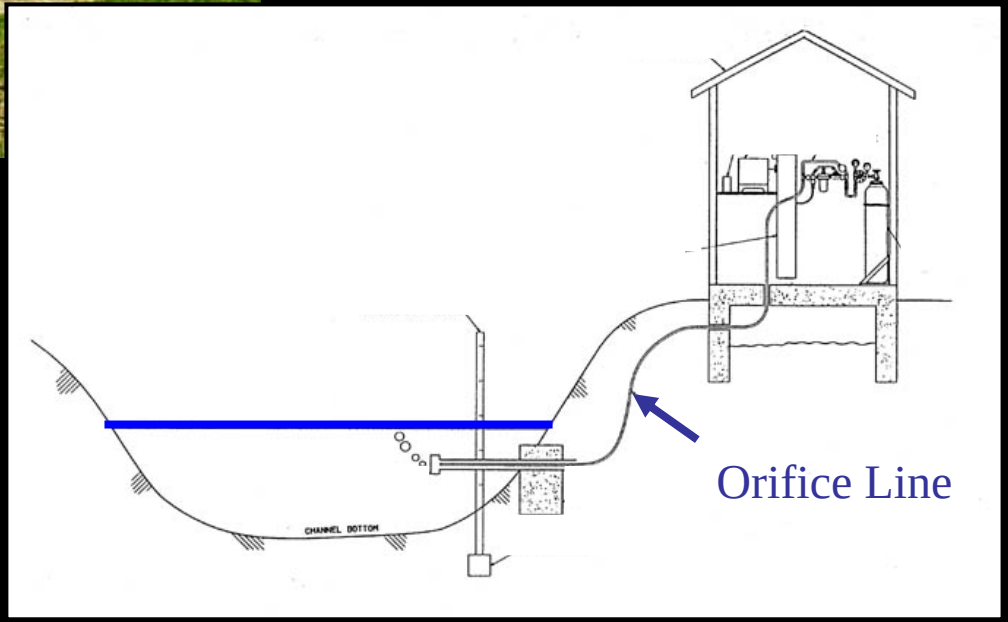
Stage can also be sensed using PRESSURE TRANSDUCERS

Pacific Cr. near Moran, WY



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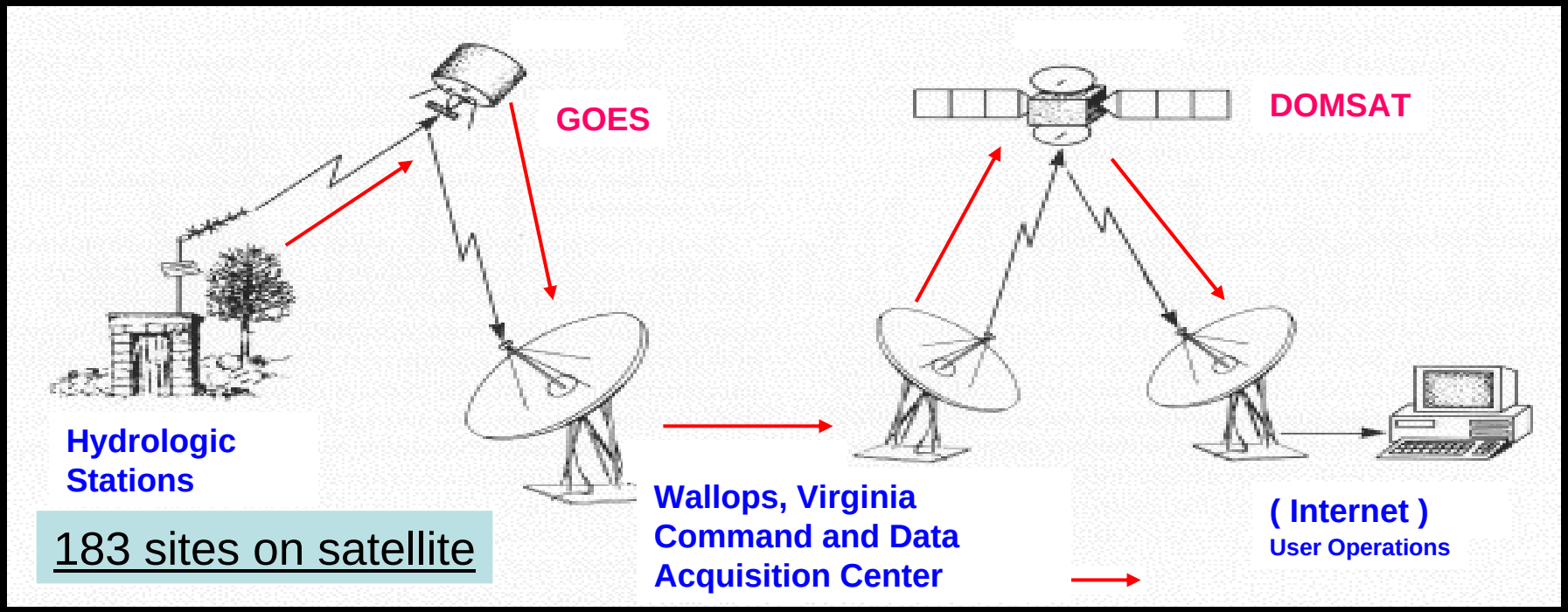
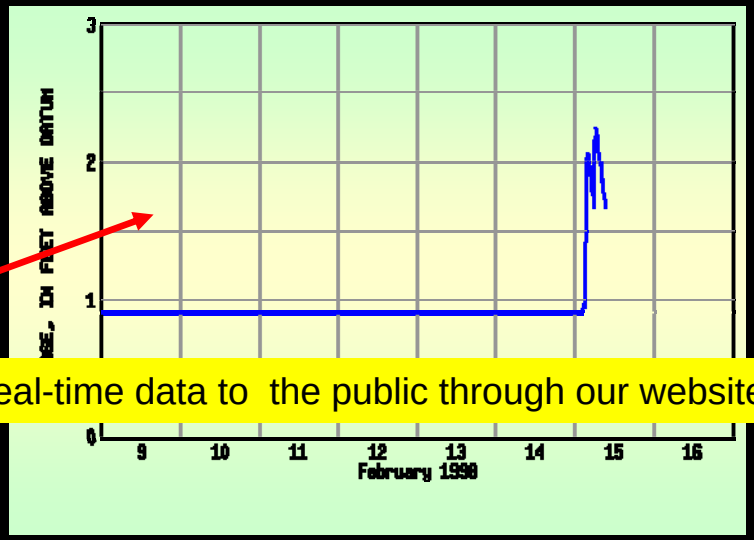


