

North Fork Clearwater River

General Information

The study reach is about a 2,200 ft length of stream at the Geological Survey(USGS) gage 13340600 (North Fork of the Clearwater River near Canyon Ranger Station, ID). The site is about 1.7 miles downstream from the Canyon Ranger Station, Idaho. The site is on land administered by the Forest Service at an elevation of about 1,660 ft above sea level. The drainage area is 1,294.2 mi² and the geology of the watershed is intrusive igneous and metamorphic rock.

Sediment transport measurements were made by USGS personnel predominantly during the spring snowmelt flows of 1994 and 1995. Two additional measurements were made during the high spring discharges of 1997. Additional measurements at this site include a survey of the stream reach, pebble counts of the surface substrate and core samples of the subsurface substrate material. Figures 1 and 2 show photographs of the site looking upstream and downstream from the bridge, just downstream of the USGS gaging station. The cableway is approximately 15 ft downstream of the gaging station.



Figure 1. North Fork Clearwater River looking upstream from bridge.



Figure 2. North Fork Clearwater River looking downstream from the bridge.

Streamflow records are available for April 1967 to present. Estimated average annual streamflow (Q_a) for the stream is $3,510 \text{ ft}^3/\text{s}$ and the estimated bankfull discharge (Q_b) is $16,000 \text{ ft}^3/\text{s}$. Stream discharge was low in 1994 and the largest daily mean discharge was only $12,600 \text{ ft}^3/\text{s}$. In 1995 the largest daily mean discharge recorded was $34,200 \text{ ft}^3/\text{s}$ on November 30, well above bankfull discharge. The largest instantaneous discharge for the period of record was $37,500 \text{ ft}^3/\text{s}$ on November 30, 1995.

Cross-Section and Channel Geometry

Figure 3 shows the cross-section at the sediment transport measurement site, the cableway about 15 ft downstream of the gaging station. The average gradient for that section of the study reach from the downstream bridge and extending about 1000 ft upstream of the gage station is 0.0005 ft/ft. Just upstream of this reach is a steep rapid that was not included in the gradient calculations.

