Boise River

General Information

The study reach is about a 2,200 ft length of river at the Geological Survey (USGS) gage 13185000 (Boise River near Twin Springs) in the Boise National Forest. The stream gaging station is approximately 1.8 miles upstream from the maximum flow line of Arrowrock Reservoir. The site is on land administered by the Forest Service at an elevation of about 3,256 ft. The drainage area upstream of this location is 831.6 mi^2 and the geology of the watershed is predominantly intrusive igneous.

Sediment transport measurements were made by USGS personnel predominantly during the spring snowmelt discharges of 1994, 1995 and 1996. Two addition measurements were made during the high spring discharges of 1997. Additional information collected at the site include a survey of the stream reach, pebble counts of the surface material, core samples of the subsurface material and samples of floodplain deposits. Figures 1 and 2 show photographs of the site looking upstream and downstream from the USGS gaging station. The cableway (Figure 2) is approximately 100 ft upstream of the gaging station.

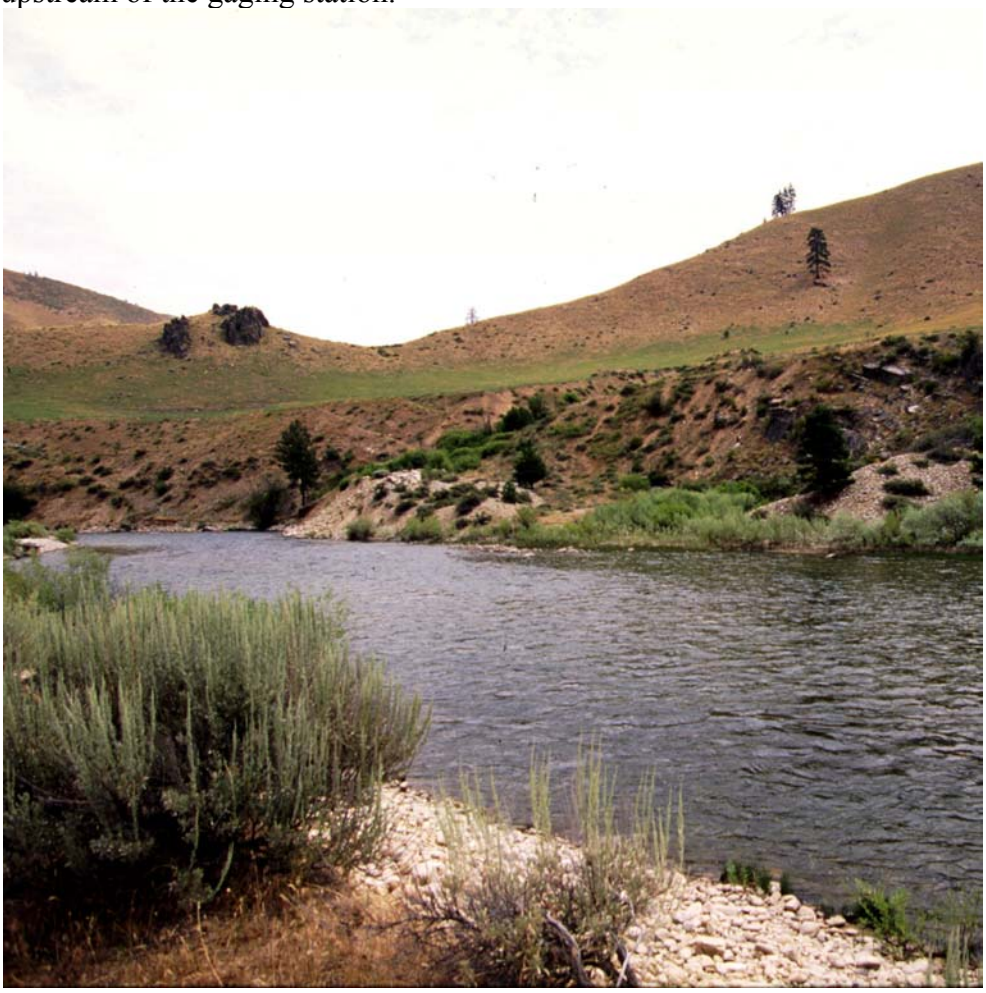

Figure 1. Boise River looking upstream from the USGS gaging station.