Stage



Provides ready access to near real-time data to the public through our website

Permits us the opportunity to better plan our trips to the field

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Stage is usually:

- **Measured to an accuracy standard of:**

"either 0.01 ft or 0.2 percent of the effective stage being measured" -- USGS, Office of Surface Water memorandum 93.07

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To assure the accuracy of the measured stage…

Datums are stable points of elevation established at a gage for referencing instrumentation…

…Levels are run at each site on a 3 year cycle

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Most users of streamflow information need to know the discharge of the stream

Discharge Measurement

Brian Loving, Salt Lake City

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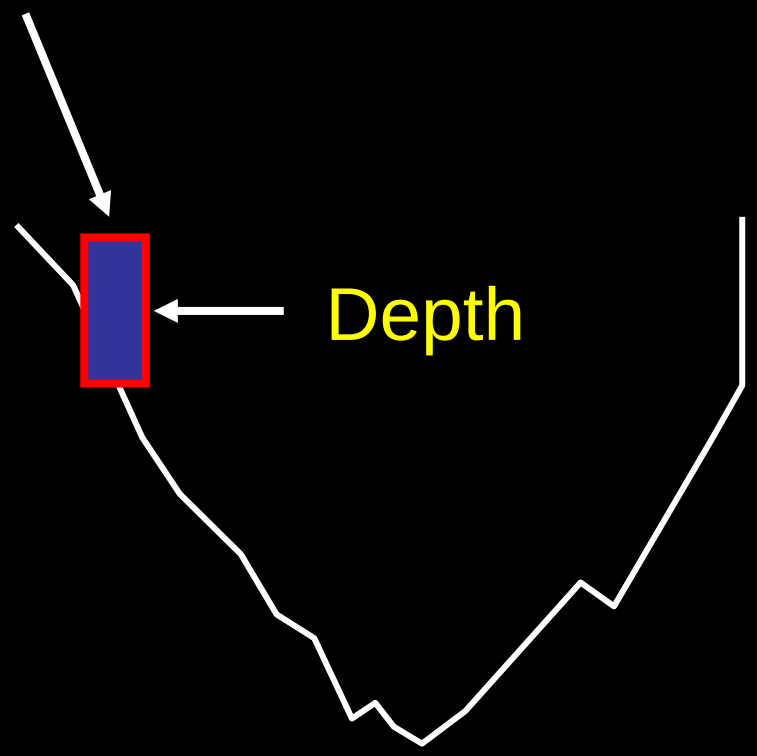
Area of each sub-section determined by measuring width and depth

Width

Area = Width x Depth



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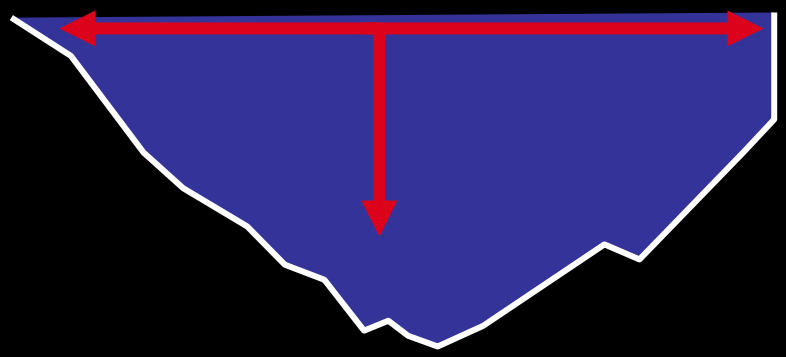
DISCHARGE IS USUALLY MEASURED USING THE VELOCITY-AREA METHOD