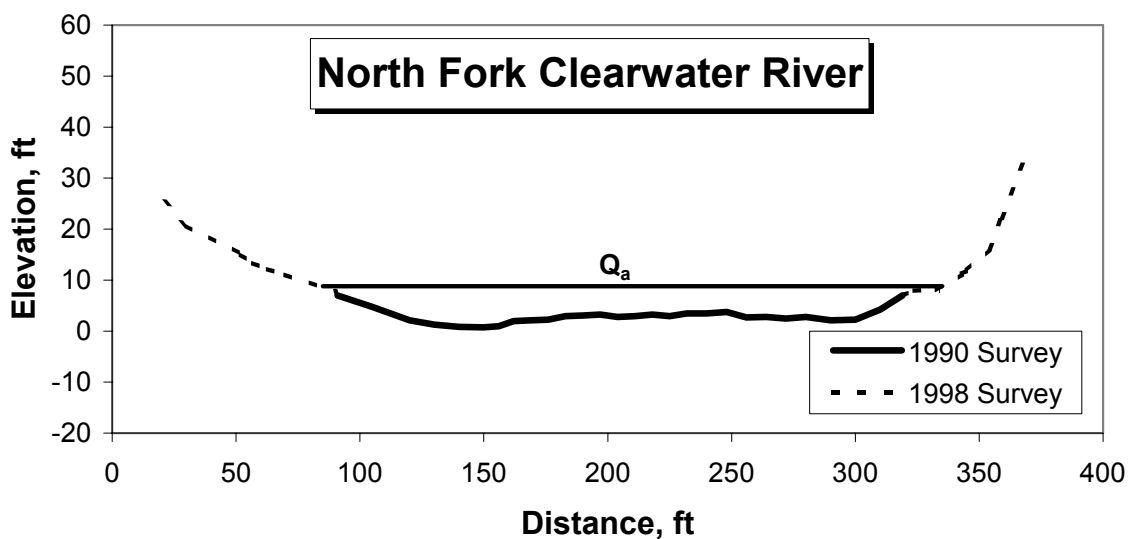
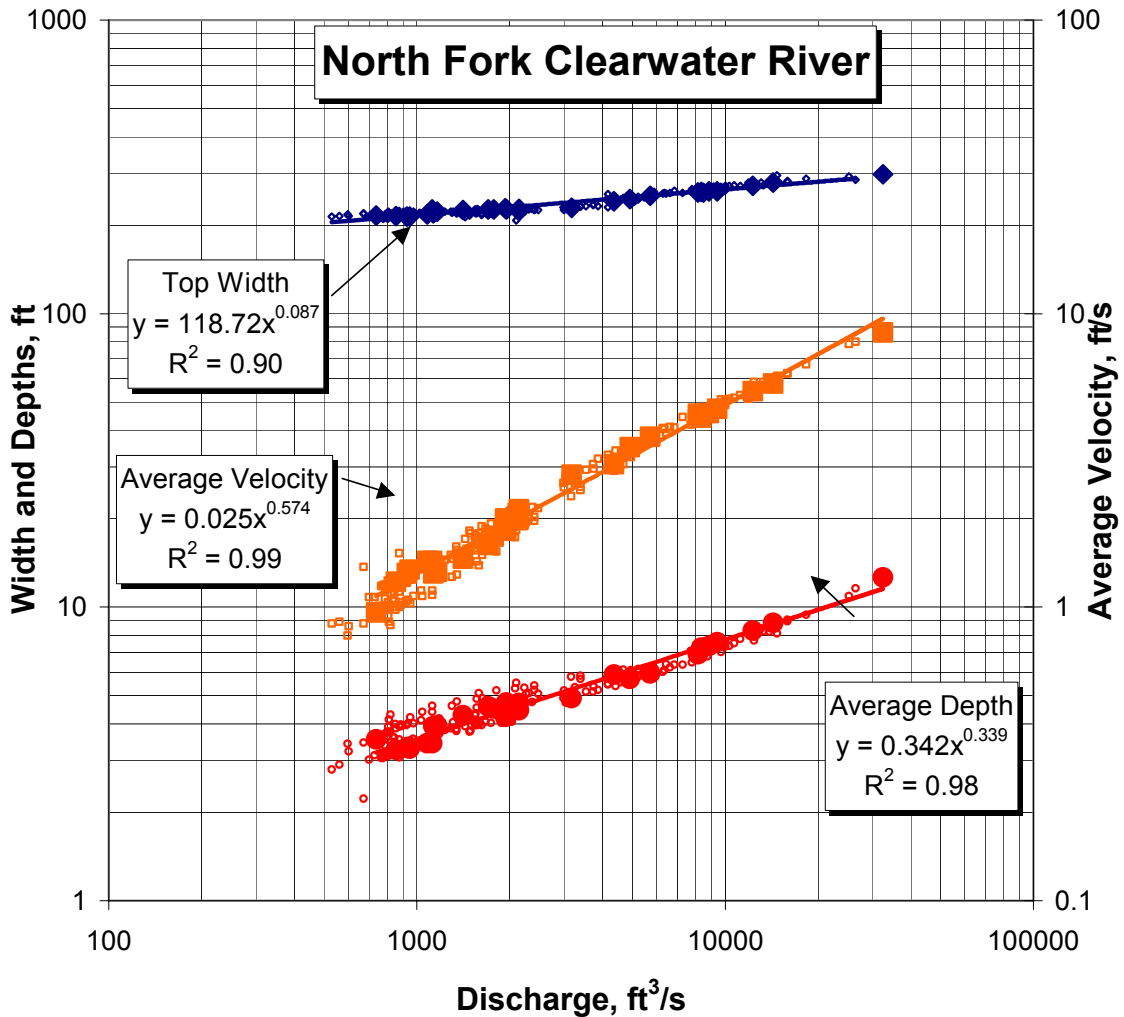


Figure 3. Cross-section of the North Fork Clearwater River at the USGS cableway.

The channel geometry relationships for this cross-section are shown in Figure 4. All data collected in 1994 through 1998 from the cableway were used to develop the displayed power relationships with discharge. Over the range of discharges when sediment transport was measured (3,560 to 34,400 ft³/s) estimated stream width, estimated average depth and estimated average velocity varied from 242 to 295 ft, 5.5 to



11.8 ft, and 2.7 to 9.9 ft/s, respectively. The average reach gradient is 0.0005 ft/ft.

Figure 4. Width, average depth, and velocity versus stream discharge at the cableway cross section on the North Fork Clearwater River. (Solid symbols represent data used to develop the power relationship; open symbols were not used because they are either outside the range of discharges when sediment transport was measured or represent data collected prior to 1994.)

