

Salmon River near Shoup, Idaho

General Information

The study reach is near the Geological Survey (USGS) discontinued gage 13307000 (Salmon River near Shoup, Idaho) in the Salmon-Challis National Forest. The stream gaging station is approximately 1.5 miles upstream from the confluence of the Middle Fork Salmon River with the Main Salmon River. The site is on land administered by the Forest Service at an elevation of 3,153.7 ft (gage elevation). The drainage area upstream of the gage is 6,236.7 mi². The geology of this large watershed is diverse and includes metamorphic, intrusive igneous, mixed volcanic and sedimentary rock. The geology in the vicinity of the study reach is metamorphic.

Sediment transport measurements were made by Utah State University (USU) personnel during the spring snowmelt flows of 1997 at a site about 0.7 miles upstream of the discontinued gage. Additional measurements at this site include a survey of the stream reach, pebble counts of the surface material and core samples of the surface and subsurface material.

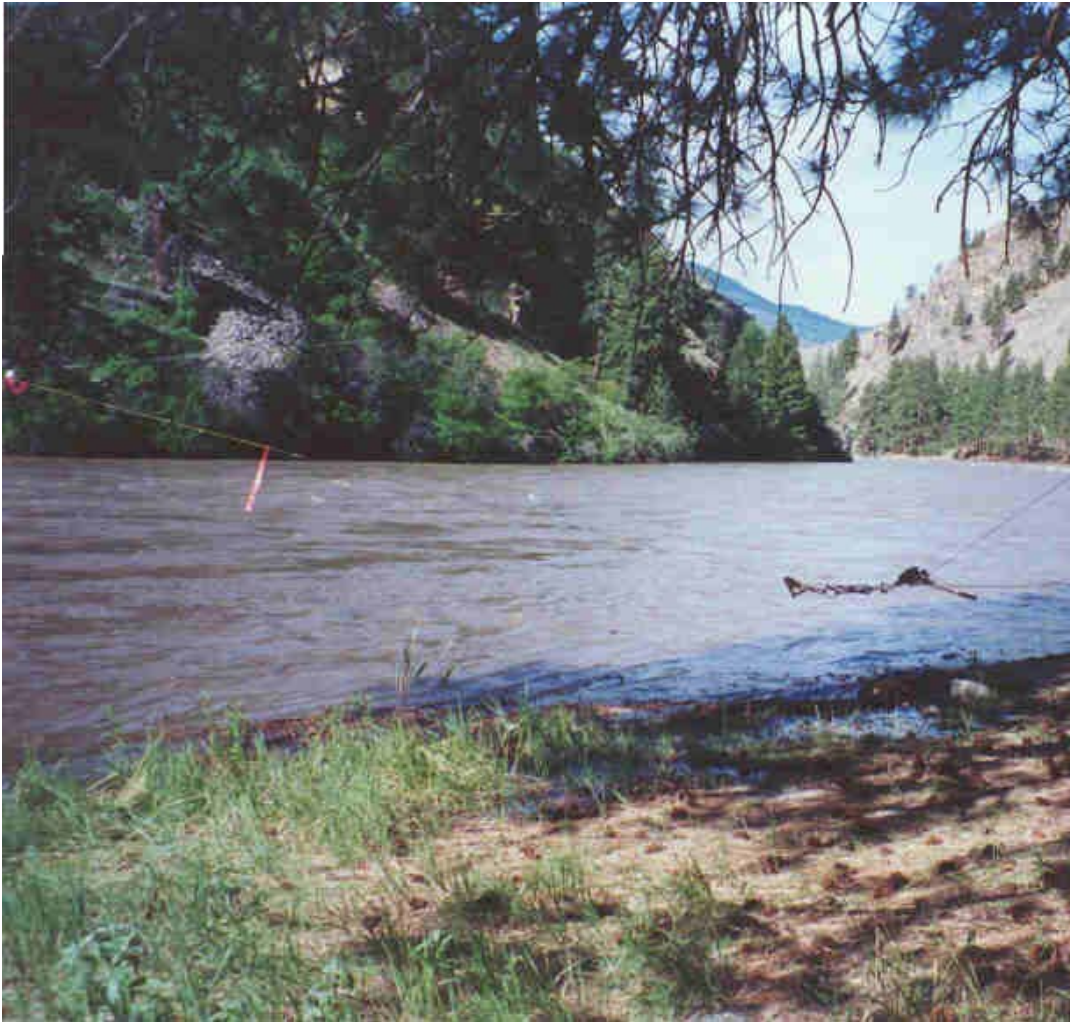


Figure 1. Photograph of the Salmon River near Shoup, Id. looking downstream.