Wading - Bridge - Boat



Cross section area x Water Velocity = Discharge

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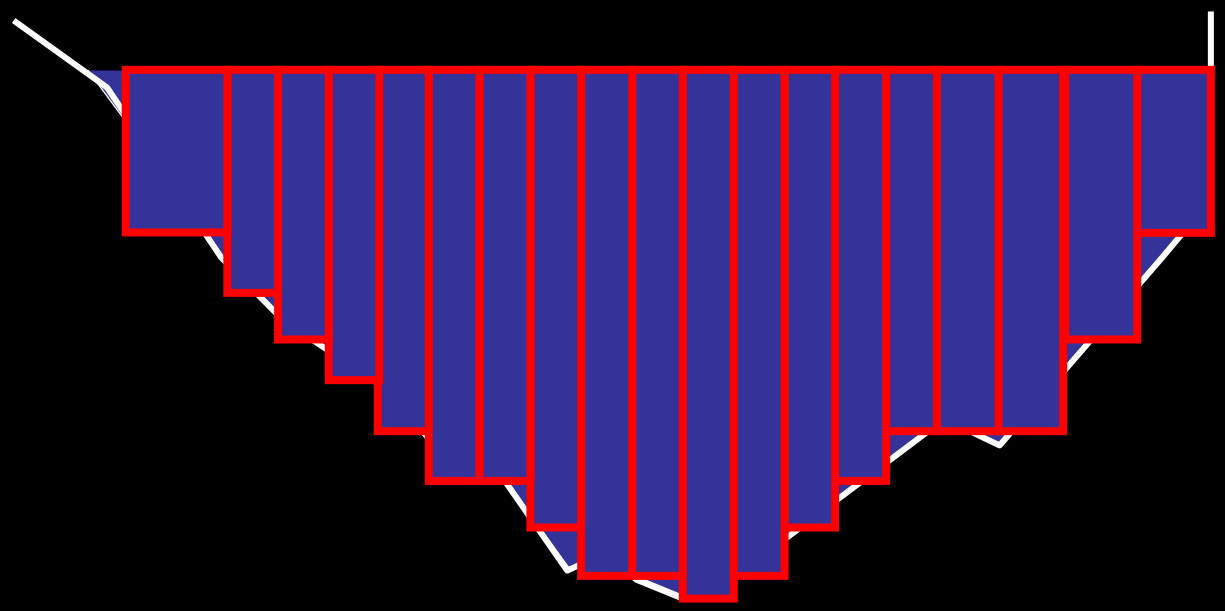
Channel cross section is divided into a number of sub-sections



… Trying not to exceed 5% of the total discharge in any sub-section

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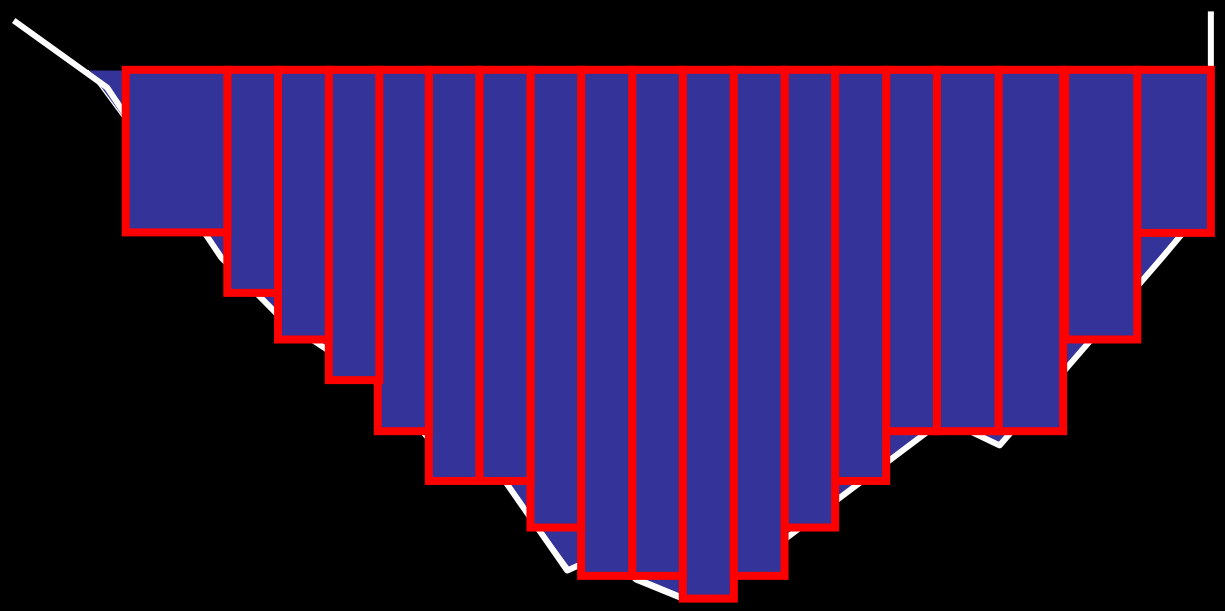
…Discharge is computed for each sub-section