Channel Material

A surface pebble count was made at the cableway cross-section in September 1994. Surface pebble counts were also made along three transects in September 1995 and three cores were collected of subsurface material. The average D_{50} and D_{90} for the surface material were 60 mm and 334 mm, respectively, in 1994 and 95 mm and 282 mm, respectively, in 1995. The average D_{50} and D_{90} for the subsurface material in 1995 were 23 mm and 135 mm, respectively (Figure 5). The median size of floodplain material was highly variable and the most notable feature is the larger percentage of material smaller than about 0.5 mm.

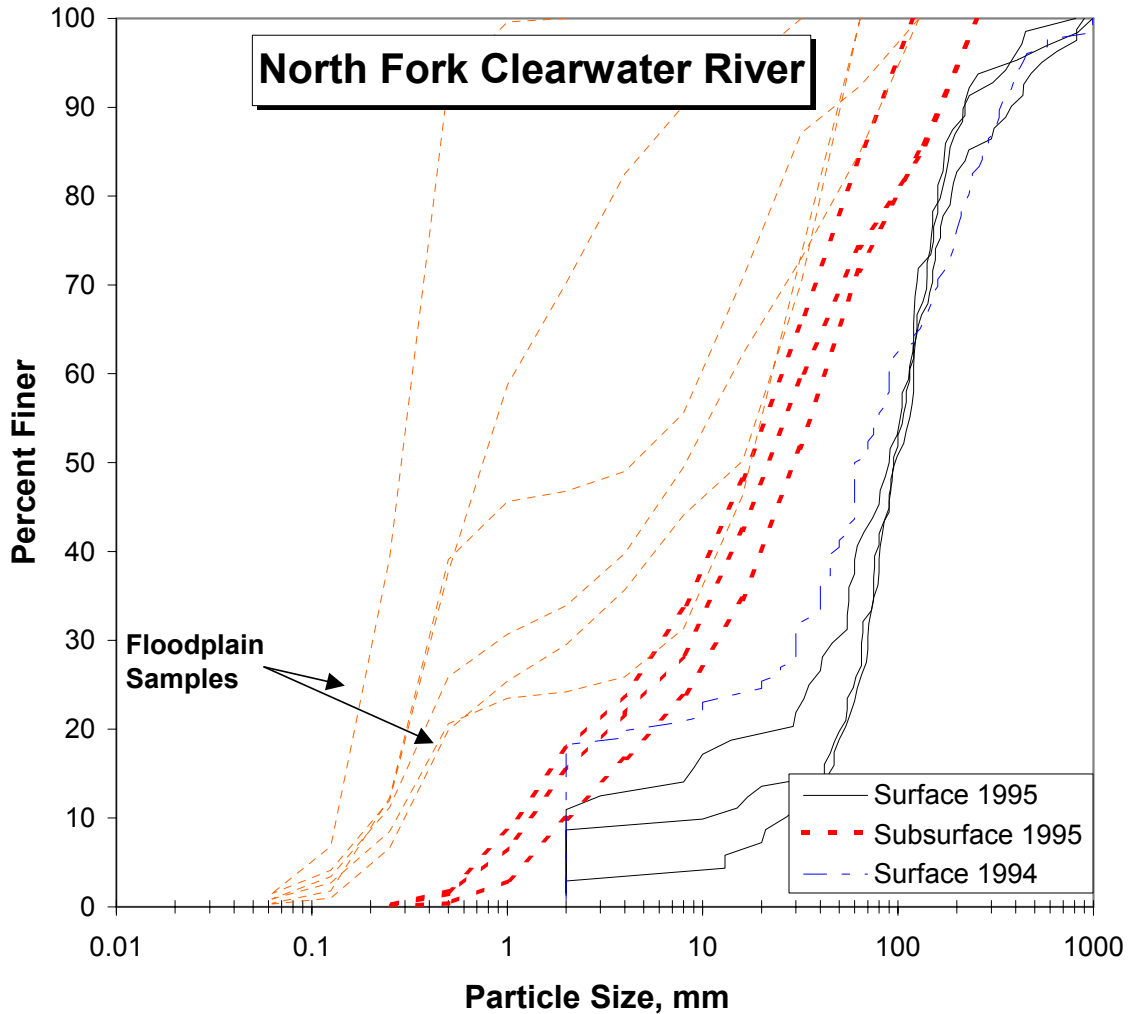


Figure 5. Particle size distribution for surface, subsurface and floodplain material samples in the North Fork Clearwater River.