Streamflow was recorded at the USGS gage site for water years 1944 to 1982. Average annual streamflow (Q_a) for the period of record is 3,040 ft^3/s and the 1.5 year return period discharge is estimated at 11,500 ft^3/s . The highest flow recorded was 25,700 ft^3/s on June 18, 1974.

Cross-Section

Figure 2 shows the cross-section at the USU gage site, upstream of the discontinued USGS gage. The average gradient for the study reach is 0.0019 ft/ft.

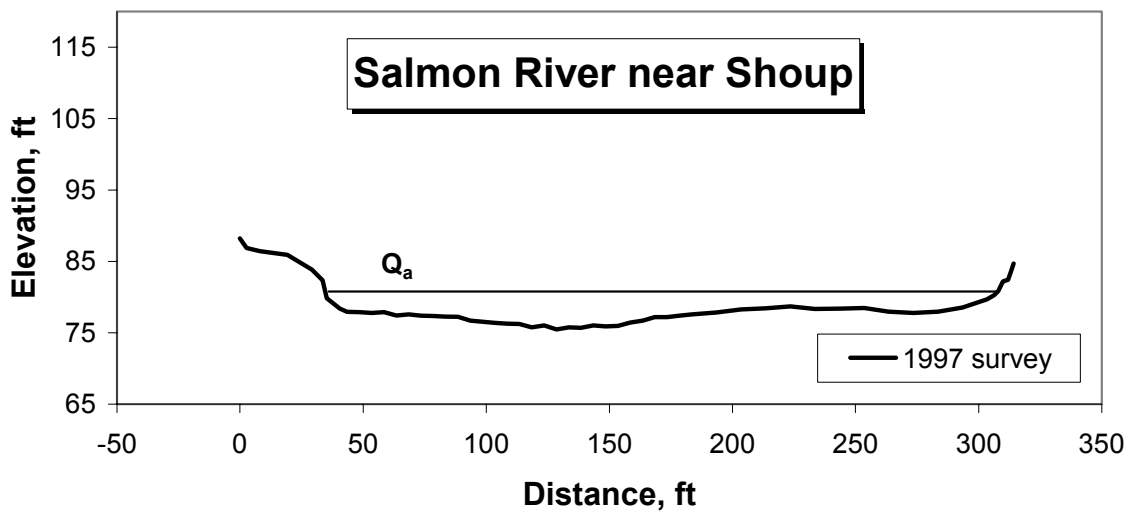


Figure 2. Cross-section of the Salmon River near Shoup, ID at the USU gage site.

Channel Geometry

The station geometry relationships for the cross-section at the USU gage are shown in Figure 3. All information for 1997 were used to develop the power relationships with discharge. Over the range of discharges when sediment transport was measured (3,830 to 19,100 ft³/s) estimated stream width, estimated average depth and estimated average velocity varied from 242.3 to 299.2 ft, 3.56 to 7.82 ft, and 4.4 to 8.2 ft/s, respectively. The average reach slope is 0.0019 ft/ft.