Discharge of each sub-section = Area x Average Water Velocity

Sum of each sub-section's discharge = Total discharge

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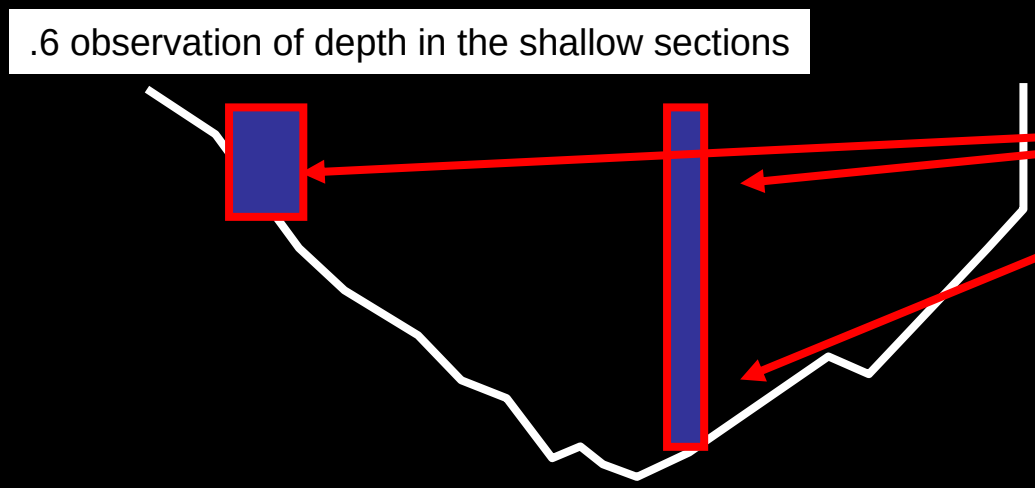
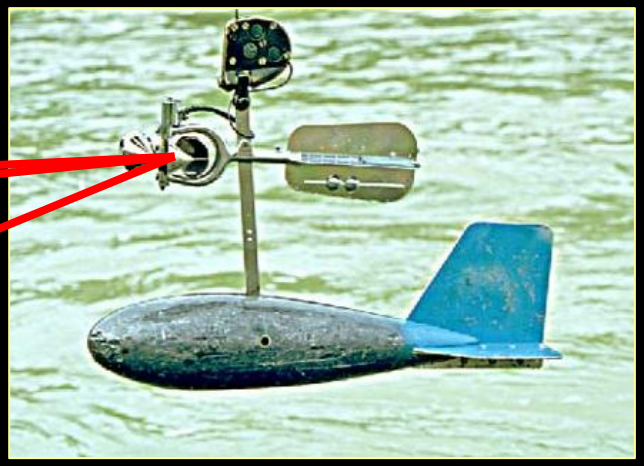
Velocity of flow is measured at each sub-section