Sediment Transport

Sediment transport measurements made in 1994 through 1997 includes 72 measurements of bedload transport and 36 measurements of suspended sediment transport. Sediment transport measurements spanned a range of stream discharges from 3,560 ft³/s (1.01Q_a; 0.22Q_b) to 34,400 ft³/s (9.80Q_a; 2.15Q_b). Bedload transport ranged from 0.140 to 5,920 t/d and suspended transport ranged from 21.1 to 411,000 t/d. Over the range of measured discharges, suspended transport accounts for the majority of the material in transport with between one and two orders of magnitude greater suspended transport than bedload transport at all discharges (Figure 6).

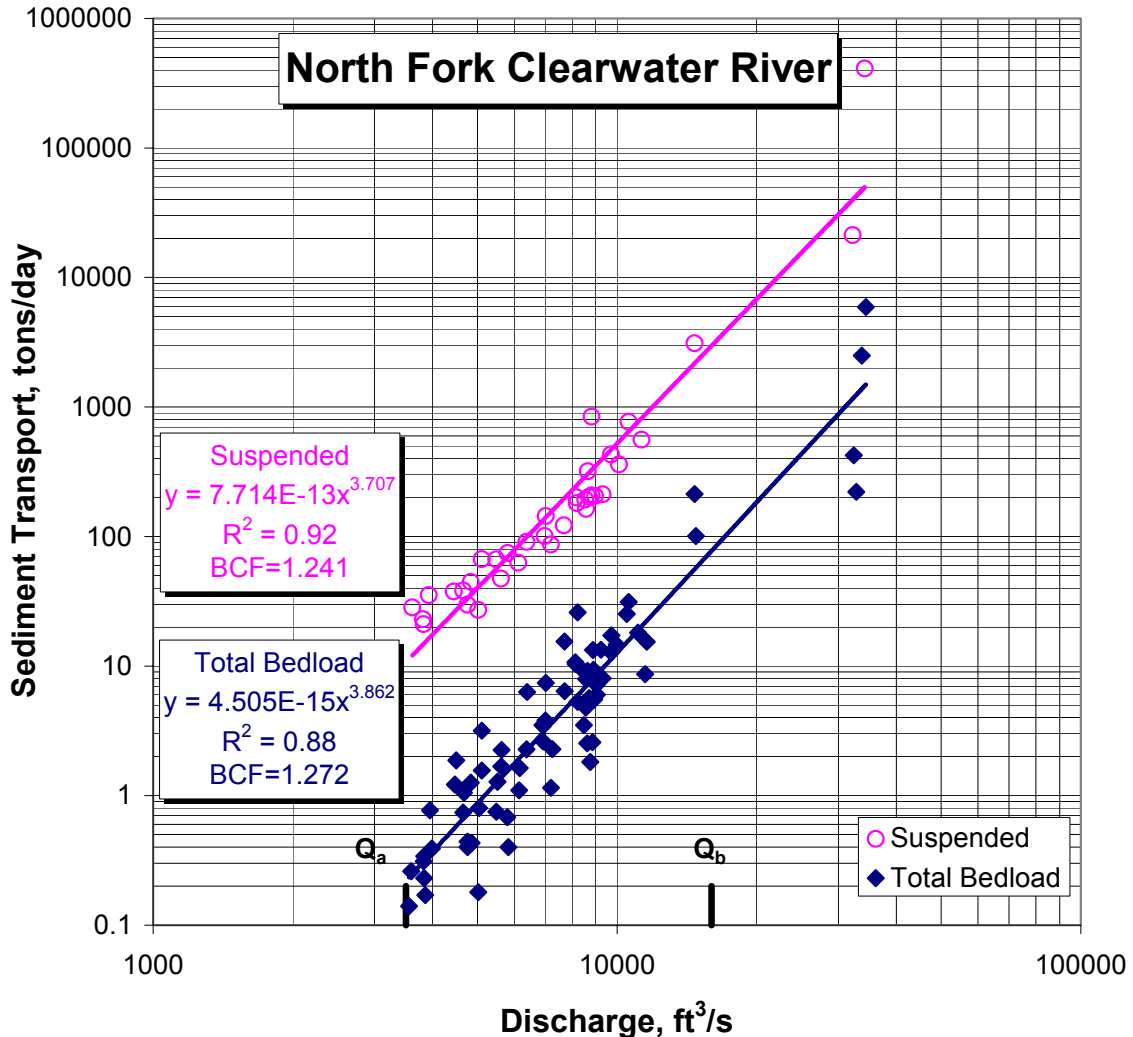


Figure 6. Bedload and suspended load transport rate versus discharge.