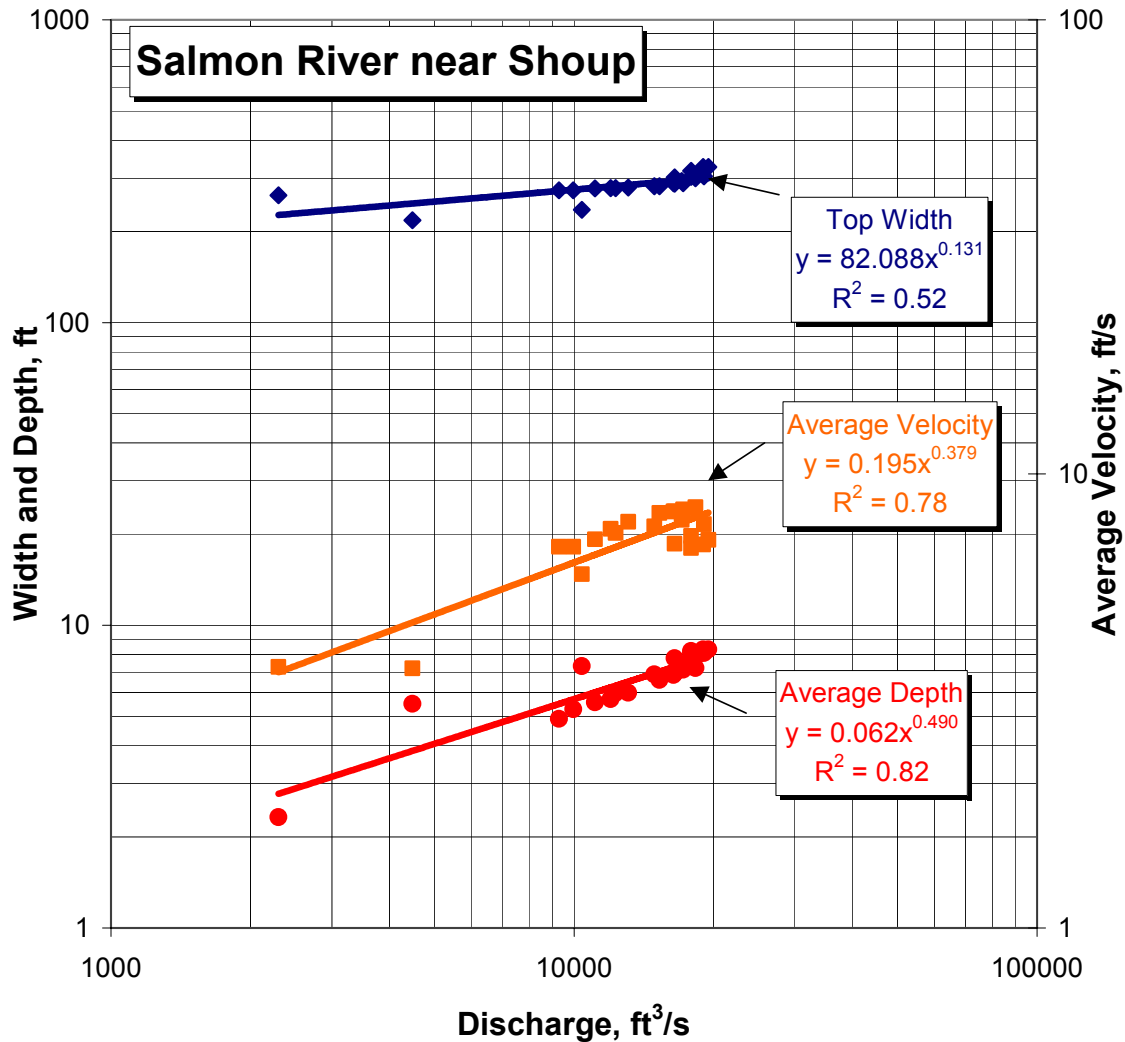


Figure 3. Width, average depth, and average velocity versus stream discharge at the USU gage cross-section on the Salmon River.

Channel Material

Pebble counts were made in August 2000 at three cross-sections and three cores of surface and subsurface material were collected, one at each cross-section. The D_{50} and D_{90} for the combined pebble counts were 96 mm and 203 mm, respectively (Figure 4). It should be noted that due to the depth of the river, pebble counts did not include the entire channel width. The D_{50} and D_{90} for the combined subsurface cores are 28 mm and 164 mm, respectively, and for the combined surface cores are 150 mm and 207 mm, respectively.