Figure 2. Boise River looking downstream past the USGS gaging station.

Stream discharge has been recorded since March 1911, although prior to October 1, 1965 the station was 0.3 miles downstream of the present location. Average annual discharge (Q_a) for the period of record is 1,200 ft^3/s and bankfull discharge (Q_b) is estimated at 5,900 ft^3/s. The range of daily mean discharge for the period of record is 123 ft^3/s to 15,400 ft^3/s. The highest instantaneous discharge recorded was 18,800 ft^3/s on December 23, 1964.

Cross-Section

Figure 3 shows the cross-section at the USGS cableway. The average gradient for the study reach is 0.0038 ft/ft. All sediment transport measurements were made at the cableway cross-section.

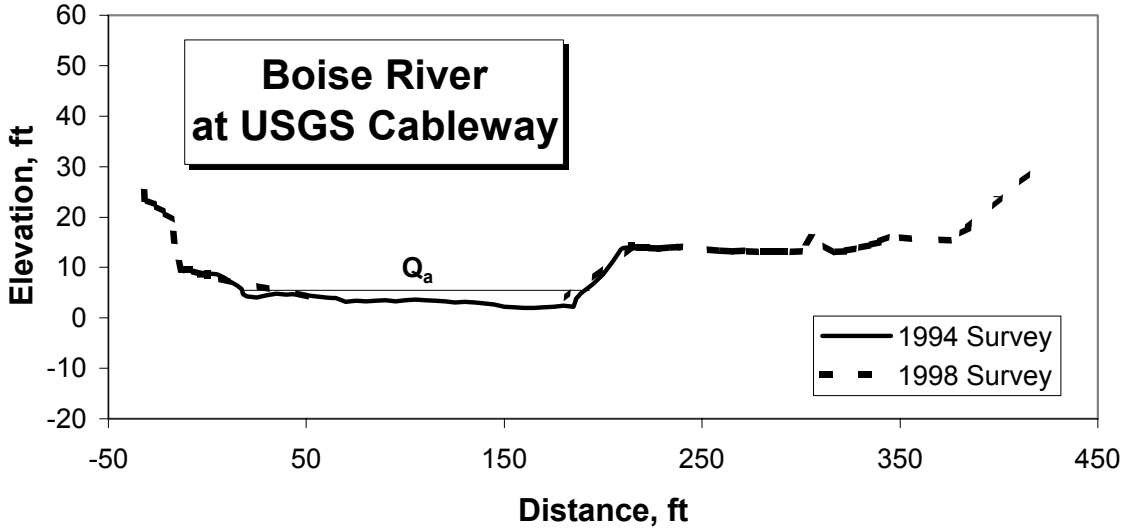

Figure 3. Cross-section of the Boise River near Twin Springs at the USGS cableway and the approximate water surface for the average annual discharge.

Channel Geometry

The station geometry relationships for the cross-section at the cableway are shown in Figure 4. Information for 1994 through 1997 within the range of discharges for the sediment transport measurements were used to develop the power relationships with discharge. Over the range of discharges when sediment transport was measured (1,190 to 10,400 ft^3/s) estimated stream width, estimated average depth and estimated average velocity varied from 166.1 to 204.1 ft, 1.89 to 6.30 ft, and 3.8 to 8.1 ft/s, respectively. The average reach slope is 0.0038 ft/ft.