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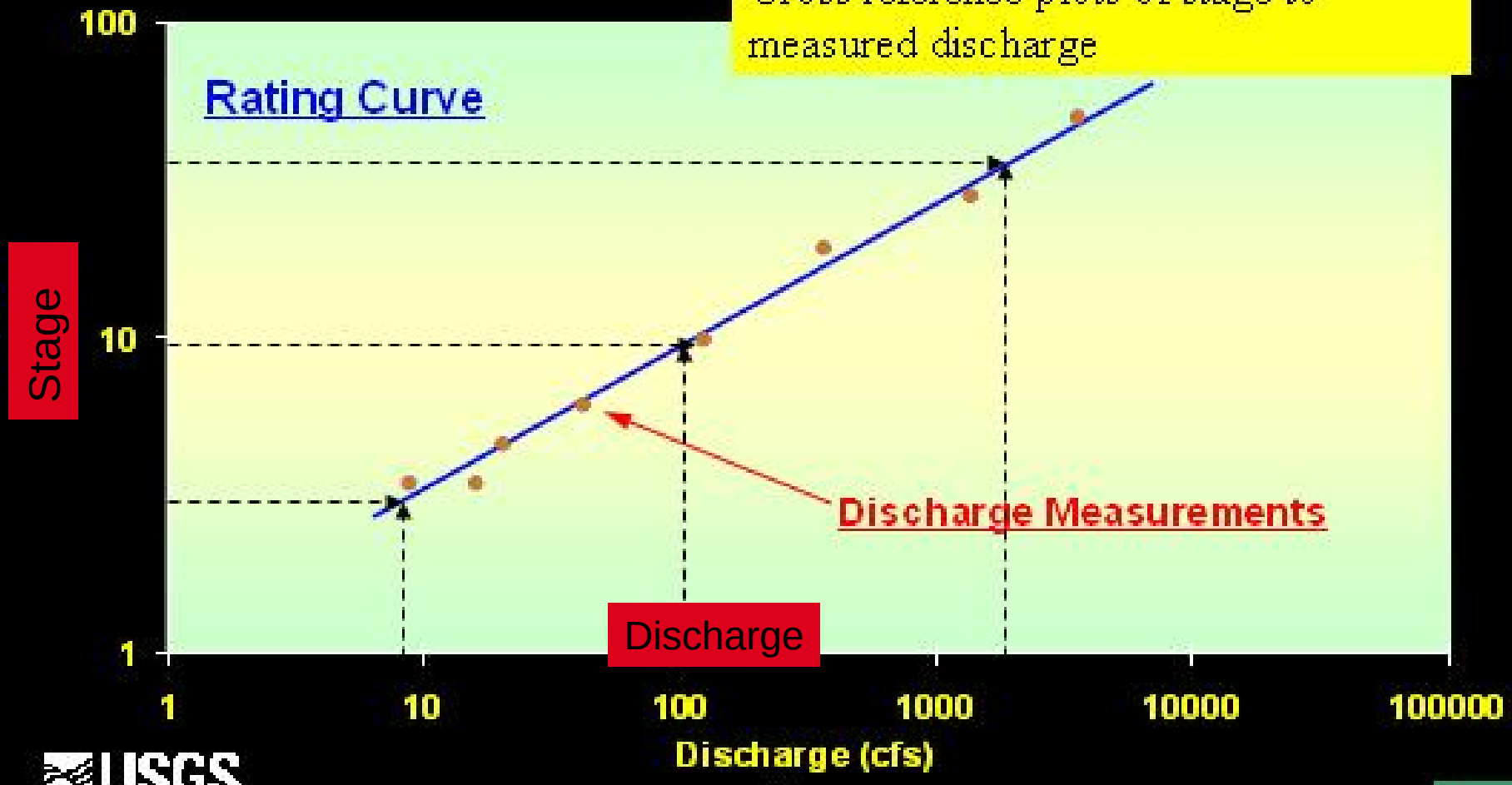
How are the discharge and gage-height data used?

Discharge measurements and stage data are used to develop rating curves

Cross reference plots of stage to measured discharge



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Graphical representations of what is happening in the stream