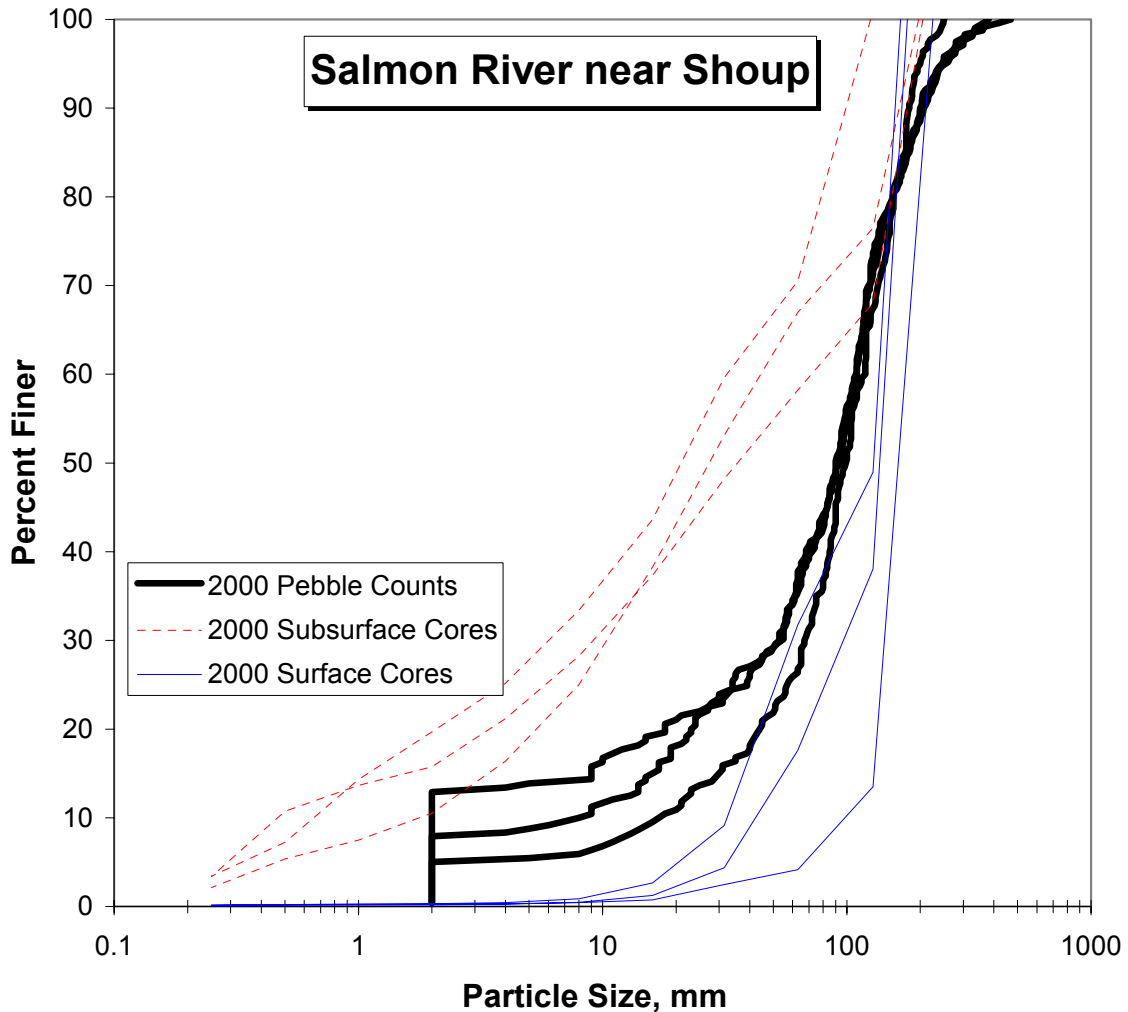


Figure 4. Particle size distribution for surface and subsurface material samples in the Salmon River near Shoup, ID reach.

Sediment Transport

The bedload and suspended load measurements in water year 1997 were all made from a boat. The sediment transport data includes 61 measurements of bedload transport and 21 measurements of suspended sediment. Sediment transport measurements spanned a range of stream discharges from 3,830 ft³/s (1.26Q_a) to 19,100 ft³/s (6.28Q_a). Bedload transport ranged from 4.18 to 4,330 t/d and suspended transport ranged from 1,920 to 159,000 t/d. Over the range of measured discharges, suspended transport accounts for the majority of the material in transport with over an order of magnitude greater suspended transport (Figure 5).