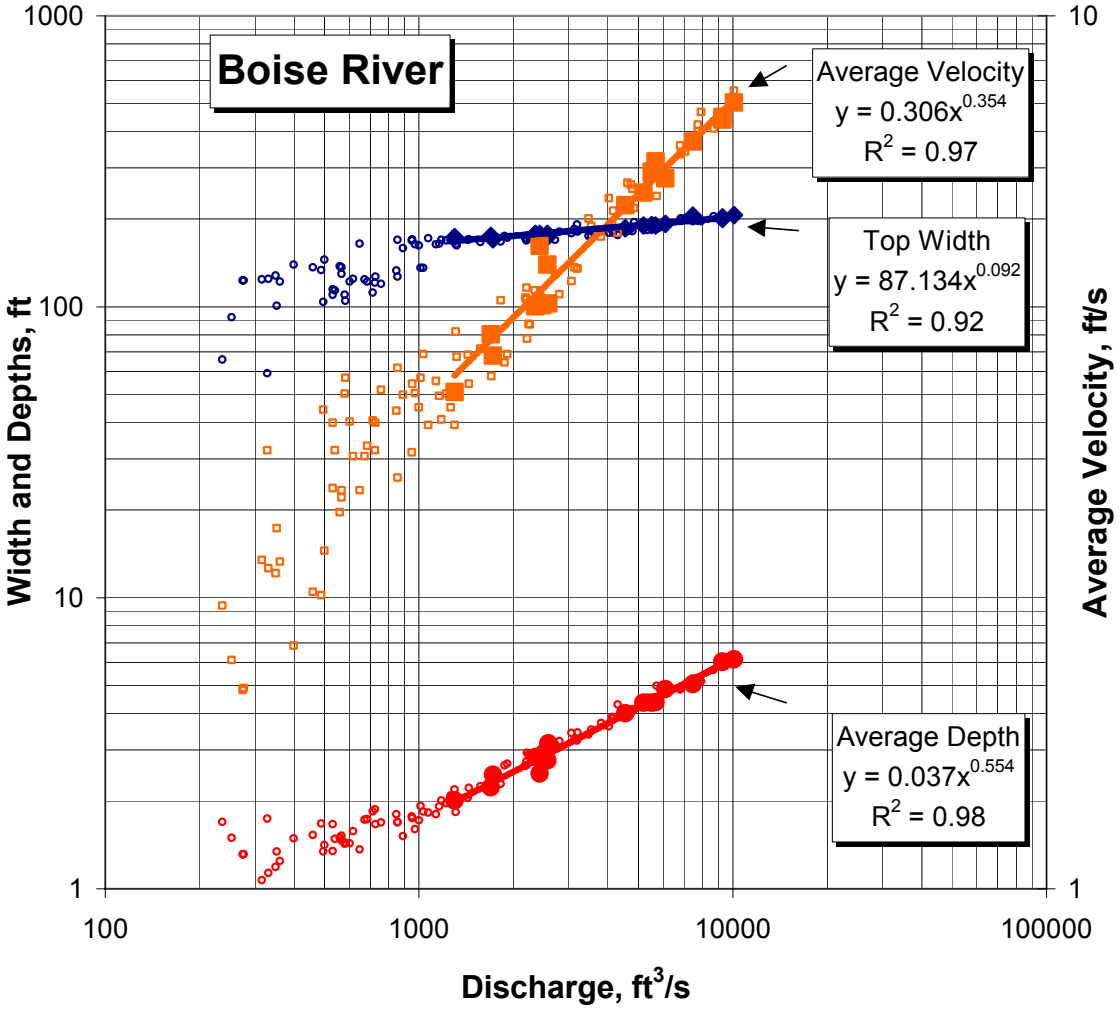

Figure 4. Width, average depth and average velocity versus stream discharge at the cableway cross-section on the Boise River. (Solid symbols represent data used to develop the power relationship; open symbols were not used because they are either outside the range of discharges when sediment transport 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 made at three cross-sections and three cores of subsurface material were collected, one at each cross-section, in October 1995. The average D_{50} and D_{90} for the surface pebble counts in 1994 and 1995 were 71 mm and 160 mm and 76 mm and 174 mm, respectively (Figure 5). The average D_{50} and D_{90} for the subsurface material collected in 1995 were 23 mm and 121 mm, respectively. About 13% (1994) and 25% (1995) of the surface material was sand (2 mm) size or smaller. The D_{50} of the floodplain deposits were 0.16 and 0.17 mm, respectively.