The bedload transport rates by size class (Figure 7) shows that the larger rates are associated with material in the 0.5 to 2mm diameter size class. Only five of the samples contained particles greater than 32 mm and these were samples with discharges of 14,700 ft³/s and larger.

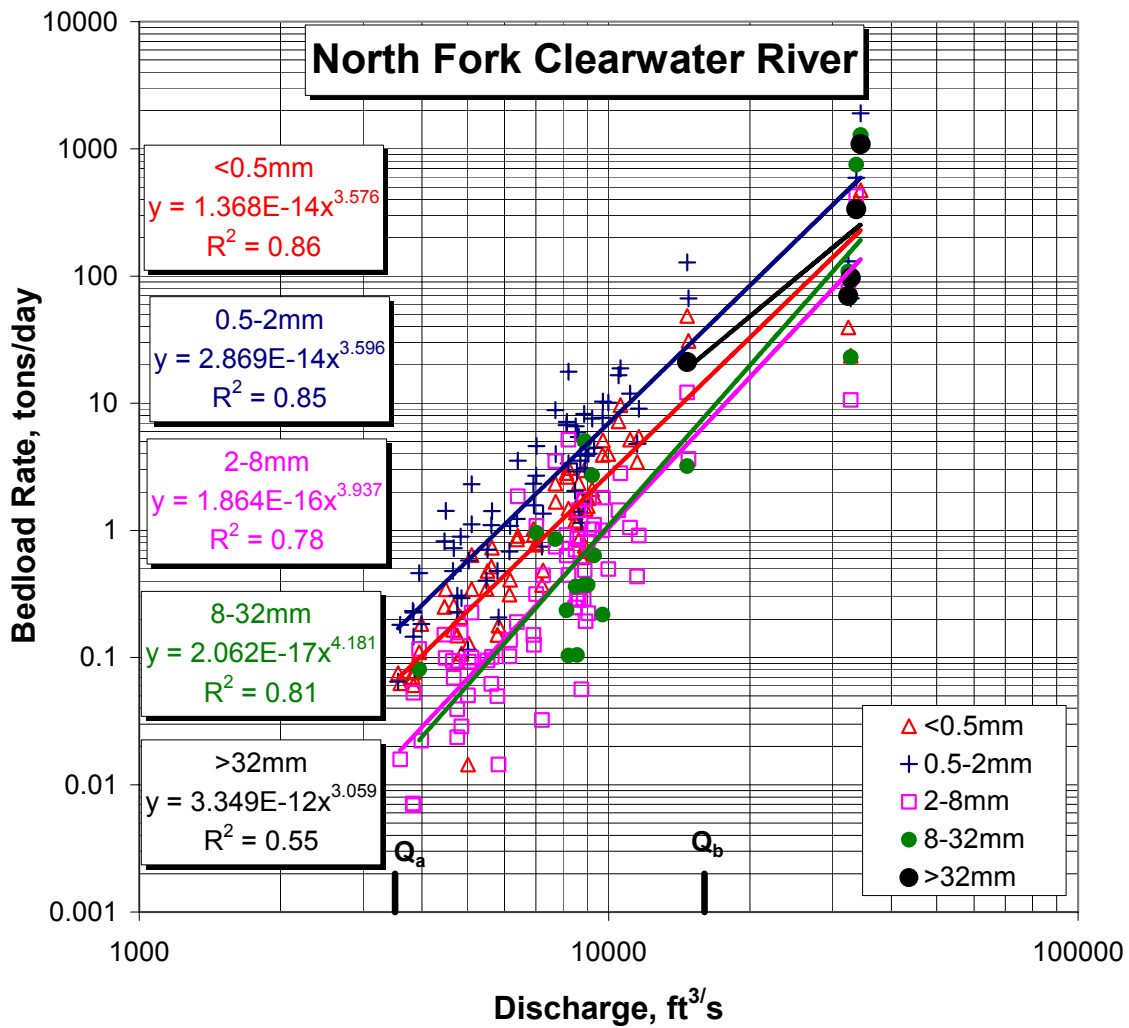


Figure 7. Bedload transport rate versus discharge for selected size classes.