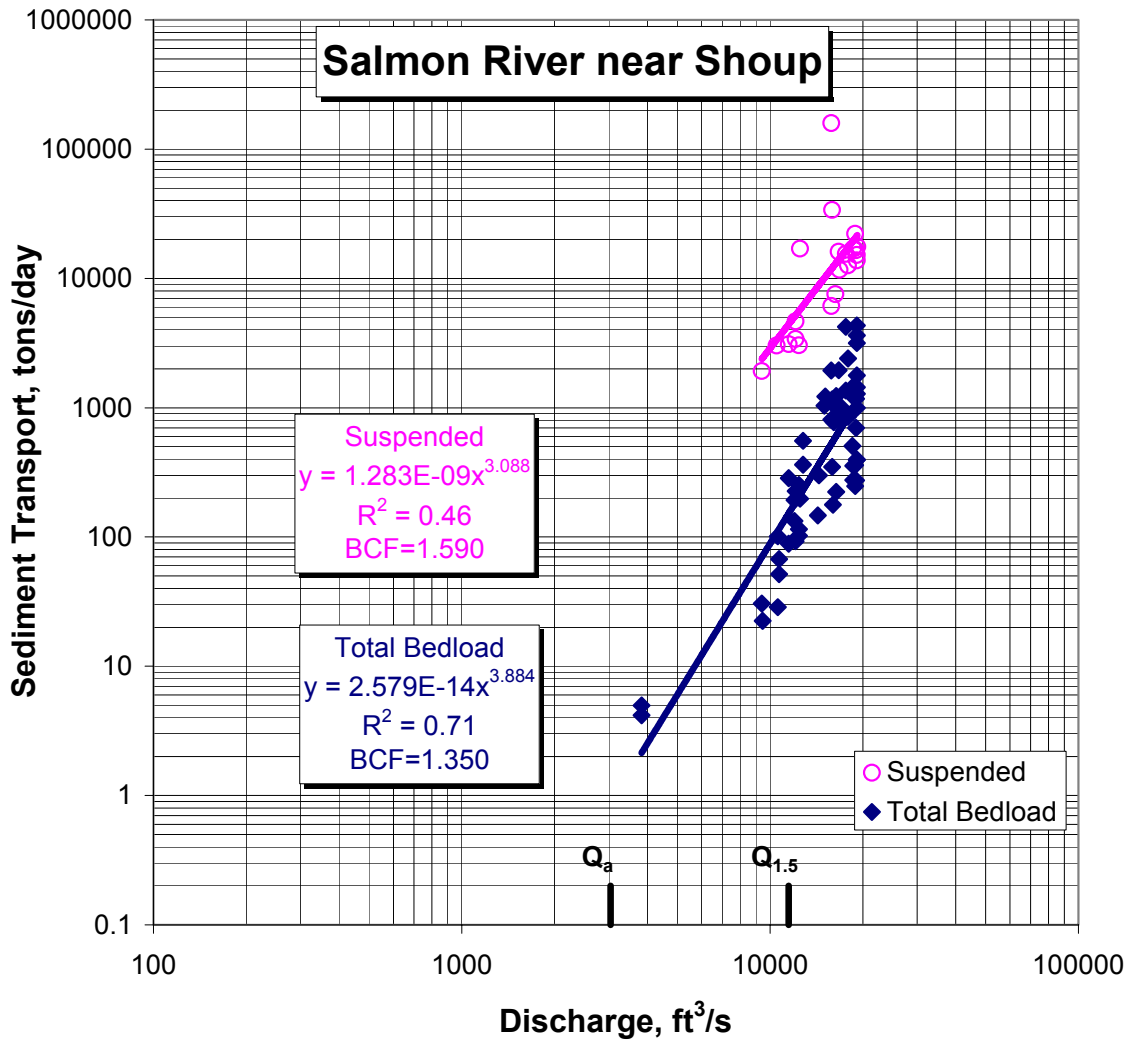


Figure 5. Bedload and suspended load transport rate versus discharge.

Most of the bedload measurements in the high water year of 1997 were made at discharges greater than the 1.5 year return period discharge (11,500 ft³/s). For many of these samples the largest transport rates were associated with material larger than 8 mm diameter (Figure 6). For the eight samples collected at discharges less than 11,500 ft³/s, there was no material >32mm diameter in the samples and the largest transport rates were typically associated with material <0.5 mm diameter.