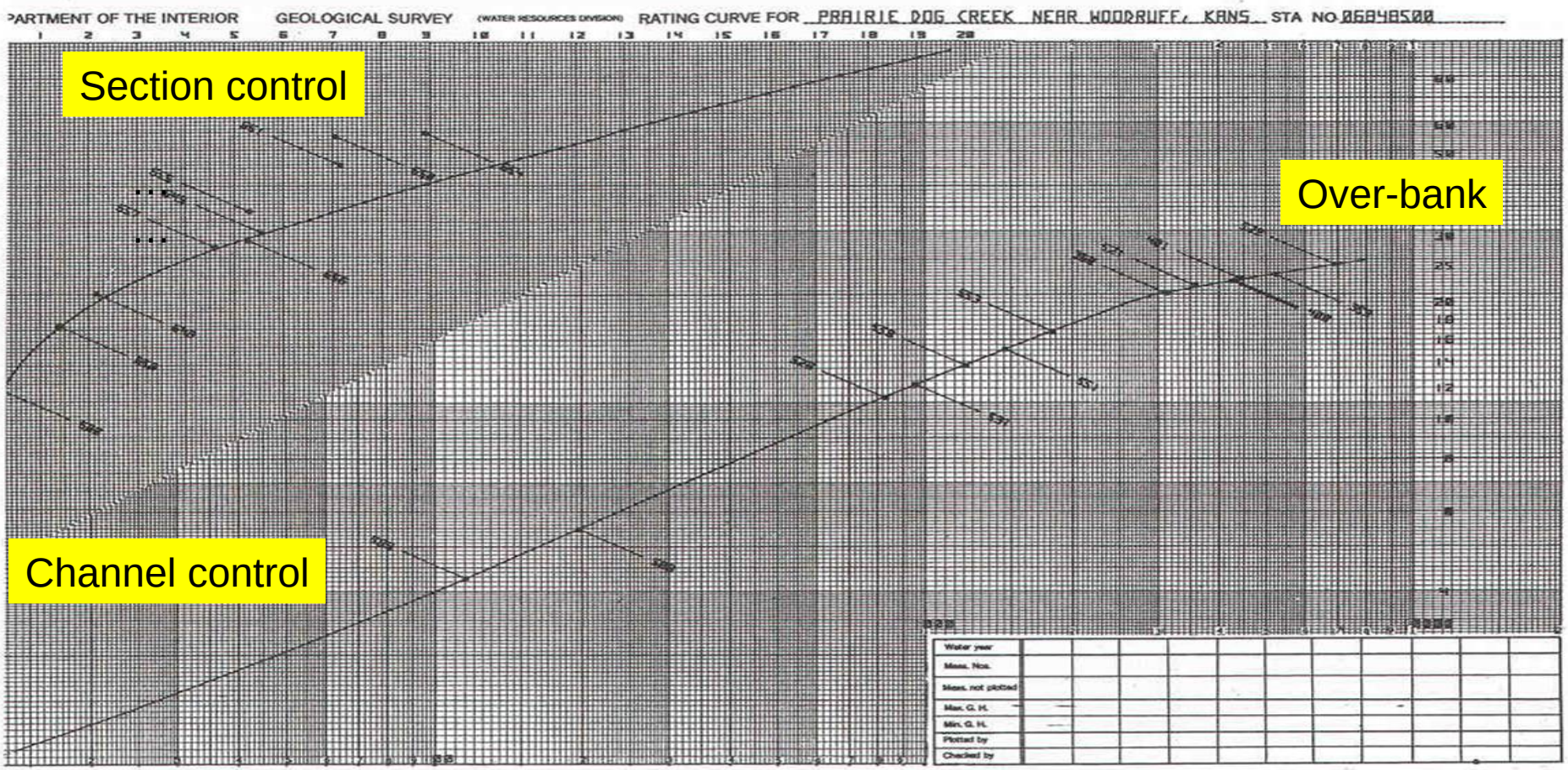
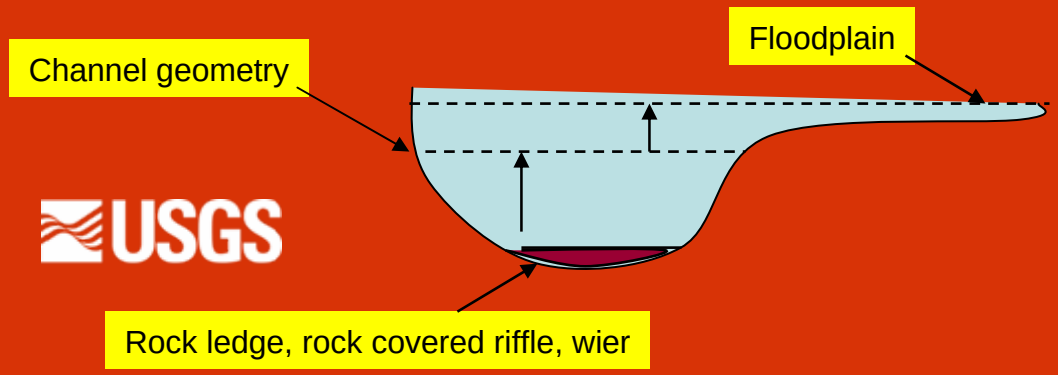