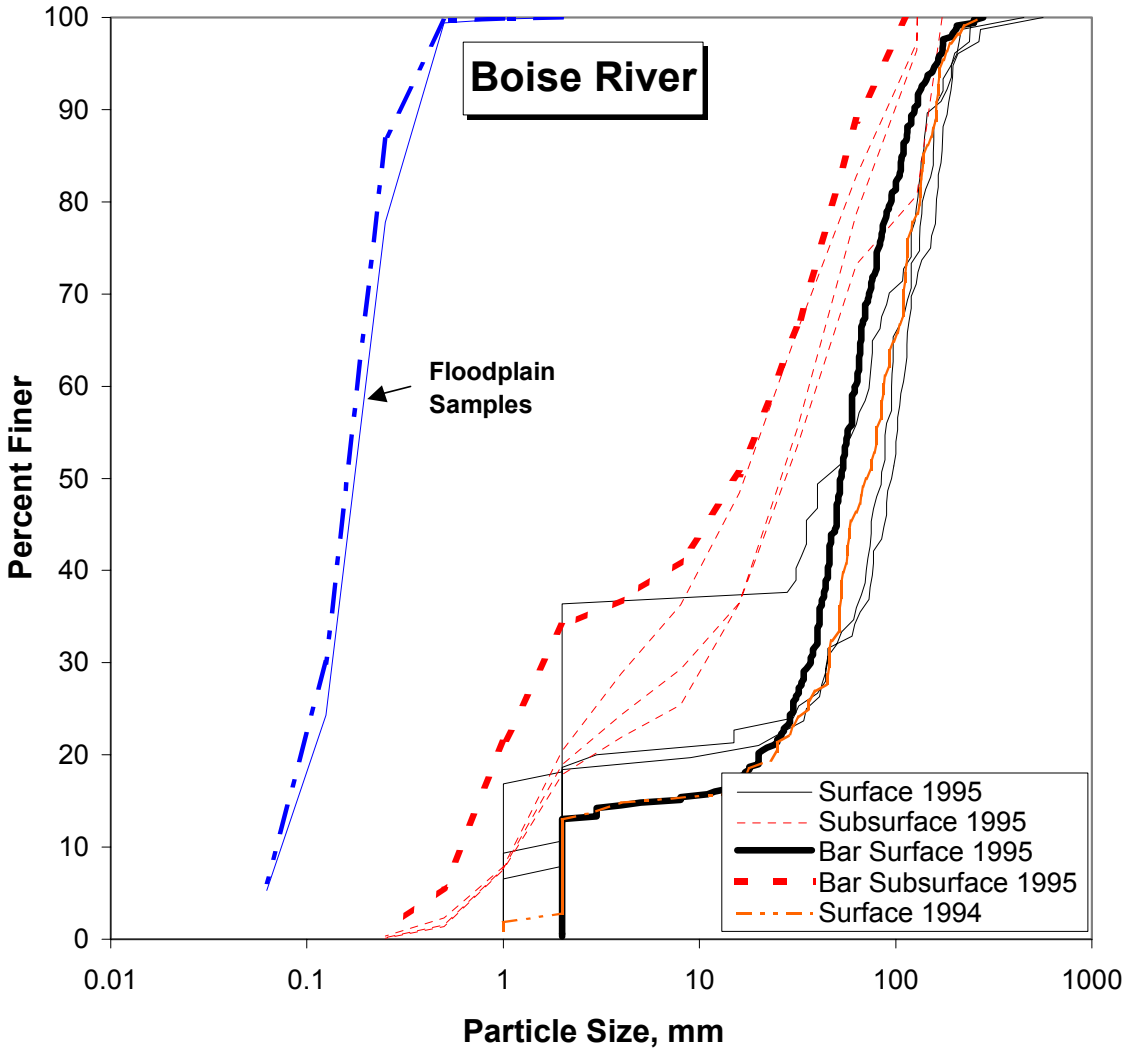

Figure 5. Particle size distribution for surface and subsurface material and floodplain samples in the Boise River study reach.

Sediment Transport

The bedload and suspended load measurements in water years 1994 through 1997 were all made from the cableway. The sediment transport data includes 82 measurements of bedload transport and 40 measurements of suspended sediment. Sediment transport measurements spanned a range of stream discharges from 1,190 ft^3/s ($0.98Q_a$; $0.20Q_b$) to 10,400 ft^3/s ($8.60Q_a$; $1.76Q_b$). Bedload transport ranged from 1.67 to 3,170 t/d and suspended transport ranged from 8.67 to 20,300 t/d. Over the range of measured discharges, suspended transport accounts for the majority of the material in transport with approximately an order of magnitude greater suspended transport at a discharge of 10,000 ft^3/s (Figure 6).