The size of the largest particle in the bedload sample increased with discharge (Figure 8). The largest particle measured in a bedload sample was 74 mm at a discharge of 33,700 ft³/s. At discharges greater than bankfull discharge (16,000 ft³/s) the largest particle exceeded 40 mm in all but one instance. The D₅₀ for most of the bedload samples collected at discharges less than bankfull discharge was in the sand size range, 0.5 to 2 mm. At discharges greater than bankfull discharge the median diameter ranged from 3.6 to 19.9 mm. The largest median diameter of a bedload sample was 19.9 mm for a sample collected at 32,800 ft³/s. The information on the largest particle in the bedload sample and observations of recently moved large rocks and associated instantaneous peak discharges for the 1997 snowmelt period suggest that the median diameter particles on the channel surface begin to move at discharges larger than the bankfull discharge.

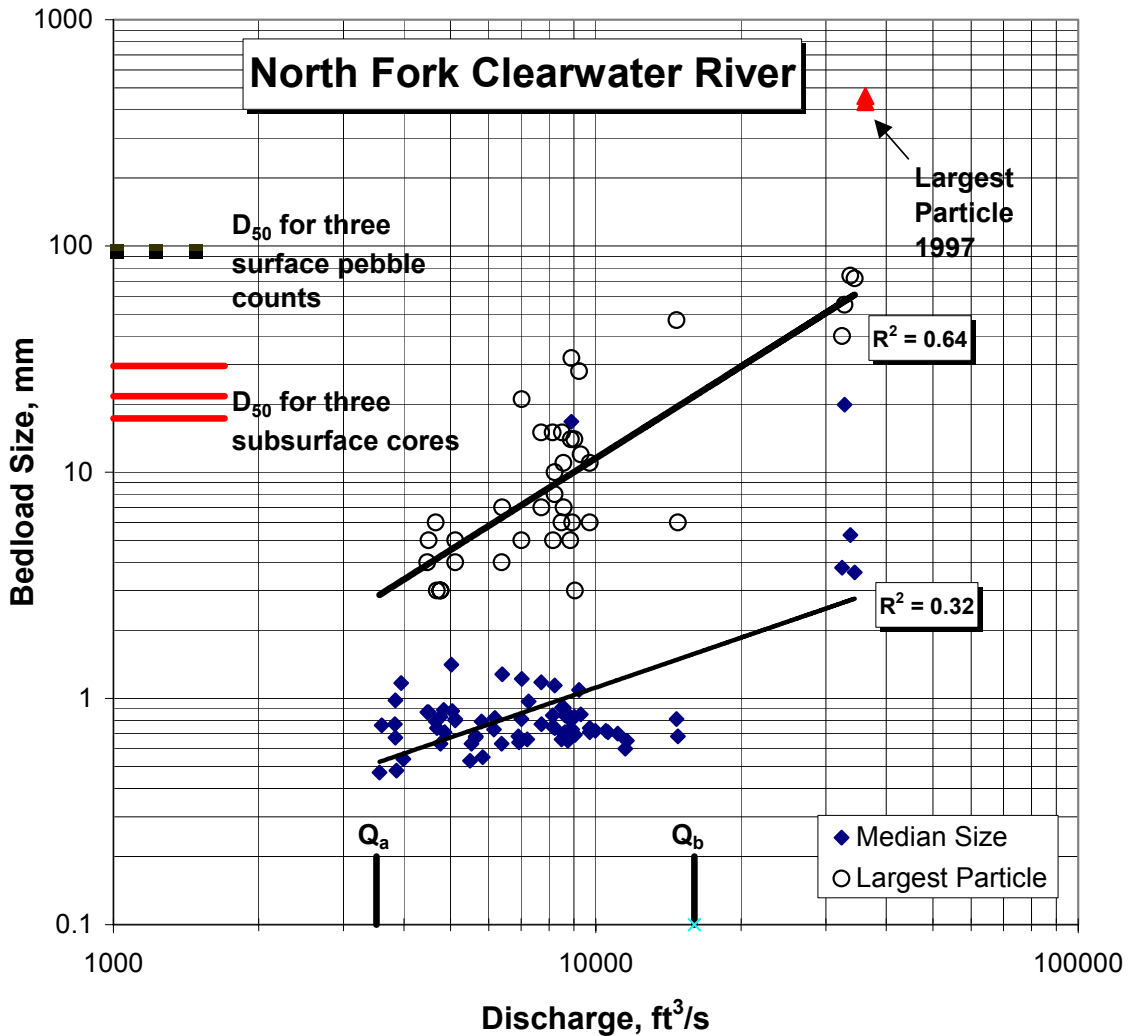


Figure 8. Median size of the bedload sample and the largest particle size versus stream discharge for the North Fork Clearwater River.