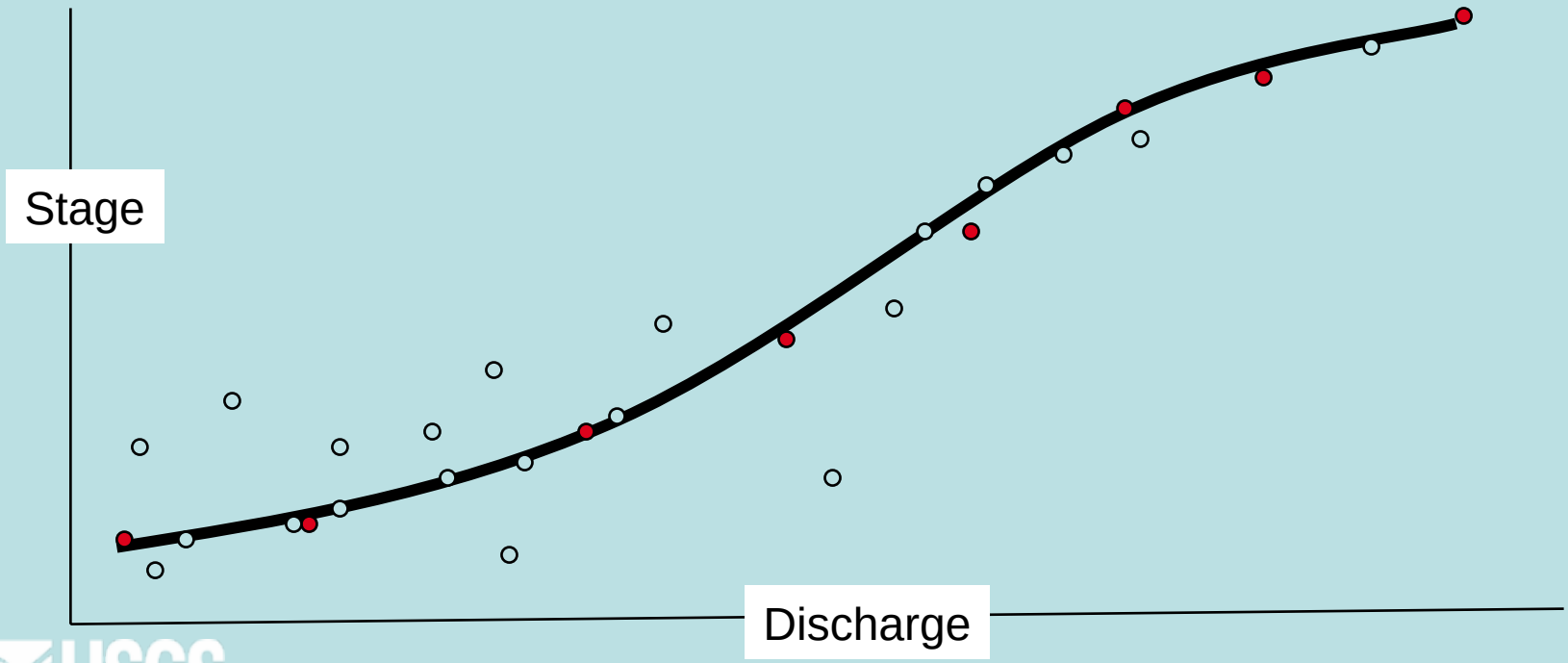
FIGURE 9.—Automatically plotted rating curve-sheet.



Station control – A section or reach of channel below the gage that eliminates the effect of all other downstream conditions on the velocity of flow at the gage

…The curve takes shape

…Definition eventually evolves from the numerous measurement plots and a good baseline curve is established



...Controls

Channel

Section

Overbank

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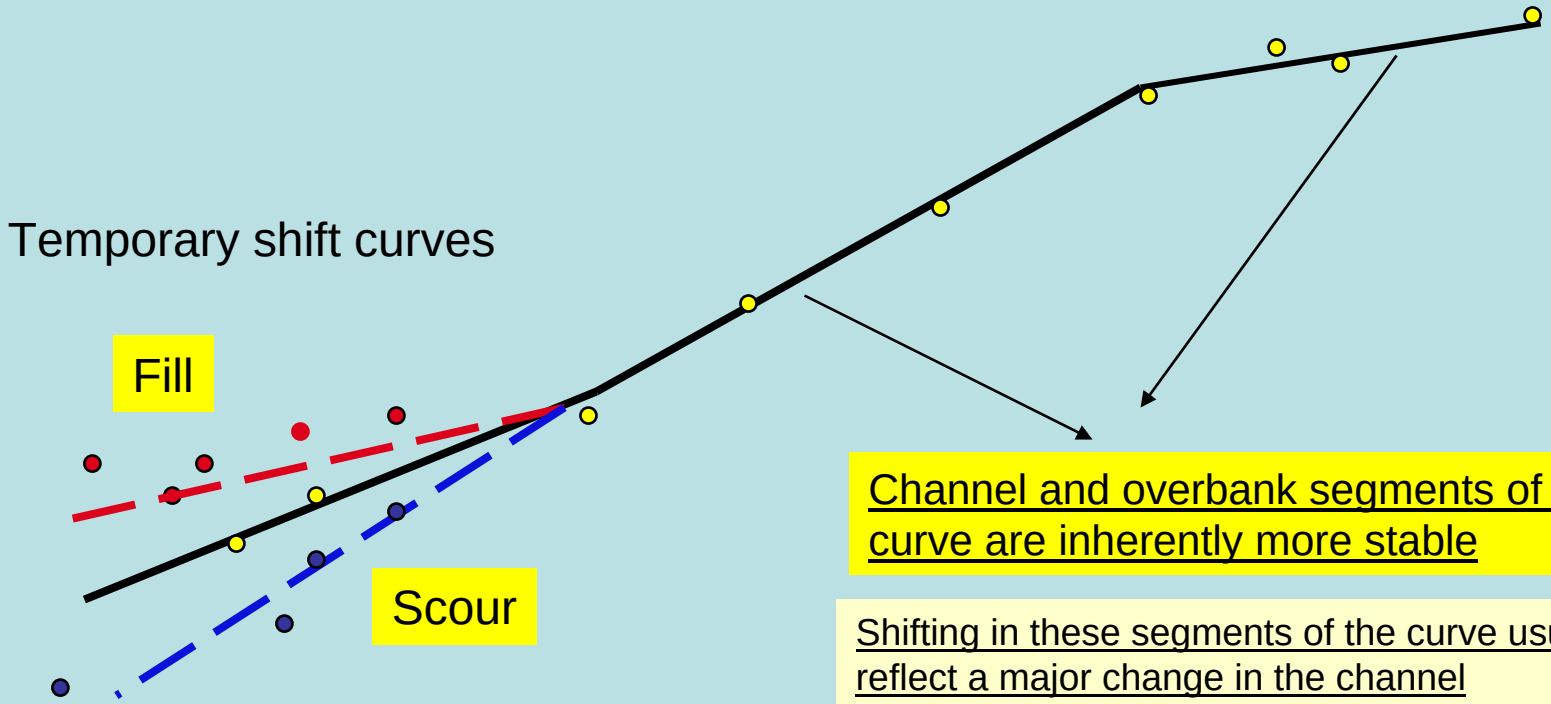
Most of the variability in a rating curve occurs at the lower portion. This variability is referred to as “shifting of the control”