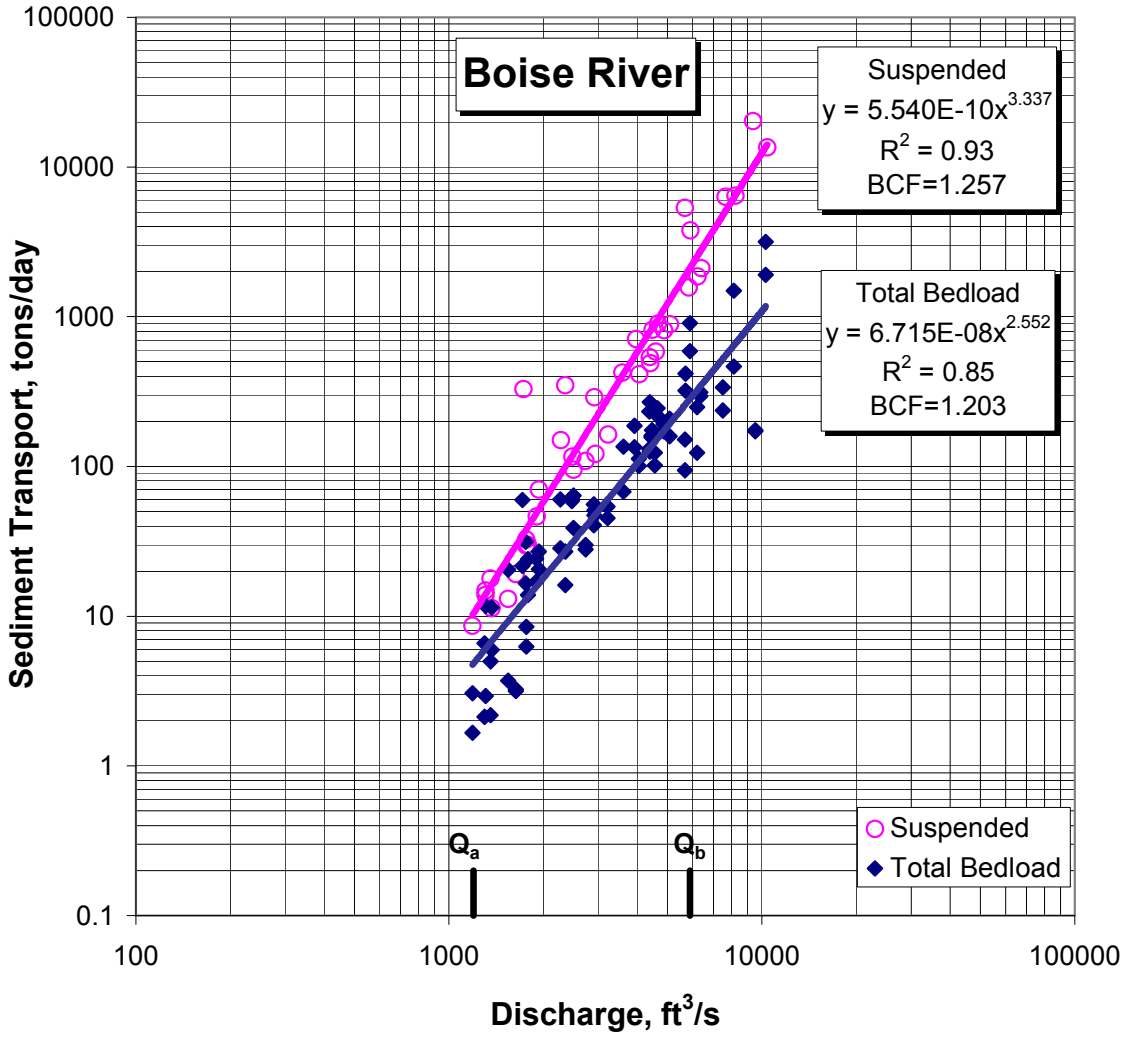

Figure 6. Bedload and suspended load transport rate versus discharge.

The bedload transport rates by size class (Figure 7) shows that the larger rates are associated with material smaller than 2 mm diameter. Only four bedload samples contained material larger than 32 mm diameter and these were at discharges of 4,440 ft^3/s and larger.