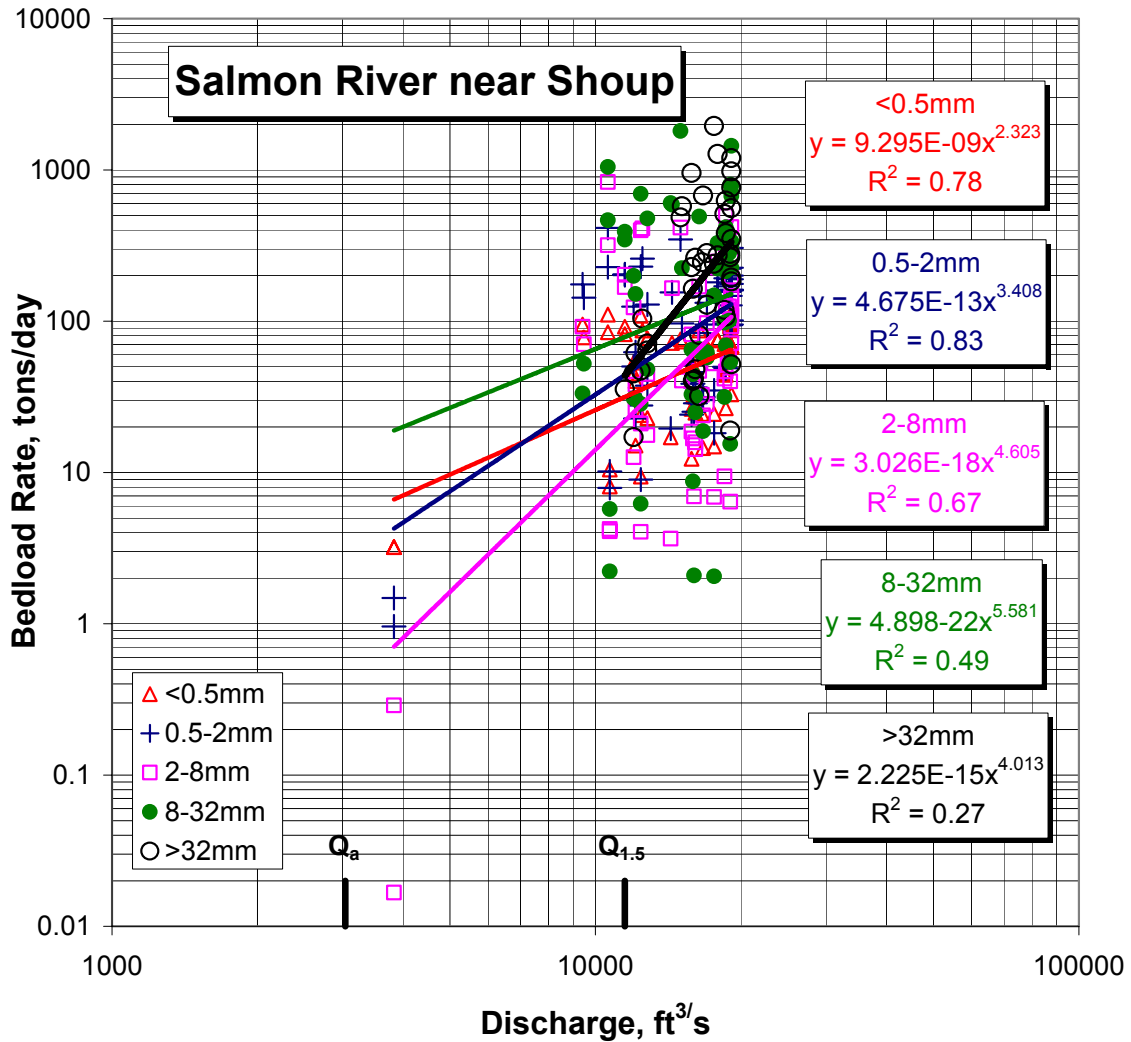


Figure 6. Bedload transport rate versus discharge for selected size classes.

The largest particle in the bedload sample increased with discharge (Figure 7). The largest particle measured in a bedload sample was 78 mm at a discharge of 19,100 ft³/s. At discharges larger than the 1.5 year return interval discharge, the median diameter of the bedload sample increases dramatically with increasing discharge. The largest median diameter of a bedload sample was 48.5 mm at a discharge of 12,500 ft³/s. The relationship between discharge and the largest particle in the bedload sample suggests that some material about the median size of the surface material is in motion at discharges near or slightly larger than the 1.5 year return interval discharge.