Channel and overbank segments of the curve are inherently more stable

Shifting in these segments of the curve usually reflect a major change in the channel

Low flow measurements

Measuring discharge volumetrically

Defining the low water portion of the curve…

…Provides the needed data for effectively managing withdrawls from and discharges into our streams during periods of drought

This office has made three statewide Low-flow runs since July

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Discharge measurements during high stages are very important

…They provide data essential for:

- Flood warning systems
- Water treatment concerns
- Commercial Development planning

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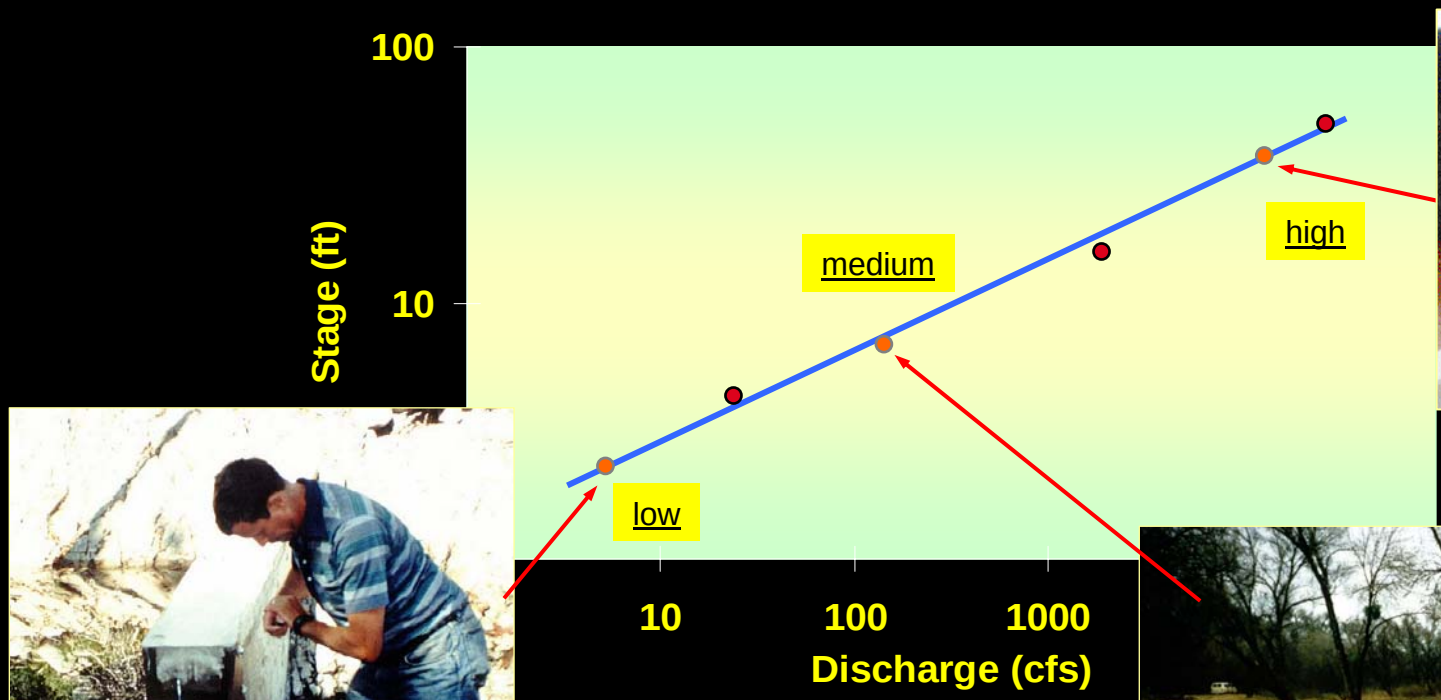
…In closing, the accuracy of a rating and the data it provides depends on discharge being measured regularly, and at all stages…



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Questions?