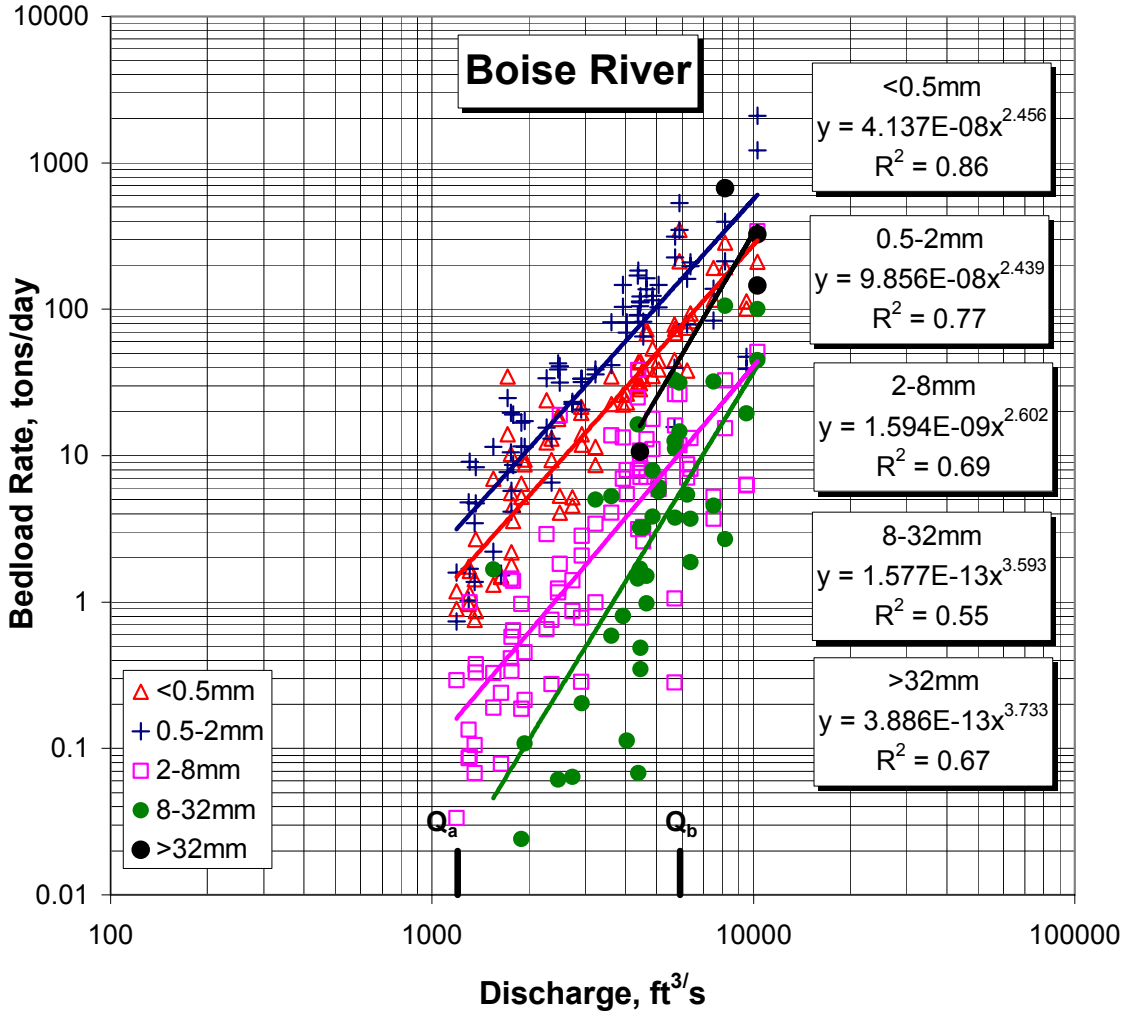

Figure 7. Bedload transport rate versus discharge for selected size classes.

The largest particle in the bedload sample generally increased with discharge (Figure 8). The largest particle measured in a bedload sample was 62 mm at a discharge of 8,150 ft^3/s. Although the largest particle size increased with discharge, the D_{50} for most bedload samples was in the sand size, ranging from 0.71 to 1.54 mm. On two occasions, associated with higher discharges, the D_{50} was appreciable larger, 19.1 mm at a discharge of 5,680 ft^3/s and 35.8 mm at a discharge of 8,150 ft^3/s. The relationship between discharge and the largest particle in the bedload sample and supporting observations of large particles recently moved on an upstream bar (1995 and 1997), and associated instantaneous peak discharges for the respective snowmelt periods, suggest that some material about the median size of the surface material is in motion at discharges near the bankfull discharge.