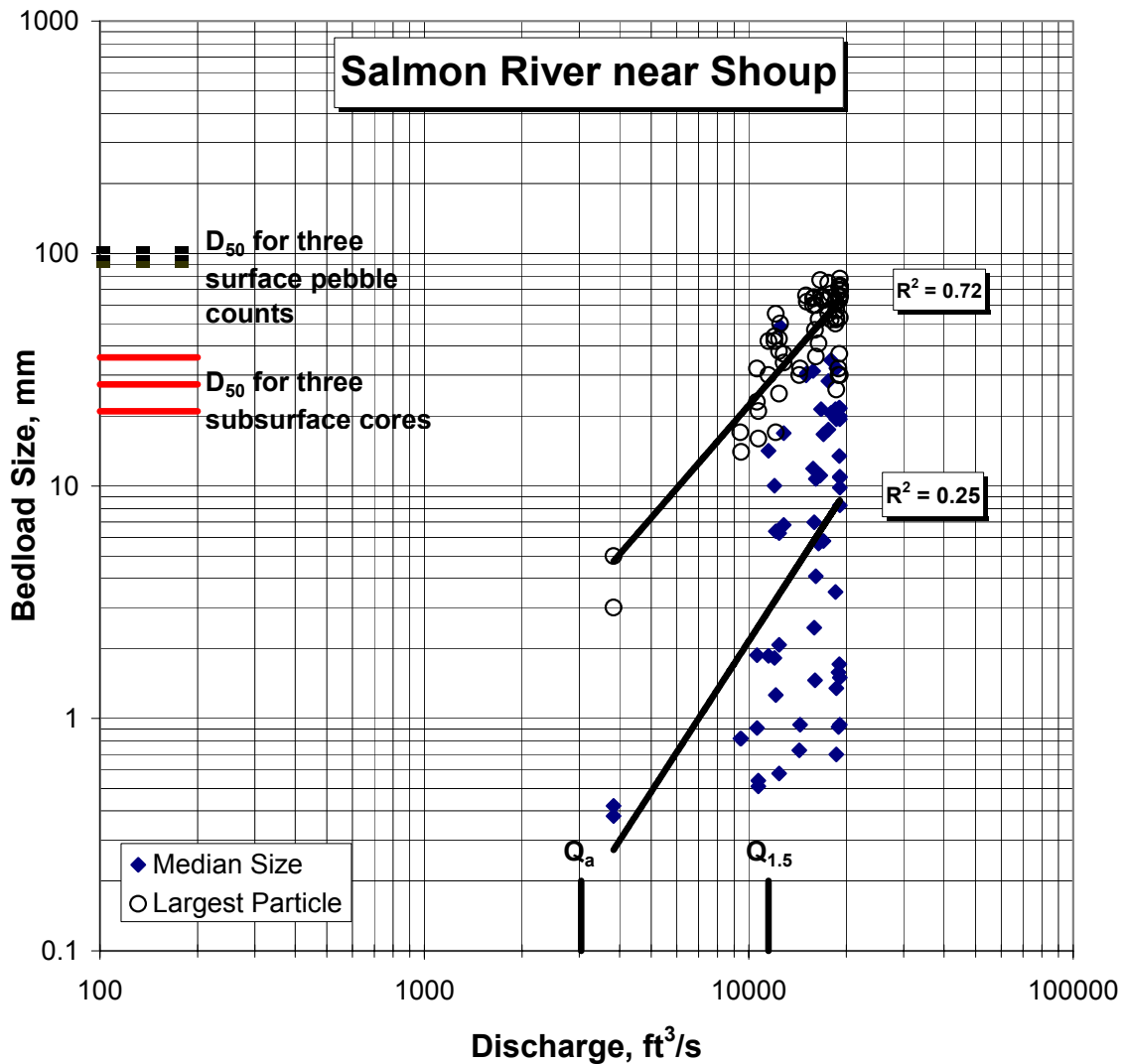


Figure 7. Largest particle in the bedload sample and median size of the sample versus stream discharge for the Salmon River near Shoup, ID.