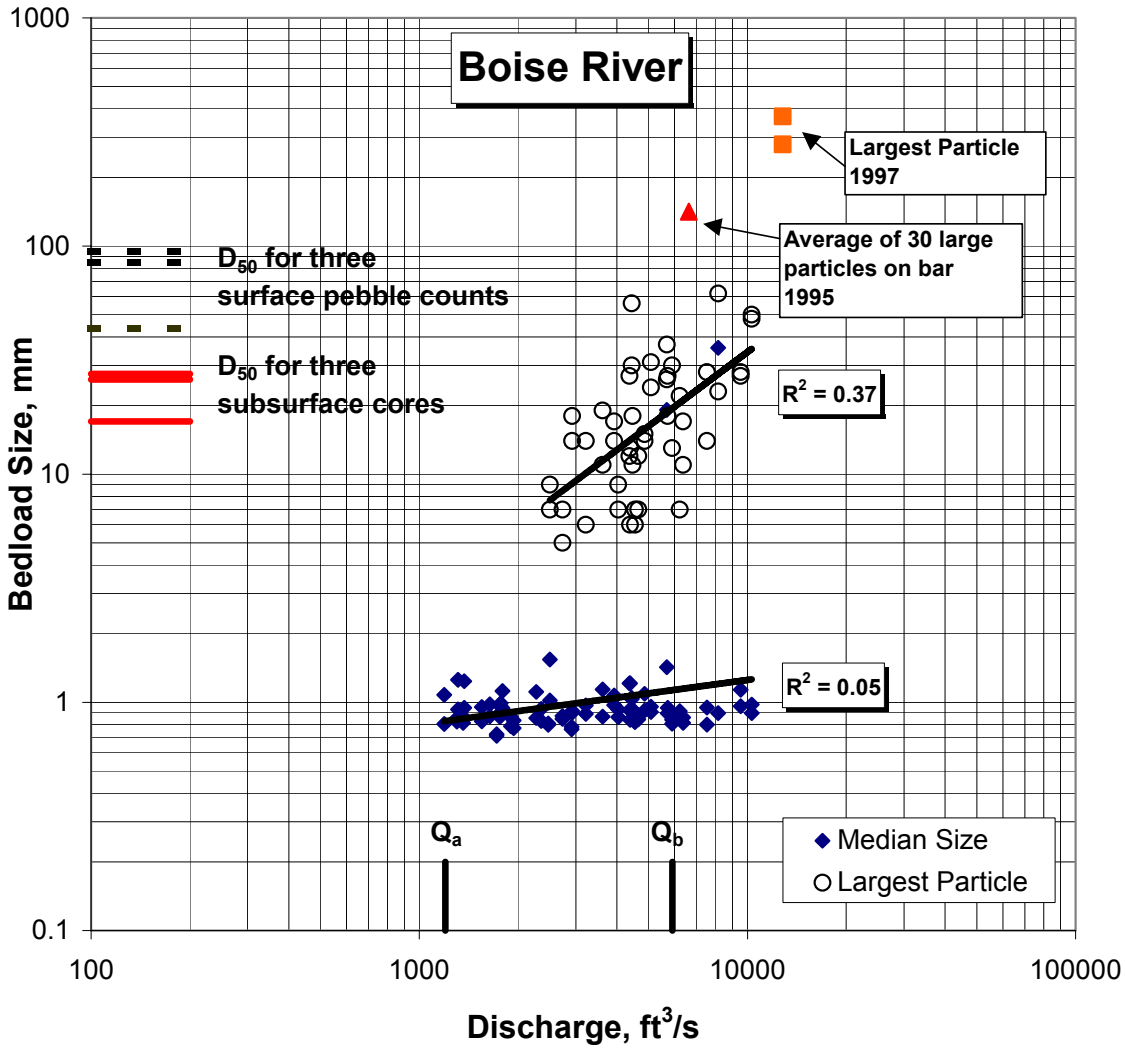

Figure 8. Largest particle in the bedload sample and median size of the sample versus stream discharge for the Boise River.